

# InteliMains 1010 BTB SC

## Bus Tie Breaker Controller

### SW version 1.1.0

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## 1.1 Declaration of Conformity

<b>Supplier's Declaration of Conformity</b> <b>47 CFR § 2.1077 Compliance Information</b>
<b>Unique identifier:</b> IM31010SCBB
<b>Responsible Party:</b> Kevin Counts 10 N Martingale Rd #400 60173 - Schaumburg, IL USA
Tel: +1 815 636 2541 E-mail: <a href="mailto:info.us@comap-control.com">info.us@comap-control.com</a>
<b>FCC Compliance Statement</b> This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 1.2 Clarification of Notation

**Note:** This type of paragraph calls the reader's attention to a notice or related theme.

**IMPORTANT:** This type of paragraph highlights a procedure, adjustment etc., which can cause a damage or improper function of the equipment if not performed correctly and may not be clear at first sight.

**WARNING:** This type of paragraph highlights a procedure, adjustment etc., which can cause a damage or improper function of the equipment if not performed correctly and may not be clear at first sight.

**Example:** This type of paragraph contains information that is used to illustrate how a specific function works.

## 1.3 About this Global Guide

This manual contains important instructions for IntelIMains 1010 BTB SC controllers family that shall be followed during installation and maintenance of the controllers.

This manual provides general information how to install and operate IntelIMains 1010 BTB SC controllers.

This manual is dedicated for:

- > Operators
- > Control panel builders
- > For everybody who is concerned with installation, operation and maintenance

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**Warning:** Some forms of technical support may be provided against payment. There is no legal or factual entitlement for technical services provided in connection to resolving problems arising from cyber-attack or other unauthorized accesses to ComAp's Products or Services.

General security recommendations and set of measures

1. Production mode

- Disable production mode BEFORE the controller is put into regular operation.

2. User accounts

- Change password for the existing default administrator account or replace that account with a completely new one BEFORE the controller is put into regular operation mode.
- Do not leave PC tools (e.g. IntelliConfig) unattended while a user, especially administrator, is logged in.

3. AirGate Key

- Change the AirGate Key BEFORE the device is connected to the network.
- Use a secure AirGate Key – preferably a random string of 8 characters containing lowercase, uppercase letters and digits.
- Use a different AirGate Key for each device.

4. MODBUS/TCP

- The MODBUS/TCP protocol (port TCP/502) is an instrumentation protocol designed to exchange data between locally connected devices like sensors, I/O modules, controllers etc. By its nature it does not contain any kind of security – neither encryption nor authentication. Thus it is intended to be used only in closed private network infrastructures.
- Avoid using MODBUS/TCP in unprotected networks (e.g. Internet).

5. SNMP

- The SNMP protocol (port UDP/161) version 1 and version 2 are not encrypted. They are intended to be used only in closed private network infrastructures.
- Avoid using SNMP v1 and v2 in unprotected networks (e.g. Internet).

**IMPORTANT:** Controller issues **Wrn Default Password (page 640)** alarm, if the factory default password is used. It is necessary to change the factory default settings of password to be able to clear the alarm.

**Used open source software:**

Name of software	Modified	Type	License condition web address	
CMSIS FreeRTOS	✓	MIT	<a href="#">license</a>	Copyright (C) 2020 Amazon.com, Inc. or its affiliates. All Rights Reserved.

FreeRTOS	✓	MIT	<a href="#">license</a>	Copyright (C) Amazon Web Services, Inc. or its affiliates. All rights reserved.
Mbed TLS	✓	Apache 2.0	<a href="#">license</a>	Copyright (C) 2006-2015, ARM Limited, All Rights Reserved
lwIP	✓	BSD 3	<a href="#">license</a>	Copyright (c) 2001-2004 Swedish Institute of Computer Science. All rights reserved.
MD5	–	Free ad-hoc license	<a href="#">license</a>	Copyright (C) 1991-2, RSA Data Security, Inc. Created 1991. All rights reserved RSA Data Security, Inc. MD5 Message-Digest Algorithm
Embedded Template Library	✓	MIT	<a href="#">license</a>	Copyright (c) 2016 jwellbelove <a href="http://www.etlcpp.com">www.etlcpp.com</a>
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FatFs	✓	Modify BSD	<a href="#">license</a>	Copyright (C) 20xx, ChaN, all right reserved. This software is provided by the copyright holder and contributors "AS IS" and any warranties related to this software are DISCLAIMED. The copyright owner or contributors be NOT LIABLE for any damages caused by use of this software.
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## 1.5 General warnings

### 1.5.1 Remote control and programming

The controller can be controlled remotely. In the event that maintenance of the site has to be done, or the controller has to be programmed, check the following points to ensure that any part of the site will not react unpredictably (unwanted/random start of the System or any other part of the system).

To be sure:

- > Disconnect remote control
- > Disconnect binary outputs

### 1.5.2 SW and HW versions compatibility

Be aware to use the proper combination of SW and HW versions.

### 1.5.3 Dangerous voltage

In no case touch the terminals for voltage and current measurement!

Always connect grounding terminals!

In no case do not disconnect controller CT terminals!



### 1.5.4 Adjust the setpoints

All parameters are adjusted to their typical values. However, the setpoints have to be checked and adjusted to their real values before the first .

**IMPORTANT: Wrong adjustment of setpoints can destroy any part of the system.**

**Note:** The controller contains a large number of configurable setpoints, because of this it is impossible to describe all of its functions. Some functions can be changed or have different behavior in different SW versions. Always check the Global guide and New feature list for SW version which is used in controller. This manual only describes the product and is not guaranteed to be set for your application.

**IMPORTANT:** Be aware that the binary outputs can change state during and after software reprogramming (before the controller is used again ensure that the proper configuration and setpoint settings are set in the controller).

The following instructions are for qualified personnel only. To avoid personal injury do not perform any action not specified in related guides for product.





## 1.6 Functions and protections

Support of functions and protections as defined by ANSI (American National Standards Institute):

Description	ANSI code	Description	ANSI code
Multi-function device	11	Overcurrent IDMT	51
Speed and frequency matching device	15	AC circuit breaker	52
Data communications device	16ECFM+16SC	Power factor	55
Synchronizing-check	25	Overvoltage	59
Automatic Synchronizing Relay	25A	Pressure switch	63
Undervoltage	27	Liquid level switch	71
Annunciator*	30	Alarm relay *	74
Overload	32	Vector shift	78
Undercurrent	37	Reclosing relay	79
Current unbalance	46	Overfrequency	81H
Voltage unbalance	47	Underfrequency	81U
Temperature monitoring	49T	ROCOF	81R
Overcurrent	50/50TD		

\* extension module IGL-RA15 required




























































## 1.7 Certifications and standards

<ul style="list-style-type: none"> <li>&gt; EN 61000-6-2</li> <li>&gt; EN 61000-6-4</li> <li>&gt; EN 61010-1</li> <li>&gt; EN 60255-1</li> <li>&gt; EN 60529 (IP20)</li> </ul>	<ul style="list-style-type: none"> <li>&gt; EN 60068-2-1 (-40 °C/16 h)</li> <li>&gt; EN 60068-2-2 (70 °C/16 h)</li> <li>&gt; EN 60068-2-6 (2÷25 Hz / ±1,6 mm; 25÷100 Hz / 4,0 g)</li> <li>&gt; EN 60068-2-27 (a=500 m/s<sup>2</sup>; T=6 ms)</li> <li>&gt; EN 60068-2-30 (25/55 °C, RH 95%, 48 h)</li> </ul>	<ul style="list-style-type: none"> <li>&gt; UL6200</li> <li>&gt; UKCA</li> </ul>	   
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## 1.8 Document history

Revision number	Related sw. version	Date	Author
2	1.1.0	28.3.2025	Jakub Slavata
1	1.0.0	14.7.2023	Jakub Slavata

## 1.9 Symbols in this manual

	3 x Phases		Coil		Fuel solenoid		Passive current sensor
	Active current sensor		Connector - female		Fuse		Pick - up
	AirGate		Connector - male		Fuse switch		Relay coil
	Alternating current		Contact		Generator		Relay coil of slow-operating
	Analog modem		Contactor		Generator schematic		Renewables
	Battery		Controller simplified		Grounding		Resistor
	Battery Energy Storage System		Module simplified		GSM		Resistor adjustable
	Binary output		Current measuring		GSM modem		Resistive sensor RPTC
	Breaker contact		Current measuring		IG-AVRi		RS 232 male
	Breaker contact		Danger		IG-AVRi TRANS		RS 232 female
	Breaker		Danger - Electric Hazard		Jumper		Starter
	Breaker		DC to AC Inverter		Load		Switch - manually operated
	Breaker		Diode		Mains		Transformer
	Capacitor		Ethernet male		Mains		USB type B male
			Ethernet female		Mobile provider		USB type B female



Voltage  
measuring



Wifi / WAN /  
LAN

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# 2 System overview

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## 2.1 General description

The IntelliMains 1010 BTB SC is a state-of-the-art bus tie breaker controller, for use in concert with the IntelliGen 1000 SC paralleling generator synchronizer and load sharing controller operating in different groups. The IntelliMains 1010 BTB SC is ideal for control systems where an external PLC is used to dictate the system sequence of operation.

The controller provides easy-to-use operation and installation. Predefined configurations for typical applications are available as well as user-defined configurations for special applications.

**Note:** See chapter *Logical Sequence and Control (page 193)* for more information about functions and behavior of IntelliMains 1010 BTB SC.

### 2.1.1 The key features of IntelliMains 1010 BTB SC

- Capable to soft transfer or open transfer the load between generators and mains / utility.
- Compatible with the IntelliGen 1000 SC for control of gen-set/generator breakers, up to 64 controllers can be combined in a system.
- Pre-programmed functions allow fast and easy system setup.
- True RMS voltage and current measurement with .25% accuracy; power calculation to .50% accuracy.
- Cybersecure remote control and monitoring to ANSI/ISA-62443 standard.
- Redundant CAN inter-controller communication.
- Redundant controller hot-swap in <10ms.
- Internal PLC functionality with easy-to-use PLC Editor, for simple and fast creation of specific logic for local control when desired (ex. local load shed/restore).
- Modbus master optional software key allows easy integration of Modbus-based devices for data sharing/control.
- Ethernet communication networks for local and remote monitoring options, with connected clients split into “trusted” and “untrusted” zones.

**Note:** The IntelliMains 1010 BTB SC is not intended to be used with other ComAp non SC products.

## 2.2 Getting Started

Congratulations to your new IntelliMains 1010 BTB SC ComAp Bus controller. Follow these steps bellow for first run of your controller.

**Note:** For a better experience with our controller, do not forget to see the [InteliConfig manual](#) before starting the configuration.

### 1. Connect controller to power supply

- Controller requires power supply between 8-36 V DC. Plug **+BAT** to the terminal no. 03 and **GND** to the terminal no. 01.
- See **Terminal Diagram (page 41)** for more information

### 2. Connect your computer to the controller

- We suggest you to use USB or ETH 1 - Trusted Interface for the first connection to your new controller. Plug the USB/ETH cable to USB type B/Ethernet 1 terminal on the controller. Open InteliConfig and select "Connect to controller". Now you can use "Detected controllers" feature, which should offer you the controller.

### 3. Authorizing as Administrator

- The alarmlist should show **Wrn Default Password (page 640)**. If this alarm is not present, this procedure bellow will not work. You will need to use your changed password or **Reset accounts to factory default (page 176)**. If you see the warning, use function "Enter password" which is located in tab "Control".

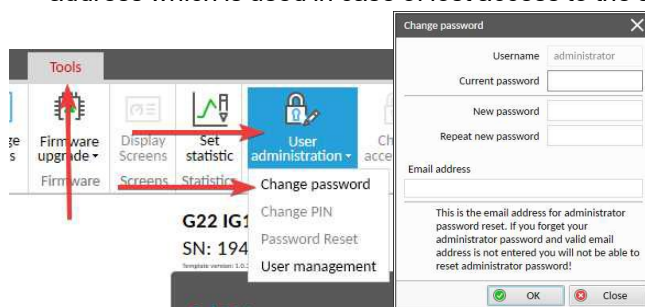
- Username = administrator
- Password = serial number of your controller

Serial number is located at the front of your controller or you can see it in left top corner of InteliConfig when connected to the controller.

You can verify that you have been successfully logged in by seeing opened lock with number "3". This means that you verified on the highest level - administrator and you have all possible rights.

### 4. Changing Administrator Password

- You should change the default password as soon as possible via InteliConfig. In the InteliConfig select tab "Tools", function "User administration" and "Change password". Do not forget to add your email address which is used in case of lost access to the account.



### 5. Adding another users

- If you are logged in as any account with permissions level 3, you can add another user. The whole procedure is explained in chapter **Adding account (page 177)**.

### 6. Connecting external display

- For InteliVision displays wiring diagram see the chapter **InteliVision Displays (page 75)**.

## 2.3 Measurement methods

The IntelliMains 1010 BTB SC contains two methods for measuring physical quantities. The method of Symmetrical components is measured all the time and the values are used whenever Grid Codes standard requires them. In all other cases True RMS method is used.

Only values from Symmetrical components, visible to user, are **+Bus Left Voltage (page 410)** and **+Bus Left Voltage Relative (page 410)**.

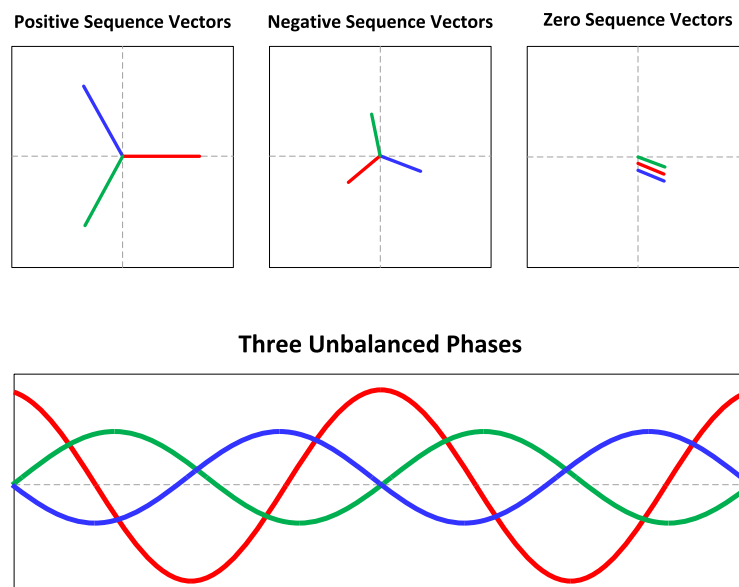
### 2.3.1 True RMS measurement

This controller measures AC values based on True RMS principle. This principle corresponds exactly to the physical definition of alternating voltage effective values. Under normal circumstances the mains voltage should have a pure sinusoidal waveform. However some nonlinear elements connected to the mains produce harmonic waveforms with frequencies of multiples of the basic mains frequency and this may result in deformation of the voltage waveforms. The True RMS measurement gives accurate readings of effective values not only for pure sinusoidal waveforms, but also for deformed waveforms.

**Note:** The harmonic deformation causes that the Power Factor of a System working parallel with the mains cannot reach values in a certain range around the PF 1.00. The higher the deformation, the wider the power factor dead range. If the requested power factor is adjusted inside the dead range, the controller cannot reach the requested value because of this fact.

### 2.3.2 Symmetrical components

The method of symmetrical components simplifies analysis of unbalanced three-phase power systems under both normal and abnormal conditions. The basic idea is that an asymmetrical set of N phasors can be expressed as a linear combination of N symmetrical sets of phasors by means of a complex linear transformation. In the most common case of three-phase systems, the resulting "symmetrical" components are referred to as direct (or positive), inverse (or negative) and zero (or homopolar). The analysis of power system is much simpler in the domain of symmetrical components, because the resulting equations are mutually linearly independent if the circuit itself is balanced.



**Note:**

These images are based on:

[https://upload.wikimedia.org/wikipedia/commons/e/e0/Unbalanced\\_symmetrical\\_components.pdf](https://upload.wikimedia.org/wikipedia/commons/e/e0/Unbalanced_symmetrical_components.pdf)

Which has license: <https://creativecommons.org/publicdomain/zero/1.0/deed.en>

## 2.4 AC measurement

With IntelliMains 1010 BTB SC it is possible to easily set the parameters for measuring.

### 2.4.1 AC measurement settings

#### AC Voltage measurement settings

The value of the AC voltage measured on the terminals of the controller can be adapted according to the used meas voltage. For measuring AC voltage use setpoints **Bus Left VT Ratio** (page 246) and **Bus Right Voltage Input Range** (page 248).

#### AC Current measurement settings

The value of the AC current measured on the terminals of the controller can be adapted phase application with neutral according to the used meas current. For measuring AC current use setpoints **Bus Left CT Ratio Prim** (page 243) and **Bus Left CT Ratio Sec** (page 244).

### 2.4.2 Frequency measurement accuracy and resolution

The resolution of the measurement is in mHz within a 45–75 Hz range. Values **Bus Left Frequency** (page 407) and **Bus Right Frequency** (page 412) are used for visualization of measured frequency.

### 2.4.3 PF measurement and evaluation

Power factor is measured with a resolution of 0.001.

Setpoint used for setting the Power factor regulation is **#System Power Factor** (page 260) with a 0.01 resolution.

Values for the Power factor are:

- **Bus Left Power Factor** (page 404), **Bus Left Load Character** (page 404)
- **Bus Left Power Factor L1** (page 405), **Bus Left Load Character L1** (page 405)
- **Bus Left Power Factor L2** (page 405), **Bus Left Load Character L2** (page 405)
- **Bus Left Power Factor L3** (page 406), **Bus Left Load Character L3** (page 406)
- **Total Running Power Factor** (page 429), **Total Running Load Character** (page 429)

### 2.4.4 Waveform distortion measurements

The controller also measures Total Harmonic Distortion (THD) for current and voltage using formulas bellow.

#### Voltage Total Harmonic Distortion

$$THD_V = \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + \dots + V_{40}^2}}{V_1} = \frac{\sqrt{\sum_{k=2}^{40} V_k^2}}{V_1},$$

Where  $V_k$  is the True RMS voltage of  $k$ th harmonic.

- Related values:
  - **Bus Left Voltage THD L1** (page 406)
  - **Bus Left Voltage THD L2** (page 406)
  - **Bus Left Voltage THD L3** (page 407)

## Current Total Harmonic Distortion

$$THD_I = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \dots + I_{40}^2}}{I_1} = \frac{\sqrt{\sum_{k=2}^{40} I_k^2}}{I_1},$$

where  $I_k$  is the True RMS current of  $k$ th harmonic.

➤ Related values:

➤➤ **Mains Current THD L1 (page 407)**

➤➤ **Mains Current THD L2 (page 407)**

➤➤ **Mains Current THD L3 (page 407)**

## 2.5 Communication peripherals

InteliMains 1010 BTB SC contains 3x Ethernet terminals, 4x CAN terminals, 1x RS485 terminal and 1x USB type B terminal. Each terminal functions are slightly different, which depends on the purpose of usage.

**IMPORTANT: Use correct terminal according to your purpose of usage for correct function.**

Peripherals	Description	Relevant links
<b>CAN1A</b>	<p>This terminal is used for connecting of external modules and Electronic Control Units. See the chapters <b>Supported combinations of modules (page 695)</b> and <b>Multiple ECU (page 152)</b> for more information.</p> <p><b>Note:</b> In case the function <b>CAN1 ECU/IO Modules Splitting (page 121)</b> is used this terminal is used only for communication with ECU.</p>	<b>CAN bus wiring (page 66)</b>
<b>CAN1B</b>	<p>This terminal is used for communication between Master and Backup Controller if the <b>Hot Swap Redundancy (page 138)</b> function is used.</p> <p><b>Note:</b> In case the function <b>CAN1 ECU/IO Modules Splitting (page 121)</b> is used this terminal is used only for communication with external modules.</p>	
<b>CAN2A</b>	This terminal is used for <b>CAN Intercontroller Communication (page 120)</b> .	
<b>CAN2B</b>	This terminal is used for <b>CAN Intercontroller Communication Redundancy (page 121)</b> .	
<b>RS485</b>	This terminal is used for <b>Modbus-RTU, Modbus/TCP (page 215)</b> communication.	<b>RS485 wiring (page 68)</b>
<b>USB Type B</b>	This terminal is used for UART communication eg. InteliConfig, WinScope1000, etc. It is considered as <b>Trusted (page 173)</b> terminal and the default account is used for connection.	<b>Controller configuration and PC tools connection (page 108)</b>
<b>Ethernet 1</b>	In the default configuration port Ethernet 1 is configured as <b>Trusted (page 173)</b> interface. It is used for LAN communication eg. Display, InteliConfig, WinScope1000, Modbus Server. The default account is	<b>Ethernet port 1 (page 323)</b>

	used for connection. <b>Use this interface for local connection only.</b>	
<b>Ethernet 2</b>	In the default configuration port Ethernet 2 is configured as <b>Untrusted (page 173)</b> interface. It is used for remote communication eg. IntelliConfig, WinScope1000, etc. The user account with password has to be used in order to connect to the controller.	<b>Ethernet port 2 (page 324)</b>
<b>Ethernet 3</b>	In the default configuration port Ethernet 3 is configured as <b>Modbus (page 174)</b> interface. It is used for <b>Modbus Client (Master) (page 149)</b> or Modbus server. It is not possible to use Modbus interface as a terminal connection (InteliConfig, WinScope 1000, etc.).	<b>Ethernet port 3 (page 325)</b>

You can see layout of the peripherals in the chapter **Terminal Diagram (page 41)**.

**Note:** The controller has one common MAC address. Do not connect more than 1 Ethernet into the same internet network.

## 2.6 Configurability and monitoring

One of the key features of the controller is the system's high level of adaptability to the needs of each individual application and wide possibilities for monitoring. This can be achieved by configuring and using the powerful PC/mobile tools.

### 2.6.1 Supported configuration and monitoring tools

- IntelliConfig - complete configuration and single / multiple controller monitoring
  - IntelliConfig - application for smart-phones
- WebSupervisor - web-based system for monitoring and controlling
  - WebSupervisor mobile - application for smart-phones
- WinScope 1000 - special graphical monitoring software
- InteliSCADA - customizable SCADA diagram for monitoring

The firmware of controller contains a large number of binary inputs and outputs needed for all necessary functions available. However, not all functions are required at the same time on the same controller and also the controller hardware does not have so many input and output terminals. One of the main tasks of the configuration is mapping of "logical" firmware inputs and outputs to the "physical" hardware inputs and outputs.

## 2.6.2 Configuration parts

- Mapping of logical binary inputs (functions) or assigning alarms to physical binary input terminals
- Mapping of logical binary outputs (functions) to physical binary output terminals
- Mapping of logical analog inputs (functions) to physical analog input terminals, assigning sensor characteristics (curves) or assigning alarms to analog inputs
- Mapping of values to physical analog outputs, assigning output HW type with conversion characteristic
- Selection of peripheral modules, which are connected to the controller, and doing the same (as mentioned above) for them
- Selection of ECU (electronic control unit) type
- Changing the language of the controller interface

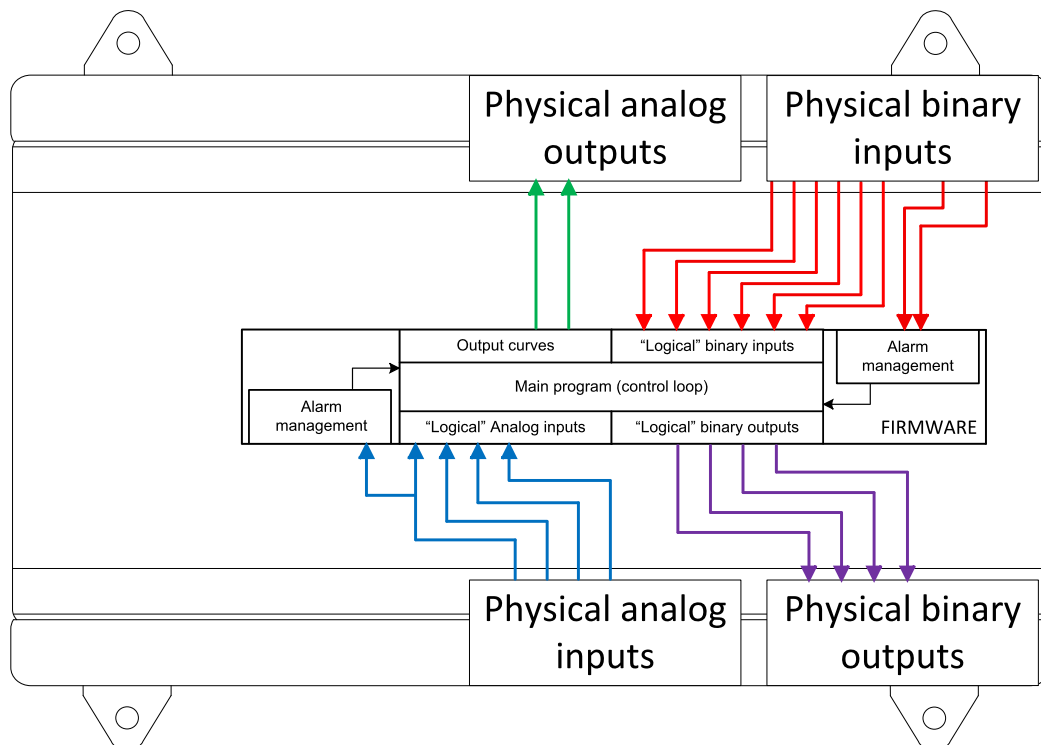


Image 2.1 Principle of inputs and outputs configuration

The controller is shipped with a **Default configuration (page 114)**, which should be suitable for most standard applications. This configuration can be changed only by using a PC with the IntelliConfig software. See IntelliConfig documentation for details.

Once the configuration is modified, it can be saved to a file for later usage with another controller or for backup purposes. The file is called archive and has the file extension .aig3. An archive contains a full image of the controller at the time of saving (if the controller is online for the PC) except the firmware. Besides configuration it also contains current adjustment of all setpoints, all measured values, a copy of the history log and a copy of the alarm list.

The archive can be simply used for cloning controllers, i.e. preparing controllers with identical configuration and settings.

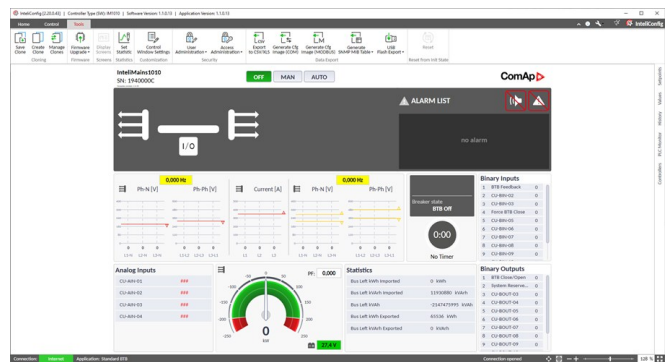
## 2.7 PC tools

### 2.7.1 IntelliConfig

PC Tool for configuration and monitoring of controllers. See more in the [IntelliConfig Global Guide](#).

**This tool provides the following functions:**

- Direct or remote internet communication with the controller
- Offline or online controller configuration
- Controller and module configuration, programming and cloning
- Reading/writing/adjustment of setpoints
- Reading of measured values
- Controllers and ECU Alarm monitoring + complete real time history
- Exporting data into a XLS file
- Controller language translation
- Power format and ECU unit selection
- Embedded manuals and F1 helps
- Auto-hiding of unused setpoints and values

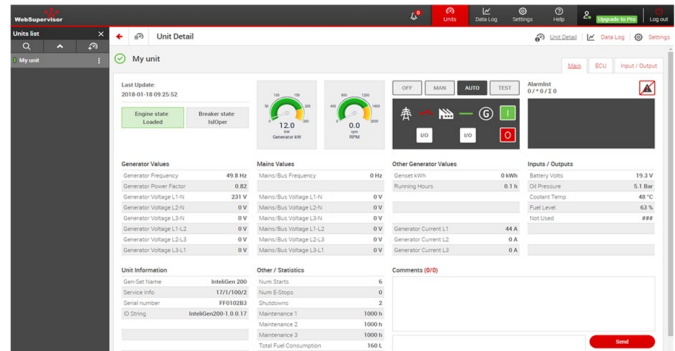


### 2.7.2 WebSupervisor

Cloud-based system designed for monitoring and management of ComAp and 3rd party devices via the internet. See more in the [WebSupervisor Global Guide](#).

**This tool provides the following functions:**

- Site and fleet monitoring
- Reading of measured values
- Browsing of controller history records
- On-line notification of alarms
- Email notification
- Also available as a smart-phone application



WebSupervisor available at: [www.websupervisor.net](http://www.websupervisor.net)

Demo account:

- Login: comaptest
- Password: ComAp123

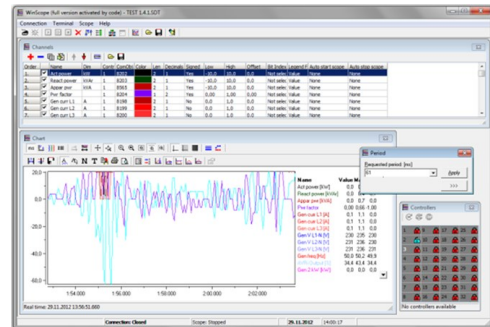


## 2.7.3 WinScope 1000

Special graphical controller monitoring software used mainly for commissioning and System troubleshooting. See more in the [WinScope 1000 Global Guide](#).

**This tool provides the following functions:**

- Monitoring and archiving of ComAp controller's parameters and values
- View of actual/historic trends in the controller
- On-line change of controller's parameters for easy regulator setup

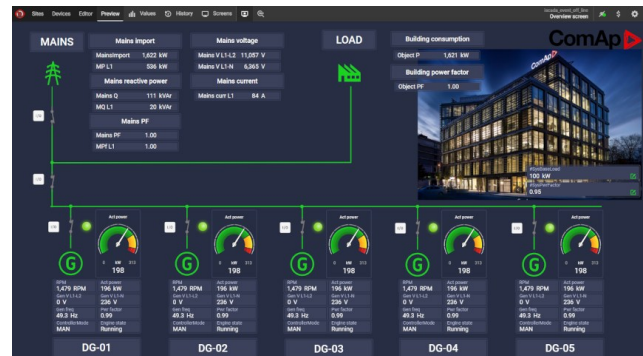


## 2.7.4 IntelISCADA

IntelISCADA is a Windows based software for monitoring of multiple controllers. See more in the [IntelISCADA Global Guide](#).

**This tool provides the following functions:**

- Basic (auto-generated) SCADA in a few minutes
- Broad range of instruments with easy and fast configuration
- Fully customizable SCADA diagram
- Browsing of all measured and computed values
- Browsing of controllers' history records



## 2.8 Displays

Remote Displays / Panel PC Displays

## 2.8.1 IntelliVision 5.2

Remote colour display for ComAp controllers, designed as an easy-to-use Plug & Play display for monitoring and control of single gen-set in various applications. See more in the [IntelliVision 5.2 Global Guide](#).

**This Display unit provides the following functions:**

- 5" colour screen with a resolution of 800 × 480 pixels
- Plug & Play operation (auto configuration based on the controller application)
- Easy screen customization using Screen Editor in IntelliConfig)
- 5 configurable user buttons under the screen
- Multi-language support
- Trends monitoring screen (up to 4 channels)
- Communication with controller via Ethernet
- Front face protection compliant with IP65



## 2.8.2 IntelliVision 10Touch

Panel PC Display equipped with a projective capacitive touch display. See more in the [IntelliVision 10Touch Global Guide](#).

**This Panel PC Display provides the following functions:**

- 10.1" touch screen with a resolution 1280 x 800 pixels
- ComAp PC tools pre-installed
- Direct monitoring (and control) of 3rd party devices via Modbus (using IntelliFieldbus Gateway)
- Possibility to remotely connect to the display using for example Remote Desktop
- 2 Ethernet ports
- Support of IP camera
- Front face protection compliant with IP66

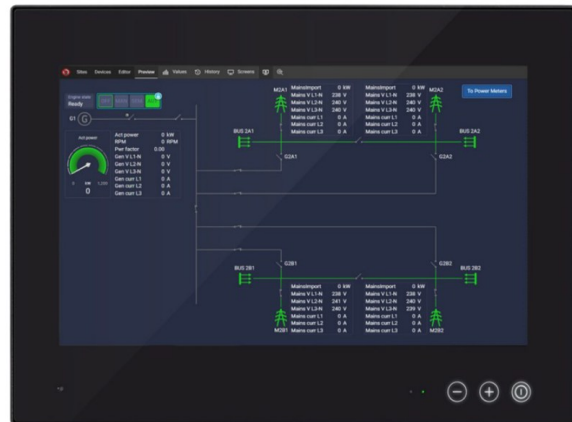


## 2.8.3 IntelliVision 13Touch

Marine certified Panel PC Display with multi-controller support and buttons for brightness change on its front face. See more in the [IntelliVision 13Touch Global Guide](#).

**This Panel PC Display provides the following functions:**

- 13.3" touch screen with a resolution 1920 × 1080 pixels
- ComAp PC tools pre-installed
- Multi-controller support for up to 4 controllers
- Buttons for brightness change on front face
- Possibility to remotely connect to the display using for example Remote Desktop
- 2 Ethernet ports
- Front face protection compliant with IP66



## 2.8.4 IntelliVision 18Touch G1/G2

Panel PC Display perfectly suitable for the most complex applications and also the simple ones. With IntelliVision 18Touch you can easily monitor and control sites consisting of many controllers, or you can use it for your CHP or Hybrid application. See more in the [IntelliVision 18Touch Global Guide G1](#) / [IntelliVision 18Touch Global Guide G2](#).

**This Panel PC Display unit provides the following functions:**

- 18,5" touch screen with a resolution 1366 × 768 pixels
- ComAp PC tools preinstalled
- Display for monitoring and control of the entire site
- History logs of all controllers
- Multi-controller support for up to 32 controllers
- Onscreen keyboard
- Possibility to remotely connect to the display using for example Remote Desktop
- 2 Ethernet ports
- Front face protection compliant with IP66



## 2.9 CAN Extension Modules

### 2.9.1 IntelI AIN8

The module allows users to expand the amount of analog inputs for sensors and add Impulse/RPM input that can be attached to a controller. Up to 8 configurable inputs (sensors) can be attached to the module. See more information on web page [IntelI AIN8](#).

#### Supported sensors:

- > Resistor 3-wire input
  - >> Common resistor: 0-250Ω, 0-2400Ω, 0-10kΩ
  - >> Temperature sensor: Pt100, Pt1000, Ni100, Ni1000
- > Current (active or passive sensors)
  - >> ±20mA , 0-20mA, 4-20mA
- > Voltage
  - >> ±1V, 0-2,4V, 0-5V, 0-10V
  - >> Lambda probes
  - >> Thermocouples are not supported (the measuring loop was designed for lambda probes, what caused non-support of thermocouples)

#### Impulse/RPM sensor:

- > RPM measuring pulses with frequency 4Hz – 10kHz
- > Impulse
  - >> Possibility to measure pulses from electrometer, flowmeter, etc.



**IMPORTANT: Impulse input is not supported by the controller.**

🔍 back to CAN Extension Modules

## 2.9.2 IntelI IO8/8

The module to expand the amount of binary inputs and outputs for ComAp controllers. It is possible to configure the unit to have 8 binary inputs, 8 binary outputs, and 2 analog outputs, or 16 binary inputs, 0 binary outputs and 2 analog outputs via switches inside the controller. See more information on web page [IntelI IO8/8](#).

### Configuration 8/8

- 8 Binary inputs (options: pull up or pull down logic)
- 8 Binary outputs (options: Low side switch (LSS) or High side switch (HSS))
- 2 Analog outputs (options: voltage (0-10V), current (0-20mA) and PWM (5V, adjustable frequency 200Hz-2,4kHz))

### Configuration 16/0

- 16 Binary inputs (options: pull up or pull down logic)
- 0 Binary outputs
- 2 Analog outputs (options: voltage (0-10V), current (0-20mA) and PWM (5V, adjustable frequency 200Hz-2,4kHz))

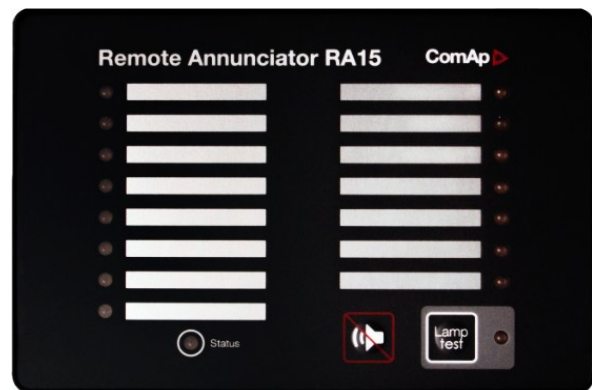
🔍 back to CAN Extension Modules



## 2.9.3 IGL-RA15

Remote annunciator. See more information on web page [IGL-RA15](#).

- 15 programmable LEDs with configurable colors red-green-yellow
- Lamp test function with status LED
- Customizable labels
- Local horn output
- Maximal distance 200 m from the controller
- Up to 4 units can be connected to the controller
- UL certified



**IMPORTANT:** This module is not compatible with different than 250 kbps communication speed. If the ECU module with 125 kbps communication speed is connected the whole system will automatically switch to the 125 kbps, and IGL-RA15 module will stop communicating.

🔍 back to CAN Extension Modules

## 2.9.4 IGS-PTM

The module expands the amount of binary/analog inputs and outputs for ComAp controllers. It is possible to configure the unit to have 8 binary inputs, 8 binary outputs, 4 analog inputs and 1 analog output. See more information on web page [IGS-PTM](#).

- > Configurable 8 binary and 4 analog inputs
- > Configurable 8 binary and 1 analog output
- > LEDs indicate the state of binary inputs/outputs
- > Measures values from Pt100 and Ni100 sensors
- > Analog inputs (resistance range 0-250 Ohms, voltage range 0-100mV, current range 0-20mA - selectable via jumper)
- > UL certified



🔍 back to CAN Extension Modules

## 2.9.5 IntelI AIO9/1

The module is suitable for measurement and control of analog inputs and output through CAN interface. It is possible to configure the unit to have 9 analog inputs and 1 analog output. See more information on web page [IntelI AIO9/1](#).

- > 4x differential voltage inputs for measurement in range of  $\pm 65$  V DC
- > 4x shielded, galvanic separated sensors: thermocouples J,K,L,  $\pm 75$  mV inputs
- > Resistance analog input (sensors: 0-2400 $\Omega$ , PT1000 or NI1000)
- > Analog output with options : 0-20mA, 0-10V or PWMt



🔍 back to CAN Extension Modules



## 2.9.6 IntelI AIN8TC

The module allows customers to configure up to 8 analog input channels for measuring temperature by thermocouples. The IntelI AIN8TC is useful in situations where extremely accurate temperature readings is required. See more information on web page [IntelI AIN8TC](#).

### Supported sensors:

- J, K or L thermocouples
- Thermocouples with and without cold junction compensation are supported



⬅ back to CAN Extension Modules

## 2.9.7 I-AOUT8

The module allows customers to configure up to 8 analog outputs. AGND terminals are on the same potential. See more information on web page [I-AOUT8](#).

Each analog output can be switched to

- 0 to 10 V DC
- 0/4 to 20 mA DC
- 1,2 kHz PWM (Pulse With Modulation)



⬅ back to CAN Extension Modules

## 2.9.8 IS-AIN8

The module is equipped with 8 analog inputs. This module is compatible with MTU ECU-7 at communication speed 125 kbps when uploaded with firmware 1.2.0 and higher. See more information on web page [IS-AIN8](#).

- Precision of inputs is 1%
- 2/3 wire resistive, current, voltage sensors
- Predefined sensors (Pt100, Pt1000, Ni100, Ni1000, thermocouple type J/K/L)
- Current and voltage inputs 0-20mA and 0-10V



⬅ back to CAN Extension Modules

## 2.9.9 IS-AIN8TC

The module is equipped with 8 analog inputs dedicated for thermocouple sensors only. See more information on web page [Inteli AIN8TC](#).

- J, K or L thermocouples
- Thermocouples with and without cold junction compensation are supported



⬅ back to CAN Extension Modules

## 2.9.10 IS-BIN16/8

The module allows users to expand the amount of binary inputs and outputs, and add 2 impulse inputs. It is possible to configure the unit to have 16 binary inputs (galvanic separated) and 8 binary outputs (galvanic separated), 2 pulse inputs (frequency measurement or pulse counting). See more information on web page [IS-BIN16/8](#).

To operate external modules:

- Configurable 16 galvanically separated inputs
- Configurable 8 outputs
- 2 pulse inputs (frequency measurement or pulse counting)
- LEDs indicate the state of binary inputs and outputs



**Note:** CAN address 0 disables corresponding CAN message (Group data are not send).



**IMPORTANT:** Impulse inputs are not supported by the controller.

🔍 back to CAN Extension Modules

## 2.10 CAN Communication Modules

### 2.10.1 IntelIGateway 300

IFG is communication gateway with configurable interfaces between Modbus TCP/RTU, ComAp CAN, WebSupervisor and IntelScada protocols allowing user-defined interconnection of all attached devices. See more information on web page [IntelIGateway](#).

- Bidirectional connectivity of 3rd party Modbus devices to ComAp controllers
- Data buffering capability for avoiding loss of data during connectivity outage
- Inbuilt support of energy industry Modbus controlled devices such as Inverters, BESS, from leading manufacturers
- Support for customizable user templates for any additional Modbus devices that are not inbuilt
- Dual ethernet interfaces decoupling trusted (private) and untrusted (public) network segments for enhanced cyber security
- Terminals: 2x Ethernet, 2x RS485, 3x CAN, 1x USB



🔍 back to CAN Extension Modules

### 2.10.2 I-CR

If the distance between units is too high to fit into the 200 m limit (or 900 m for 8 controllers), CAN repeater module (I-CR) can be used to extend it. See more information on web page [I-CR](#).

- Intercontroller CAN bus repeater
- **Supported CAN modes: CAN8C and CAN32C**
- CAN bus redundancy
- One or more I-CR modules can be used
- Intercontroller CAN bus bus-tie bridging - makes groups of controllers in CAN segments A and B "invisible" one for another depending on bus-tie breaker state



🔍 back to CAN Extension Modules

## 2.11 Virtual modules

**Note:** The protection for all virtual modules' values is working only if the User protection is set for the specific bit of the virtual module. If the protection is set and communication with virtual module is lost, all bits with user protection will show #####.

**Note:** When communication with any virtual module is lost the behavior of the value is defined according to the setpoint **Fail Safe Binary State** (page 252).

## 2.11.1 Distributed modules

### DIST-IN

DIST-IN virtual modules receives binary and analog values from other controllers via **CAN Intercontroller Communication** (page 120). There are 64 modules, DIST-IN 1 to DIST-IN64, which are firmly connected with **CAN Controller Address** (page 316).

**IMPORTANT:** This means that if you need to receive data from Controller Unit with CAN Controller Address (page 316) = 5, you need to use module DIST-IN 5.

Proper alarm from a range **Wrn DISTIN 01** (page 641) to **Wrn DISTIN 64** (page 656) is activated in case that data are not received from the Controller Unit.

### Binary Inputs

32 binary states are paired by eight to two shared values:

- > Binary inputs 1 1-8 (page 512)
- > Binary inputs 1 9-16 (page 512)
- > Binary inputs 1 17-24 (page 513)
- > Binary inputs 1 25-32 (page 513)

**Note:** Values above are related to virtual module DIST-IN 1. See values for other modules here:

GROUP: DIST-IN 1-32 (PAGE 512)

GROUP: DIST-IN 33-64 (PAGE 519)

**IMPORTANT:** Binary inputs X 9-16 and higher can be shared only if CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD.

### Analog Inputs

Up to 4 analog values are shared:

- > DISTAIN-1 1 (page 514)
- > DISTAIN-1 2 (page 514)
- > DISTAIN-1 3 (page 514)
- > DISTAIN-1 4 (page 515)

**Note:** Values above are related to virtual module DIST-IN 1. See values for other modules here:

GROUP: DIST-IN 1-32 (PAGE 512)

GROUP: DIST-IN 33-64 (PAGE 519)

**IMPORTANT:** Analog values can be shared only if CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD.

**Note:** If the CAN communication is lost, the DIST-IN analog inputs become invalid and the values are shown as '####'.

### Configuration

Configuration of the virtual module itself, binary and analog outputs is done via IntelliConfig. As with other modules, you can choose whether history columns and display screens are added as well as select type of

protection upon module failure.

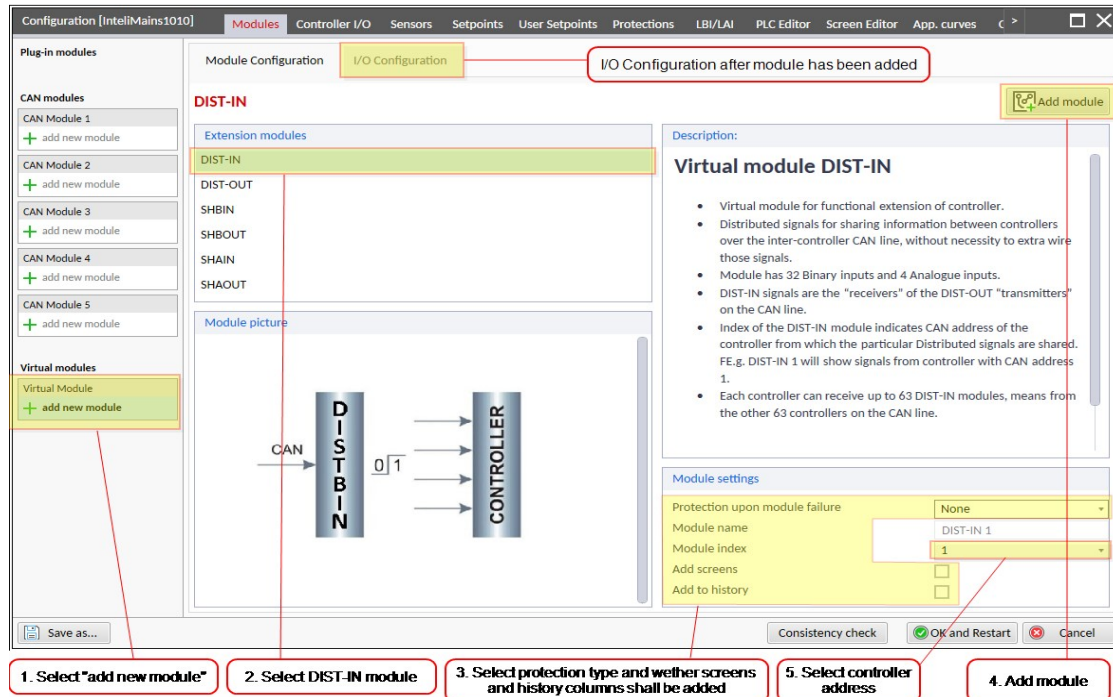


Image 2.2 Configuration of virtual module DIST-IN

## DIST-OUT

This virtual module shares binary and analog values to other controller units via **CAN Intercontroller Communication** (page 120).

In case that there is detected module failure, alarm **Wrn DISTOUT** (page 657) is activated.

### Binary Outputs

32 binary states are paired by eight to four shared values:

- Binary outputs 1-8 (page 534)
- Binary outputs 9-16 (page 534)
- Binary outputs 17-24 (page 535)
- Binary outputs 25-32 (page 535)

**IMPORTANT:** Binary outputs 9-16 and higher can be shared only if CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD.

### Analog Outputs

Up to 4 analog values can be shared.

**IMPORTANT:** Analog values can be shared only if CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD.

### Configuration

Configuration of the virtual module itself, binary and analog outputs is done via IntelIConfig. As with other modules, you can choose whether history columns and display screens are added as well as select type of protection upon module failure.

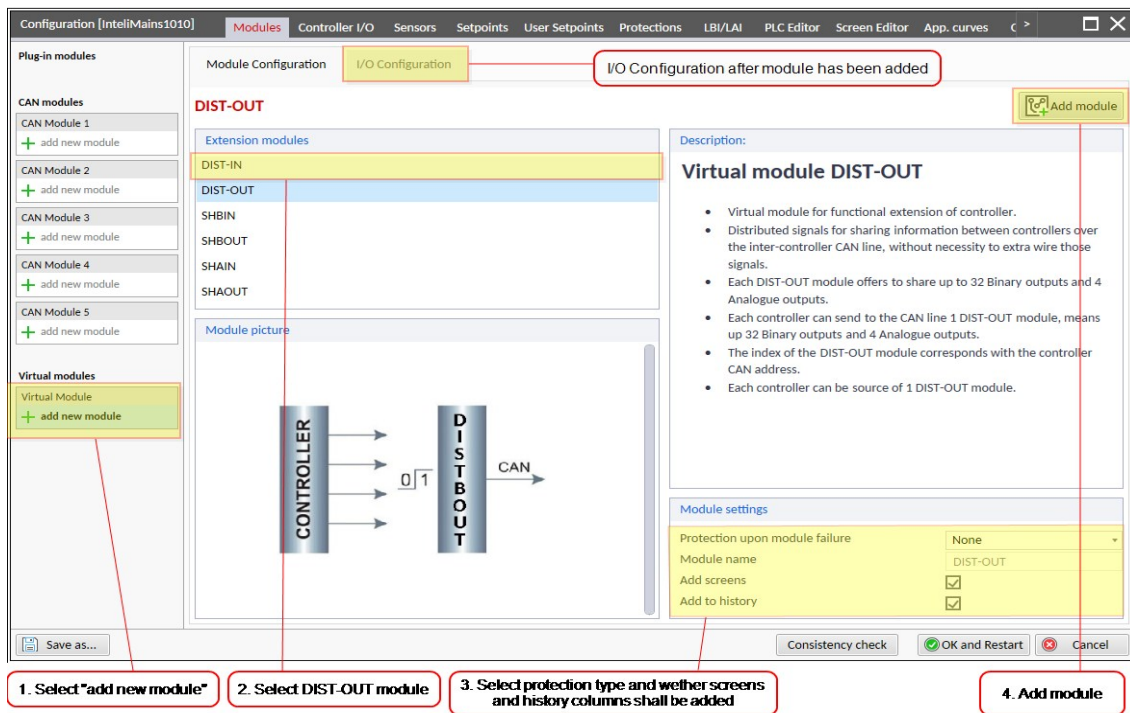


Image 2.3 Configuration of virtual module DIST-OUT

## 2.11.2 Shared modules

Shared modules are not connected with **CAN Controller Address (page 316)**, which means that you need to pay close attention during configuration so that you do not create collision. Each SHBOUT and SHAOUT module index can be used only once in CAN topology.

### Binary shared modules

#### SHBIN

SHBIN virtual modules receives binary values from other controllers via **CAN Intercontroller Communication (page 120)**. There are 6 modules, SHBIN-1 to SHBIN-6, which are firmly connected with SHBOUT-1 to SHBOUT-6.

**IMPORTANT:** This means that you need to use module SHBIN-1 if you wish to receive data from SHBOUT-1.

An alarm **Wrn SHBIN Collision (page 668)** - is activated in case that more than just one controller has configured SHBOUT module with same module index in CAN topology.

**IMPORTANT:** Shared modules work only if CAN Intercontroller Comm Mode (page 320) = 8C or 16C or 32C.

Proper alarm from a range **Wrn SHBIN 1 (page 667)** to **Wrn SHBIN 6 (page 668)** is activated in case that data are not received.

### Binary Inputs

#### > SHBIN-1 (page 526)

**Note:** Value above is related to virtual module SHBIN-1. See values for other modules here: **Group: SH Modules (page 526)**

## Configuration

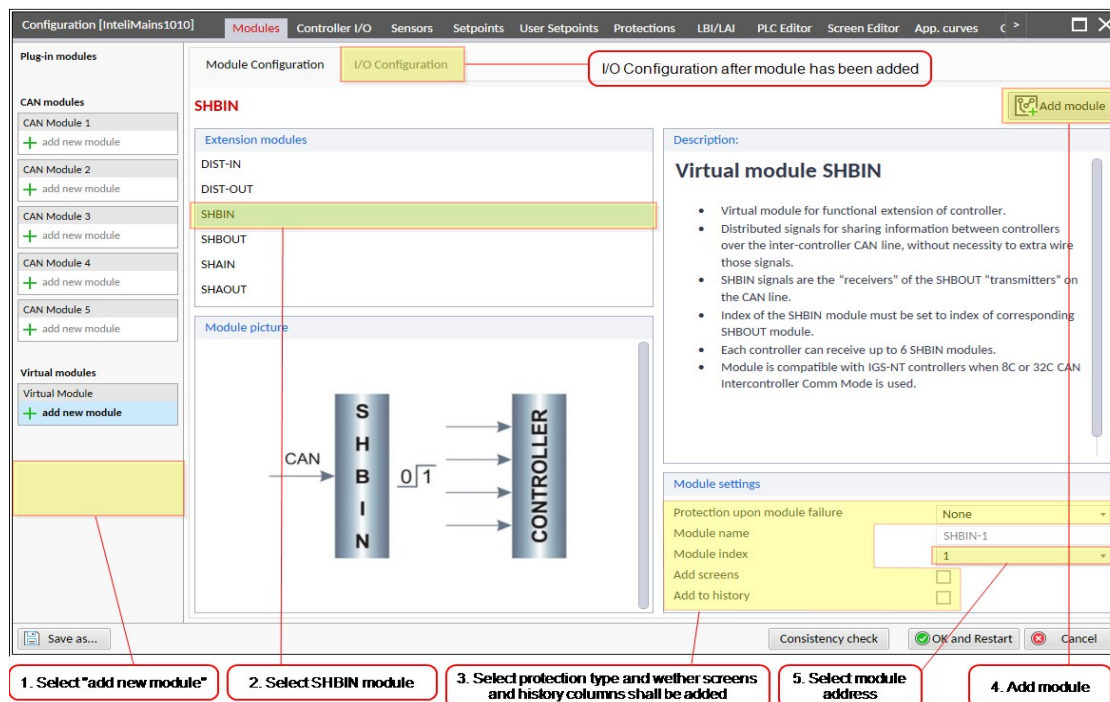


Image 2.4 Configuration of shared module SHBIN

## SHBOUT

SHBOUT virtual modules share binary values to other controllers via **CAN Intercontroller Communication** (page 120). There are 6 modules, SHBOUT-1 to SHBOUT-6, which are firmly connected with SHBIN-1 to SHBIN-6.

**IMPORTANT:** This means that you need to use module SHBOUT-1 if you wish to send data to SHBIN-1.

**IMPORTANT:** Shared modules work only if CAN Intercontroller Comm Mode (page 320) = 8C or 16C or 32C.

### Binary Outputs

➤ SHBOUT-1 (page 529)

**Note:** Value above is related to virtual module SHBIN-1. See values for other modules here: **Group: SH Modules** (page 526)



## Configuration

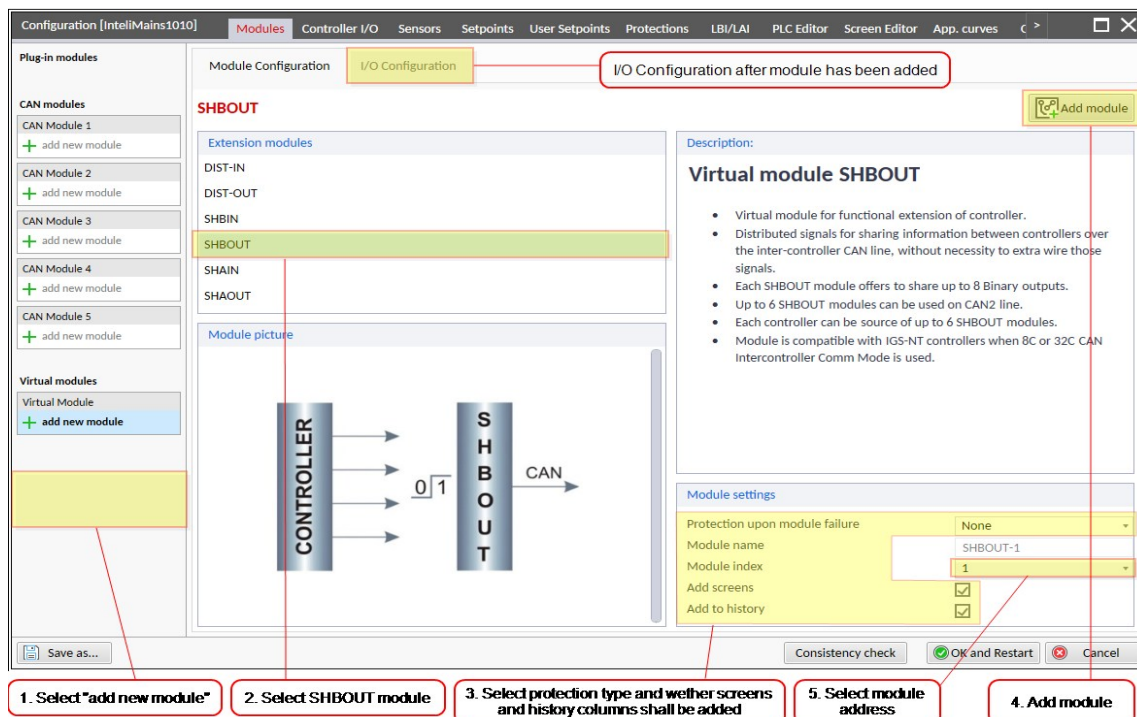


Image 2.5 Configuration of shared module SHBOUT

## Analog shared modules

### SHAIN

SHAIN virtual modules receives analog values from other controllers via **CAN Intercontroller Communication** (page 120). There are 2 modules, SHAIN-1 and SHAIN-2, which are firmly connected with SHAOUT-1 and SHAOUT-2.

**IMPORTANT:** This means that you need to use module **SHAIN-1** if you wish to receive data from **SHAOUT-1**.

An alarm **Wrn SHAIN Collision** (page 666) is activated in case that more than just one controller has configured SHAOUT module with same module index in CAN topology.

**IMPORTANT:** Shared modules work only if **CAN Intercontroller Comm Mode** (page 320) = **8C** or **16C** or **32C**.

Proper alarm from a range **Wrn SHAIN 1** (page 666) to **Wrn SHAIN 2** (page 666) is activated in case that data are not received.

### Analog Inputs

- > SHAIN-1 1 (page 532)
- > SHAIN-1 2 (page 532)
- > SHAIN-1 3 (page 532)
- > SHAIN-1 4 (page 532)

**Note:** Value above is related to virtual module SHAIN-1. See values for other modules here: **Group: SH Modules** (page 526)

## Configuration

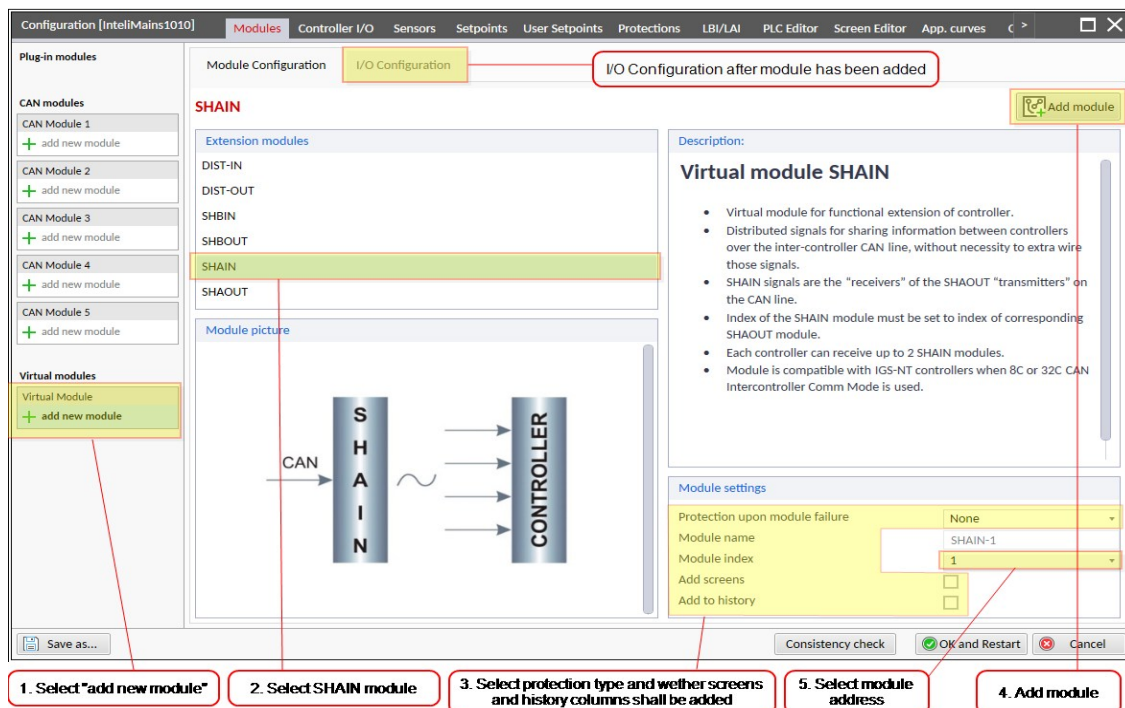


Image 2.6 Configuration of shared module SHAIN

## SHAOUT

SHAOUT virtual modules share analog values to other controllers via **CAN Intercontroller Communication** (page 120). There are 2 modules, SHAOUT-1 and SHAOUT-2, which are firmly connected with SHAIN-1 and SHAIN-2.

**IMPORTANT:** This means that you need to use module SHAOUT-1 if you wish to send data to SHAIN-1.

**IMPORTANT:** Shared modules work only if CAN Intercontroller Comm Mode (page 320) = 8C or 16C or 32C.

# Configuration

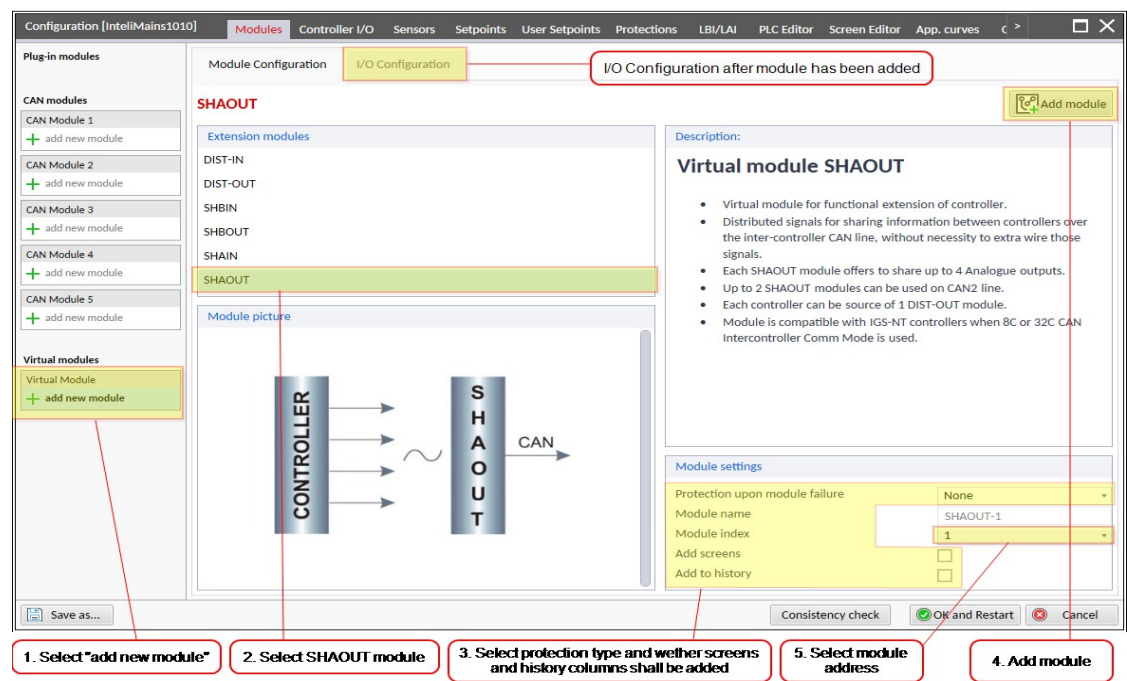


Image 2.7 Configuration of shared module SHAOUT

🔍 back to System overview

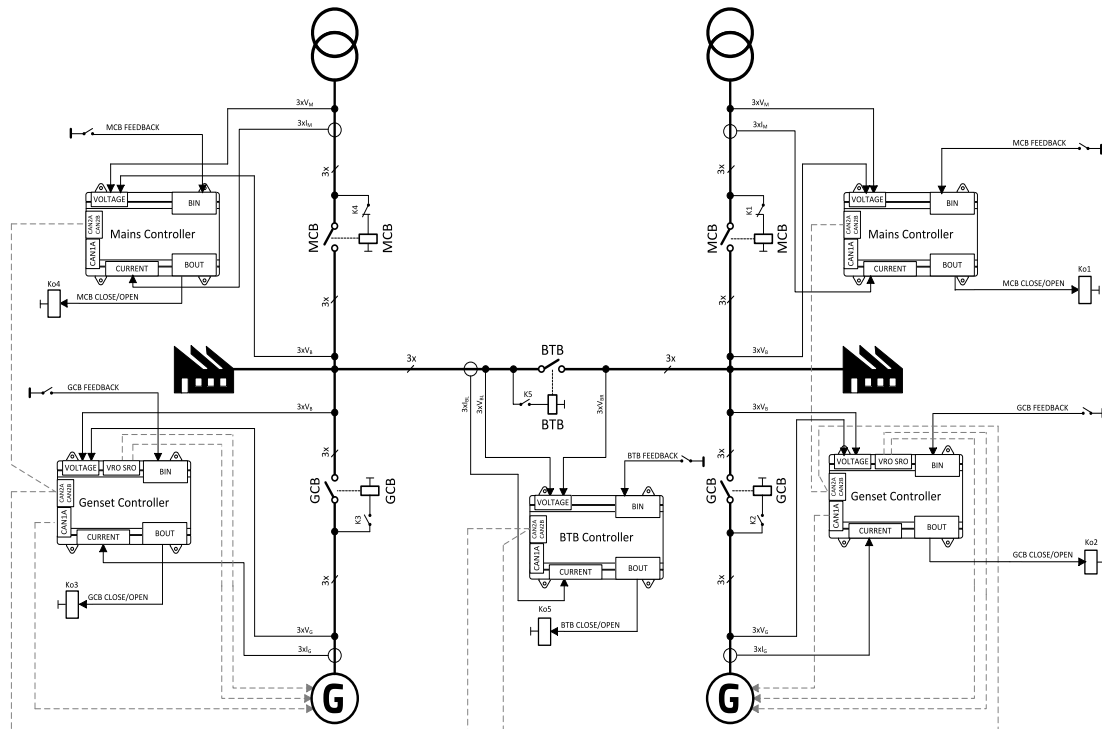


# 3 Applications overview

## 3.1 BTB ..... 37

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### 3.1 BTB



IntelIMains 1010 BTB SC directly controls only the BTB. Frequency and voltage on the left or right side of the bus is controlled via load sharing and var sharing outputs using **CAN2A (page 17)** and/or **CAN2B (page 17)** communication. The BTB cannot control the side with already connected Mains to it.

BTB can be closed in **Controller Mode (page 435) = RUN** if

- **BTB DISABLE (PAGE 538)** is NOT active and
- **BUS LEFT HEALTHY (PAGE 562)** and **BUS RIGHT HEALTHY (PAGE 562)** are both active while **Dead Bus Closing (page 270) = Disabled** or
- **BUS LEFT HEALTHY (PAGE 562)** is active and **Dead Bus Closing (page 270) = Both or Left To Right** or
- **BUS RIGHT HEALTHY (PAGE 562)** is active and **Dead Bus Closing (page 270) = Both or Right To Left**

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# 4 Installation and wiring

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4.6 Maintenance .....	77

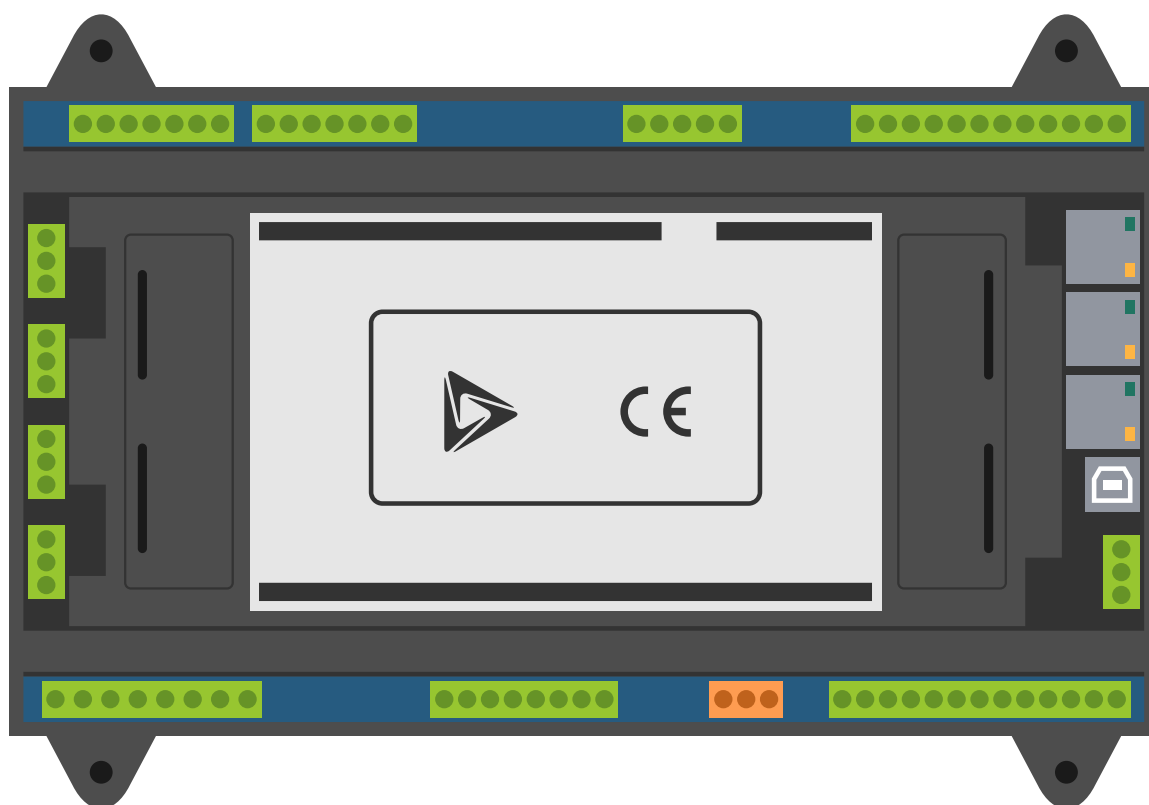
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## 4.1 Package content

The package contains:

- > Controller IntelliMains1010 BTB SC
- > Terminal blocks

**Note:** The package does not contain a communication or extension modules. The required modules should be ordered separately.



## 4.2 Controller installation

### 4.2.1 Dimensions

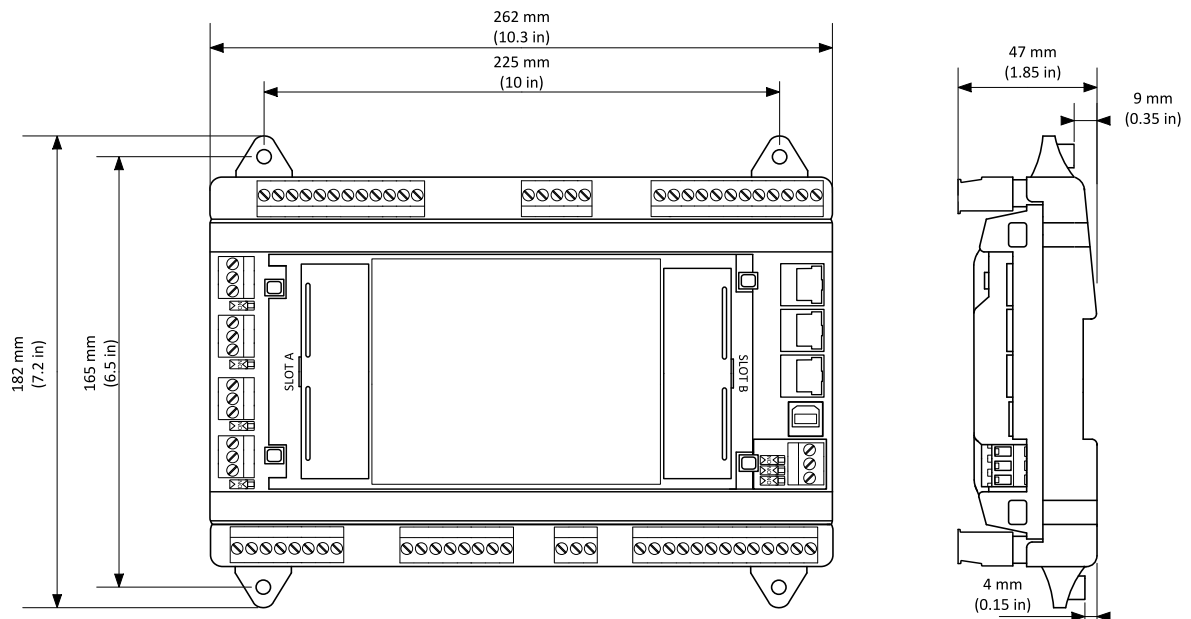


Image 4.1 Controller dimensions

**Note:** Dimensions are in millimeters.

**Note:** The controller is mounted into panel doors as a standalone unit using provided holders. The requested cutout size is 187 × 132 mm. Use the screw holders delivered with the controller to fix the controller into the door.

### 4.2.2 Mounting

The controller unit should be mounted onto the backside of the switchboard door and after the installation it should be inaccessible for nonauthorized people. There are two ways how to mount the CU.

## Mounting on DIN rail

Mount the controller on the DIN rail as described on the picture below.

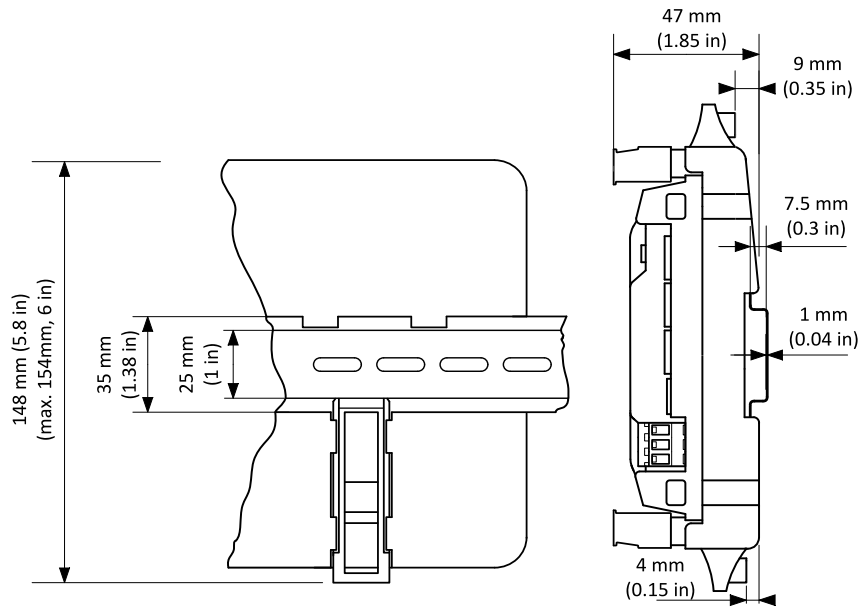


Image 4.2 Controller mounting on DIN rail

## Mounting in switchboard doors

The upper part of the back side of the controller cover is not same as the lower part, the spacers have to be placed between switchboard doors and the controller cover. Use the 10 mm spacers for the upper part of the CU cover and the 5 mm spacers for the lower part of the CU cover. Use the screws and spacers to fix the controller into the door as described on the picture below.

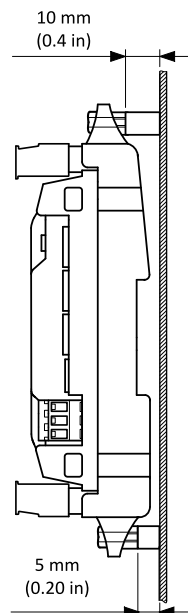
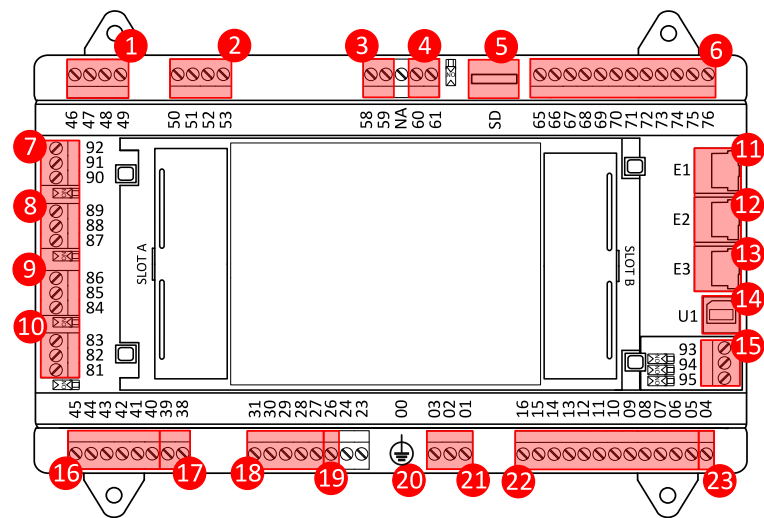


Image 4.3 Controller mounting in the switchboard doors

# 4.3 Terminal Diagram

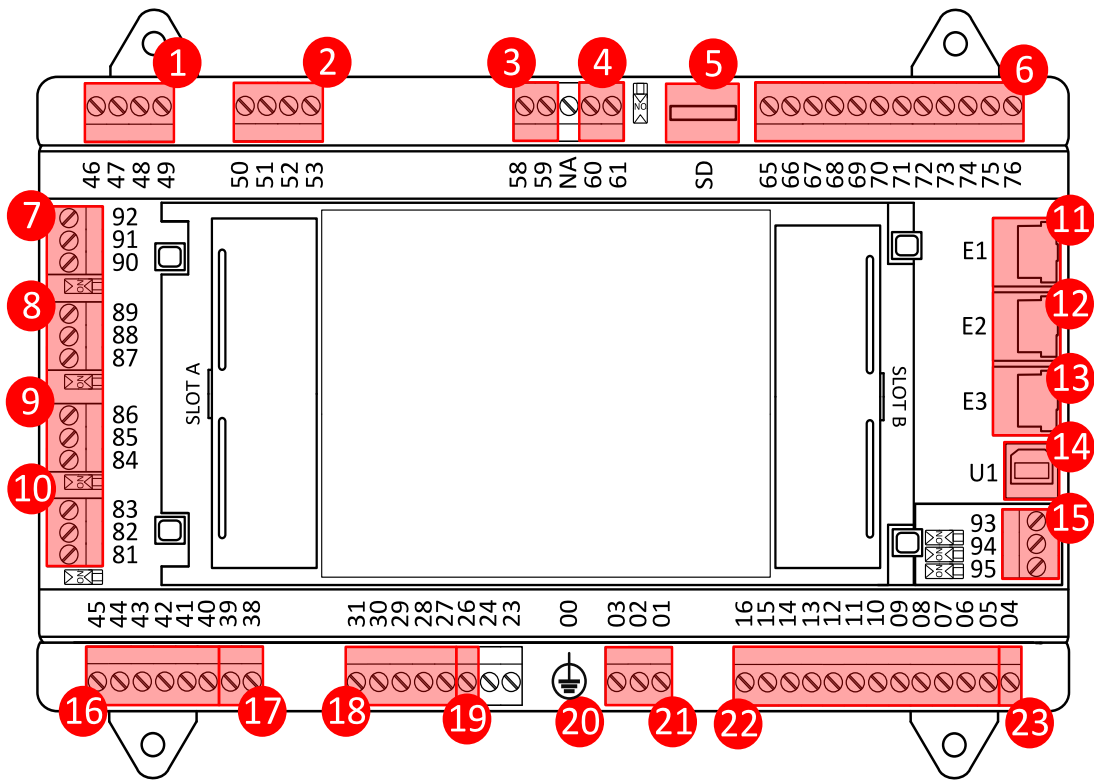
① <b>MAINS (BUS-L) VOLTAGE</b>	46	N	⑥ <b>BINARY INPUTS</b>	65	BI1	⑧ <b>CAN2A</b>	89	H
	47	L1		66	BI2		88	COM
	48	L2		67	BI3		87	L
	49	L3		68	BI4	⑨ <b>CAN1B</b>	86	H
② <b>BUS (BUS-R) VOLTAGE</b>	50	N		69	BI5		85	COM
	51	L1		70	BI6		84	L
	52	L2		71	BI7	⑩ <b>CAN1A</b>	83	H
	53	L3		72	BI8		82	COM
③ ④ <b>ANALOG OUTPUTS</b>	58	AO1 COM		73	BI9		81	L
	59	AO1 OUT		74	BI10	⑪ ⑫ ⑬ <b>ETHERNET</b>	E1	Ethernet 1
	60	AO2 COM		75	BI11		E2	Ethernet 2
	61	AO2 OUT		76	BI12		E3	Ethernet 3
⑤ <b>SD Card</b>	SD	SD Card	⑦ <b>CAN2B</b>	92	H	⑭ <b>USB</b>	U1	USB
				91	COM			
				90	L			



⑮ RS 485	93	B	⑮ ANALOG INPUTS	31	AI4	⑳ BINARY OUTPUTS	16	BO12
	94	COM		30	AI3		15	BO11
	95	A		29	AI2		14	BO10
⑯ MAINS (BUS-L) CURRENT	45	L1k		28	AI1		13	BO9
	44	L1l		27	ACOM		12	BO8
	43	L2k	⑰ +5V SENSOR	26	+5V SENSOR		11	BO7
	42	L2l					10	BO6
	41	L3k	⑱ GROUNDING	00	GROUND		09	BO5
40	L3l	08					BO4	
⑰ AUX CURRENT	39	LAk					㉑ POWER SUPPLY	03
	38	LAI	02	D+	06			BO2
			01	-	㉒ E-STOP			05
						04		E-STOP

# 4.4 Recommended wiring

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<b>1</b>	Mains (Bus-L) voltage inputs	max 600 V AC Ph-Ph	<b>Voltage measurement wiring (page 51)</b>
<b>2</b>	Bus (Bus-R) voltage inputs	max 600 V AC Ph-Ph	<b>Voltage measurement wiring (page 51)</b>
<b>3</b>	Analog output	max $\pm 10$ V DC	<b>Analog Outputs (page 65)</b>
<b>4</b>	Analog output	max $\pm 10$ V DC	<b>Analog Outputs (page 65)</b>



5	SD card slot		
6	Binary inputs	max 36 V DC	<b>Binary Inputs (page 59)</b>
7	CAN2B	H, COM, L	<b>CAN bus and RS485 wiring (page 66)</b>
8	CAN2A	H, COM, L	<b>CAN bus and RS485 wiring (page 66)</b>
9	CAN1B	H, COM, L	<b>CAN bus and RS485 wiring (page 66)</b>
10	CAN1A	H, COM, L	<b>CAN bus and RS485 wiring (page 66)</b>
11	Ethernet 1	ETH 1	<b>Ethernet (page 70)</b>
12	Ethernet 2	ETH 2	<b>Ethernet (page 70)</b>
13	Ethernet 3	ETH 3	<b>Ethernet (page 70)</b>
14	USB		<b>USB (page 69)</b>
15	RS485	A, COM, B	<b>CAN bus and RS485 wiring (page 66)</b>
16	Mains (Bus-L) Current	max 5 A AC	<b>Current measurement wiring (page 47)</b>
17	Aux current	max 5 A AC	<b>Current measurement wiring (page 47)</b>
18	Analog inputs	max 10 V DC	<b>Analog Inputs (page 61)</b>
19	Sensor power supply	5 V DC max 100 mA	
20	Grounding		Improves resistance to electrical interference if connected to the ground.
21	Power supply	+, N/A, - 8 - 36 V DC max 7,5 A	<b>Power supply (page 46)</b>
22	Binary outputs	max 36 V; 0,5 A	<b>Binary Outputs (page 60)</b>
23	E-stop	max 1 A	<b>E-Stop (page 61)</b>

## 4.4.1 General

To ensure proper function:

- Use grounding terminals.
- Wiring for binary inputs and analog inputs must not be run with power cables.
- Analog and binary inputs should use shielded cables, especially when the length is more than 3 m.

### Tightening torque and allowable wire size and type for the Field-Wiring Terminals:

For Bus (Bus Right) Voltage and Mains (Bus Left) Voltage terminals



Specified tightening torque is 0.5 Nm (4.425 In-lbs).

Use only diameter 2.0 - 0.5 mm (12 - 26 AWG) copper conductor rated for 90 °C minimum.

For Current terminals



Specified tightening torque is 0.5 Nm (4.425 In-lbs).

Use only diameter 2.0 - 0.5 mm (12 - 26 AWG) copper conductor rated for 90 °C minimum.

For other controller field wiring terminals



Specified tightening torque is 0.5 Nm (4.425 In-lbs).

Use only diameter 2.0 - 0.5 mm (12 - 26 AWG) copper conductor rated for 75 °C minimum.

## 4.4.2 Grounding

The shortest possible length of wire should be used for controller grounding. Use cable min 2.5 mm<sup>2</sup>.

The negative " - " battery terminal used as power supply for CU must be properly grounded.

Switchboard must be grounded at common point. Use as short cable as possible to the grounding point.

### 4.4.3 Power supply

To ensure proper function:

- Use power supply cable min. 1.5 mm<sup>2</sup>
- Maximum continuous DC power supply voltage is 36 V DC
- Minimum continuous DC power supply voltage is 8 V DC
- It is strongly recommended to use 8 A fusing (12xBOUT 0.5 A)

The controller's power supply terminals are protected against large pulse power disturbances. When there is a potential risk of the controller being subjected to conditions outside its capabilities, an outside protection device should be used.

**Note:** The controller should be grounded properly in order to protect against lighting strikes. The maximum allowable current through the controller's negative terminal is 4 A (without consumption of the binary outputs).

The controller includes internal capacitors that allows the controller to continue in operation if the voltage dip occurs. The capacitors are useful mainly during short cranking voltage dips for the connections with 12 V battery power supply. If the voltage dip goes during cranking to 0 V and after 50 ms it recovers to 8 V, the controller continues operating. When this situation occurs the binary outputs are temporarily switched off and after recovering to 8 V back on. This cycle can be repeated several times.

**Note:** It is also possible to further support the controller by connecting the external capacitor and separating diode. The capacitor size depends on required time. It shall be approximately thousands of  $\mu\text{F}$ . The capacitor size should be 5 000  $\mu\text{F}$  to withstand 150 ms voltage dip under following conditions: Voltage before dip is 12 V, after 150 ms the voltage recovers to min. allowed voltage, i.e. 8 V.

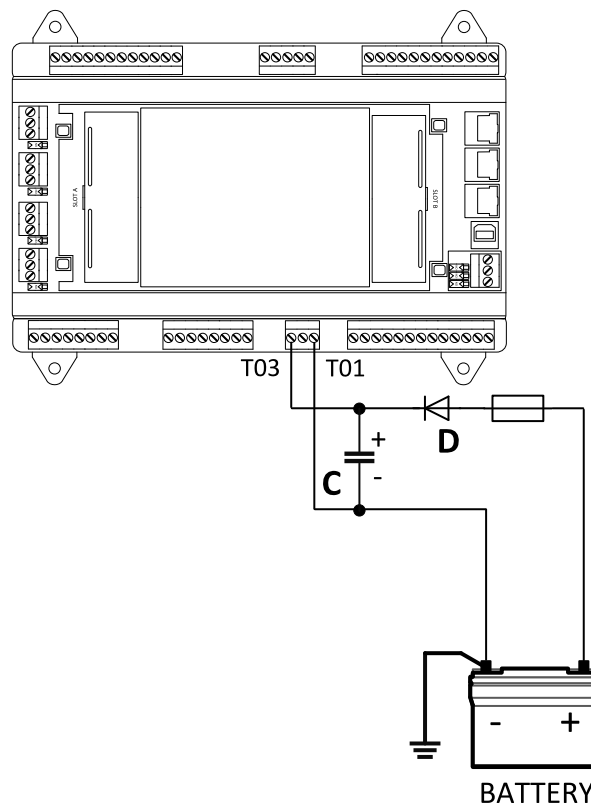


Image 4.4 Controllers power supply with external capacitor, separating diode and fusing

**IMPORTANT:** It is strongly recommended to use fusing in-line with the battery positive terminal to the controller and modules.

**Note:** Suitable conductor protection shall be provided in accordance with NFPA 70, Article 240.

**Note:** Low voltage circuits (35 volts or less) shall be supplied from the engine starting battery or an isolated secondary circuit.

## Power supply fusing

It is strongly recommended to use 8 A fuse in-line with the battery positive terminal to the controller and modules. These electronics should never be connected directly to the starting battery. Fuse value and type depends on number of connected devices and wire length. It is recommended to use slow blow fuse T8 A. The fast blow fuse is inappropriate due to internal capacitors charging during power up.

**IMPORTANT:** 8 A fuse is calculated without BOUT consumption nor extension modules. Real value of fuse depends on consumption of binary outputs and modules.

**Example:** Maximal consumption of binary outputs can be 22 A

- > 2 x 10 A on high current outputs (for 10 seconds)
- > 2 A on all others binary outputs

## 4.4.4 Measurement wiring

Use 1.5 mm<sup>2</sup> cables for voltage connection and 2.5 mm<sup>2</sup> for current transformers connection. Adjust **Connection type** (page 244), **Bus Left AC Shore Nominal Voltage Ph-N** (page 246), **Bus Left Nominal Voltage Ph-Ph** (page 246), **Bus Right AC Bus Nominal Voltage Ph-N** (page 245), **Bus Right Nominal Voltage Ph-Ph** (page 245) and **Nominal Current** (page 243) by appropriate setpoints in the Basic Settings group.



**IMPORTANT:** Risk of personal injury due to electric shock when manipulating voltage terminals under voltage. Be sure the terminals are not under voltage before touching them.

Do not open the secondary circuit of current transformers when the primary circuit is closed. Open the primary circuit first.

## Current measurement wiring

The number of CT's is automatically selected based on selected value of setpoint **Connection type** (page 244). Current and power measurement is suppressed if current level is below 1 % of CT range.

The auxiliary current measurement (T38, T39) is used for the Bus measurement.

**ConnectionType: 3Ph4Wire / High Leg D / 3Ph3Wire**

**Connection type (page 244) = 3Ph4Wire / High Leg D / 3Ph3Wire**

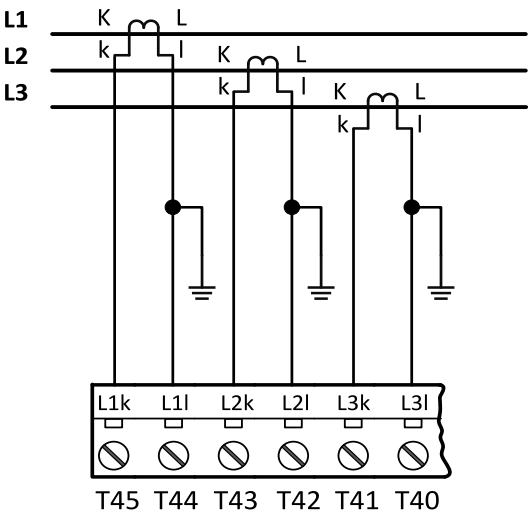


Image 4.5 Bus Left current measurement wiring

**ConnectionType: SplitPhase**

**Connection type (page 244) = SplitPhase**

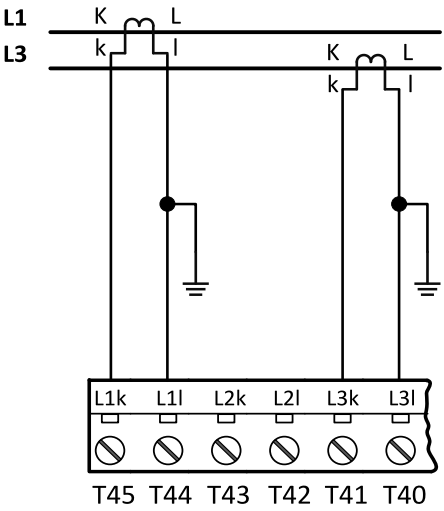


Image 4.6 Bus Left current measurement wiring

## ConnectionType: MonoPhase

Connection type (page 244) = MonoPhase

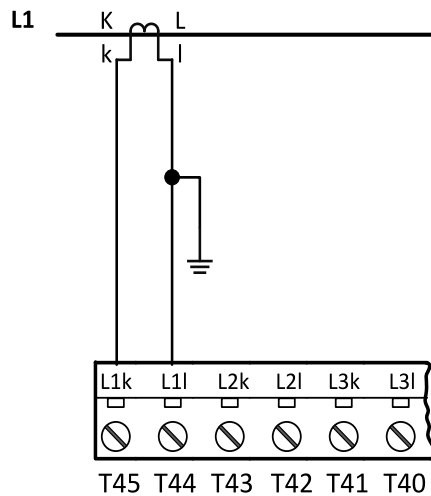


Image 4.7 Bus Left current measurement wiring

## Principle of two transformers measuring for 3 phase connections

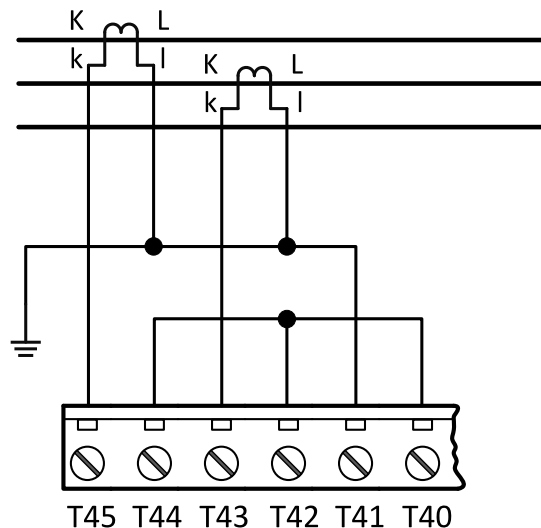


Image 4.8 Principle of two current transformers measuring

**IMPORTANT:** Check measurement connections carefully! Failure is possible if phases are connected in wrong order (WrongPh Sequence detected by the controller) but this is not detected if the phases are just rotated (i.e. instead of phase sequence L1, L2, L3, phase sequence is e.g. L2, L3, L1).

## Ethernet

Ethernet Cat5/Cat6 cable fitted with the RJ45 connector can be connected to the ethernet interface. The ethernet can be used for direct computer connection. See the chapter **Connection via Ethernet (page 211)** for more information.

**Note:** It is necessary to use manual IP address on both PC and controller if there is no device which will provide DHCP.

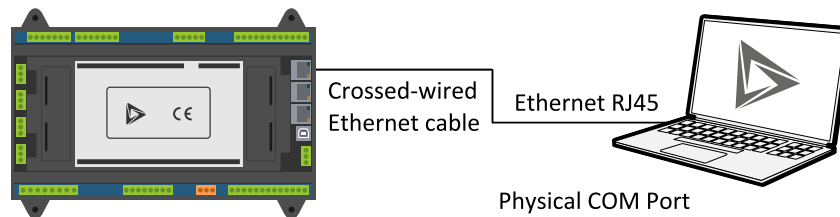


Image 4.9 Ethernet Connection

**IMPORTANT: The IntelIMains1010 BTB SC is using same MAC address for all Ethernet ports so it is not possible to use more than one Ethernet port in the same network. If you connect for example Ethernet 1 and 2 to the same network the communication will breakdown.**

In the image below you can see the topology using all 3 Ethernet ports with one Modbus Client. The ETH1 is used for connection of displays (IV5.2) or it can be also used for remote LAN connection. The ETH2 is used for remote connection using the internet (WAN). The ETH3 is used for Modbus Server and Client which are connected to the LAN with Modbus Devices.

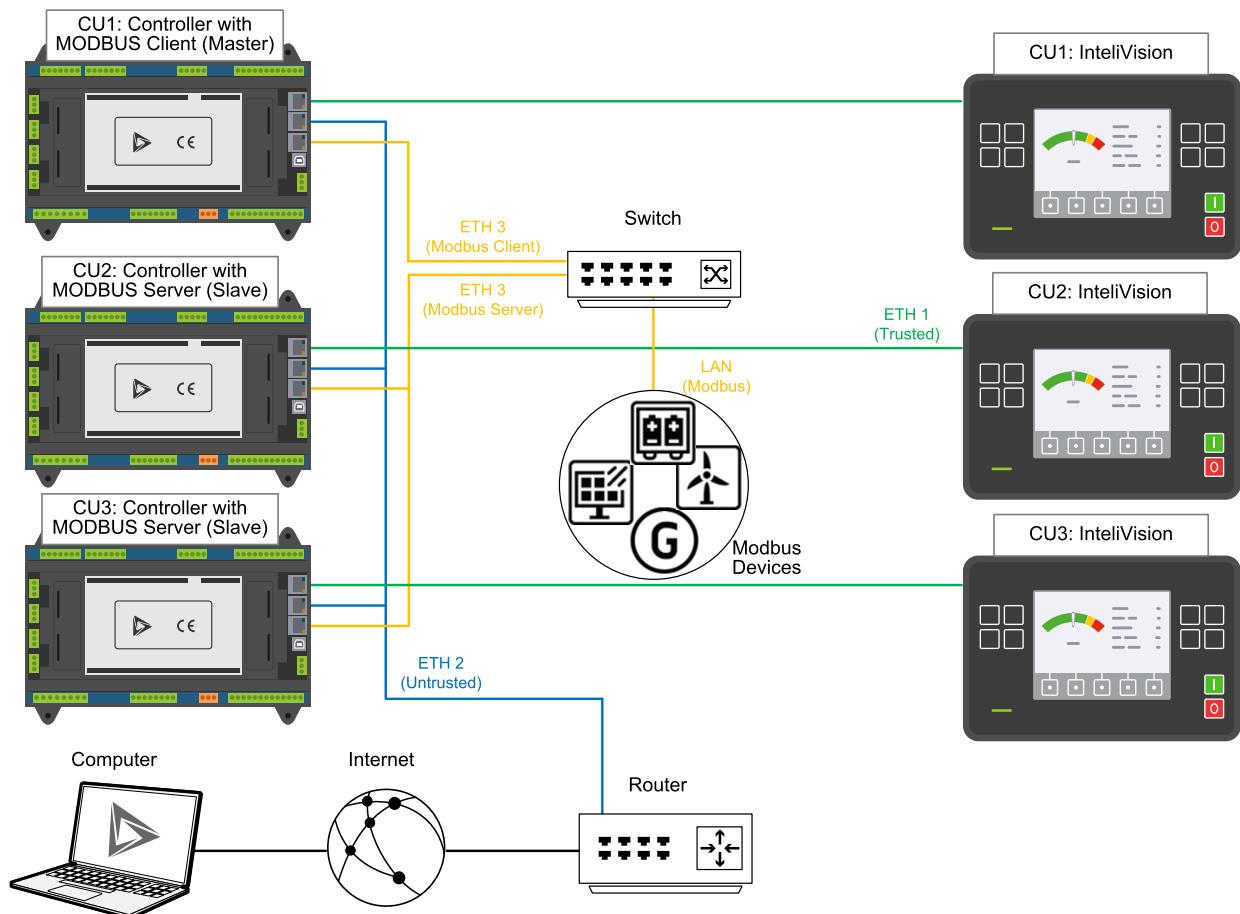


Image 4.10 Advanced Ethernet Topology With One Modbus Client

In the image below you can see the topology using all 3 Ethernet ports with multiple Modbus Clients (CU 1 is the first level client, CU 2 and CU 3 are second level clients). The ETH1 is used for Modbus Server, connection of displays (IV5.2), or it can be also used for remote LAN connection. The ETH2 is used for remote connection using the internet (WAN). The ETH3 is used for Modbus Clients which are connected between CU 1 and other CUs, and between other CUs and Modbus Devices.



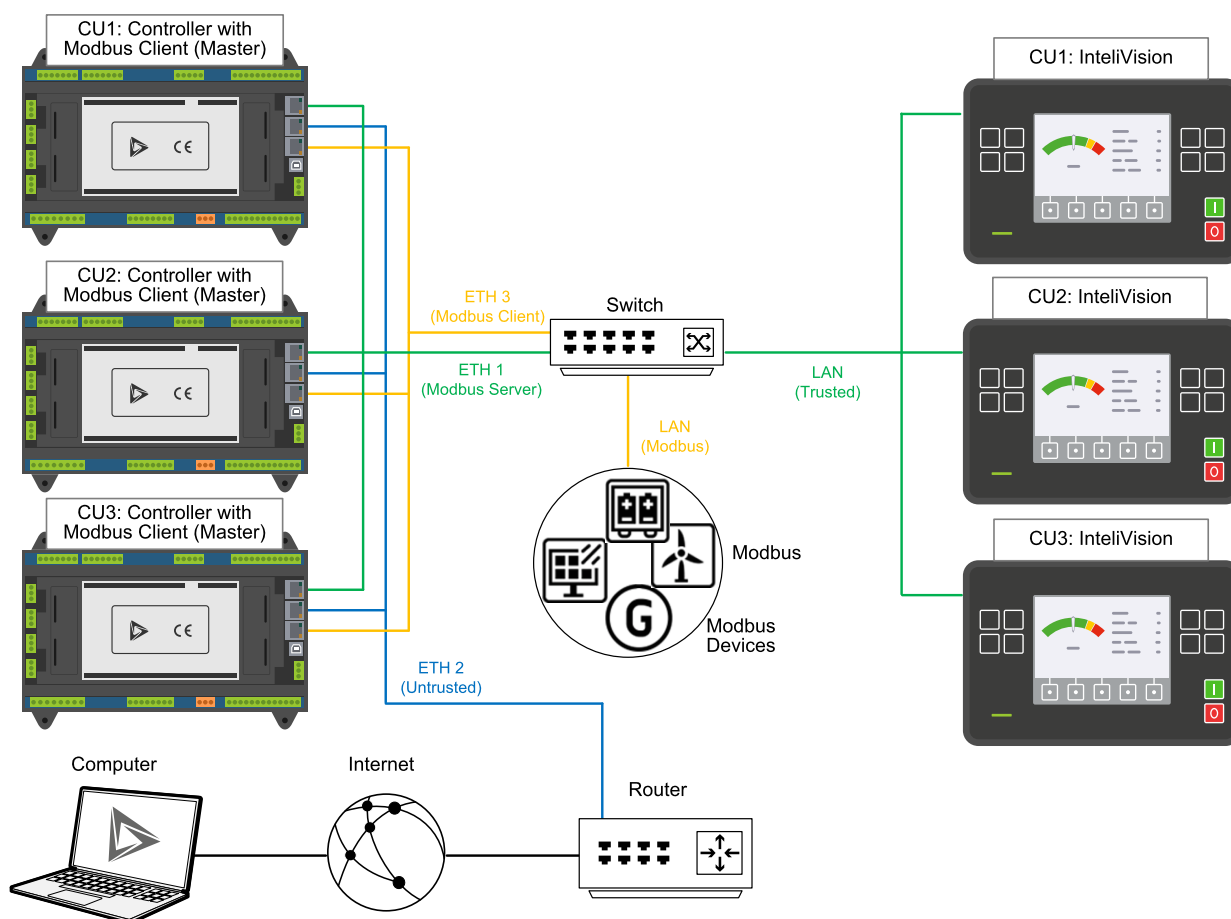


Image 4.11 Advanced Ethernet Topology With Multiple Modbus Clients

**Note:** The IP address of each device in the same network must vary.

**Note:** IntelliVision 5.2 is used for illustrative purposes, the same wiring diagrams apply for all supported displays mentioned in *Displays* (page 21).

## Voltage measurement wiring

The Bus Left and Bus Right protections are evaluated from different voltages based on **Connection type** (page 244) setting:

- 3Ph4Wire – Ph-Ph voltage, Ph-N voltage
- High Leg D – Ph-N voltage, Ph-N voltage
- 3Ph3Wire – Ph-Ph voltage
- SplitPhase – Ph-N voltage, Ph-N voltage
- MonoPhase – Ph-N voltage

## ConnectionType: 3 Phase 4 Wires

Connection type (page 244) = 3Ph4Wire

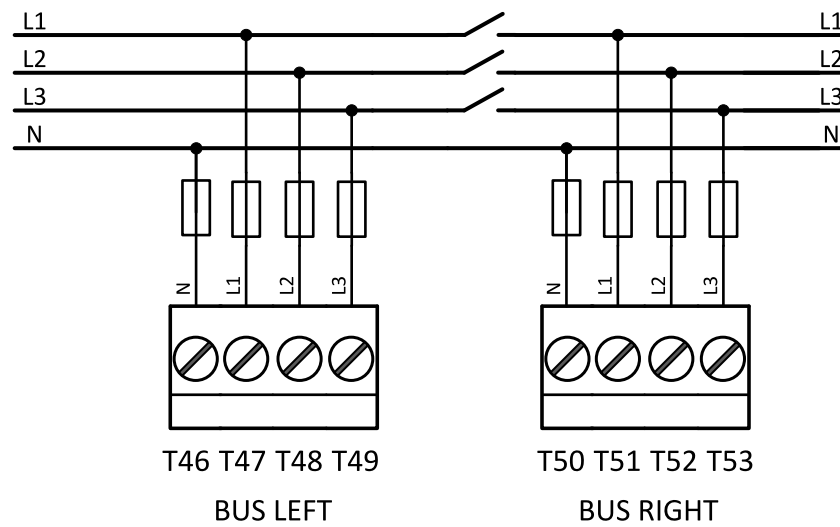


Image 4.12 Controller wiring for voltage measurement of 3 phase application with neutral

**Note:** Fuse on "N" wire is not obligatory but recommended.

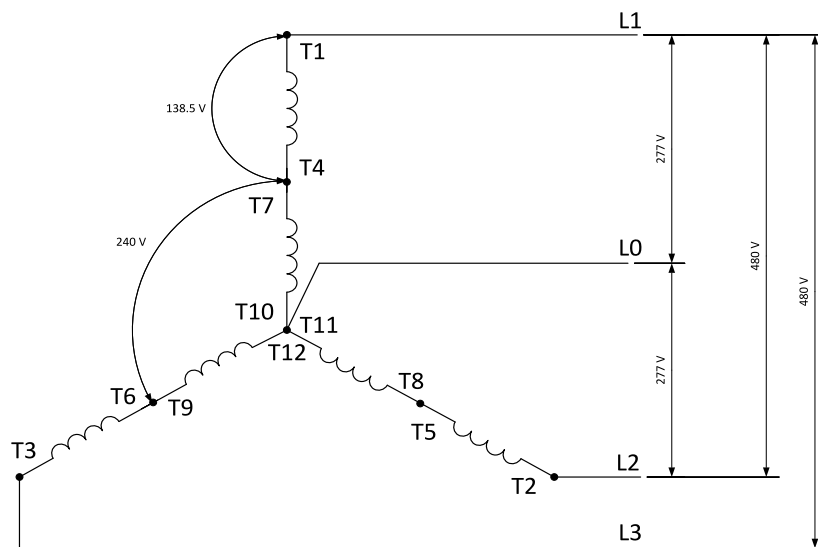


Image 4.13 Typical Bus Left wiring of 3 phase application with neutral

**Note:** Terminals marked by Tx in the picture above are Bus Left's terminals. These markers are not the same as markers for the controller wiring.

ConnectionType: High Leg D

Connection type (page 244) = High Leg D

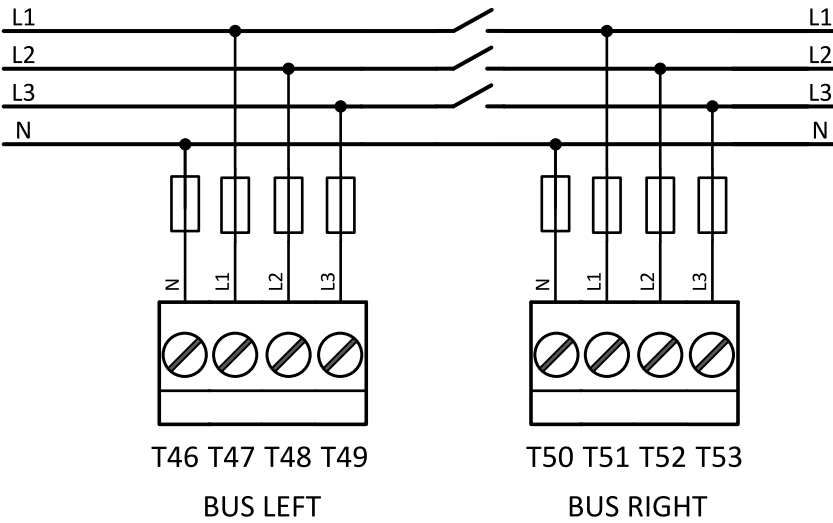


Image 4.14 Controller wiring for voltage measurement of High Leg Delta application

**Note:** Fuse on "N" wire is not obligatory but recommended.

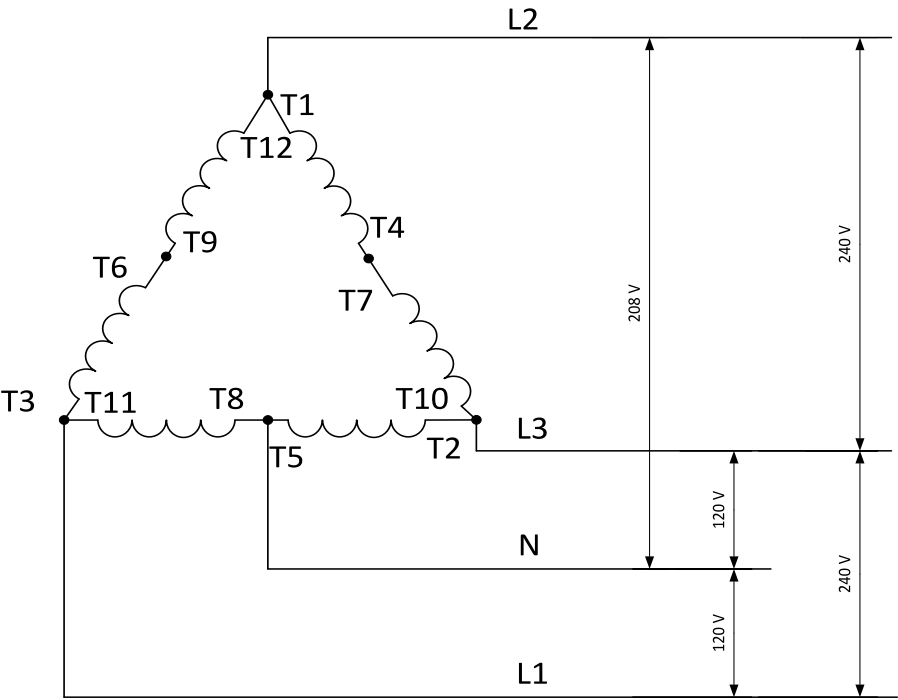


Table 4.1 Typical Bus Left wiring of High Leg Delta application

**Note:** Terminals marked by Tx in the picture above are Bus Left's terminals. These markers are not the same as markers for the controller wiring.

## ConnectionType: 3 Phase 3 Wires

Connection type (page 244) = 3Ph3Wire

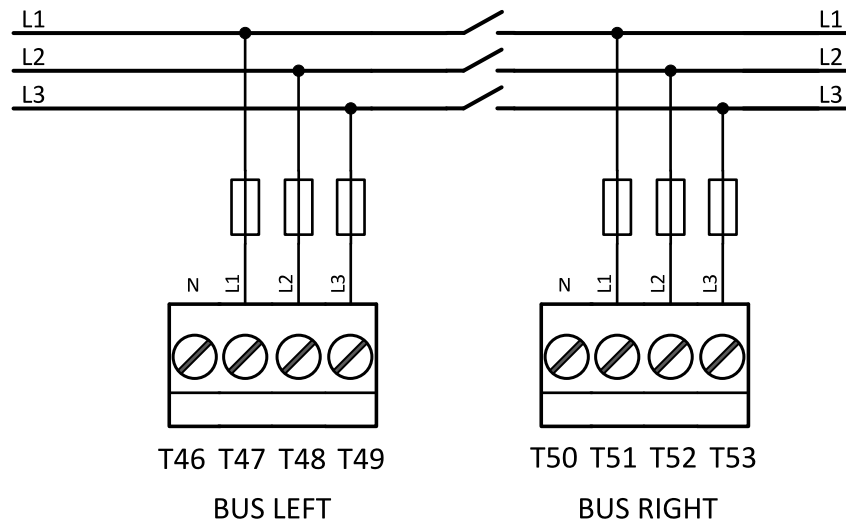


Image 4.15 3 Controller wiring for voltage measurement of 3 phase application without neutral

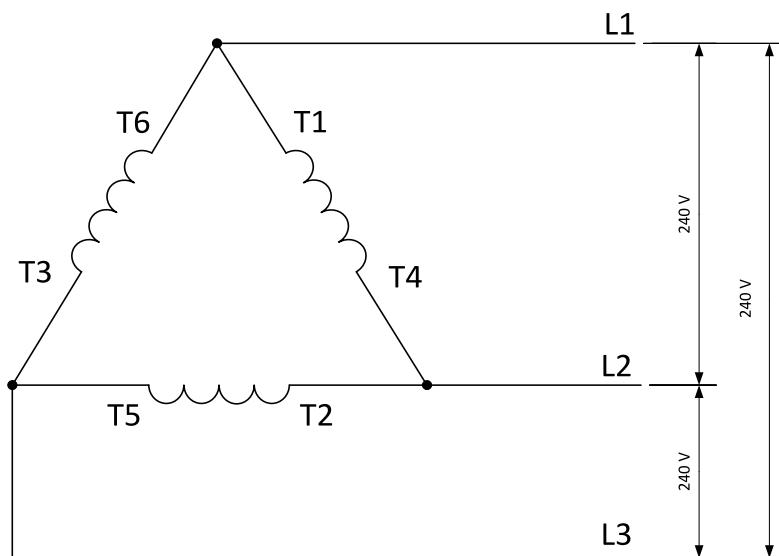


Image 4.16 Typical Bus Left wiring of 3 phase application without neutral

**Note:** Terminals marked by Tx in the picture above are Bus Left's terminals. These markers are not the same as markers for the controller wiring.

## ConnectionType: SplitPhase

Connection type (page 244) = SplitPhase

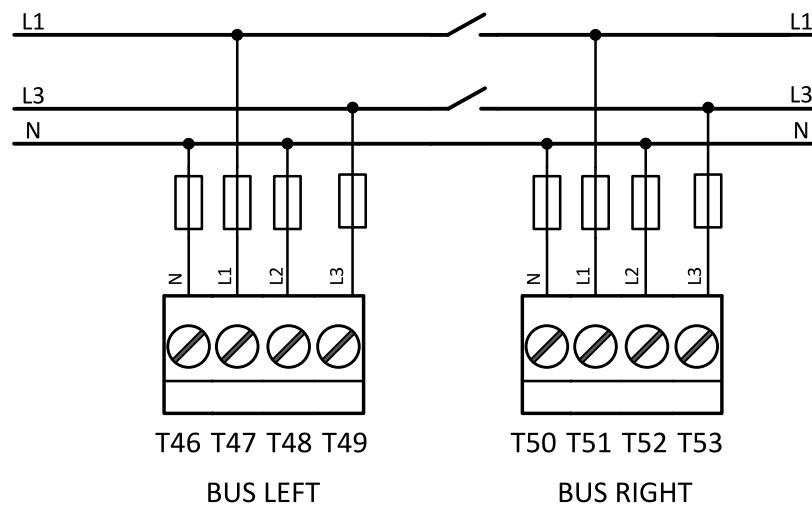
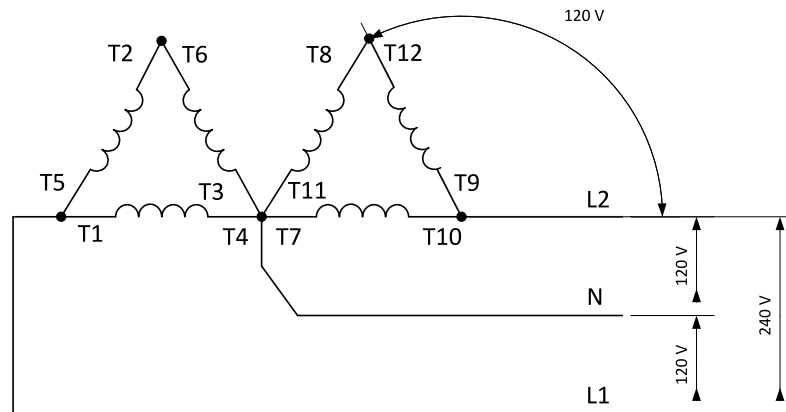


Image 4.17 Controller wiring for voltage measurement of SplitPhase application

**Note:** Fuse on "N" wire is not obligatory but recommended.

## DOUBLE DELTA Connection



## ZIG ZAG (DOG LEG) Connection

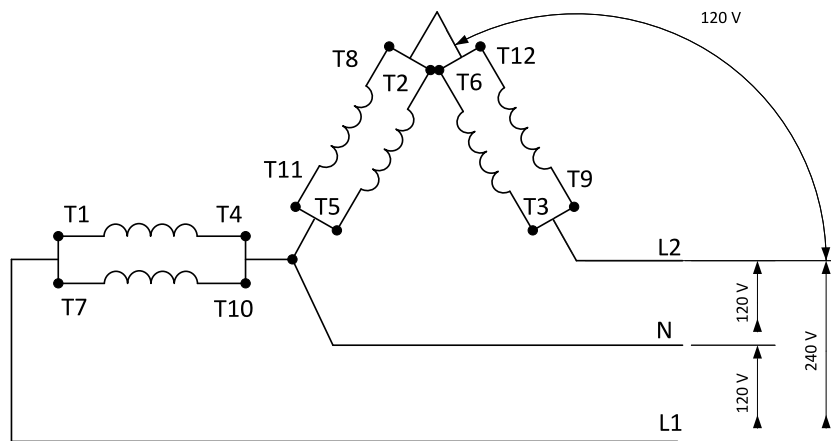


Image 4.18 Typical Bus Left wiring of SplitPhase application

**Note:** Terminals marked by Tx in the pictures above are Bus Left's terminals. These markers are not the same as markers for the controller wiring.

## ConnectionType: Mono Phase

Connection type (page 244) = MonoPhase

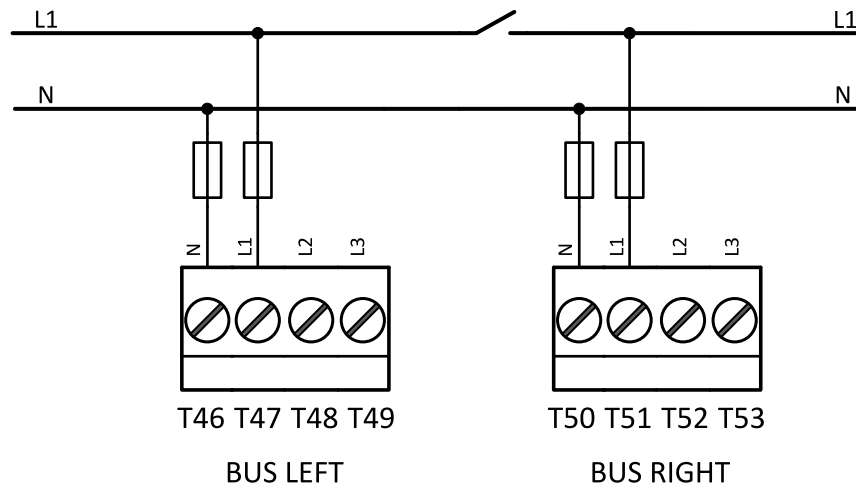


Image 4.19 Controller wiring for voltage measurement of MonoPhase application

**Note:** Fuse on "N" wire is not obligatory but recommended.



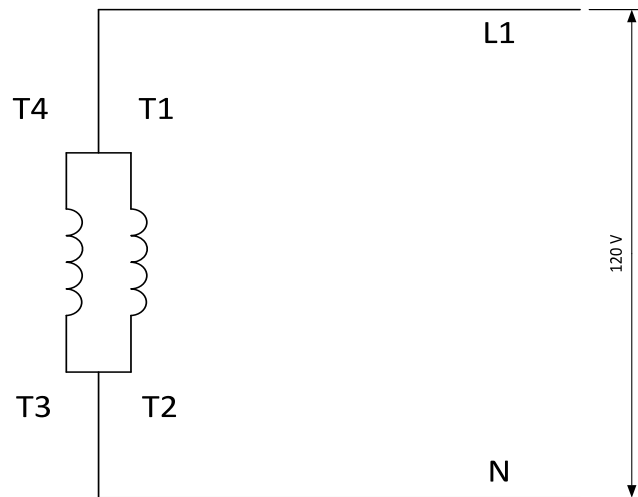


Image 4.20 Typical Bus Left wiring of MonoPhase application

**Note:** Terminals marked by Tx in the picture above are Bus Left's terminals. These markers are not the same as markers for the controller wiring.

### Principle of two transformers measuring for 3 phase connections

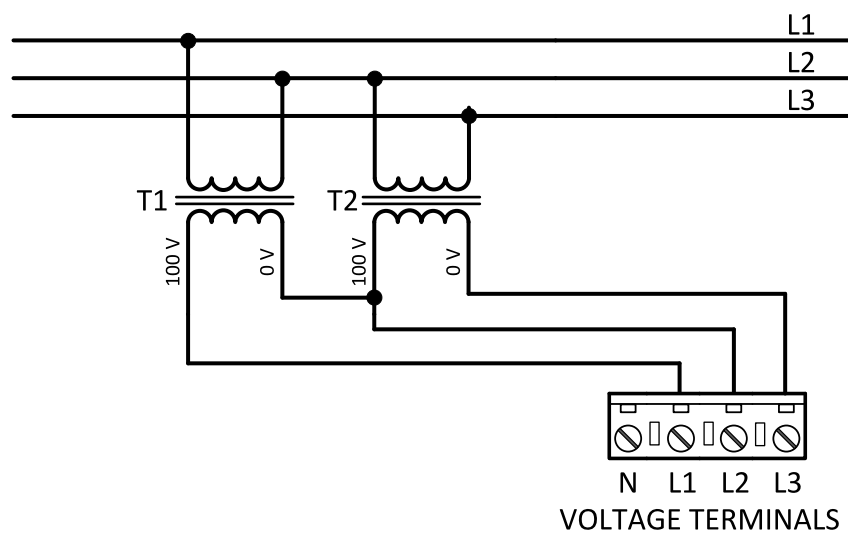


Image 4.21 Principle of two voltage transformers measuring

## 4.4.5 Binary Inputs

InteliMains 1010 BTB SC offers switchable types of inputs. You can select from **Pull Up** and **Pull Down** settings. Use minimally 1 mm<sup>2</sup> cables for wiring of Binary inputs. It is recommended to separate inputs by diodes when two or more binary inputs are connected in parallel to avoid wrong input activation when one controller is switched off. See the chapter **Binary inputs (page 697)** for more information about Pull Up and Pull Down settings.

**Note:** The name and function or alarm type for each binary input have to be assigned during the configuration.

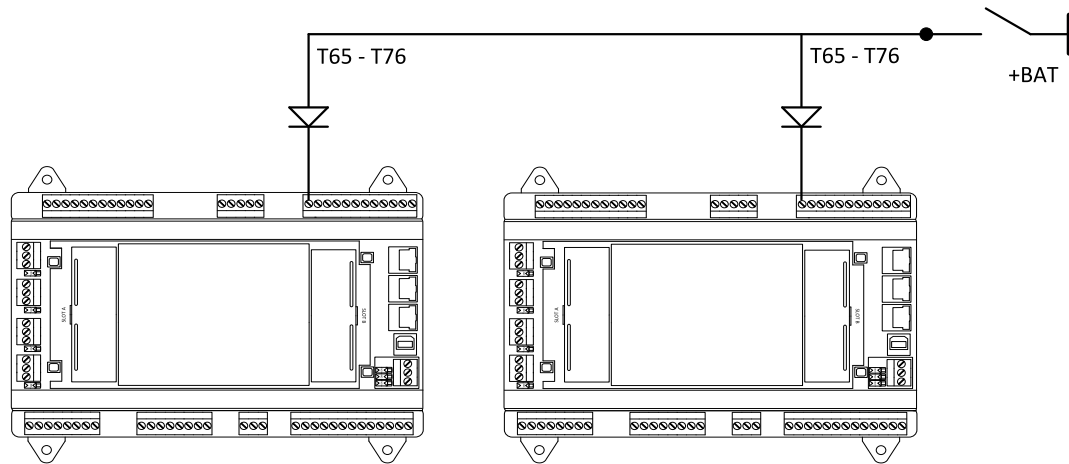


Image 4.22 Wiring of pull down binary inputs with separation diodes

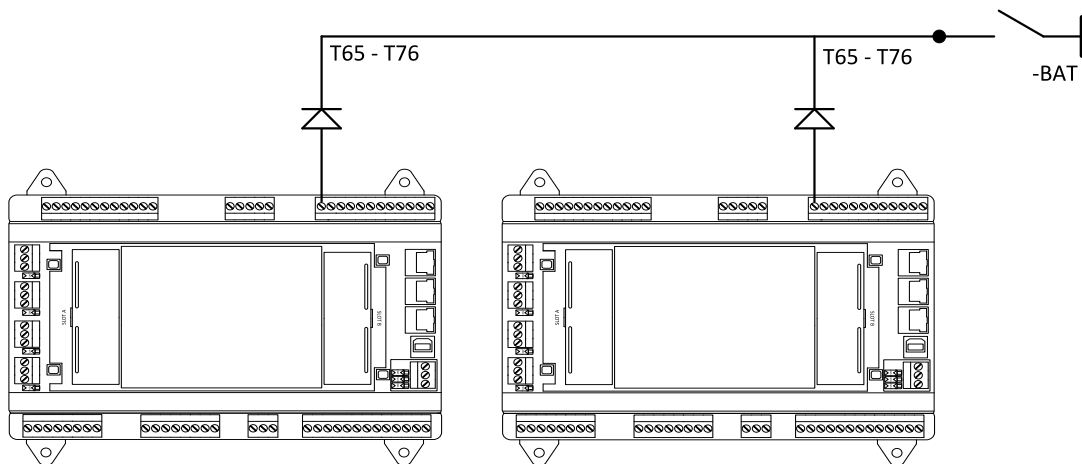


Image 4.23 Wiring of pull up binary inputs with separation diodes

## 4.4.6 Binary Outputs

Use min. 1 mm<sup>2</sup> cables for wiring of binary outputs. Use external relays as indicated on the schematic below for all outputs except those where low-current loads are connected (LED signalization etc.). There are two Binary Output groups, the first one is powered by E-STOP (BO1 and BO2) and second one is powered by the controllers main power supply connector (BO3 .. BO12). Every group of outputs can provide steady current of up to 2 A. Every single binary output can provide up to 0.5 A of steady current unless the total current of the group of outputs does not exceed 2 A.

**Note:** Because of safety reasons the IntelliMains 1010 BTB SC supports only high side binary outputs.

**IMPORTANT:** Use suppression diodes on all relays and other inductive loads even if they are not connected directly to the controller Binary Outputs.

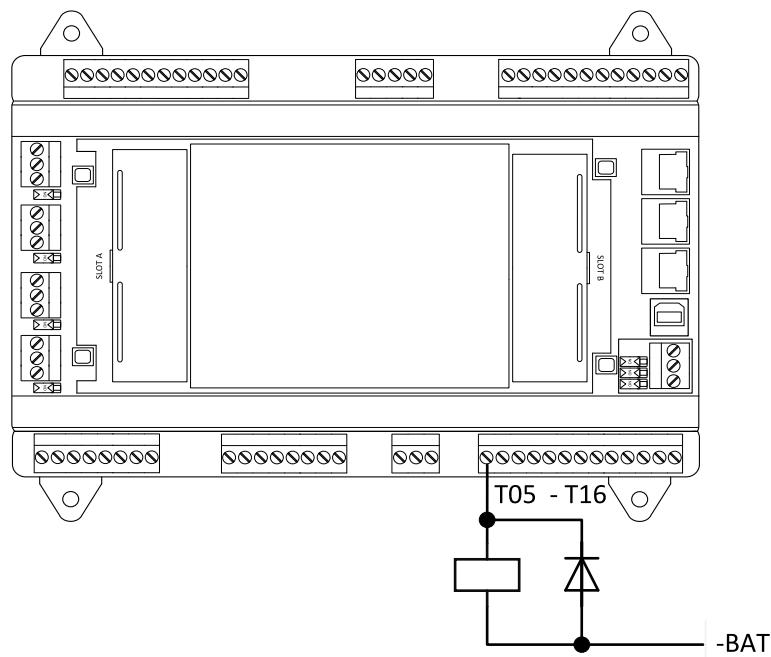


Image 4.24 Wiring of binary outputs (high side)

#### 4.4.7 E-Stop

The E-Stop in the IntelMains 1010 BTB SC controller is common HW part of the PCB and it is not used for any special function. It has dedicated terminal T04 which should be wired to the battery voltage because it is used as power supply for binary output 1 (T05) and binary output 2 (T06).

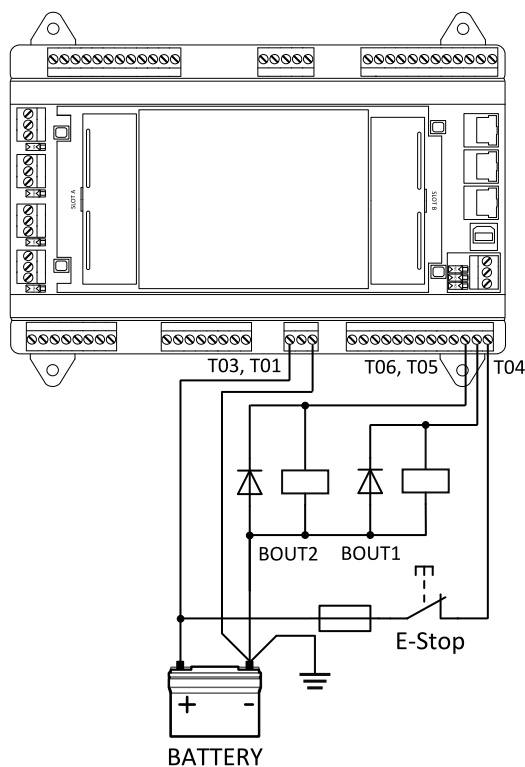


Image 4.25 E-Stop wiring

**Note:** Recommended fusing is 1.2 A fuse.

**Note:** Grey dashed line symbolizes internal connection between E-Stop and binary outputs 1 and 2.

**Note:** For proper functionality of E-Stop, the terminal T04 must be always wired. Terminal can be connected to battery+ or to terminal T03 (BATT+)

**IMPORTANT: Use suppression diodes on all relays and other inductive loads even if they are not connected directly to the controller Binary Outputs.**

#### 4.4.8 Analog Inputs

On each analog input there is possibility to connect a voltage, current, or resistive sensor.

## Resistive sensors

The analog inputs for resistive automotive type sensors like VDO or DATCON are connected either by one wire (the second pole is the sensor body) or by two wires.

- In the case of grounded sensors, connect the **ACOM** terminal to the ground as near to the sensors as possible.
- In the case of isolated sensors, connect the **ACOM** terminal to the negative power supply terminal of the controller as well as one pole of each sensor.

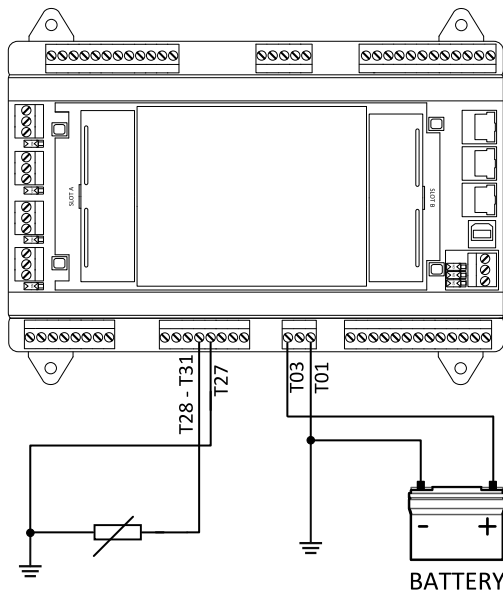


Image 4.26 Grounded sensors

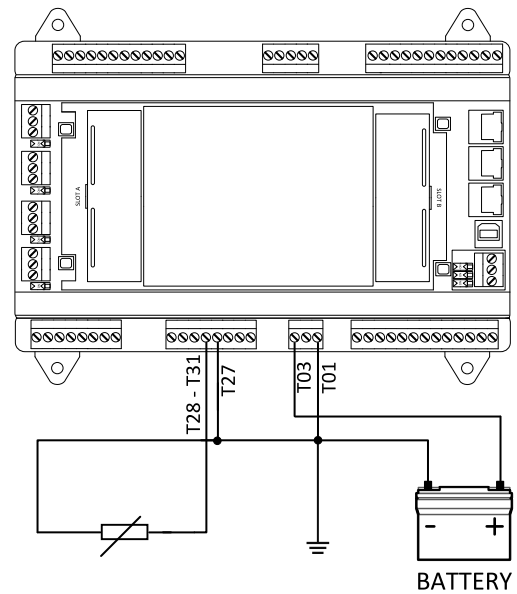


Image 4.27 Isolated sensors

**Note:** Schemes show only analog input connection overview, not actual wiring.

**Note:** The name, sensor characteristic and alarm types for each analog input have to be assigned during configuration.

## Voltage sensors

Recommended wiring for the voltage measurement with voltage divider. The voltage sensor is displayed as voltage source which is usually powered from battery or any external DC power source. The **ACOM** terminal is connected to the negative power supply terminal of the controller as well as negative pole of each sensor.

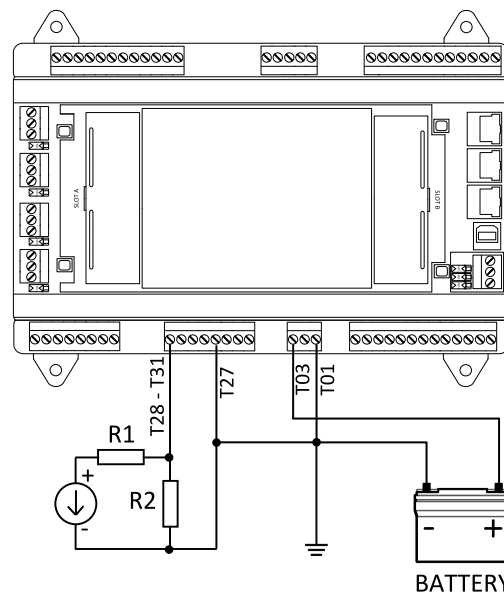


Image 4.28 Wiring of analog input with voltage sensor

**Note:** The voltage divider is only relevant for sensors which are outside the 0-10 VDC range.

## Current sensors

Recommended wiring connections for the active and passive current sensors. The active sensor is displayed as current source which is usually powered from battery or any external DC power source. The passive sensor is displayed as resistive load which is placed between battery + and AIN. The passive sensor does not require additional power supply.

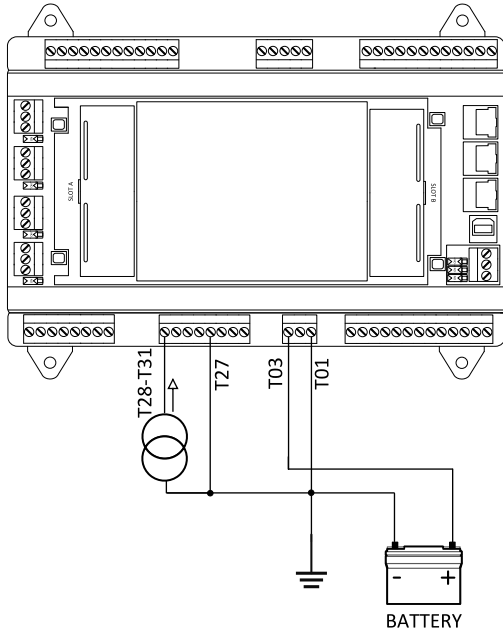


Image 4.29 Wiring of analog input with active current sensor

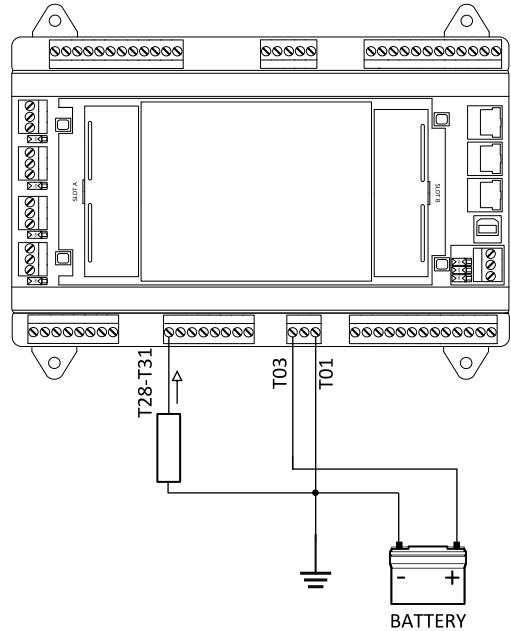


Image 4.30 Wiring of analog input with passive current sensor

## Analog as binary or tristate inputs

Analog inputs can be used also as binary or tri-state, i.e. for contact sensors without or with circuit check. The threshold level is 750  $\Omega$ . In the case of tri-state, values lower than 10  $\Omega$  and values over 2500  $\Omega$  are evaluated as sensor failure (short or open circuit), values over 750  $\Omega$  are evaluated as logical 0 and values below 750  $\Omega$  are evaluated as logical 1. This can be used for example to prevent running the engine with failed temperature sensor, so it won't be overheated.

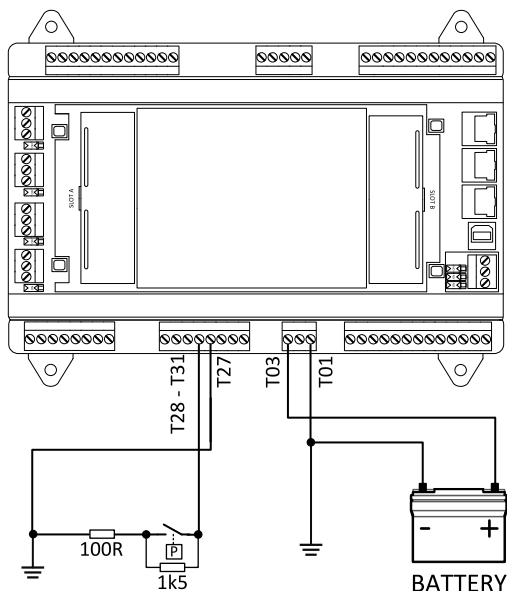


Image 4.31 Analog inputs as tristate

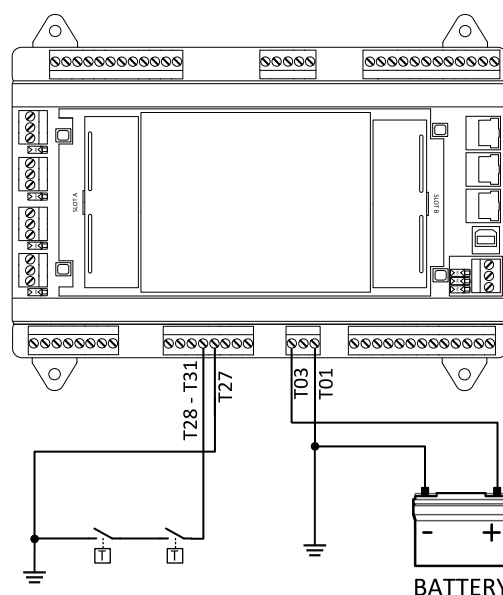


Image 4.32 Analog inputs as binary

**Note:** The name, sensor characteristic and alarm types for each analog input have to be assigned during configuration.

Curve of tristate sensor is prepared for resistive analog inputs 0 .. 2500  $\Omega$ .

**Tristate sensor has 3 states:**

- > Fls – fail of sensor
- > 1 – value is in logical 1
- > 0 – value is in logical 0

**Curve of sensor:**

- > < 10  $\Omega$  – fail of sensor
- > 10 .. 750  $\Omega$  – logical 1
- > 750 .. 2500  $\Omega$  – logical 0
- > > 2500 – fail of sensor

## 4.4.9 Analog Outputs

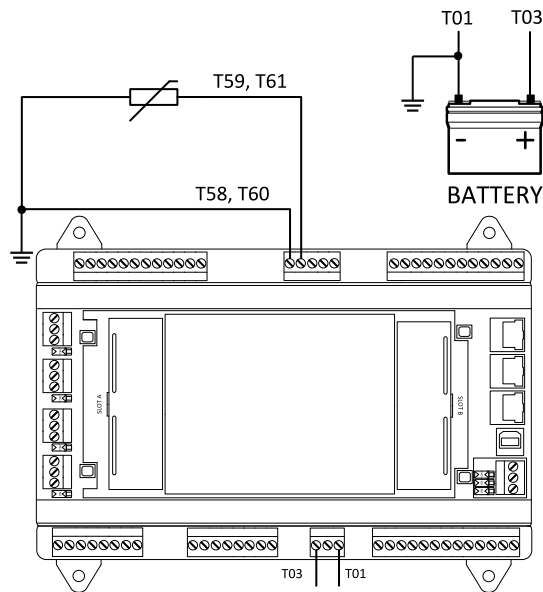


Image 4.33 Analog outputs - Wiring

Analog outputs can be used for any purpose and their outputs can be switched according to options below.

**Note:** The jumper switch next to the terminal 61 is a short switch of 10k serial resistor at analog output 2. By default, the jumper is switched off (the resistor is included in the circuit).

### > Voltage

- » Output range: -10 to +10 V
- » Maximum load: 5 mA
- » Output accuracy: 1 % from set value  $\pm 100$  mV (measured at load 10 k $\Omega$ )
- » Minimum step: 1/10000 of full range (approx. 14bit resolution)
- » Step response: 10 ms max. (measured between 10 and 90 %)
- » Output ripple: 30 mV max. (measured at 50% duty cycle at 3000 Hz PWM)

### > Current

- » Output range -20 to +20 mA
- » Maximum load: 500  $\Omega$
- » Output accuracy: 1 % from set value  $\pm 200$   $\mu$ A
- » Minimum step: 1/10000 of full range (approx. 14bit resolution)
- » Step response: 10 ms max. (measured between 10 and 90 %)
- » Output ripple: 60  $\mu$ A max. (measured at 50% duty cycle at 3000 Hz PWM)

### > PWM

- » Output voltage levels: 0 V / 5 V
- » Maximum load: 10 mA
- » Output High level: >4 V @ 10 mA
- » Output Low level: <1 V @ 10 mA



- » Minimum step: 1/10000 of full range (approx. 14bit resolution)
- » Frequency range: 500 to 3000 Hz (settable during configuration)

## 4.4.10 CAN bus and RS485 wiring

### CAN bus wiring

The wiring of the CAN bus should be provided in such a way that the following rules are observed:

- The maximum length of the CAN bus depends on the communication speed. For a speed of 250 kbps, which is used on the **CAN1A (page 17)** bus (extension modules, ECU) and **CAN2A (page 17) (CAN2B (page 17))** bus, the maximum length is 200 m.
- The bus must be wired in linear form with termination resistors at both ends. No nodes are allowed except on the controller terminals.
- Shielded cable<sup>1</sup> has to be used, shielding has to be connected to the terminal T01 (Grounding).
- External units can be connected on the CAN bus line in any order, but keeping line arrangement (no tails, no star) is necessary.
- The CAN bus has to be terminated by 120  $\Omega$  resistors at both ends use a cable with following parameters:

<b>Cable type</b>	Shielded twisted pair
<b>Impedance</b>	120 $\Omega$
<b>Propagation velocity</b>	$\geq 75\%$ (delay $\leq 4.4$ ns/m)
<b>Wire crosscut</b>	$\geq 0.25$ mm <sup>2</sup>
<b>Attenuation (@1MHz)</b>	$\leq 2$ dB/100 m

**Note:** Communication circuits shall be connected to communication circuits of Listed equipment.

**Note:** A termination resistor at the CAN (120  $\Omega$ ) is already implemented on the PCB. For connecting, close the DIP switch near the appropriate CAN terminal. External 120  $\Omega$  resistor can be used between L and H instead of DIP switch with integrated termination resistor. If external resistor is used the DIP switch must be set to the OFF position.

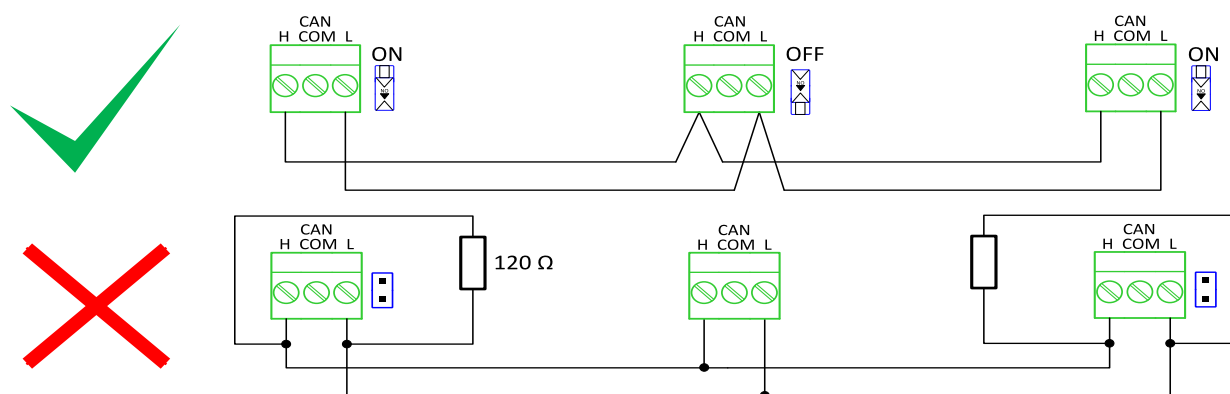


Image 4.34 CAN bus topology

<sup>1</sup>Recommended data cables: BELDEN (<http://www.belden.com>) - for shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors); for longer distances: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)

- For shorter distances (connection within one building)

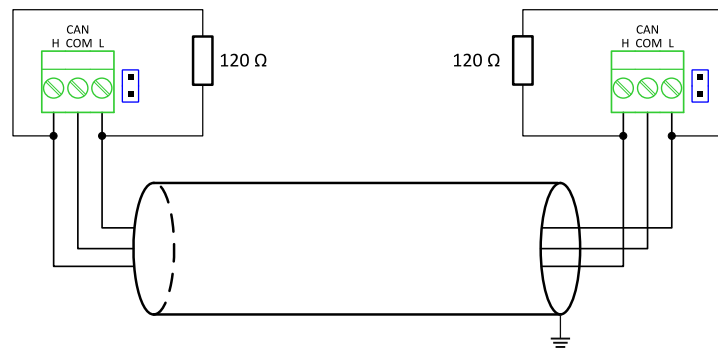


Image 4.35 CAN bus wiring for shorter distances

**Note:** Shielding shall be grounded at one end only. Shielding shall not be connected to CAN COM terminal.

- For longer distances or in case of surge hazard (connection out of building, in case of storm etc.)

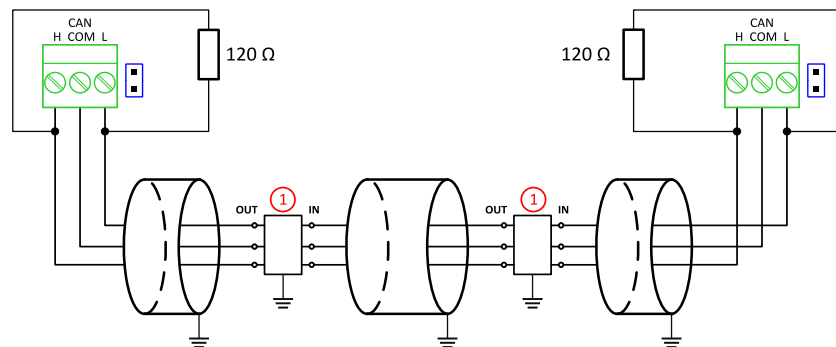


Image 4.36 CAN bus wiring for longer distances

① Recommended PT5-HF-12DC-ST<sup>1</sup>

<sup>1</sup>Protections recommended: Phoenix Contact (<http://www.phoenixcontact.com>): PT 5-HF-12DC-ST with PT2x2-BE (base element) or Saltek (<http://www.saltek.cz>): DM-012/2 R DJ

## RS485 wiring

The wiring of the RS485 communication should be provided in such a way that the following rules are observed:

**Note:** A termination resistor at the RS485 (120  $\Omega$ ) is already implemented on the PCB. For connecting, close the DIP switch near the RS485 terminal. External 120  $\Omega$  resistor can be used between L and H instead of DIP switch with integrated termination resistor. If external resistor is used the DIP switch must be set to the OFF position.

- Standard maximum bus length is 1000 m.
- Shielded cable<sup>1</sup> has to be used, shielding has to be connected to the terminal T00 (Grounding).
- External units can be connected on the RS485 line in any order, but keeping line arrangement (no tails, no star) is necessary.
- The line has to be terminated by 120  $\Omega$  resistors at both ends.
- For shorter distances (connection within one building).

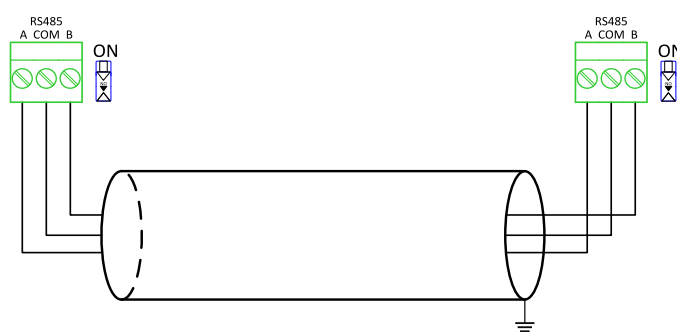


Image 4.37 RS485 wiring for shorter distances

- For longer distances or in case of surge hazard (connection out of building, in case of storm etc.)

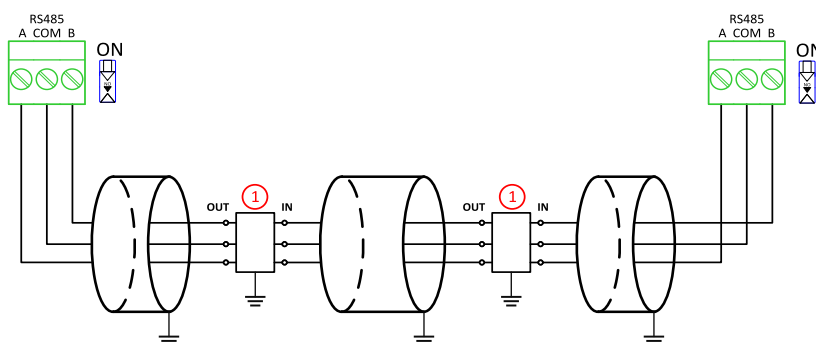


Image 4.38 RS485 wiring for longer distances

① Recommended PT5HF-5DC-ST<sup>2</sup>

**Note:** Communication circuits shall be connected to communication circuits of Listed equipment.

<sup>1</sup>Recommended data cables: BELDEN (<http://www.belden.com>) - for shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors); for longer distances: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)

<sup>2</sup>Recommended protections: Phoenix Contact (<http://www.phoenixcontact.com>): PT 5-HF-5DC-ST with PT2x2-BE (base element)(or MT-RS485-TTL) or Saltek (<http://www.saltek.cz>): DM-006/2 R DJ

## On board RS485 description

### Balancing resistors

The transmission bus into the RS-485 port enters an indeterminate state when it is not being transmitted to. This indeterminate state can cause the receivers to receive invalid data bits from the noise picked up on the cable. To prevent these data bits, you should force the transmission line into a known state. By installing two 560  $\Omega$  balancing resistors at one node on the transmission line, you can create a voltage divider that forces the voltage between the differential pair to be less than 200 milli-Volts, the threshold for the receiver. You should install these resistors on only one node. The figure below shows a transmission line using bias resistors. Balancing resistors are placed directly on the PCB of controller. Use DIP switches PULL UP/PULL DOWN to connect the balancing resistors.

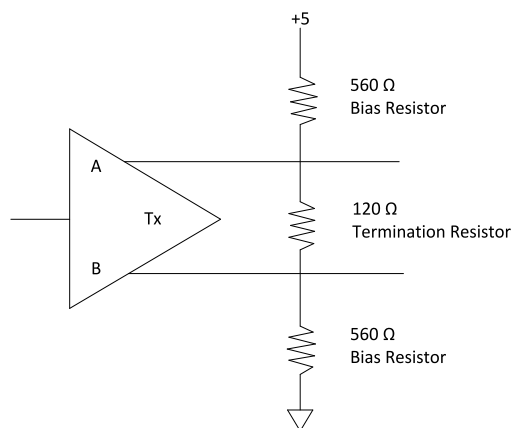


Image 4.39 Balancing resistors

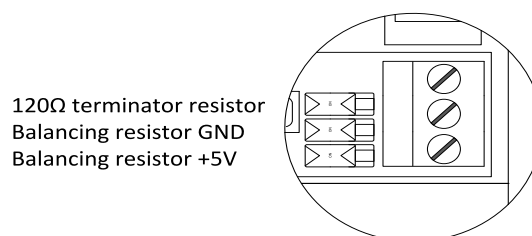


Image 4.40 RS485 on board

## 4.4.11 USB

The USB can be used for direct computer connection. Use the shielded USB A-B cable. See the chapter **Connection via USB (page 210)** for more information.

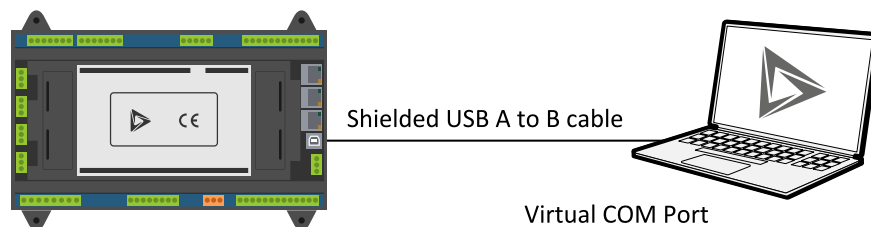


Image 4.41 USB connection

The USB cannot be used instead of power supply. The controller will not be turned on when the USB is connected and the controller is not powered from power supply.

## 4.4.12 Ethernet

Ethernet Cat5/Cat6 cable fitted with the RJ45 connector can be connected to the ethernet interface. The ethernet can be used for direct computer connection. See the chapter **Connection via Ethernet (page 211)** for more information.

**Note:** It is necessary to use manual IP address on both PC and controller if there is no device which will provide DHCP.

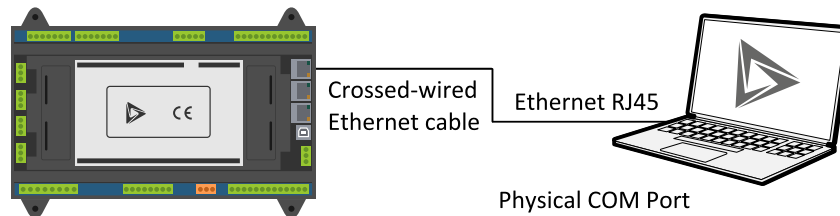


Image 4.42 Ethernet Connection

**IMPORTANT:** The InteliMains1010 BTB SC is using same MAC address for all Ethernet ports so it is not possible to use more than one Ethernet port in the same network. If you connect for example Ethernet 1 and 2 to the same network the communication will breakdown.

In the image below you can see the topology using all 3 Ethernet ports with one Modbus Client. The ETH1 is used for connection of displays (IV5.2) or it can be also used for remote LAN connection. The ETH2 is used for remote connection using the internet (WAN). The ETH3 is used for Modbus Server and Client which are connected to the LAN with Modbus Devices.

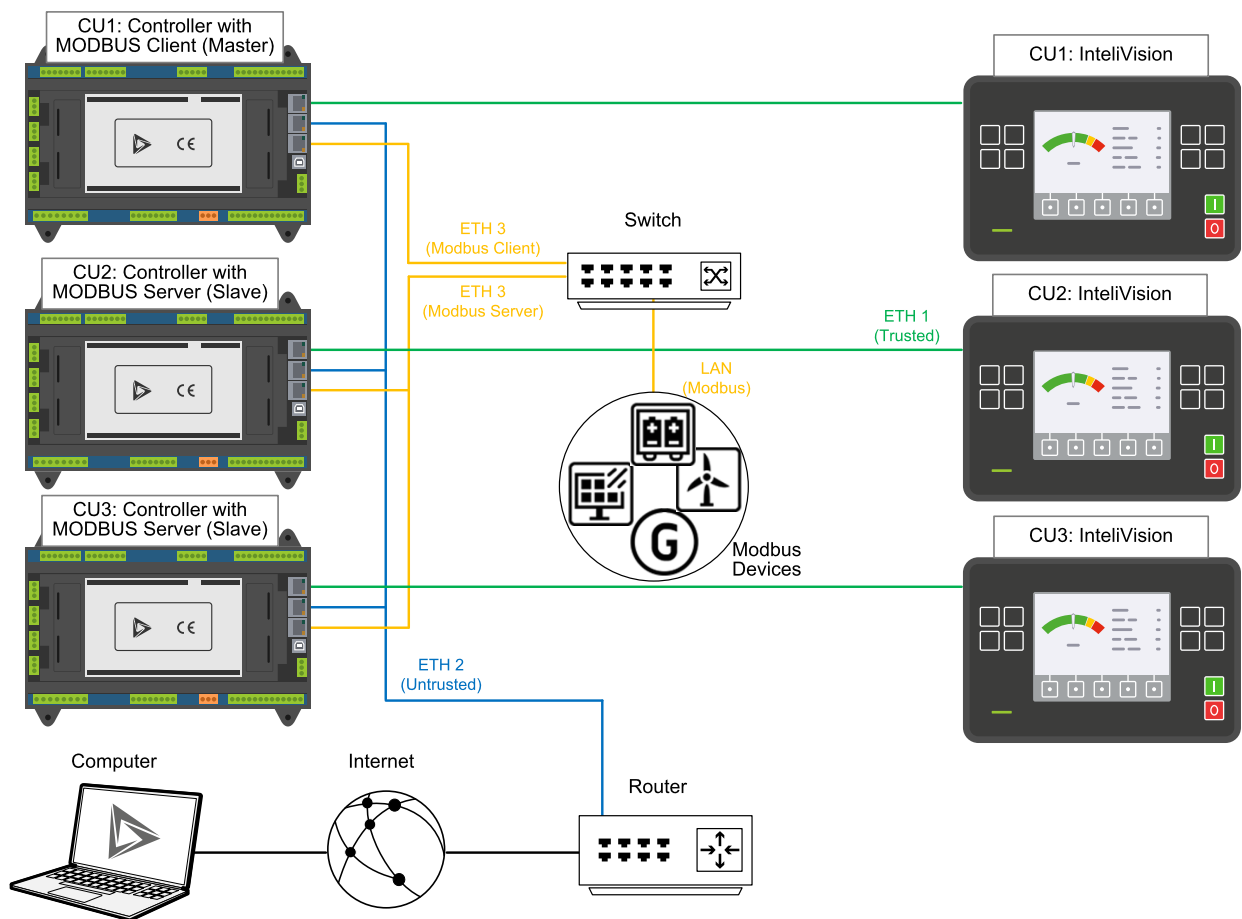


Image 4.43 Advanced Ethernet Topology With One Modbus Client

In the image below you can see the topology using all 3 Ethernet ports with multiple Modbus Clients (CU 1 is the first level client, CU 2 and CU 3 are second level clients). The ETH1 is used for Modbus Server, connection of displays (IV5.2), or it can be also used for remote LAN connection. The ETH2 is used for remote connection using the internet (WAN). The ETH3 is used for Modbus Clients which are connected between CU 1 and other CUs, and between other CUs and Modbus Devices.

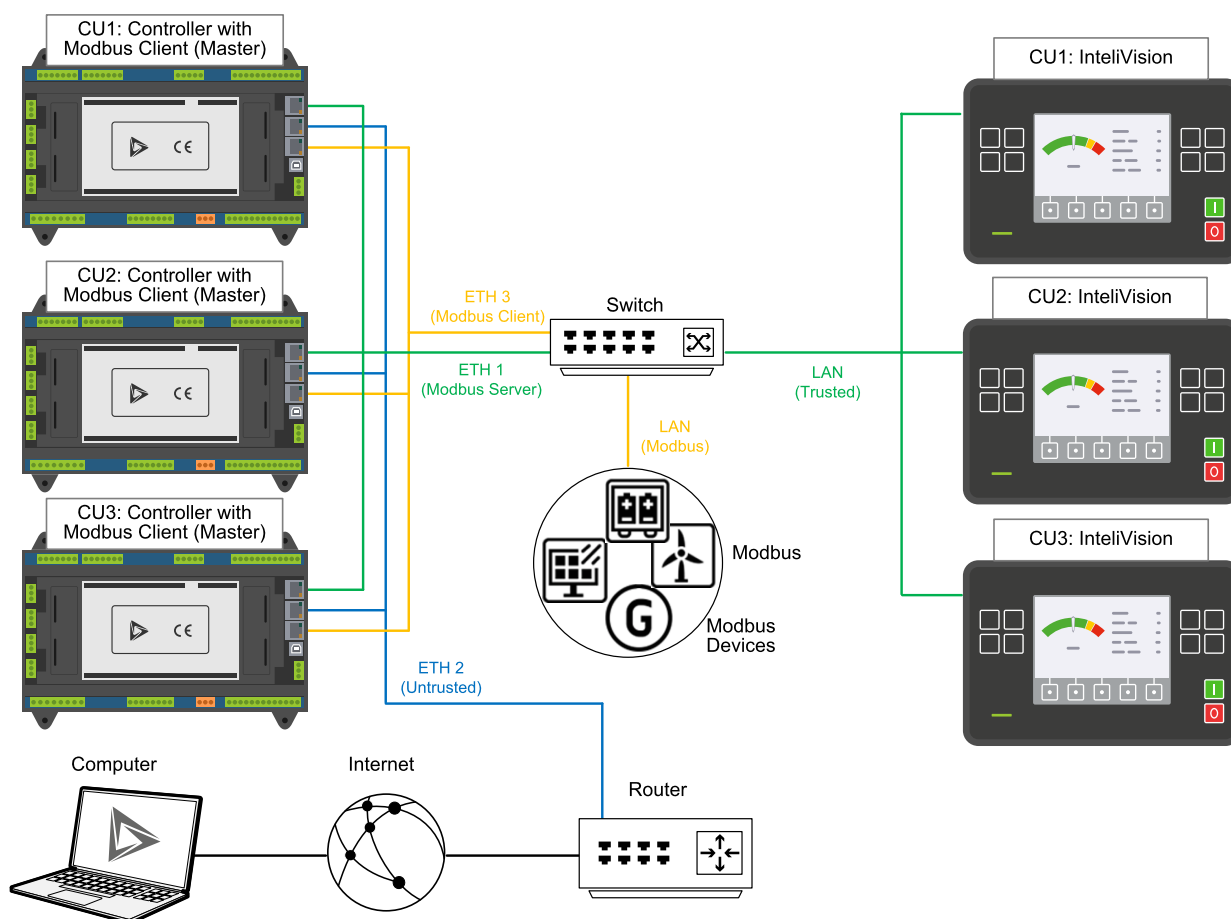


Image 4.44 Advanced Ethernet Topology With Multiple Modbus Clients

**Note:** The IP address of each device in the same network must vary.

**Note:** IntelliVision 5.2 is used for illustrative purposes, the same wiring diagrams apply for all supported displays mentioned in *Displays* (page 21).

### 4.4.13 Cellular Connection

Cellular connection of controllers can be created by using a router, which is a device that represents the gateway between the controllers and the Internet.

- It creates a Local Area Network (LAN) in which the controllers are connected
- On the opposite side it is connected to Internet (Wide Area Network, WAN)

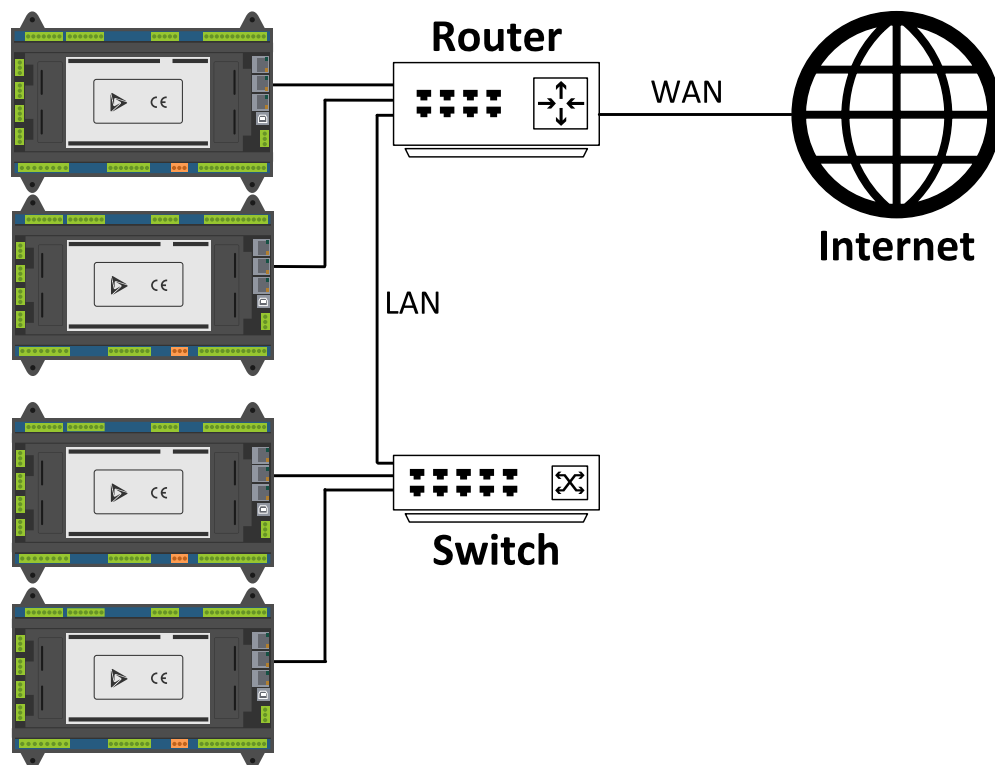


Image 4.45 Example of a topology

**Note:** The picture above is only an example of the topology. An additional switch/switches may be needed to match the required network topology (i.e. number and location of the LAN connection points). Please consult this topic with ethernet network specialist.

While selecting a suitable cellular router following aspects should be considered:

- What cellular network technology and frequency bands are available in the target region?
- Is the cellular connection the primary Internet connection or just a backup connection while the primary one is wired ethernet?
- Power supply and operating conditions

**Note:** We recommend to only use devices designed for industrial applications.



## Cellular network technology

There are multiple cellular technologies available on the market. They are called either as "generations" (G) or abbreviations are used.

Technology	Description
4G (LTE)	Current, most advanced, technology. It is being deployed rapidly in some areas it may replace the legacy 2G networks. We recommend using this technology if it is available in the target area <ul style="list-style-type: none"><li>➤ Provides highest data throughput rate and lowest latency</li><li>➤ Best user experience – like a wired connection</li></ul>
3G (UMTS, HSPA, CDMA)	Successor of 2G. It is in operation in some areas, but it is not expanding anymore. <ul style="list-style-type: none"><li>➤ Provides lower throughput rate and higher latency then 4G*</li><li>➤ Still quite good user experience</li></ul>
2G (GSM, GPRS, EDGE)	Very first digital cellular network technology. It is still available in many areas, however it is slowly starting to decline. <ul style="list-style-type: none"><li>➤ Provides lowest throughput rate and quite high latency</li><li>➤ Generally not suitable for connection of multiple ComAp devices via a router</li></ul>

## Frequency bands

It is very important that selected cellular router matches the frequency bands used by providers in the target country or area. 4G networks worldwide use many of frequency bands and manufacturers of cellular modules and routers sell their devices in multiple variants according to the region. A useful overview of LTE frequency bands is available at [Wikipedia page](#).

**Note:** Consult the technical documentation and/or technical support of the router's manufacturer to get more information about ordering proper regional version of your selected router.

## Additional router functions

### Backup WAN connection

Router may provides secondary SIM card slot which is used as a backup connection when the main connection is lost. You can also combine cellular and wired Internet connection as the main and backup one.

### Connection alive check

Router may periodically checks whether the cellular connection is alive - has access to the Internet. When there is not access to the Internet, router may perform automatic reboot to reinitialize the connection or switch to backup SIM card.

### Automatic scheduled reboot

Router may perform periodically scheduled reboot. This function is a bit "harder" alternative to the **Connection alive check (page 74)**.

**Note:** It may be very helpful at remote sites where freezing of the connection would require traveling to the site.

## Typical router configuration

**Note:** Please always refer to the documentation of the specific router for detailed setup procedure.

**IMPORTANT:** When configuring a router, the very first step to do should be changing the username and password for administration access.

### Cellular network

Usually the only setpoint that needs to be adjusted is the APN name. A frequent APN name is "internet", but if you are not sure ask your SIM card provider for proper APN name.

### WAN interface

If the router contains also ethernet socket for WAN connection it may be required to select cellular module as the main WAN interface.

### LAN setup

Most routers do not require any changes in the LAN configuration as their default configuration contains DHCP server activated. Clients will get IP settings automatically.

## Cellular router examples

- Teltonika RUT955 – comprehensive industrial LTE router based on Linux and customized OpenWRT distribution.
- Gemalto ELS61T – industrial cellular modem with LTE router function based on Linux and OpenWRT distribution.

## 4.5 External display

InteliMains 1010 BTB SC does not have an integrated display. External Remote Displays or PC Panel Displays are used when needed. InteliMains 1010 BTB SC package does **not** include any external displays. External displays must be acquired separately, see the chapter **Displays (page 21)**.

### 4.5.1 InteliVision Displays

#### Wiring diagrams

**IMPORTANT:** Fixed IP address must be configured if the terminal is not connected to the DHCP server.

For display connection it is recommended to use Ethernet 1 (trusted interface in default). Direct connection of InteliVision display to InteliMains 1010 BTB SC via ethernet cable can be used only for connection of single device. Using switch for connection allows you to connect multiple devices such as display, computer and Modbus to InteliMains 1010 BTB SC at one time.

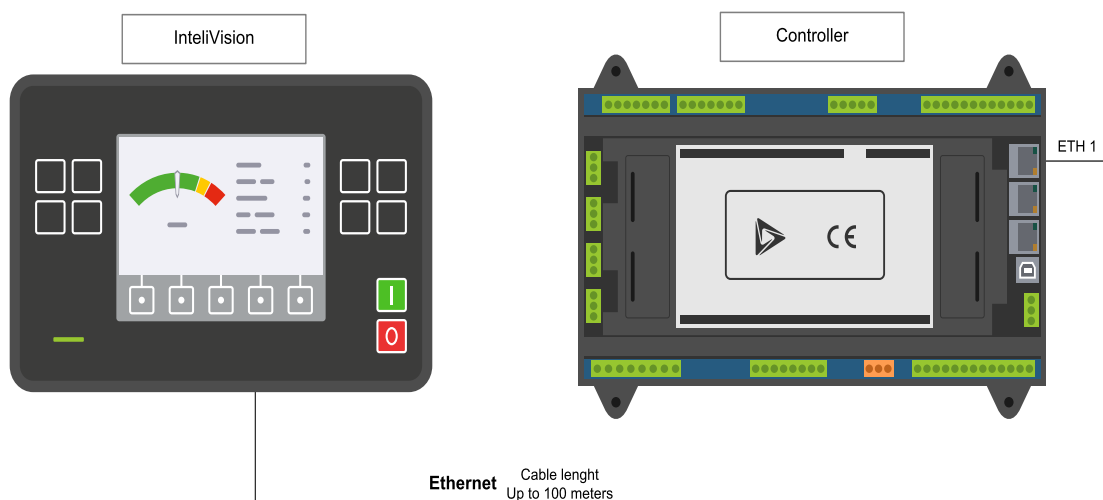


Image 4.46 Connection of IntelIVision display to IntelIMains 1010 BTB SC

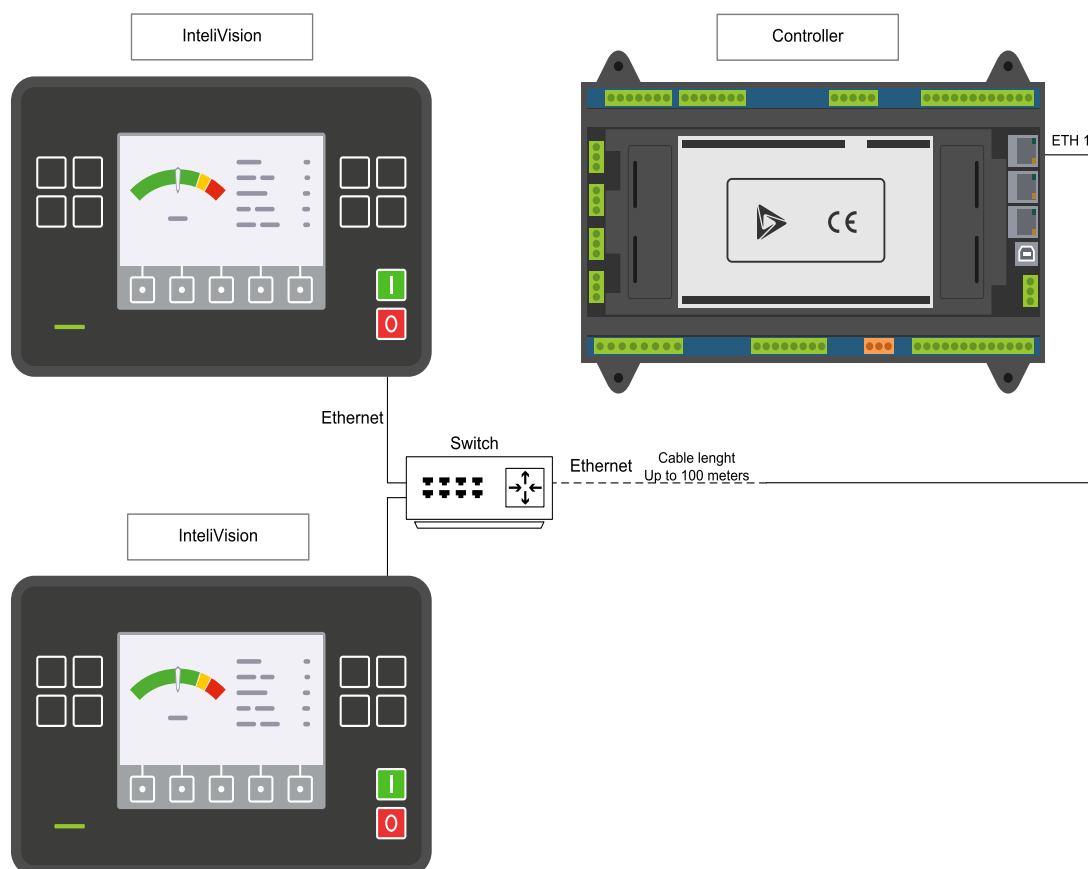


Image 4.47 Multiple connection to a single controller via switch

**Note:** The IP address of each device in the same network must vary.

**Note:** IntelIVision 5.2 is used for illustrative purposes, the same wiring diagrams apply for all supported displays mentioned in *Displays* (page 21).

## 4.6 Maintenance

### 4.6.1 Backup battery replacement

The internal backup battery lifetime is approx. 6 years. If alarm **Wrn RTC Battery Flat (page 665)** is present, replacement of backup battery is needed. Follow these instructions:

- Connect the controller to a PC and save an archive for backup purposes (not necessary but recommended).
- Disconnect all terminals from the controller and remove the controller from the switchboard.
- Release the rear cover using a flat screwdriver or another suitable tool.



- The battery is located in a holder on the circuit board. Remove the old battery with a small sharp screwdriver and push with a finger the new battery into the holder.



**Warning** – Risk of fire if battery is replaced with incorrect type or polarity. Dispose of used batteries according to instructions. The CR1632 3V Lithium battery have to be used."



**Note:** The picture above is only illustrative and actual battery placement may vary.

- Put the rear cover back. Use slight pressure to lock the snaps into the housing. Pay attention that the cover is in correct position and not upside down!
- Put back the plugin modules and back cover.
- Power the controller on, adjust date and time and check all setpoints.

🔍 **back to Installation and wiring**

# 5 Controller setup

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## 5.1 Operator Guide

**Note:** This chapter is relevant only for users who want to use external displays. If you want to operate / monitor / configure your site using the computer with installed PC tool see the chapter **PC tools** (page 20). See the chapter **Displays** (page 21) if you want to use any PC panel display, for example with installed IntelliSCADA PC tool. In above mentioned chapters you can find links to Global Guide for each product.

### 5.1.1 IntelliVision 5.2

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**Note:** The images used in the Operator Guide are only illustrative. The screens shown in the images are compatible with the IntelliGen 1000 Controller, but the functionality of the IV 5.2 Display such as Connection, Login, Setpoints Settings, Display Settings, etc. remains the same.

### Front panel elements

Front panel of the unit uses hardware buttons for configuring, moving, scrolling, commands and other functions.



Image 5.1 : Front panel overview

## Navigation buttons

Arrow buttons on the front panel are mainly used for navigation inside the entire graphical user interface. In addition the arrows left and right are used for changing the controller mode if the actual position is any metering screen.

### Arrow left and right



Image 5.2 : Arrow left and right

The buttons are used for :

- > Changing the controller mode (only on metering screens)
- > Movement between history columns
- > Movement in the dialogs

### Arrow up and down



Image 5.3 : Arrow up and down

The buttons are used for :

- Cyclical movement between the metering Screens
- Movement in the dialogs
- Changing the value in the dialogs
- Movement in menus
- Listing on pages

### Enter



Image 5.4 : Enter button

The button is used for :

- Confirming the values
- Confirming the selections
- Confirming the listing options

### Menu



Image 5.5 : Menu button

The button is used for :

- Escape function
- Step back function
- Cyclical change of the page (from any metering screen)

### Function buttons

Function buttons are dedicated for the performing of the concrete function. By pressing the button the controller action or controller command is performed (see bellow).



Image 5.6 : Function buttons (Start, Stop, Alarm/Horn reset, Horn reset)

- **Start** :no function
- **Stop** : no function
- **Alarm/Horn reset** : resets the horn and confirms all the alarms in the alarmlist
- **Horn reset** : resets only the horn

## User buttons



Image 5.7 : User button

User button is dedicated for predefined user function.

- > Performing the controller command
- > Jump to the specific page or metering screen
- > special function on the pages

## Special and button combination

In this manual the shortcut is a term for the combination of the buttons or long press of the button.



Image 5.8 : Shortcut (jump to the administration)

- > **Enter + Menu** : performs the jump to the administration. Enter button has to be pressed first.
- > **Long press** of the arrow up or down button
  - » in the menus : performs the cyclical listing
  - » in the dialog : velocity of the changing value is increased based on special algorithm

## Status LED

There is one multicolor (RGB) LED on the front panel of the unit. The specified color and flashing function describes the actual state of the unit.



Image 5.9 : Status LED

- > LED intensity is directly connected with the actual setting of the backlight intensity in Administration menu "Settings" accessible by shortcut Enter + Menu
  - » the intensity respects the value of the Manual or External brightness control
- > The flashing of the status LED and indicative Alarm icon in the top statusbar have the same period
- > Meaning of the status LED colors is described below



Priority	LED State	Description
1	Red is flashing	<ul style="list-style-type: none"> <li>&gt; Active unconfirmed level2 (shutdown) alarm</li> <li>&gt; Inactive unconfirmed level2 (shutdown) alarm</li> <li>&gt; Lost of internal communication line</li> <li>&gt; Controller unit in init state</li> </ul>
2	Red lights	<ul style="list-style-type: none"> <li>&gt; Active confirmed level2 (shutdown) alarm</li> <li>&gt; Display unit in init state</li> <li>&gt; Display unit booting procedure</li> <li>&gt; Lost of communication line with controller unit</li> </ul>
3	Cyan lights	<ul style="list-style-type: none"> <li>&gt; temperature inside the housing exceeded the 85°C (185°F)</li> </ul>
4	Yellow lights	<ul style="list-style-type: none"> <li>&gt; Active unconfirmed level1 (warning) alarm</li> <li>&gt; Inactive unconfirmed level1 (warning) alarm</li> <li>&gt; Active confirmed level1 (warning) alarm</li> <li>&gt; Active unconfirmed fail sensor alarm</li> <li>&gt; Inactive unconfirmed fail sensor alarm</li> <li>&gt; Active confirmed fail sensor alarm</li> </ul>
5	Green lights	<ul style="list-style-type: none"> <li>&gt; unit is running correctly without any errors or alarms</li> </ul>

## Page Structure

### Pages

There are several screens called pages in the graphical user interface (GUI), which are accessible by pressing the Menu button or concrete user button in the bottom status bar. Each page has a different function and different structure. Pages are described in special chapters in this manual.

The actual GUI consists of 6 different pages :

- > Setpoints
- > Metering screen
- > Alarmlist
- > History
- > Trends
- > Administration
  - » Page administration is accessible only by pressing the combination of the Enter and Menu buttons from only Metering screen.

### Screens

Each type of controller has special set of screens stored in the controller configuration. The description of the each metering screens is by default predefined by ComAp. Scrolling between the screens is performed using the arrow up and down buttons.

**Note:** The metering screens are adjustable using the Screen Editor (in IntelliConfig). See chapter Screen Editor for more information. The Screen Editor tool also has its own manual.

## Status bars

### Bottom status bar

The bottom status bar is used for the user button functions. There are several status bars in the GUI. Bottom status bar consists of 5 areas (user buttons) dedicated for emitting the command to the controller unit (e.g. BTB Close/Open), jump to the specified page (e.g. alarmlist, history) or special functions on some pages.

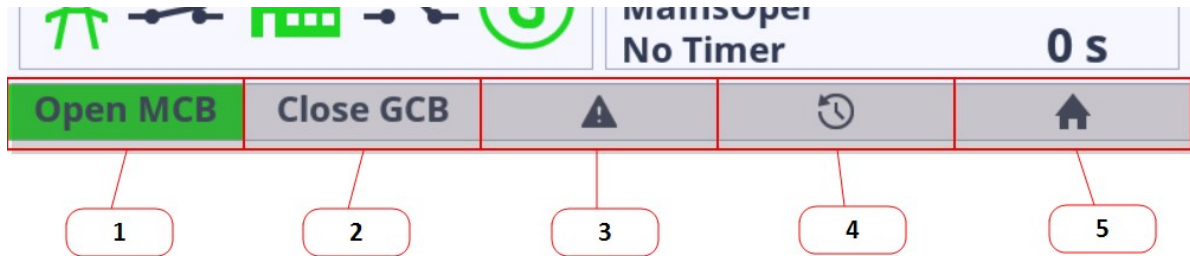


Image 5.10 : Bottom status bar on Home metering screen

1. **User button 1** - BTB Close/Open
2. **User button 2** -
3. **User button 3** - Show Alarm List
4. **User button 4** - Show History
5. **User button 5** - Show Home Screen

**Note:** The button press is visually indicated by black frame around the button area. The indication does not mean that requested command is performed, it is only press indication.

**Note:** Concrete status bar views for concrete page are described in specific chapters in this manual.

**Note:** Inactive buttons are visually indicated as grayed button. It means that the button is not available for any reason (e.g. password protected button).

### Top status bar

The top status bar can NOT be adjusted. Information in the top status bar is fixed and controlled by ComAp.

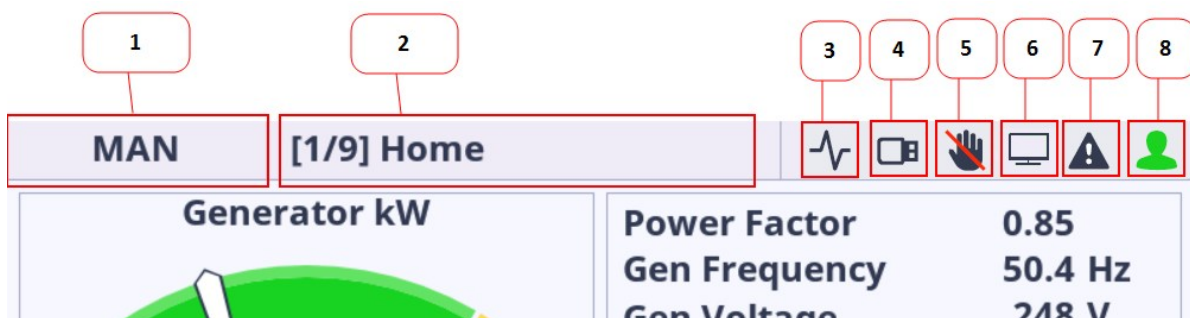


Image 5.11 Top Status Bar description

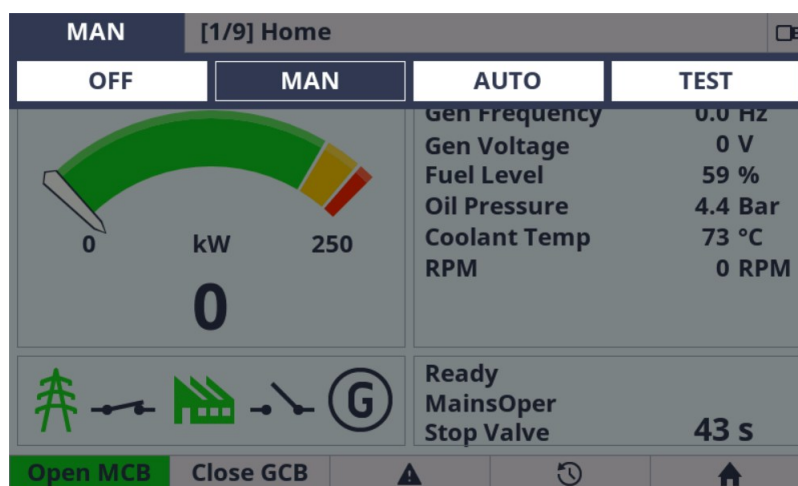


Image 5.12 : Top Status Bar - Mode selector dialog

1. **Mode selector** - Mode selector is dedicated for the controller mode selection. Using arrow left and right the controller mode is changed (only on the metering screens). The choice must be always confirmed by enter button. There is 5s timer for the automatic mode selector dialog cancellation. The mode selector dialog can be also canceled by menu button.
2. **Page title** - Each page and each metering screen has its own title. The first number in square brackets describes the actual metering screen position. The second number describes the total available number of metering screens.
3. **Trending** - The icon is active when the trending is running. Icon is inactive when the trending is stopped.
4. **USB Stick** - The icon is active if the USB stick is plugged in the display unit. Icon is inactive if there is no USB stick plugged in.
5. **Access Lock** - Access lock icon is active if the display is locked for security reasons. Icon is inactive if the controller unit is not locked.
  - IntelIMains 1010 BTB SC - the function in IntelIMains 1010 BTB SC is connected to the specific user account. It means only the user with sufficient rights can operate the controller or deactivate access lock function.
    - Icon (🔒 - Single Lock) is displayed if the controller is locked and actually logged-in user is the lock owner. User is able to operate the controller or to deactivate the access lock function.
    - Icon (🔒🔒 - Double Lock) is displayed if the controller is locked and actually logged-in user is NOT the lock owner. Also the Access Lock function can not be deactivated because of insufficient access rights. See chapter Access Lock for more information.
6. **PC connection** - PC connection icon is not supported in IntelIVision 5.2.
7. **Alarm indication** - The alarm icon is flashing red if there is at least one unconfirmed alarm (shutdown or warning) in the alarmlist. The icon lights red if there is at least one confirmed active alarm and no unconfirmed alarm in the alarmlist. The icon is inactive if the alarmlist is empty.
8. **User** - The user icon lights green if the user is logged in to the controller. The icon is inactive if the user is logged out.

## StartUp screen

The StartUp screen is defined in firmware and can not be adjusted. The screen is used as a default point in user interface. The main purpose of the screen is to handle all the necessary messages from the display to

the user. If the StartUp screen is displayed it is possible to Import the new display firmware, to see the IntelliVision Info screen, to set new communication parameters or to set other display parameters.

StartUp screen is displayed :

- during the booting procedure
- if the connection with controller is not established or interrupted

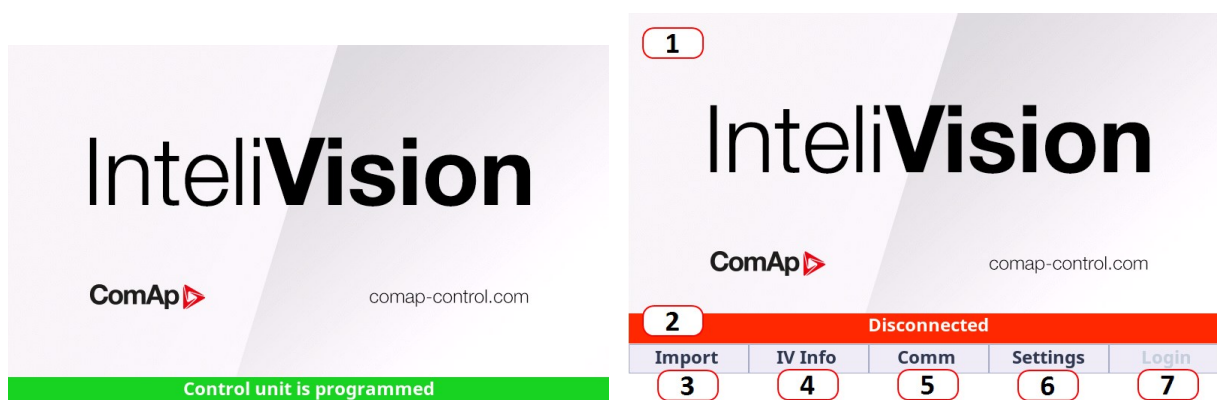


Image 5.13 : StartUp screen

1. **Init logo** - Init screen logo
2. **Status panel with message** - see Messages table below for more info
  - green - if the device is running, initialization, controller programming
  - red - other than running state (communication error, connecting to the controller)
3. **User button 1 - Import** - Firmware Import
4. **User button 2 - IV Info** - IntelliVision Info screen
5. **User button 3 - Comm** - Communication settings screen
6. **User button 4 - Settings** - Display settings screen
7. **User button 5 - Login** - Login to the controller
  - Inactive if comm. channel between display and controller is not established
  - Active if comm. channel between display and controller is established

### Status panel message table

Message / color	Message description
<b>Running</b>	The device is running without any issue.
<b>Initialize control unit</b>	Booting procedure and handshaking of internal processes.
<b>Control unit is programmed</b>	Connected controller is programmed.
<b>Detecting main CU failed</b>	Internal communication error.
<b>Not compatible application branch in CU</b>	Unsupported display or controller branch. Display and communication bridge are not compatible.

<b>Firmware is corrupted</b>	Display firmware or bootloader is corrupted.
<b>Unsupported configuration format</b>	Display does not support configuration in controller. Configuration reading failed for any reason. Issues with controller configuration. Issues with display memory allocation for controller configuration.
<b>Unsupported screen format</b>	Display does not support screen format in controller configuration controller. Language identifier has not been found in controller configuration
<b>Wrong configuration content</b>	Issues with the content of the controller configuration. Corrupted content of controller configuration.
<b>Disconnected</b>	Controller unit is (has been) disconnected for any reason. Transition state when the controller unit is programmed.
<b>Connecting</b>	Display tries to establish the secured communication channel with controller.
<b>Connected</b>	Secured communication channel between display and controller is established.
<b>Controller unreachable</b>	TCP/IP socket can not be created for any reason.
<b>Controller identification timeout</b>	TCP/IP socket was established but the communication inside the socket does not run.
<b>Controller authentication failed</b>	Display unit acquired unknown public key from the controller unit.
<b>Secure connection was not established</b>	Secured connection with controller can not be established.
<b>Wrong Credentials</b>	Attempt to login to the controller is refused. The wrong credentials have been inserted (Username, Password, UID or PIN)
<b>Access Blocked</b>	Brute force protection. Controller is temporarily blocked because of too many attempts of incorrect login.
<b>Wrong Interface</b>	Attempt for login using UID/PIN on untrusted interface. Only controller Ethernet 1 port accepts the login using UID and PIN.

**Note:** Connecting and connected state are marked red because at that moment the user is not logged in yet. Login procedure is automatic to IntelliMains 1010 BTB SC controller on StartUp screen (user with access rights 0 is always logged in). Due to this fact the connecting and connected state are the transition states only on StartUp screen.

## Connecting to the controller

The procedure of connecting display to the controller slightly differs based on which Ethernet terminal is used. In case of using **Ethernet 1 (page 17)** will not be required user login for connection and basic operations because the terminal is considered as Trusted. Any other terminal is considered as Untrusted and before actual connection user login is required.

**Note:** If display is not used (button is not pressed) for longer period, the user is logged out. This would cause disconnection from the controller if an Untrusted terminal is being used.



1. **Accept Unknown Certificate** - Connection acceptance of the unknown devices (with unknown public keys) or not supported branches.
  - a. Never (by default) - display unit never accepts the unknown devices.
  - b. Always - display unit always accepts the unknown devices.
2. **IP Controller** - IP address of the controller unit to be connected.
3. **IP Port** - IP port of the controller unit to be connected. Default IP Port is 23.
4. **Address** - Terminal Comm Address (page 316) of the controller.
5. **IP Mode** - there are two modes :
  - a. Automatic - display unit ethernet communication parameters are acquired automatically from the DHCP server (which must exist in the network infrastructure).
  - b. Manual (by default) - display unit ethernet communication parameters are configured manually by user.
6. **IP InteliVision** (by default 192.168.1.101) - The IP address of the display. Note that IP InteliVision address and IP Controller address must be in the same network to establish the connection.
7. **IP Subnet Mask** (by default 255.255.255.0) - Mask of the network where the ethernet communication is established.
8. **IP Gateway** (by default 192.168.1.101) - The gateway in network on which the packets are directed.
9. **User button 1 : Connect** - By pressing the button the communication automat is restarted to newly set parameters. Until the button is not pressed the previous communication channel is still in progress.

## Login to the controller

### Login via Untrusted terminal

If an **Untrusted terminal** is being used, the display stays connected to the controller but awaits user login, otherwise the controller does not provide any data. Login with an user to proceed to measurement screens.



### Login

☐ UserID
 ☒ Username

Username

Password

## Login via Trusted terminal

If the **Trusted terminal** is being used, the display automatically logs on to the controller with inbuilt user account level 0. The measurement screens are immediately showed and an user login is required only for specific functions which are set in configuration.

The group Password is not setpoint group. This Password item is manually placed to the first group position on the program code level just for this controller unit.

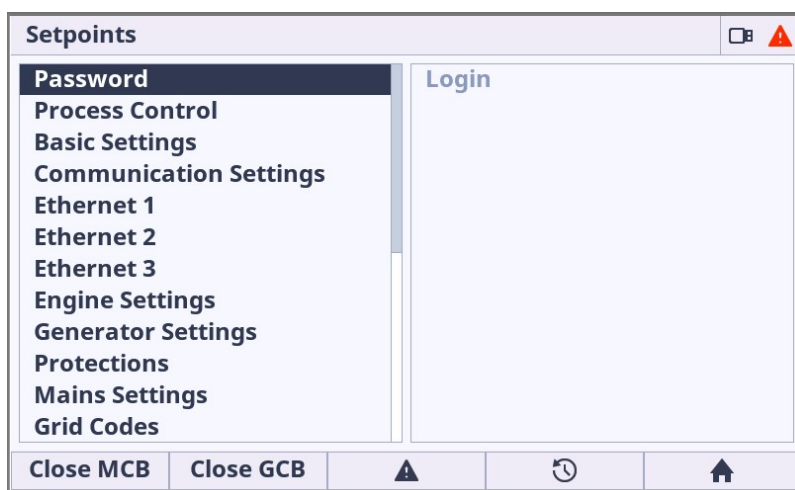


Image 5.14 : Main Setpoints Page

**Password item** - the item dedicated for the login and logout to the controller.

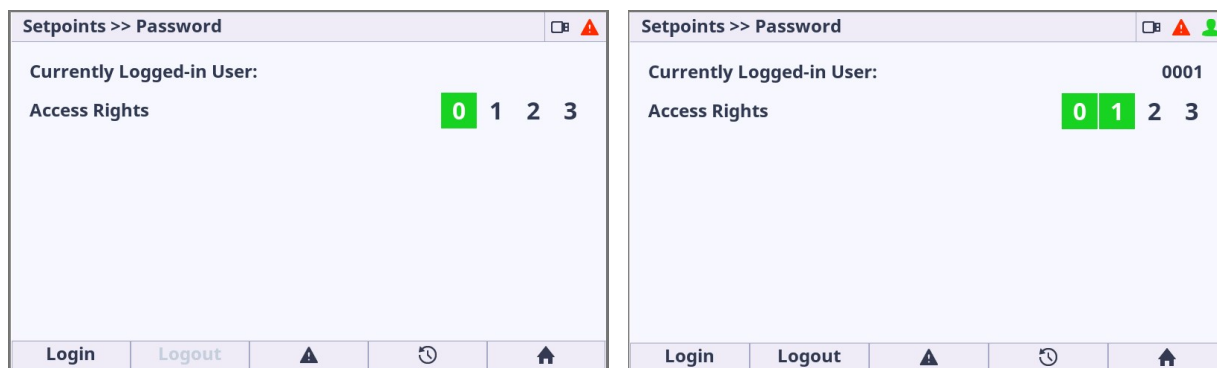


Image 5.15 : Setpoints Password Page



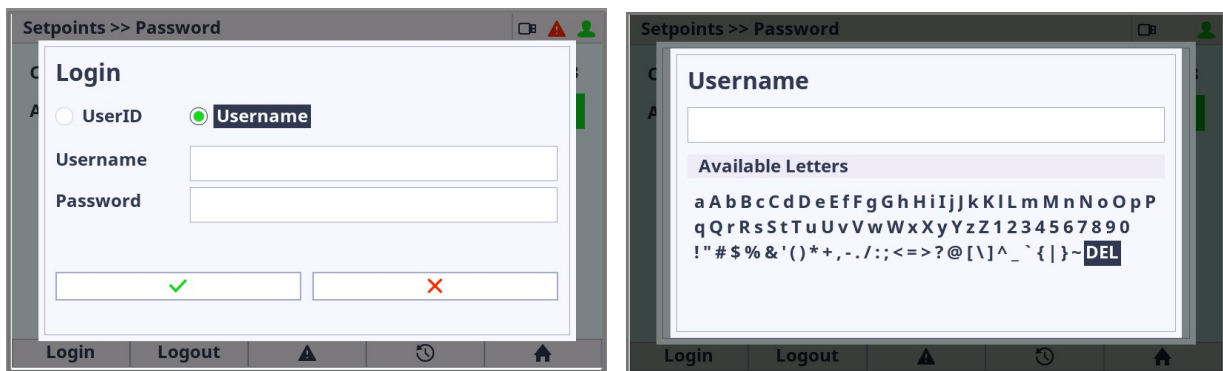


Image 5.16 : Login Dialog

**Currently Logged-in User** - the information about actually logged in user or his ID if logged using ID and PIN.

**Access Rights** - Access rights of the actually logged in user

- > 0 - user has access rights 0, which means "logged-out" user
- > 0,1 - user has access rights 0 + 1 access rights
- > 0,1,2 - user has access rights 0 + 1 + 2 access rights
- > 0,1,2,3 - user has access rights 0 + 1 + 2 + 3, which means administrator rights

**Login and Logout buttons**

- > Login button calls the login dialog.
- > Logout button performs the logout action.

## Enter Password

The dialog password is dedicated for password insertion. When the dialog is active the buttons arrow up and down are used for number selection. Enter button confirms the option. Menu button cancels the dialog without saving.

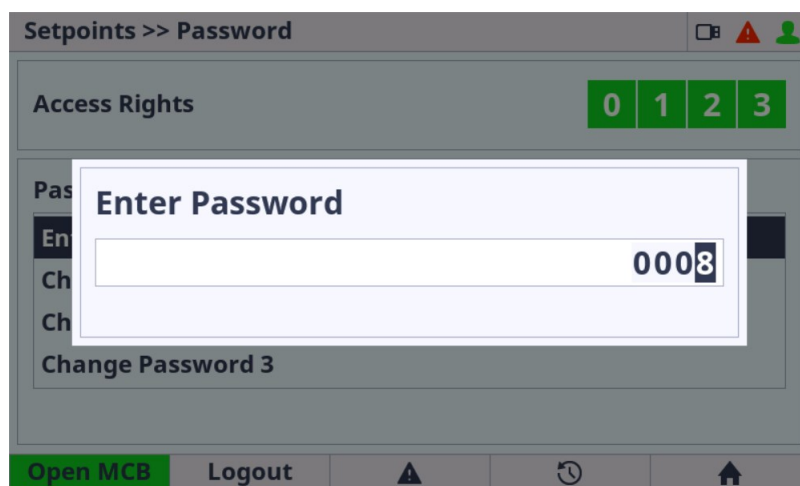


Image 5.17 : Dialog Password overview

## Password Change

The dialog password change is dedicated for password change. When the dialog is active the buttons arrow up and down are used for number selection. Enter button confirms the first option and the same password



must be inserted again. Enter button after insertion the second cell performs the password change (in case the password are same). Menu button cancels the dialog without saving.

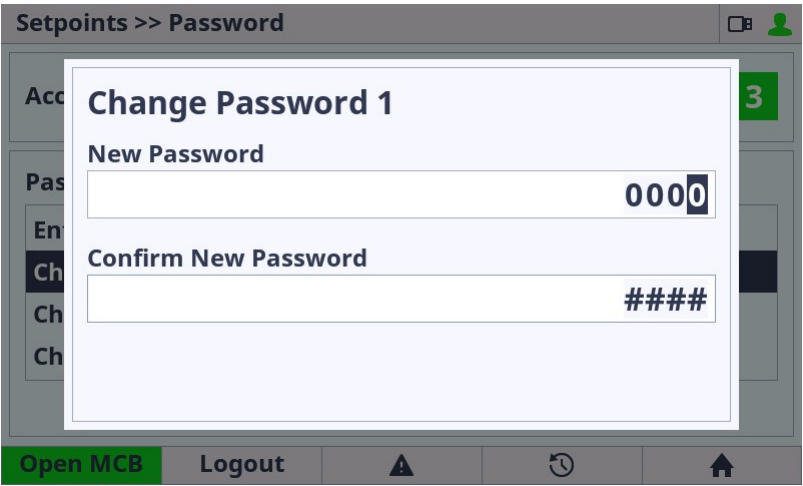


Image 5.18 : Dialog Password Change overview

**Note:** The user must be logged in with respective rights to be able to change password for respective rights.

### Setpoints

The setpoint page is intended for setting the controller values. Each type of controller has specific setpoints to be set. Availability of the setpoint item also depends on configuration level settings in Administration page. Setpoint is set in 2 steps.

- 1st step - Setpoint group is selected using buttons arrow up and down and confirmed using enter button

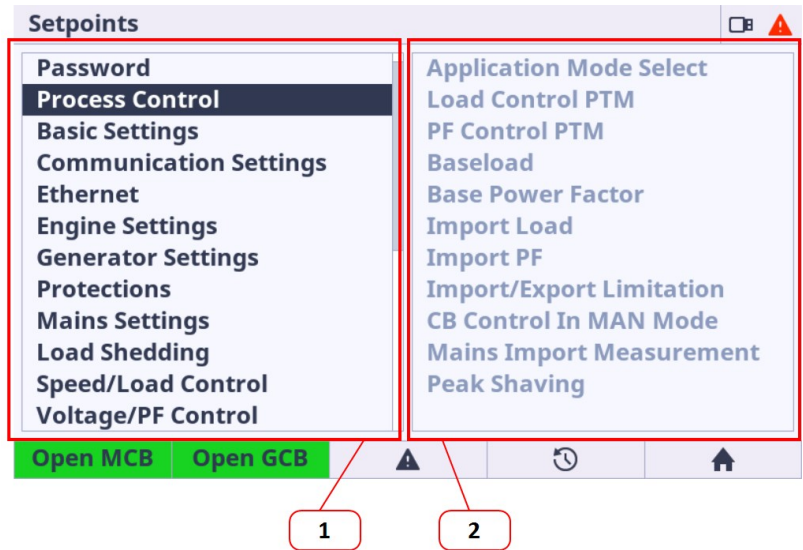


Image 5.19 : Setpoints Page overview

1. **Setpoints group** - the column setpoint group displays the available groups based on the controller, application type and configuration level settings. Respective setpoint group is selected using enter button.
2. **Available setpoints in actually selected group** - each setpoint group contains specific setpoints. The informative column Setpoint name displays the available set of setpoints to be set in each Setpoint group.

This column is only informative and can NOT be set using the arrow left and right. The setpoint setting is done using the 2nd step - see below.

- 2nd step - Setpoint item is selected using the buttons arrow up and down and the dialog for value setting is called using the enter button. The dialogs are described in the chapter Dialogs.

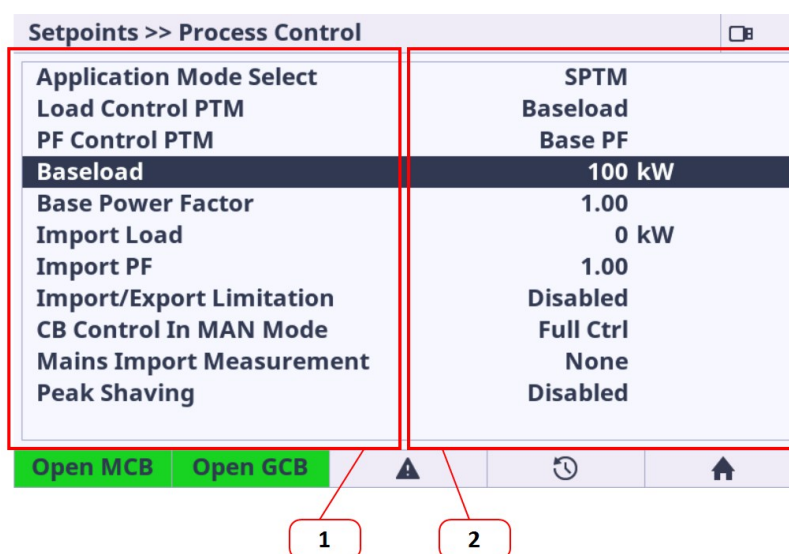


Image 5.20 : Group Setpoints Page

1. **Setpoint name** - Setpoint is set using the enter button. Specific dialog is displayed and the value can be set. There are several types of dialogs (text, numeric, stringlist) and the type of called dialog depends on the setpoint type. The dialogs are described in the chapter Dialogs.
2. **Actual value** - Informative actual value for specific setpoint is displayed. Value range, original value and default value for the selected setpoint are displayed inside the dialog.

## Protected Setpoint Indication

If the setpoint is protected by password then the icon (crossed hand) is displayed just behind the setpoint value. The setpoint protection is set using PC Tool InteliConfig.

## Force Value Indication

If the setpoint is forced by another setpoint then the icon (double right arrow) is displayed just behind the setpoint value.

- Green Icon - Forcing is active
- Grey Icon - Force Value is set to the specific setpoint and forcing is inactive

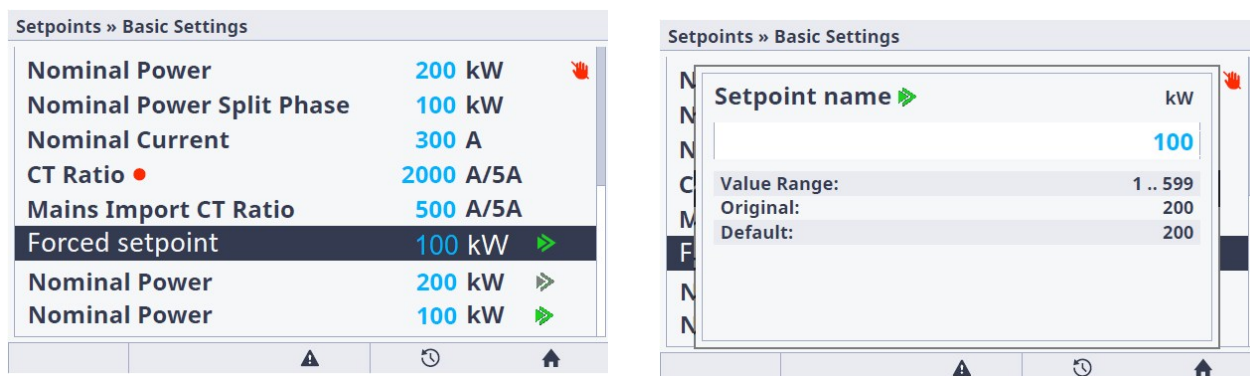


Image 5.21 : Force Value and Protected Setpoint Indication

**IMPORTANT:** If the controller is locked (Access Lock function is active) then the attempt for setpoint edition is denied and the information dialog is displayed (Controller is Locked). See chapter Administration and Access Lock.

## Numeric change

### Value

The dialog value is dedicated for number setting. When the dialog is active the buttons arrow up and down are used for number selection. Enter button confirms the option. Menu button cancels the dialog without saving.

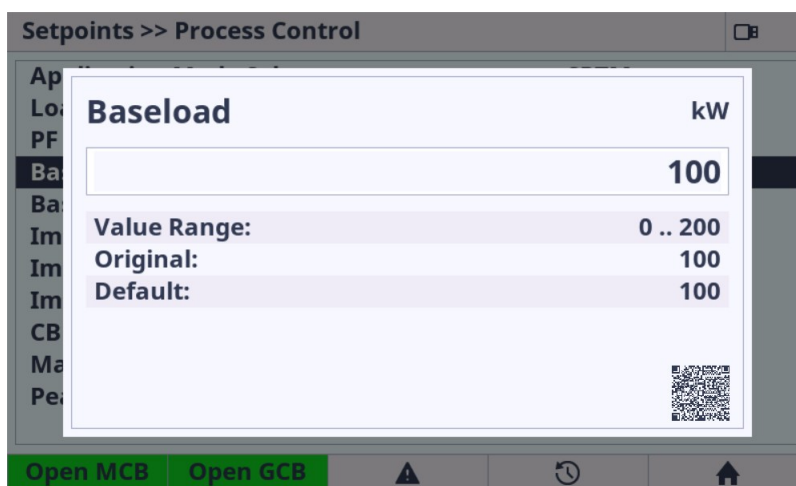


Image 5.22 : Dialog Value overview

### Value Extended

The dialog value extended is dedicated for number setting with combination with one or more string value. When the dialog is active the buttons arrow up and down are used for number/item selection. Enter button confirms the option. Menu button cancels the dialog without saving.

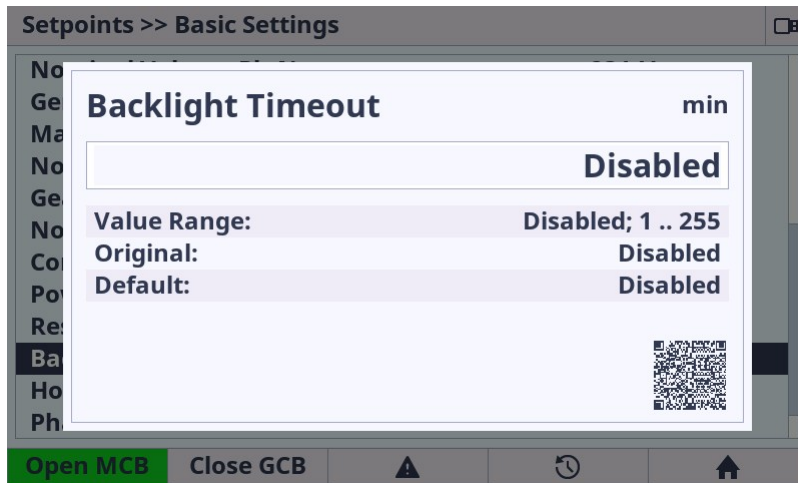


Image 5.23 : Dialog Value Extended overview

## IP address

The dialog IP address is dedicated for IP address insertion. When the dialog is active the buttons arrow up and down are used for number selection. Arrows left and right are used for moving between the IP cells. Enter button confirms the option. Menu button cancels the dialog without saving.

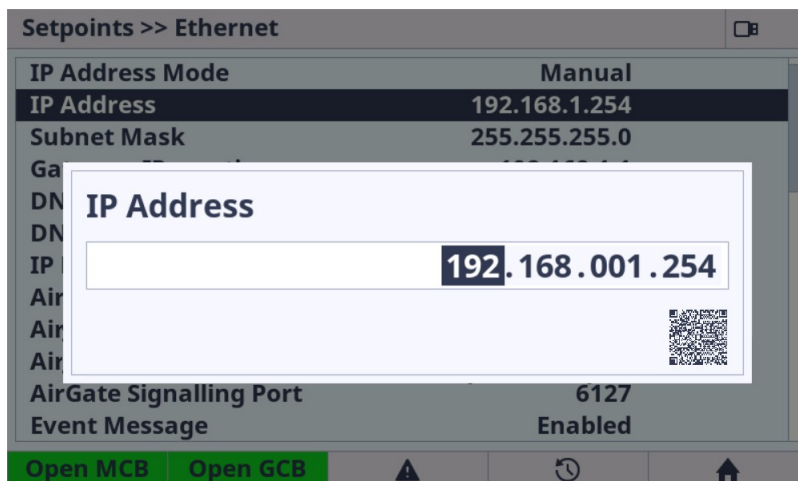


Image 5.24 : Dialog IP address overview

## String List Selection

The dialog string list is dedicated for list item selection. When the dialog is active the buttons arrow up and down are used for item selection. Enter button confirms the option. Menu button cancels the dialog without saving.

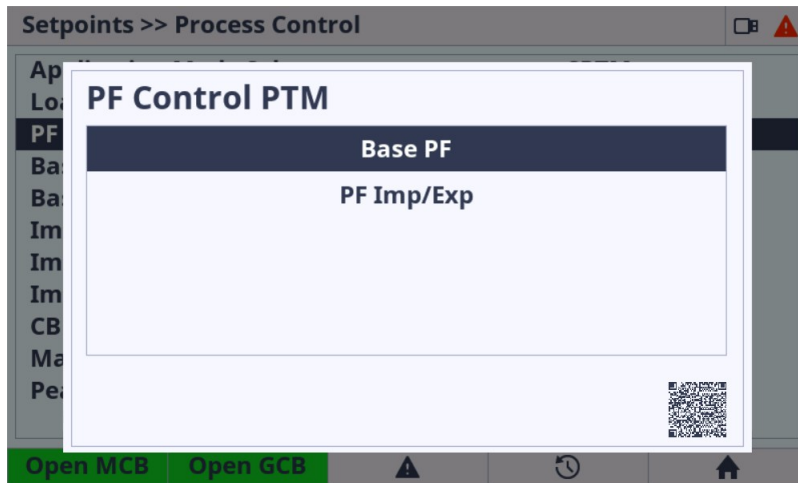


Image 5.25 : Dialog String List overview

## Text Edit

The dialog text is dedicated for text inserting or modification. When the dialog is active the buttons arrow up and down are used for letter selection. Arrow up means the selection in left direction, arrow down means the selection in right direction. Arrows right/left are used for moving between the letters to the next/previous letter position in the text field. If actual position is very right letter then the arrow right inserts new letter to the right. Letter DEL deletes actually selected letter (using left or right arrow). Insert letter (empty letter - just behind the DEL letter) inserts the letter to the actual position (using left or right arrow) Enter button confirms the text modification. Menu button cancels the dialog without saving.

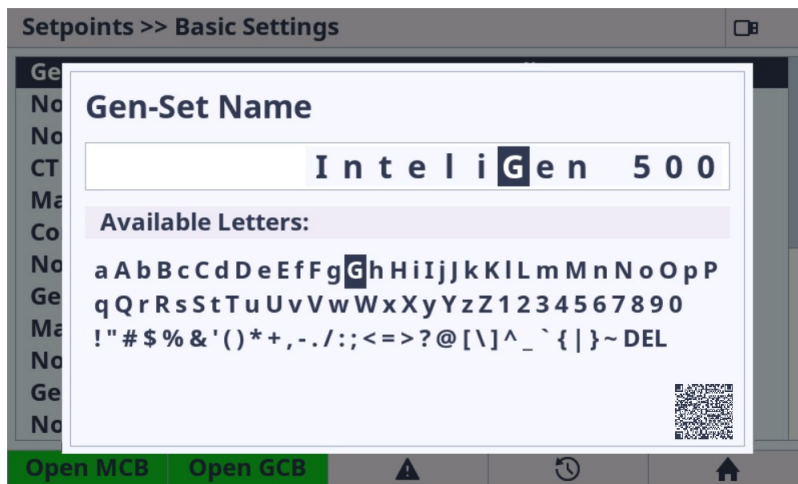


Image 5.26 : Dialog Text overview

**Note:** Enter button is used for dialog confirmation and saving the entire text to the configuration and because of this the DEL and INS letter is inserted using the left or right arrow button.

## Time and date edit

### Date

The dialog date is dedicated for date setting. When the dialog is active the buttons arrow up and down are used for number selection. Arrows left and right are used for moving between the date cells. Enter button confirms the option. Menu button cancels the dialog without saving.

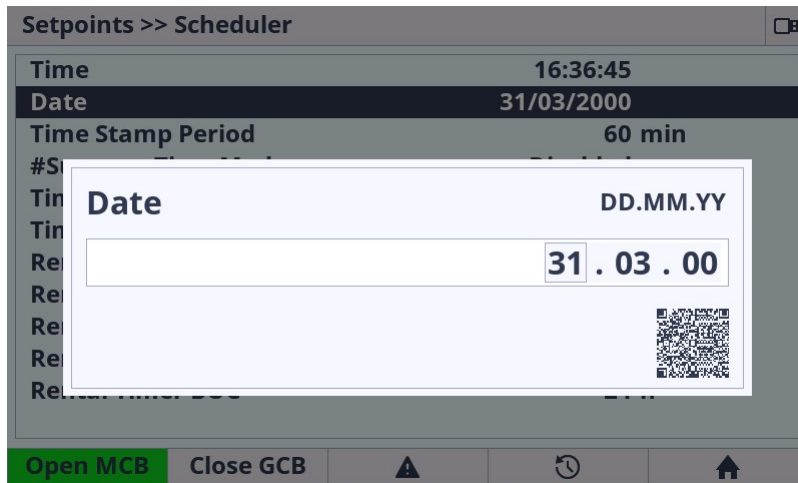


Image 5.27 : Dialog Date overview

## Time

The dialog time is dedicated for date setting. When the dialog is active the buttons arrow up and down are used for number selection. Arrows left and right are used for moving between the time cells. Enter button confirms the option. Menu button cancels the dialog without saving.

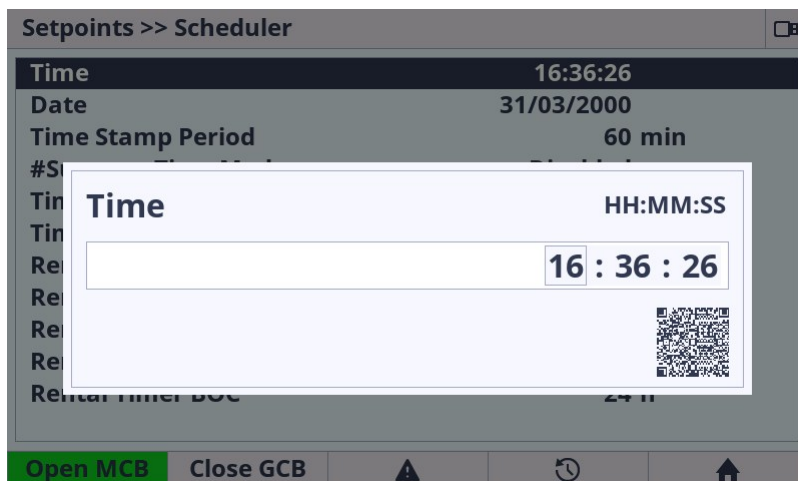


Image 5.28 : Dialog Time overview

## Timer settings

The dialog timer is dedicated for timer setting. When the dialog is active the buttons arrow left and right are used for the line option selection. Enter button confirms the actual option in the line and the next option can be performed. Enter button on the last line confirms all the option in dialog and save the timer settings to the controller. Menu button cancels the dialog without saving.

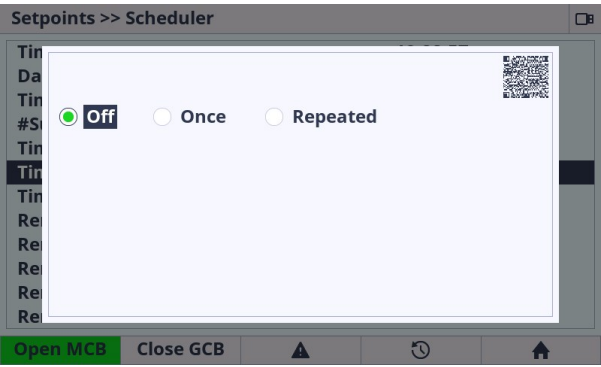


Image 5.29 : Dialog Timer (Off) overview

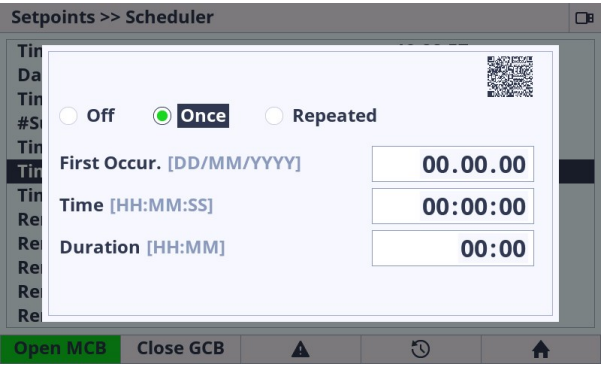
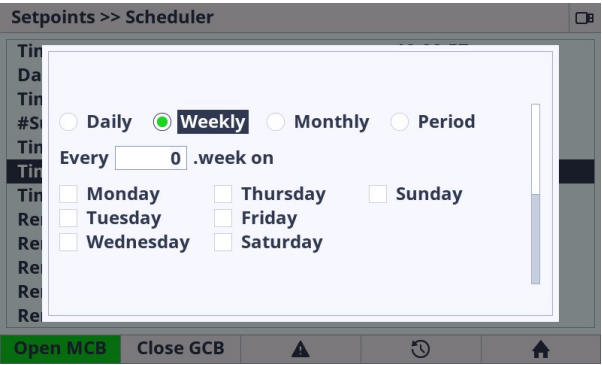
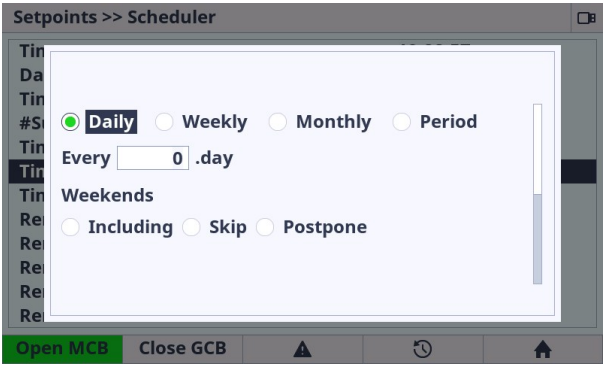
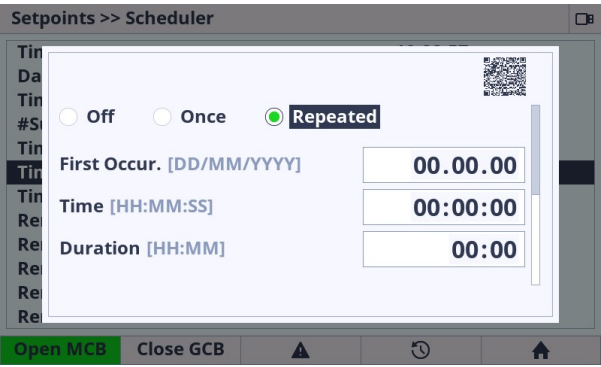


Image 5.30 : Dialog Timer (Once) overview



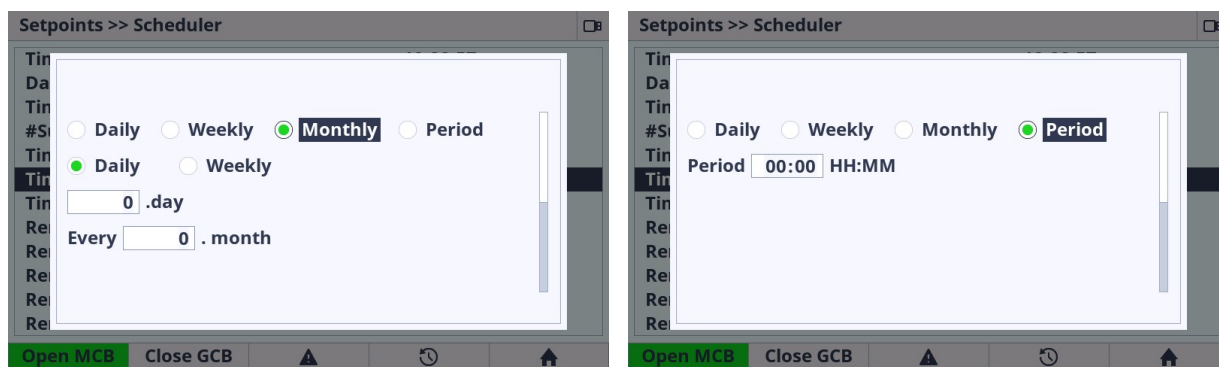


Image 5.31 : Dialog Timer (Repeated) overview

## Metering screens

### InteliMains 1010 BTB SC Controller screens

InteliMains 1010 BTB SC metering screens are predefined by ComAp and covers all the application types.

- > the movement between the metering screens is done using the arrow up and down buttons in the front panel
- > the entire screens and instruments on the screens are dynamically displayed or hidden based on the following state of the controller unit :
  - >> Application type
  - >> Wiring controller settings
  - >> Configured CAN modules
  - >> ECU list settings

### InteliMains 1010 BTB SC metering screens

- |                    |                         |
|--------------------|-------------------------|
| > Home             | > Statistics            |
| > Power            | > Ethernet 1            |
| > Bus Left         | > Ethernet 2            |
| > Bus Right        | > Ethernet 3            |
| > Synchronization  | > Hot Swap Redundancy   |
| > Power Management | > CAN modules           |
| > Analog inputs    | > ECU modules           |
| > Binary Outputs   | > Modbus Master Devices |
| > Binary Inputs    | > Virtual modules       |
| > Grid Codes       |                         |

## Alarmlist

The alarmlist page is intended for displaying the controller alarms. If any of the following type of the controller alarm occurs The alarmlist page is displayed and also the alarm icon in the Top status bar starts flashing RED, even if it is not the shutdown alarm. The Automatic jump to the Alarmlist page is performed only in case the actual GUI position is the Home metering screen. The alarm icon in the top status bar is informative icon where the display unit informs the user that there is any alarm stored in the controller unit. Pressing the User



button 3 opens the alarmlist page. The alarmlist page is displayed until the alarmlist contains at least one unconfirmed alarm.

There are 4 different types of controller alarms :

- > **Warning (often also known as 1st level alarm)** - represented by the YELLOW colour. These types of alarms inform the user that something is wrong and need to be checked and confirmed.
- > **Shutdown (often also known as 2nd level alarm)** - represented by the RED colour. These types of alarms protects the System during the wrong state.
- > **ECU alarm** - represented by the BLUE colour. This type of alarm comes from the connected external ECU units.

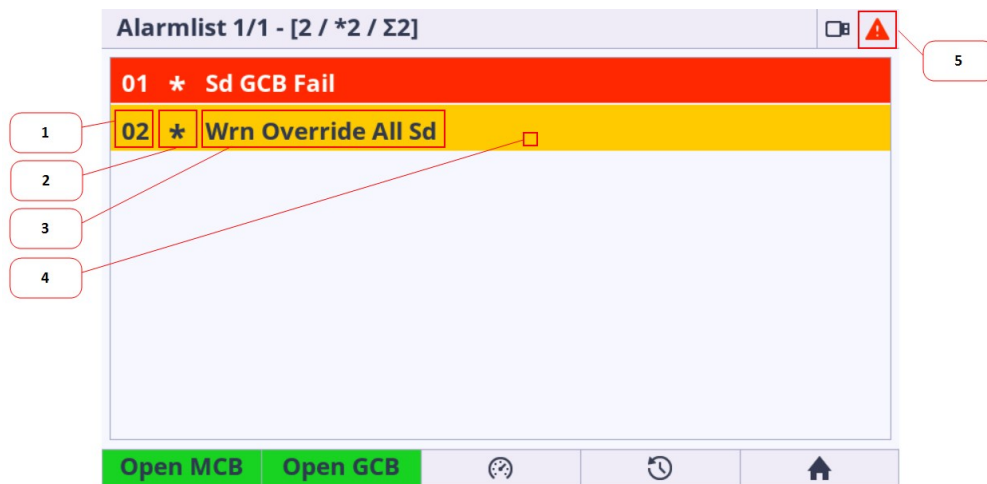


Image 5.32 : Alarmlist Page

1. **Alarm item number** - displays the number of the concrete alarm.
2. **Alarm item star** - describes if the alarm is CONFIRMED or NOT COFIRMED. The confirmation action is performed by the Alarm reset button in the front panel
  - a. Star is displayed - alarm is NOT CONFIRMED
  - b. Star is not displayed - alarm is CONFIRMED (using alarm reset button)
3. **Alarm description** - The short description of the alarm
4. **Alarm coloring** - There are specified the color and asterix combination
  - > level 1 (warning) alarm
    - Active/unconfirmed : \* / yellow background / dark text (asterix active)
    - Active/confirmed : yellow background / dark text (asterix inactive)
    - Inactive/unconfirmed : \* / dark background / yellow text / asterix active
  - > level 2 (shutdown) alarm
    - Active/unconfirmed : \* / red background / white text (asterix active)
    - Active/confirmed : red background / white text (asterix inactive)
    - Inactive/unconfirmed : \* / dark background / red text (asterix active)
  - > ECU alarm
    - Active/unconfirmed : \* / blue background / white text (asterix active)
    - Active/confirmed : blue background / white text (asterix inactive)

- Inactive/unconfirmed : **\*** / dark background / blue text (asterix active)

5. **Topstatus bar Alarmlist icon** - The alarm icon is flashing red if there is at least one unconfirmed alarm (shutdown or warning) in the alarmlist. The icon lights red if there is at least one confirmed active alarm and no unconfirmed alarm in the alarmlist. The icon is inactive if the alarmlist is empty. This is information that something is wrong and need to be checked and resolved.

**Note:** The Alarmlist displays maximum 8 alarm items at the same time. If there is more than 8 alarms in the alarmlist it is possible to list in the page to another alarm items by arrow up and down buttons.

**Note:** The alarmlist page is automatically displayed and backlight is turned on if the new alarm appears (only in case the actual GUI position is the Home metering screen).

**IMPORTANT:** IntelliVision 5.2 displays maximum 16 alarms.

**IMPORTANT:** Alarm reset button confirms all the unconfirmed alarms stored in controller and resets the horn. Horn reset button resets only the horn.

**IMPORTANT:** If the actual GUI position is Alarmlist page and there is at least one unconfirmed alarm in the Alarmlist the jump to the home metering screen and backlight timeout are ignored.

## History

The history page displays the records of the important moments in the controller history.

There are 2 types of history records :

- **Event records** - are also known as standard history records. This type of record appears in case the controller event has been made. The time stamp history also belongs in the event history. The time record is stored for a specified period of time.
- **System records** - are also known as text history record. These type of records are generated during the user login/off, controller programming or other system actions.

The screenshot shows the 'History' page interface. Callout 1 points to the 'History' title bar. Callout 2 points to the 'Reason' column. Callout 3 points to the 'RPM' column. Callout 4 points to the '1st Row/Col' button. Callout 5 points to the '1x' button.

No.	Reason	Date	Time	RPM
0.	Sd GCB Fail	25/02/2000	00:33:23	
-1.	SetpointChange	25/02/2000	00:30:44	T=USB C
-2.	Ready	25/02/2000	00:27:23	
-3.	Wrn Override All Sd	25/02/2000	00:27:21	
-4.	Gen-set Stop	25/02/2000	00:27:19	
-5.	Loaded	25/02/2000	00:27:18	
-6.	Soft Load	25/02/2000	00:27:12	
-7.	Sd GCB Fail	25/02/2000	00:27:12	

1st Row/Col 1x

Image 5.33 : History page overview

1. **Fixed column** - has a different shade of colour. Fixed column is always merged and anchored on the left side of the history page.

2. **Event history record** - this type of record appears in case the controller event has been made. The time stamp history also belongs in the event history. The time record is stored for a specified period of time. Pressing the enter button the dialog with detailed information for selected record is displayed.
3. **System history record** - this type of record appears in case the controller system action has been made. The time stamp history also belongs in the event history. The time record is stored for a specified period of time. Pressing the enter button the dialog with detailed information for selected record is displayed.
4. **Jump to first row and column** - the jump to the first row and first column is performed if the button is pressed.
5. **Listing mode** - by pressing this button the listing mode is changed. There are available 3 modes : listing by 1 item, listing by 1 page, listing by 10 page. The mode is useful if the history is full of records. Listing mode is also automatically changed if the listing buttons arrow up and down are pressed for longer time. Original mode is set when the listing buttons are released.

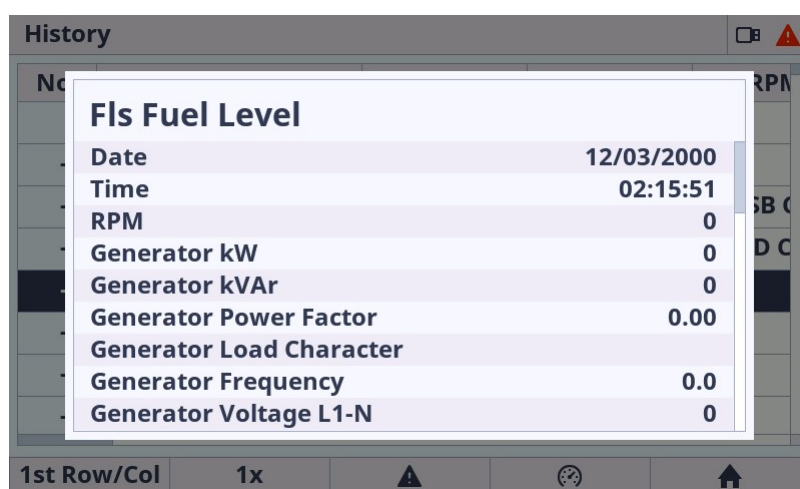


Image 5.34 : History page - Item detail dialog

**Note:** Pressing the enter button on the actually selected row the dialog with detailed information for selected record is displayed.

**IMPORTANT:** Each controller unit supports the specific number of history records. E.g. controller IntelliMains 1010 BTB SC supports 1000 history records. Default configuration consists of 33 columns. Maximal column amount is approximately 100 columns based on the type of the observed value.

## Trends

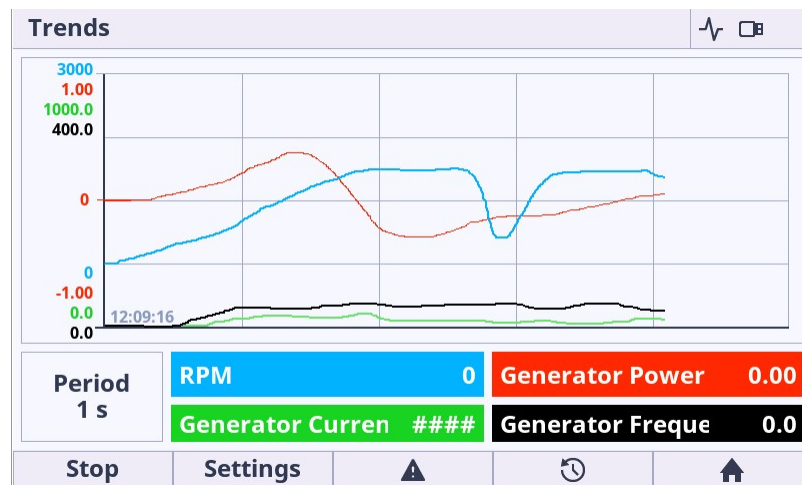


Image 5.35 : Trends page overview

The Trends page is divided on to 3 main blocks :

- **Main Trends Window** is intended to display all trends. The view and chart movement is fully automatic.
- **Channel panel** displays the actual values and sample period.
- **Function buttons** is intended for start, stop and settings of the trends.

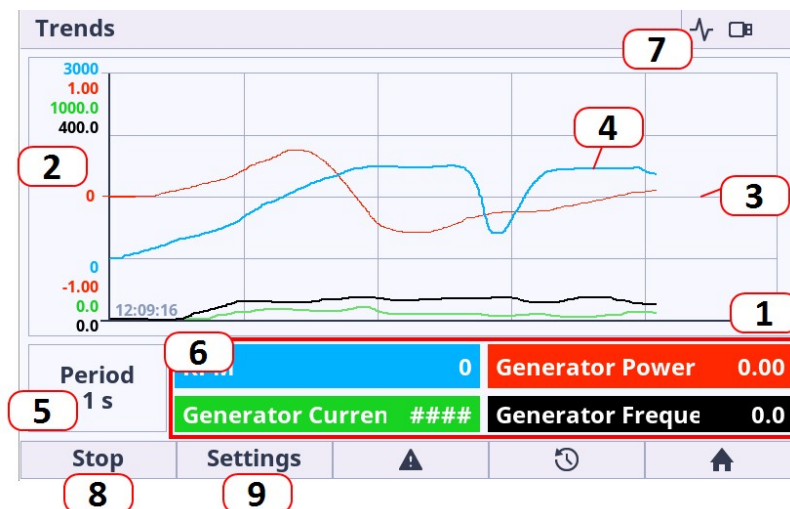


Image 5.36 : Trends page description

1. **X axis** -X axis displays the time stamps. The view of X axis is fully automatic.
2. **Y axis** - If the default range is not suitable for the displaying of the value it can be adjusted in settings option. See below for more information.
3. **Grid** - the grid is displayed behind the trends charts. The grid is fully automatic.
4. **Trend line** - each channel have different colour for better value identification. The color of the trend line match to the Value color in channel panel.
5. **Actual period** - Actual period settings. The period can be adjusted in settings option.
6. **Actual channel value panels** - display the values of the newest (actual) sample.

7. **Trend Icon** (Top Status bar) -if the trends are running the informative icon is shown in the top status bar
8. **Start / Stop button** - the button is dedicated for manual start and stop of the trends. It is possible to setup the automatic start of trending based on the trigger. There are 2 triggers : Return to Home metering screen and the specified bit of the available binary value.
9. **Channel settings button** - There are some settings available for the trends. See more information below.

## Administration

Administration menu screen is accessible by using the buttons combination Enter + Menu just only from the metering screens. Enter button has to be pressed first.



Image 5.37 : Shortcut (jump to the administration)

## Configuration Level

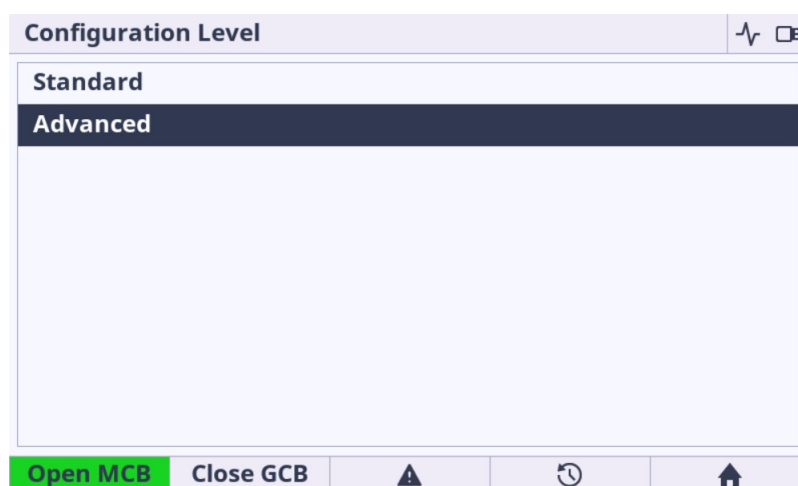


Image 5.38 : Administration Page - Configuration Level

- > **Standard** - Limited amount of settings are available for configuration. The description which settings are available in chapters concerning to controller functions.
- > **Advanced** - Set by factory default. All the settings are available for configuration. Be aware that only experiences users should perform the settings of extended functions.

**Note:** By default the Advanced settings is selected which means all the setpoints are available by default. To restrict the availability the Standard setting must be performed. The advanced and standard category are set in IntelliConfig PC application.

**Note:** Configuration Level screen is accessible using the buttons combination Enter + Menu just only from the metering screens. Enter button has to be pressed first.

## Display settings

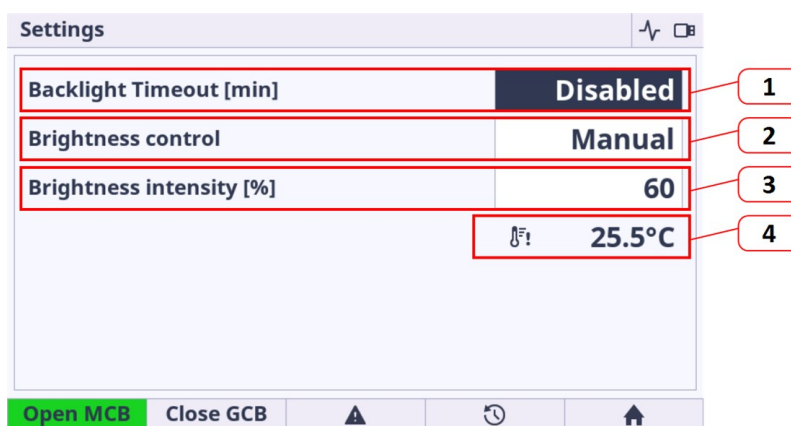


Image 5.39 : Administration Page - Settings

1. **Backlight Time** - if the cell area is pressed the dialog for time settings is displayed. The user is able to set the period from 1 up to 241 minutes. There is also the option to set NO Timeout which means the display unit is backlit forever. Note that in remote displays like IntelliVision 5.2 the Backlight Timeout option is not mirrored with controller setpoint Backlight Timeout (it is mirrored in Integrated Color Display).
2. **Brightness Control** :
  - a. Manual (by default) - the value of the backlight is set manually using the value dialog (point 3)
  - b. External - the value of the backlight is controlled by the external resistor or potentiometer. Resistor 5-2400  $\Omega$  corresponds to 0-100% backlight. If the resistor value is out of range, the manual option is used.
3. **Brightness intensity** - the value is selected using the value dialog. Note the value is applied immediately during the change of the value.
4. **Internal Temperature information**- gives the actual inside temperature of the unit. There is implemented automatic mechanism for lowering the backlight intensity based the internal derating backlight curve. If the inside temperature exceeds 35 °C the area behind the temperature lights yellow. The yellow color indicates that the display backlight curve is applied and automatically starts derate the backlight intensity. The backlight intensity returns to normal when the temperature is decreased below 35 °C. This feature saves the lifetime of the internal components.

**IMPORTANT:** It is strongly recommended to use backlight on the standard level max. 60%. Maximal backlight intensity level of 100% is suitable only for application with higher amount of the ambient light. Be aware that higher intensity level means higher surface front glass temperature and lower lifetime.

**IMPORTANT:** It is strongly recommended to use Backlight Time (timer) set on the reasonable amount of time (approximately 30 minutes) during the normal running Gen-set phase. It is because of saving lifetime of the display unit. The display unit is still running if the backlight is off. For switching on the LCD backlight the simple pressing any button is necessary.

**Note:** Settings screen is accessible using the buttons combination Enter + Menu just only from the metering screens. Enter button has to be pressed first.

## Languages

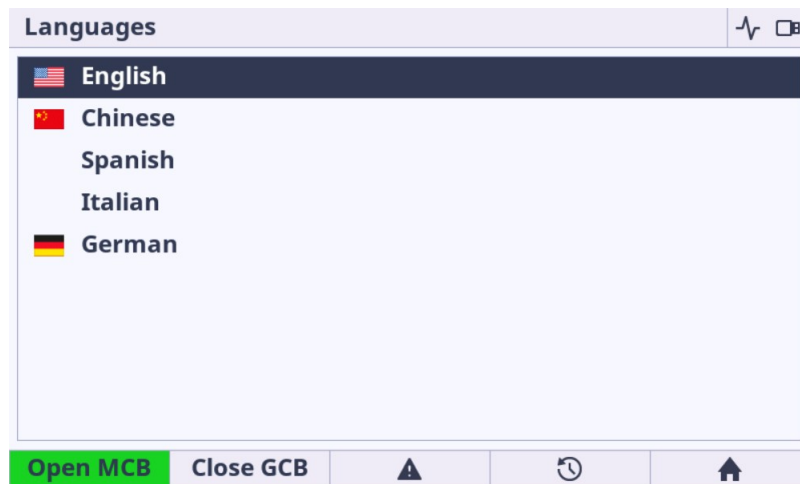


Image 5.40 : Administration Page - Languages

- > **Language settings** - the list of languages stored in the controller configuration is displayed in the list of possible languages.
- > The IntelliVision 5.2 and Integrated Color Display units support the following languages
  - >> English
  - >> Chinese
  - >> Japanese
- > The IntelliVision 5.2 and Integrated Color Display units **partially** support the following languages
  - >> Bulgarian, Taiwan, Czech, German, Greek, Spanish, Finnish, French, Hungarian, Icelandic, Italian, Korean, Dutch - Netherlands, Norwegian, Polish, Roman, Russian, Croatian, Slovak, Swedish, Turkish, Ukrainian, Slovenian, Estonian, Latvian, Lithunian, Vietnamese, Italian, Portuguese, Bosnian
- > The IntelliVision 5.2 and Integrated Color Display units support the following Unicode standard character sets
  - >> Basic Latin, Latin-1 Supplement, Latin Extended-A, Latin Extended-B, Latin Extended Additional, Cyrillic, Greek, Greek Extended, Arabic, Arabic Supplement, General Punctuation, Superscripts and Subscripts, Currency Symbols, Arrows, CJK Unified Ideographs, Kanji, Hiragana (full width), Katakana (full width), Hangul Jamo, Thai

**IMPORTANT:** Even the language is configured in IntelliConfig the specific language is unavailable if the language is empty or the language is not supported by the display unit.

**Note:** The flag is not displayed if the language is supported but the flag icon does not exist in the integrated color display unit.

**Note:** Languages screen is accessible using the buttons combination Enter + Menu just only from the metering screens. Enter button has to be pressed first.

## Controller Info

Controller Info screen in IntelliVision 5.2 is dedicated for important information about the connected controller unit. These information is useful mainly for issues troubleshooting.

Controller info page is divided into 2 main blocks of information :

- Controller unit
  - ID String
  - Software Version
  - Serial Number
  - Controller Type (HW)
  - Application Type (HW)
  - Application Branch (HW)
  - Hardware Type (PCB)
  - Hardware Version
  - ID Chip Version
  - Hardware Features
- Configuration
  - Application Version
  - Controller Type (SW)
  - Application Type (SW)
  - Application Branch (SW)
  - Application
  - Configuration Format / Configuration Terminal Format
  - Configured by

Controller Info		Controller Info	
Name	Value	Name	Value
ID String	InteliGen-500-1.2.1.2	Hardware features	0100000000000000
Software version	1.2.1.2	Application version	1.2.1.2
Serial number	FF08038A	Controller type (SW)	21
Controller type (HW)	21	Application type (SW)	2
Application type (HW)	2	Application branch (SW)	1
Application branch (HW)	1	Application	Standard-GC
Hardware type (PCB)	2	Configuration format	6 / 5
Hardware version	1.0.0.0	Configured by	24 5.6.0.21
Close GCB		Close GCB	

Image 5.41 : Administration Page - Controller Info

**Note:** Similar values with similar structure can be displayed using IntelliConfig PC tool.

**Note:** Controller Info screen is accessible using the buttons combination Enter + Menu just only from the metering screens. Enter button has to be pressed first.

**IMPORTANT:** Integrated Color Display information in Controller Info screen is not available in remote displays.



## Modules Info

Modules Info screen is dedicated for important information about the connected CAN and Plug-In modules information. The page Modules Info displays the information from the following type of connected modules :

- Plug-In modules
- CAN peripheral extension modules



Image 5.42 : Administration Page - Modules Info

**Note:** The availability of the connected module depends on the type of controller unit.

**Note:** Modules Info screen is accessible using the buttons combination Enter + Menu just only from the metering screens. Enter button has to be pressed first.

## ECU Modules Info

Electronic Control Unit Modules screen is dedicated for important information about the connected modules information.

The screen ECU Modules displays the information from the following type of connected modules :

## > ECU Modules

ECU Modules			 
ID	Module name	Module Addr.	Contr. Addr.
4	ECU 1	255	255

Close GCB








Image 5.43 : Administration Page - ECU Modules

**Note:** The availability of the connected ECU module depends on the type of controller unit.

**Note:** ECU Modules screen is accessible using the buttons combination Enter + Menu just only from the metering screens. Enter button has to be pressed first.

## Operating Modes

The operating mode can be selected by pressing Left and Right buttons  on the front panel/display, by changing the **Controller mode (page 250)** setpoint, or by activating respective LBI.

**Note:** If the setpoint is configured as password-protected, the correct password must be entered prior to attempting to change the mode.

The following binary inputs can be used to force one respective operating mode independent of the mode setpoint selection:

- Remote OFF (page 556)
- Remote MAN (page 556)

If the respective input is active the controller will change the mode to the respective position according to the active input. If multiple inputs are active, the mode will be changed according to priorities of the inputs. The priorities match the order in the list above. If all inputs are deactivated, the mode will return to the original position given by the setpoint.

# 5.2 Controller configuration and PC tools connection

5.2.1 USB .....	108
5.2.2 Ethernet .....	109

🔍 back to Controller setup

This chapter contains brief introduction into the specifics of firmware and archive upload and connection of various PC tools to the controller. If you require detailed information on each PC tool please use the included Help in those PC tools or download their Reference Guides.

## 5.2.1 USB

You may connect to the controller using the 📡 **USB (page 41)** Port. In this case standard USB A to B cable should be used - **USB (page 69)** connection.

### Connection using InteliConfig

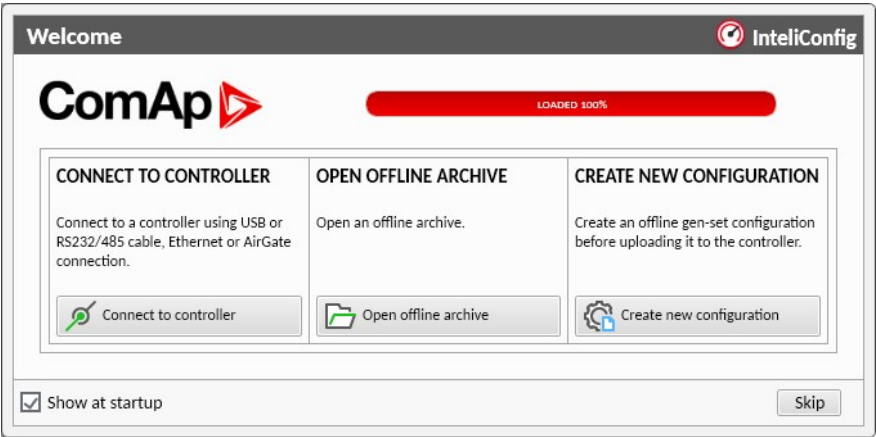


Image 5.44 First screen of InteliConfig - select connect to controller

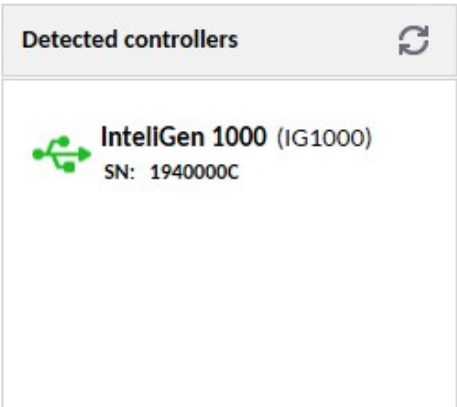


Image 5.45 Second screen of InteliConfig - Select your controller from list of Detected controllers.

Select your controller from the list of Detected controllers. You need to know your controller's serial number.

**Note:** You do not need to be using user account while connecting via USB.

## Connection using WinScope

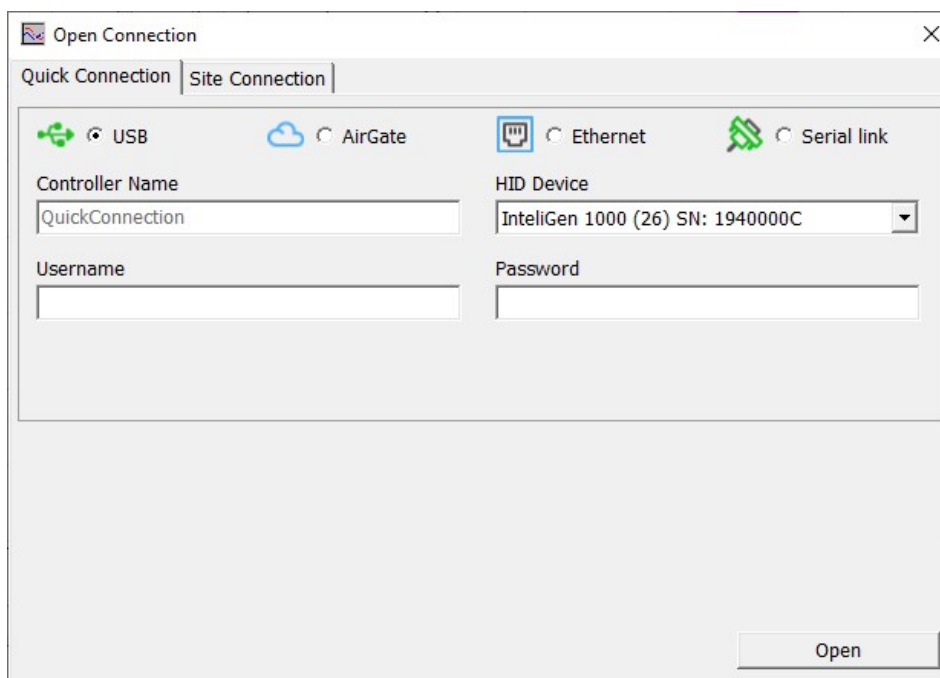


Image 5.46 WinScope screen - Select your controller from list of Detected controllers.

Select your controller from the list of Detected controllers. You need to know your controller's serial number.

**Note:** You do not need to be using user account while using WinScope1000 connected via USB.

### 5.2.2 Ethernet

You may connect to the controller using any of the **Ethernet 1 (page 44)**, **Ethernet 2 (page 44)** or **Ethernet 3 (page 44)** ports, if correct ETH Port Configuration settings are applied (**Ethernet port 1 (page 323)**, **Ethernet port 2 (page 324)**, **Ethernet port 3 (page 325)**).

**Note:** See *Communication peripherals (page 17)* to see differences between these peripherals.

**Note:** Go to *Types of interfaces (page 173)* to see types of ethernet interfaces and possibilities of connections.

### Direct connection

When you use direct connection the controller needs to be reachable directly from the PC you use (i.e. one LAN or WAN without any firewalls and other points that may not allow the connection). The following settings need to be checked in the controller:

- **Direct Connection Port (page 330)** has to be set to the same value as in the PC tool.
- **IP Address Mode (page 326)** can be set to AUTOMATIC when there is DHCP service is available. Otherwise it needs to be set to FIXED.
- **IP Address (page 327)** is either set automatically or it can be adjusted to a specific requested value.
- **Subnet Mask (page 327)** is either set automatically or it can be adjusted to a specific requested.
- **Gateway IP (page 328)** can be set here when it is used.

**Note:** The connection speed might be significantly limited when you connect the controller directly from the PC and your Ethernet card is setup to Energy-Efficient Ethernet option.

Connection using IntelliConfig

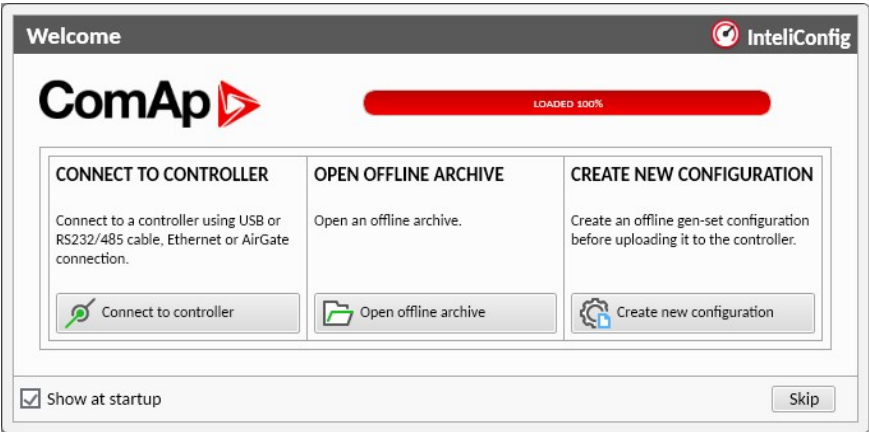


Image 5.47 First screen of IntelliConfig - select connect to controller

The screenshot shows the 'Online Connection' tab in the IntelConfig interface. Three connection methods are available: AirGate, Ethernet (selected), and Serial link. Below the selection, there are input fields for 'IP address' (containing '10.0.0.6:23'), 'Access code', 'Controller address' (containing '1'), 'Username/UID', and 'Password/PIN'. A red 'OPEN' button is located at the bottom right of the form.

Image 5.48 Second screen of IntelConfig - select Ethernet

Use **IP address** which is stored in proper value (based on selected Ethernet peripheral) and fill **Controller address** - this needs to be same as value of **Terminal Comm Address** (page 316).

**IMPORTANT: Never fill Access code!**

**IMPORTANT: In case of using Ethernet 2 (page 18) you need to fill Username and Password of actual user account.**

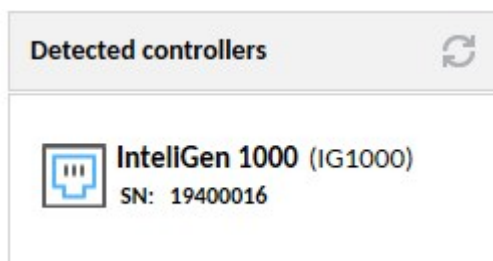


Image 5.49 Second option of connection via IntelConfig

You can also select controller from "Detected controllers" feature. If this controller is connected via **Ethernet 2** (page 18) you will be prompted to fill **Username** and **Password** of actual user account.

## Connection using WinScope

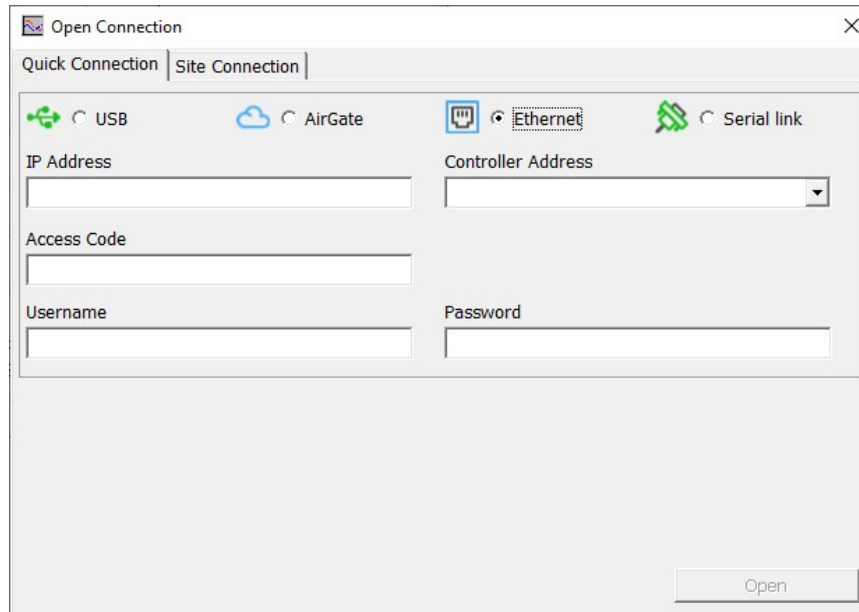


Image 5.50 WinScope screen - select Ethernet

Use **IP address** which is stored in proper value (based on selected Ethernet peripheral) and fill **Controller address** - this needs to be same as value of **Terminal Comm Address (page 316)**.

**IMPORTANT: Never fill Access code!**

**IMPORTANT: In case of using Ethernet 2 (page 18) you need to fill Username and Password of actual user account.**

### AirGate connection

You may connect to the controller using AirGate which works only via **Ethernet 2 (page 18)**. If the AirGate key in the Access Administration is empty the controller will not connect to the AirGate despite the function is enabled. Access Administration is available in Tools of the IntelliConfig.

Setpoints and values related to connection via AirGate:

- > **AirGate Connection (page 335)** - has to be **ENABLED**
- > **AirGate Address (page 336)** - manually adjusted address of AirGate server
- > **AirGate Port (page 336)** - manually adjusted port for communication between Controller and AirGate server
- > **AirGate Status (page 451)** - has to be **connected, operable**
- > **AirGate ID (page 452)** - 9 numbers long ID of the controller

**IMPORTANT: Controller has to be connected to the Internet.**

## Connection using IntelliConfig

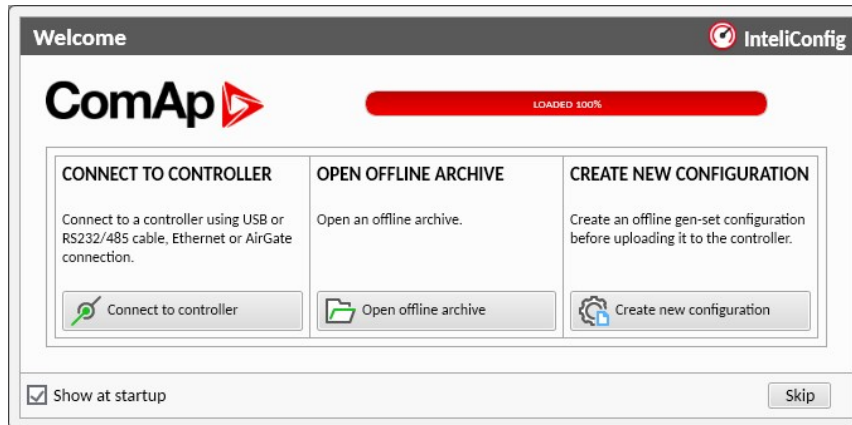


Image 5.51 First screen of IntelliConfig - select connect to controller

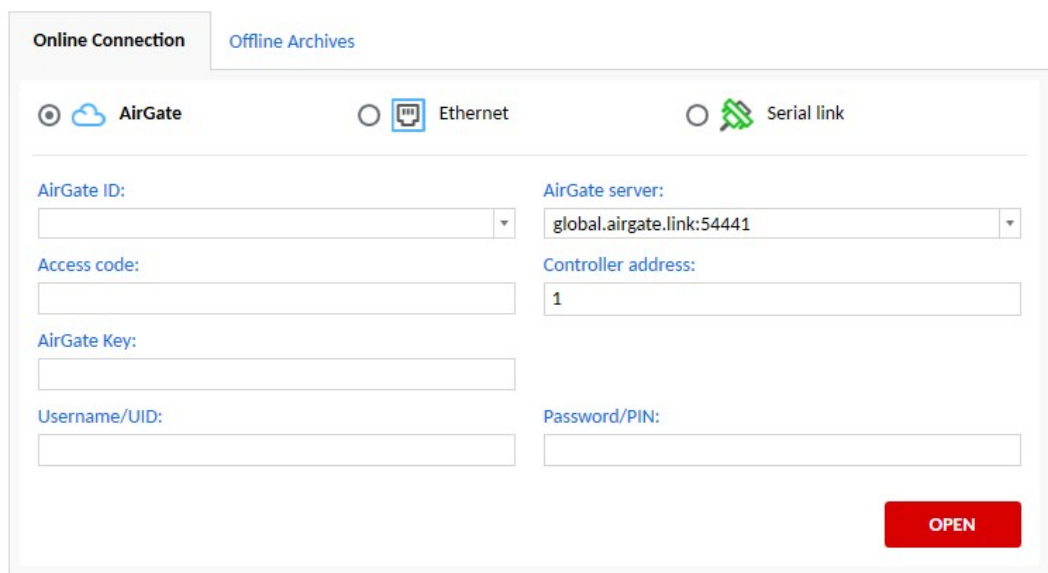
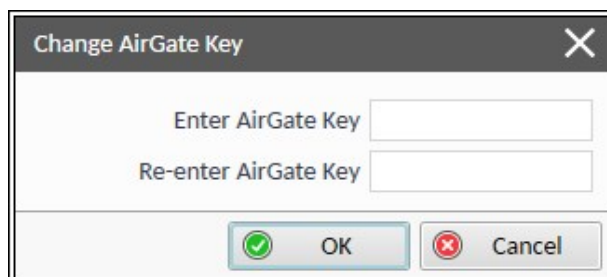
The image shows the 'Online Connection' tab of the IntelliConfig software. It features three radio buttons for connection types: 'AirGate' (selected), 'Ethernet', and 'Serial link'. Below these are several input fields: 'AirGate ID' (a dropdown menu), 'AirGate server' (a dropdown menu with 'global.airgate.link:54441' selected), 'Access code' (a text field), 'Controller address' (a text field with '1' entered), 'AirGate Key' (a text field), 'Username/UID' (a text field), and 'Password/PIN' (a text field). A red 'OPEN' button is located at the bottom right.

Image 5.52 Second screen of IntelliConfig - AirGate

Use **AirGate ID**, **AirGate server** with proper port (54441 for global.airgate.link), **AirGate Key** and **Controller address** - this needs to be same as value of **Terminal Comm Address** (page 316). Valid user account - **Username** and **Password** - is required for the connection.

**IMPORTANT: Never fill Access code!**

**Note:** Ask your administrator for **AirGate Key**. Administrator can always change the key via IntelliConfig using "Tools -> Access administration -> Change AirGate key"

The image shows a 'Change AirGate Key' dialog box. It has a title bar with a close button (X). Inside, there are two text input fields: 'Enter AirGate Key' and 'Re-enter AirGate Key'. At the bottom, there are two buttons: 'OK' (with a green checkmark icon) and 'Cancel' (with a red X icon).



## Connection using WinScope

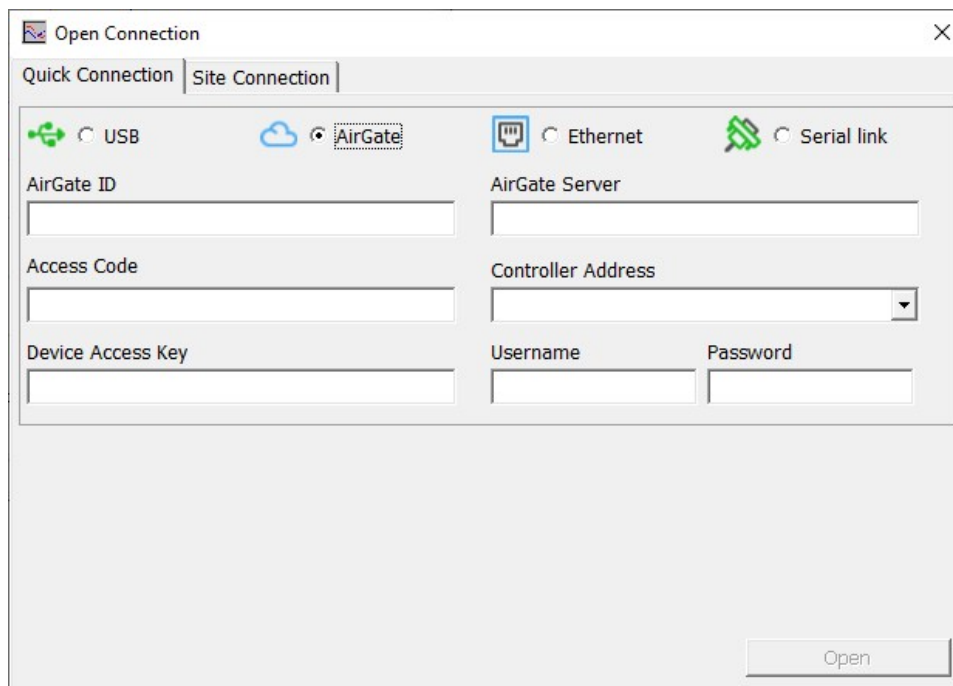


Image 5.53 WinScope1000 screen - select AirGate

Use **AirGate ID**, **AirGate Server** with proper port (54441 for global.airgate.link), **Device Access Key** and **Controller Address** - this needs to be same as value of **Terminal Comm Address** (page 316). Valid user account - **Username** and **Password** - is required for the connection.

**IMPORTANT: Never fill Access code!**

## 5.3 Default configuration

This chapter describes default configuration of physical inputs and outputs of the CU. For the MCB application there is also **Preconfigured** archive with user defined PLC functions, Protections and setpoints.

### 5.3.1 Binary inputs

HW Name	Name	Description	Configured function
<b>BIN1</b>	Sync Check	Check of synchronization process	<b>SYNCHRONIZATION CHECK (PAGE 557)</b>
<b>BIN2</b>	Sync Permissive	Passive synchronization	<b>SYNCHRONIZATION PERMISSIVE (PAGE 557)</b>
<b>BIN3</b>	Sync Run	Active synchronization	<b>SYNCHRONIZATION RUN (PAGE 557)</b>
<b>BIN4</b>	BTB Feedback	Bus circuit breaker feedback	<b>BTB FEEDBACK (PAGE 539)</b>
<b>BIN5</b>	CU-BIN-05	Free slot	-
<b>BIN6</b>	CU-BIN-06	Free slot	-
<b>BIN7</b>	CU-BIN-07	Free slot	-
<b>BIN8</b>	Breaker Trip	Request to open BTB	<b>BREAKER TRIP (PAGE 538)</b>

<b>BIN9</b>	CU-BIN-09	Free slot	-
<b>BIN10</b>	CU-BIN-10	Free slot	-
<b>BIN11</b>	CU-BIN-11	Free slot	-
<b>BIN12</b>	CU-BIN-12	Free slot	-

### 5.3.2 Binary outputs

HW Name	Name	Description	Configured source
<b>BOUT1</b>	CU-BOUT-01	Free slot	Not Used
<b>BOUT2</b>	CU-BOUT-02	Free slot	Not Used
<b>BOUT3</b>	Initialized	Controller is initialized	<b>INITIALIZED (PAGE 574)</b>
<b>BOUT4</b>	CU-BOUT-04	Free slot	Not Used
<b>BOUT5</b>	CU-BOUT-05	Free slot	Not Used
<b>BOUT6</b>	CU-BOUT-06	Free slot	Not Used
<b>BOUT7</b>	BTB On Coil	Command to close generator circuit breaker feedback	<b>BTB ON COIL (PAGE 576)</b>
<b>BOUT8</b>	BTB Off Coil	Command to open generator circuit breaker feedback	<b>BTB OFF COIL (PAGE 575)</b>
<b>BOUT9</b>	Common Alarm Active Level 1	Any level 1 alarm is active	<b>COMMON ALARM ACTIVE LEVEL 1 (PAGE 562)</b>
<b>BOUT10</b>	Common Alarm Active Level 2	Any level 2 alarm is active	<b>COMMON ALARM ACTIVE LEVEL 2 (PAGE 563)</b>
<b>BOUT11</b>	CU-BOUT-11	Free slot	Not Used
<b>BOUT12</b>	CU-BOUT-12	Free slot	Not Used

### 5.3.3 Analog inputs

HW Name	Name	Configured sensor	Configured function
<b>AIN1</b>	CU-AIN-01	None	Not Used
<b>AIN2</b>	CU-AIN-02	None	Not Used
<b>AIN3</b>	CU-AIN-03	None	Not Used
<b>AIN4</b>	CU-AIN-04	None	Not Used

### 5.3.4 Analog Outputs

HW Name	Description	Output HW type	Configured source
<b>AOUT1</b>	Free slot	N/A	Not Used
<b>AOUT2</b>	Free slot	N/A	Not Used

## 5.4 General Functions

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### 5.4.1 3V3 Reference Voltage Measurement

The 3V3 reference voltage is critical for the right functionality of analog/digital converters (ADC). If the 3V3 reference is out of the limit (less than 3.2 V or more than 3.4 V) all voltage measurements will be distorted. In this case, the **LBO HW AC VOLTAGE MEASUREMENT ERROR (PAGE 573)** is activated. It is recommended to use this LBO to activate user protection which will the System to prevent any damage to theSystem, load, or mains.

The input value for the LBO is given by the average of all 3 measured reference voltages which increases the robustness of the protection. The reference voltage should be always fixed and within the limit. Wrong reference voltage might mean the controller unit is going to fail. The **LBO HW AC VOLTAGE MEASUREMENT ERROR (PAGE 573)** is deactivated immediately after the average value of the reference voltage is back within the limit. If the LBO is still being active, you can try to power off and power on the controller unit. If it doesn't help, it is recommended to contact the technical support.

## 5.4.2 Access lock

The Access lock function allows any user with Access level 1 and higher to Lock the controller configuration for other users. So, only the user who locked the controller will be able to use the controller buttons, change setpoints or write configuration into the locked controller. All LBIs will be still operable, using the PLC the LBO **ACCESS LOCKED (PAGE 560)** can be used to block any LBIs. The configuration can be unlocked only by the user who locked it or by the administrator. This function can be especially useful if more people are remotely connected to the same controller. The access lock works the same way for configuration via the IntelliVision display.

There are 5 types of buttons in the IntelliConfig that signalize the actual state of the Access lock.

1. Default state: The controller configuration is unlocked and the user has permission to lock it for other users.
2. The controller configuration is locked by you.
3. The controller configuration is locked by another user and you can unlock it because you are logged in as administrator.
4. The controller configuration is locked by another user and you cannot unlock it.
5. The controller configuration is unlocked and your Access level is too low to lock it.



## 5.4.3 Alarm Management

Alarms purpose is to indicate occurrence of unwanted situation such as unexpected opening of breaker, generator overvoltage etc. But in certain situations, we use alarms as a way to visualize information that affects current behavior of the controller.

The controller evaluates two levels of alarms. Level 1 – yellow alarm – is a non-critical alarm that is only informative and does not take any action regarding the System control. Level 2 – red alarm – represents a critical situation, where an action must be taken to prevent damage of the System or technology.

- One alarm of level 1 and one alarm of level 2 can be assigned to each binary input
- Multiple protections can be assigned on each analog input.
- There are also **Controller integrated protections (page 120)** with **Fixed Protection States (page 586)**.
- Each alarm is written to the **Alarmlist (page 119)**.
- Each alarm causes a record to be written into the history log.
- Each alarm activates the Alarm and Horn output.
- Each alarm can cause sending of a SMS message or an email.

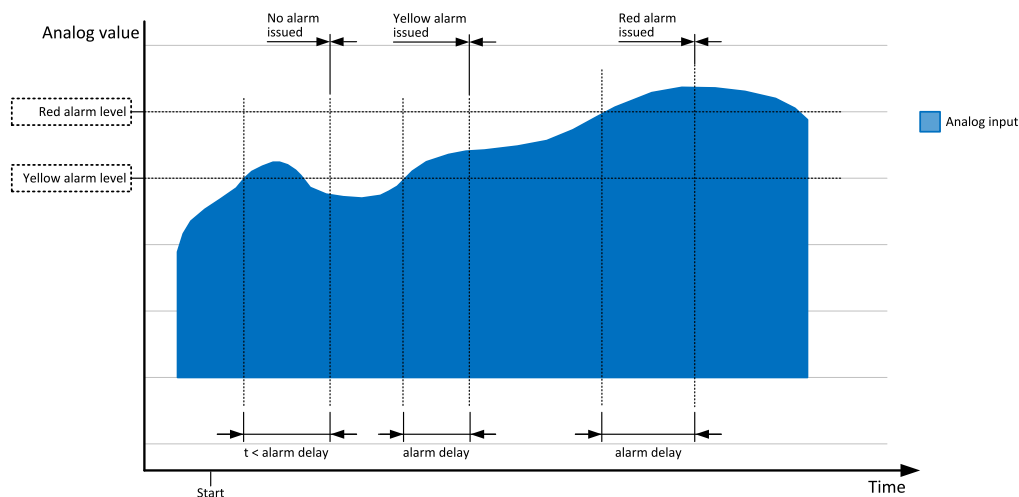


Image 5.54 Analog input alarm evaluation principle

## Alarm states

An alarm can have following states:

- Active alarm: the alarm condition persists, alarm delay has elapsed.
- Inactive alarm: the alarm condition has disappeared, but the alarm has not been confirmed.
- Confirmed alarm: the alarm condition persists, but the alarm has already been confirmed.

*Sd ECU Communication Fail	Unconfirmed inactive alarm lvl 2
*ECU FC: 029953 (07501h) FMI:0; OC:0; ADR:0	Unconfirmed active ecu alarm
*ECU FC: 037888 (09400h) FMI:0; OC:0; ADR:0	Unconfirmed inactive ecu alarm
*Wrn Fuel Level	Unconfirmed inactive alarm lvl 1
*Wrn Coolant Temp	Unconfirmed active alarm lvl 1
Sd DISTIN 03	Confirmed active alarm lvl 2

Image 5.55 Alarm List

Visual interpretation of alarm is decided by terminal side. Commonly for active alarms whole row background is colored (yellow/red/blue). Inactive alarms have transparent background color and text is colored (yellow/red/blue)

## Alarm types

The controller recognize 3 basic types of the alarm. Each type of alarm is paired with specific types of **Protection types** (page 196).

### Alarm Level 1

The level 1 alarm indicates that a value or parameter is out of normal limits, but has still not reached critical level. This alarm does not cause any actions regarding the System control. For whole list see **Alarms level 1** (page 635)

### Alarm Level 2

The level 2 level alarm indicates that a critical level of the respective value or parameter has been reached. For whole list see **Alarms level 2** (page 692)

### Sensor fail detection (FIs)

If the measured resistance on an analog input exceeds the valid range, a sensor fail will be detected and a sensor fail message will appear in the **Alarmlist (page 119)**. The valid range is defined by the most-left (RL) and most-right (RH) points of the sensor characteristic  $\pm 12.5\%$  from RH-RL.

**Note:** Sometimes there can be problem with lower limit of valid range which can be counted as negative number. In this case the lower limit is set as one half of the RL point of the sensor curve characteristic.

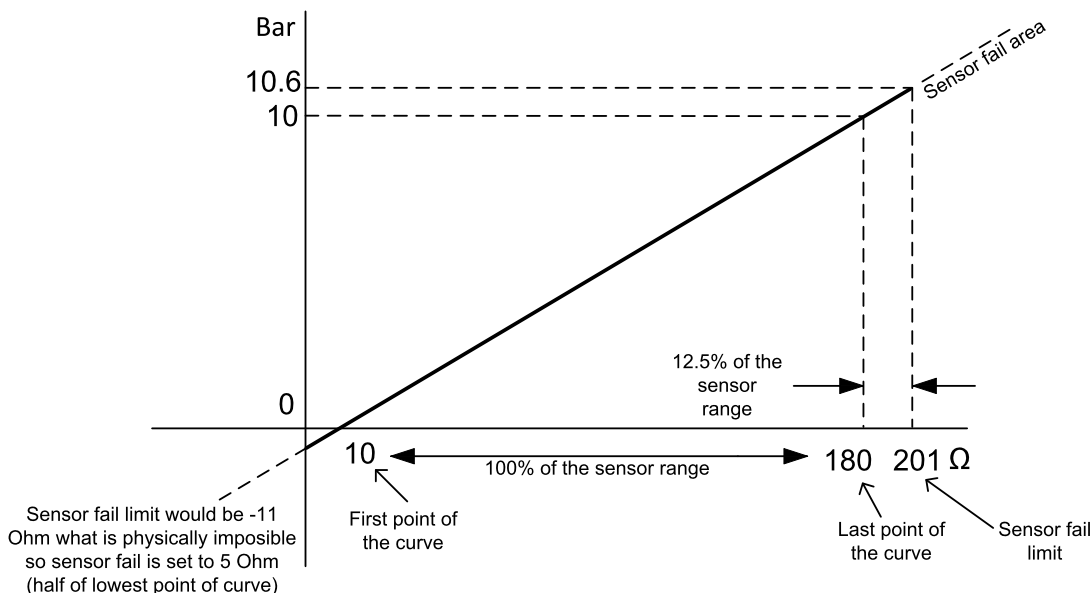


Image 5.56 Sensor fail detection principle

### Remote alarm messaging

The controller can send emails at the moment when a new alarm appears in the **Alarmlist (page 119)** or new event is written in **Event History (page 126)**. The message will contain a copy of the **Alarmlist (page 119)** or reasons from **Event History (page 126)**. To enable this function, adjust setpoints **BOR Message (page 338)**, **Wrn Message (page 337)**, or **Event Message (page 337)** to ON. Also enter a valid email address to the setpoints, **E-mail Address 1 (page 339)**, **E-mail Address 2 (page 339)**, **E-mail Address 3 (page 339)**, or **E-mail Address 4 (page 340)**.

The list of all supported terminals shows the table below:

Terminal	Event email	Warning email	Breaker Open email
RS485	NO	NO	NO
USB	NO	NO	NO
Ethernet	YES	YES	YES

### Alarmlist

Alarmlist is a container of active and inactive alarms. It will appear automatically on the controller display, if a new alarm occurs, or can be displayed manually from the display menu.

Active alarms are shown as inverted, not yet confirmed alarms are marked with asterisk before them.

Alarmlist contains three types of alarms:

- > Controller built-in alarms
- > User configured alarms
- > ECU alarms

## Controller integrated protections

An alarm message in the alarmlist begins with a prefix, which represents the alarm type (e.g. Wrn, Al, Hst, ALI, BOR). Then the alarm name follows. In some cases the prefix can be omitted.

## User configured protections

An alarm message in the alarmlist begins with a prefix, which represents the protection type (e.g. Wrn, Al, Hst, ALI). Protection type and alarm name are selected by user during the **Configuration of protections in IntelliConfig (page 202)**. Then the alarm name follows.

## ECU alarms

The ECU alarms are received from the Electronic Control Unit. The alarms are represented by the Diagnostic Trouble Code, which contains information about the subsystem where the alarm occurred, the alarm type and the alarm occurrence counter.

The most common fault codes are translated into text form. Other fault codes are displayed as a numeric code and the ECU fault codes list must be used to determine the reason.

## 5.4.4 CAN Bus Log

This function is used to log communication between the CU, ECU, and I/O modules on the CAN line. These logs can be shared with our technical support and used for solving specific problems. The CAN Bus Log uses **CAN2B (page 17)** which should be physically connected to the observed CAN. The **CAN2B (page 17)** will work as another device on the CAN line and it is necessary to do wiring in accordance with rules for wiring the CAN line.

**IMPORTANT: The bus must be wired in linear form with termination resistors at both ends. No nodes are allowed except on the controller terminals.**

**IMPORTANT: The CAN bus log works only if CAN Intercontroller Communication Redundancy is not used.**

To activate the CAN bus log function, go to the Tools in IntelliConfig and press the button CAN Bus Log to open the settings. You need to log in as at least a level 2 user. In the settings, you will choose the Output directory in your PC, the Logging option (CAN for modules + communication speed or type of the Intercontroller CAN), and press Start. The Logging status will be changed from Logging is stopped to Logging is running.

## 5.4.5 CAN Intercontroller Communication

This function allows to share information between other ComAp controllers via CAN interface. This communication is always present on ® **CAN2A (page 41)** and may be present on ⑦ **CAN2B (page 41)**. For better security of sharing information, you may use CAN Intercontroller Communication Redundancy function.

The communication can run in different modes. Select your required mode by setpoint **CAN Intercontroller Comm Mode (page 320)**. The mode is changed only during powering up of the controller and actual mode is stored in value **CAN Intercontroller Comm Mode (page 437)**. In case that there is a mismatch between the setpoint and the value, alarm **ALI CAN Mode Inconsistency (page 671)** is activated. Restart the controller to change the communication mode to selected mode by setpoint **CAN Intercontroller Comm Mode (page 320)**.

For easy detection of empty CAN you can set **CAN Intercontroller Empty Check (page 321)** to Enabled. **Wrn CAN2 Empty (page 640)** is activated every time when controller doesn't see any other controller connected via ⑧ **CAN2A (page 41)** and ⑦ **CAN2B (page 41)** .

**IMPORTANT: Options 64C CAN FD or 32C CAN FD or 8C CAN FD are compatible only with controllers which support the CAN FD communication. Set correct mode by setpoint CAN Intercontroller Comm Mode (page 320) otherwise controller will not communicate with each other.**

- Relevant setpoints
  - **CAN Controller Address (page 316)**
  - **CAN Intercontroller Comm Mode (page 320)**
- Usage
  - **CAN Intercontroller Communication Redundancy (page 121)**
  - **Virtual modules (page 29)**
  - **Load Sharing, Var Sharing, and Shared signals**

## CAN Intercontroller Communication Redundancy

**IMPORTANT: The function works only if CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD.**

This function duplicates whole Intercontroller communication, which is on **CAN2A (page 17)** and sends it via **CAN2B (page 17)**.

The same wiring principles apply to **CAN2B (page 17)** as to **CAN2A (page 17)** (see **CAN bus wiring (page 66)**).

### Step by step guide

**Note:** Following steps have to be done for each controller in the system.

1. Insert the **SW Key (page 252)** for CAN Intercontroller Redundancy
2. Restart the controller
3. Check the value **SW Key Feature List (page 440) - CAN Intercontroller Redundancy** has to be enabled
4. Switch the setpoint **CAN Intercontroller Comm Redundancy (page 319)** to Enabled
5. Restart the controller
6. Check that the value **CAN Intercontroller Comm Redundancy (page 438)** is Enabled

In case of mismatch between the value **CAN Intercontroller Comm Redundancy (page 438)** and the setpoint **CAN Intercontroller Comm Redundancy (page 319)**, alarm **ALI Redundant CAN Error (page 672)** is raised.

In case of inconsistency of data on ⑧ **CAN2A (page 41)** and ⑦ **CAN2B (page 41)** line, alarm **Wrn Redundant CAN inconsistency (page 665)** is activated

## 5.4.6 CAN1 ECU/IO Modules Splitting

This function allows the user to change the behavior of CAN1 communication terminals.

In default configuration:

- **CAN1A** terminal is used for communication with ECU and IO Modules.
- **CAN1B** terminal is used for **Hot Swap Redundancy (page 138)**



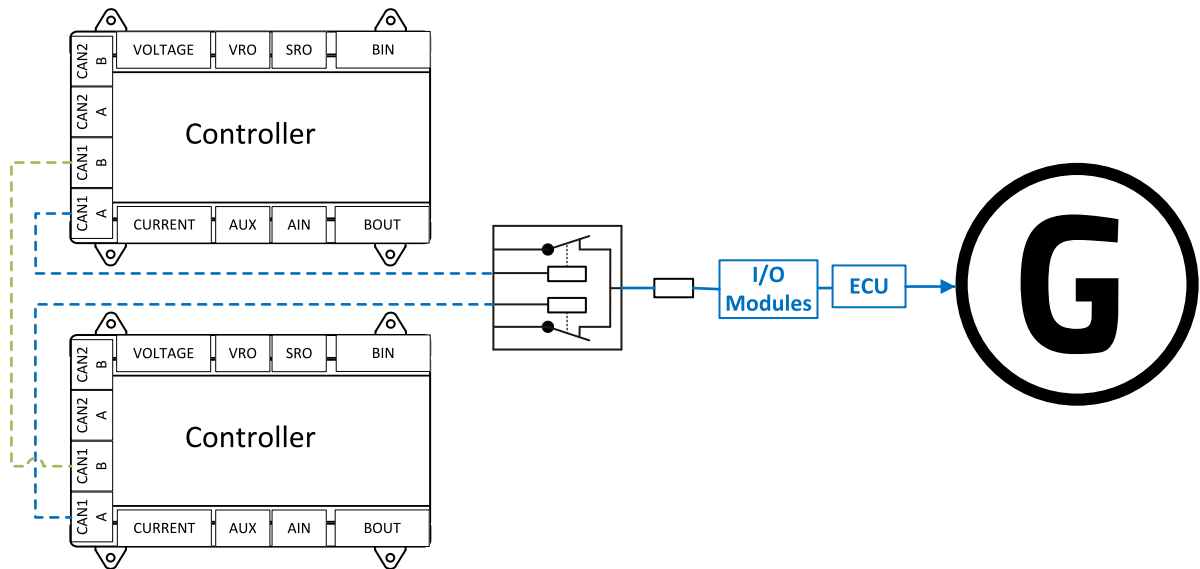


Image 5.57 Hot Swap Redundancy connection

If the setpoint **CAN1 ECU/IOModules Split (page 322)** is enabled, the behavior of CAN1A terminal is changed:

- **CAN1A** terminal can be used only for communication with ECU
- **CAN1B** terminal can be used only for communication with IO Modules

**IMPORTANT:** In case that **CAN1 ECU/IOModules Split (page 322)** is enabled, the **Hot Swap Redundancy (page 253)** is disabled (and vice versa).

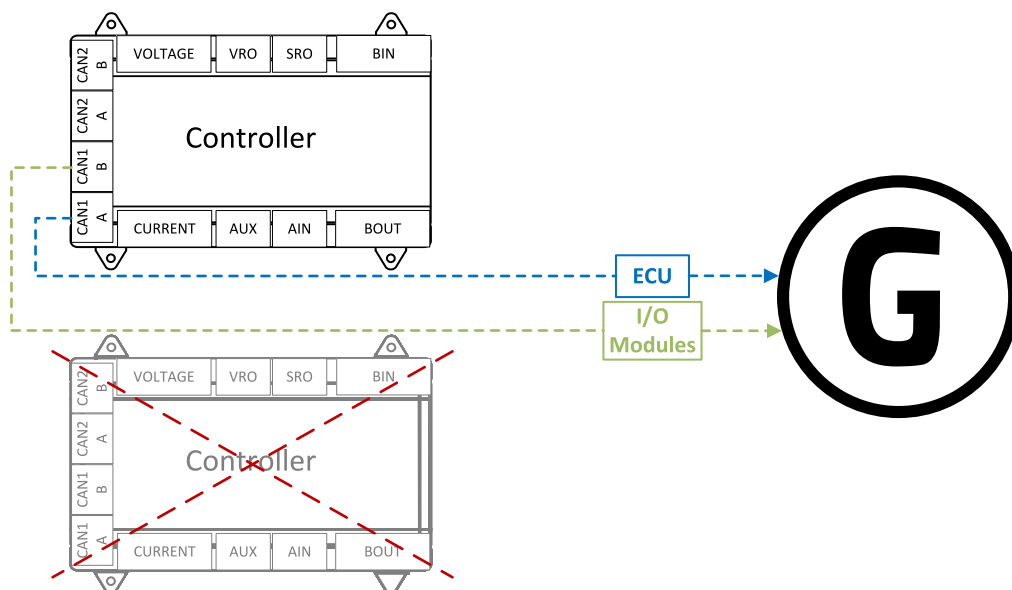


Image 5.58 CAN1 ECU/IO Modules Split connection

**Note:** The splitting of CAN1 enables to prevent overloading the bus line.

## 5.4.7 Configuration Lock

The Configuration lock function allows the user to lock the the Controller Configuration by the password and encrypt the PLC data. The Controller Configuration can be locked by the checkbox Configuration Lock inside of the Controller Configuration next to the button Consistency check. Once the checkbox is hit, the user will be asked for the password, after this step all PLC data will be encrypted. Once the user will try access to the locked Controller Configuration, the IntelliConfig will automatically ask the user for the password. If the correct password is submitted the Controller Configuration will be unlocked and PLC data decrypt. Without correct password the user cannot open the Controller Configuration and see configuration in it.

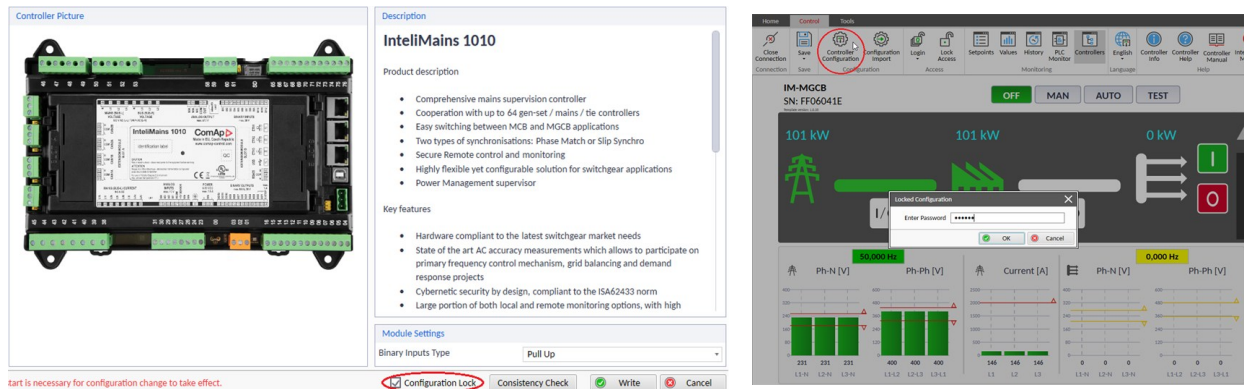


Image 5.59 Configuration lock

## 5.4.8 Configuration Override

There may appear a situation, when controller reprogramming is not possible for some reason. The typical example is a situation, when the controller is configured to be always in Remote AUT mode. So, the controller cannot be switched to OFF mode to change the configuration. To enable controller configuration change in these cases, the IntelliMains 1010 BTB SC is offering a DIP switch located under the front cover of the controller. If the switch is enabled the controller configuration is forced to the invalid state so it is possible to upgrade the controller's FW or import new configuration. The older controllers are using the boot jumper to do the same thing and it is called "Boot Jumper Programming" or "Unsuccessful Controller Programming".

### Process of configuration overriding

- Remove front cover of IntelliMains 1010 BTB SC
- Enable the DIP switch
- Restart the controller
- Connect to the controller via IntelliConfig
- Log-in as level 3 user
- Go to the Control and Import new configuration (button Configuration Import)
- Disable the DIP switch
- Restart the controller

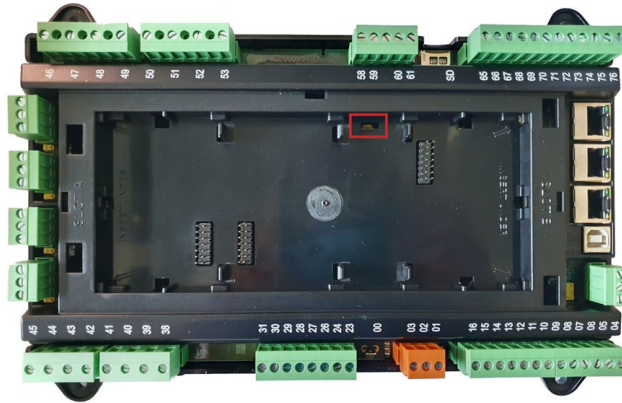



Image 5.60 Location of the DIP switch for Configuration override

## 5.4.9 Crash Dump

Crash dump is new functionality which allows controller to collect and store important information related to controller's failure before the controller is restarted. These information are stored in controller's nonvolatile memory for later evaluation and easier solution of a problem.

### Collecting crash dump

To collect Crash Dump from the controller, you need to connect to the controller using IntelliConfig either via **USB** (page 108) or **Ethernet** (page 109).

- Log in as user with administrator rights.
- In top right corner click wrench icon  and select "Collect logs".
- IntelliConfig begins to collect Crash Dump data from the controller and also adds its own crash logs. User is informed about the ongoing process in IntelliConfig, before prompt to save \*.zip file appears.

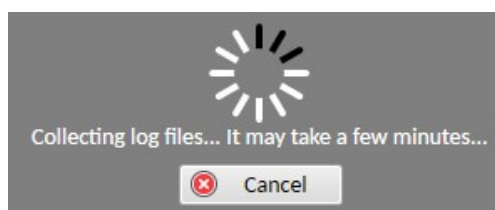


Image 5.61 Crash Dump Collection

**Note:** It is recommended to use connection via Ethernet to reduce time required for data collection.

**IMPORTANT:** This action may take significantly long period.

### Contacting TSUP with crash dump

After collection of Crash Dump, you shall contact TSUP. To help resolve your issue:

- Send description of the issue from your side of view
- Send approximated time of the event
- Send Crash Dump data collected in \*.zip file

## 5.4.10 E-STOP

The E-Stop is used as power supply for binary outputs 1 and 2. These binary outputs are designated for some essential functions and they are internally wired as "safe". It means, that their deactivation is directly connected with the dedicated E-STOP Input (T04).

**Note:** There is no difference in the way of configuration of all binary outputs. Binary outputs BO1 and BO2 can be activated only while E-Stop is powered up with **Battery Voltage** (page 430).

The CU is measuring actual input voltage of the E-STOP which activation level depends on the actual controller supply voltage (battery voltage). The E-STOP is activated if input voltage drops below approximately 60 % of the Controller supply voltage.

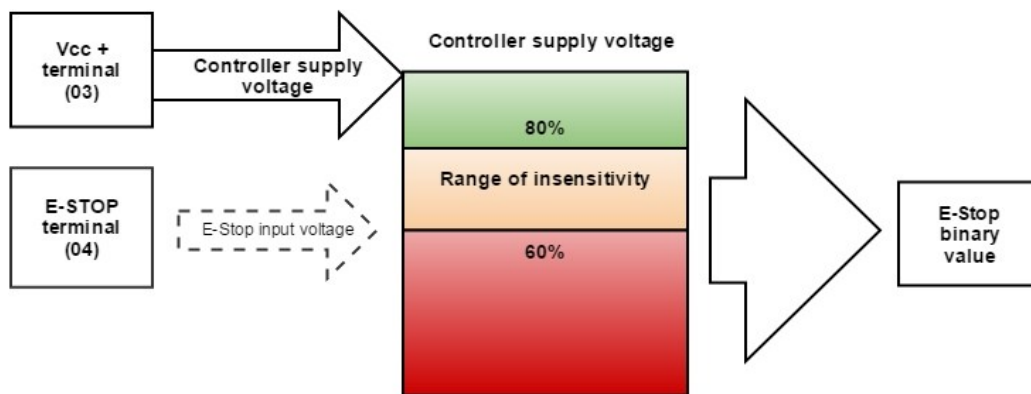


Image 5.62 SW principle of E-STOP

- If the input voltage of E-stop is higher than high comparison level (for ex. higher than 80% of the supply voltage), then E-stop is not activated.
- If the input voltage of E-stop is lower than low comparison level (for ex. lower than 60% of the supply voltage), then E-stop is activated.
- If the input voltage of E-stop is located somewhere between low and high comparison levels (for ex. between 60 and 80 % of the supply voltage), then E-stop binary value will stay on its previous state (means E-stop binary value will not change).

For wiring information **see E-Stop on page 61**.

## 5.4.11 Event History

The history log is an area in the controller's non-volatile memory that records "snapshots" of the system at moments when important events occur. The history log is important especially for diagnostics of failures and problems. When the history file is full, the oldest records are removed.

Each record has the same structure and contains:

- The event which caused the record (e.g. "Overfrequency alarm, undervoltage alarm, BTB closed, etc.).
- The date and time when it was recorded.
- All important data values like frequency, kW, voltages, etc. from the moment that the event occurred.
- The number of events is fixed to 1000 lines.
- Values are recorded based on actual column selected, on special events values are recorded in text form.
- Special events:
  - When the user logs in
  - Modifying a setpoint
  - Fault Reset
  - Horn Reset

### Configurable history

It is possible to configure the columns (values) which will be displayed in the History window. The configuration can be found in the Controller Configuration → Others → History. See the picture below.

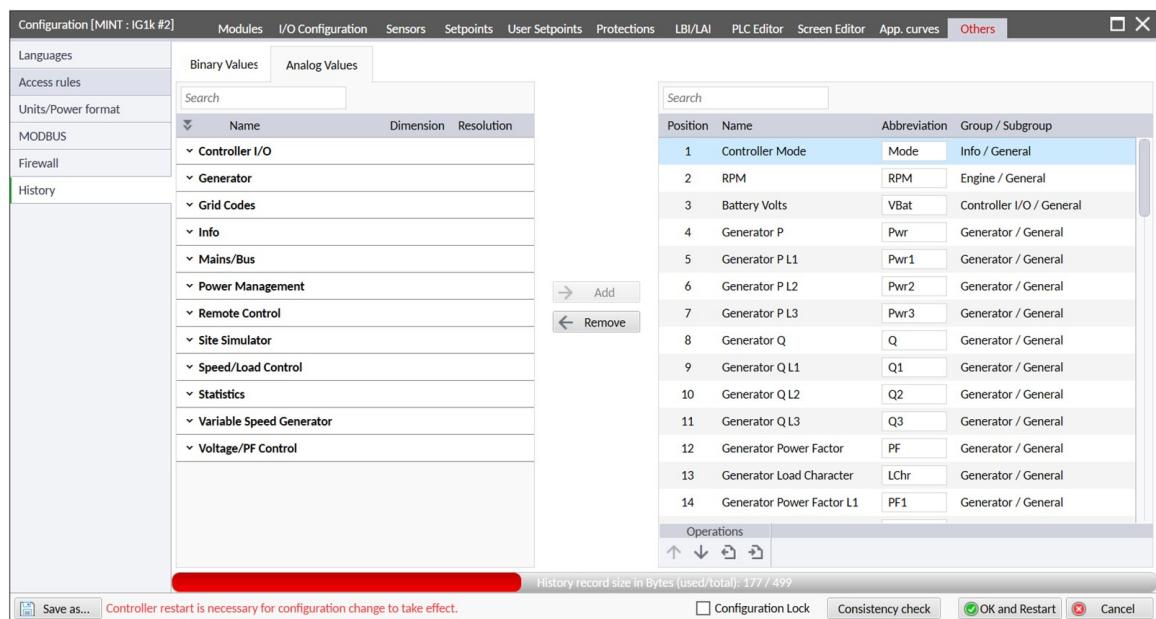


Image 5.63 Configurable history

In the left part of the configuration window there are all available binary and analog values (columns) which can be configured to history event log. In the right side of the configuration window there is a table with all already configured columns. By buttons Add and Remove in the middle of the configuration window or by double click on value in the left / right part of the configuration, it is possible to add / remove any analog or binary value to / from the history event log.

Under the table with already configured values there are buttons for the operations. By the buttons Move up and Move down it is possible to change the position of the history columns so you can sort all columns according to your priorities. Next to these buttons there are buttons for export and import data so you can import history columns configuration from another controller. And it is also possible to change the abbreviation for each history column. In the down part of the configuration window there is a progress bar which shows how much memory for history events is used. For one history record maximum 499 Bytes can be used.

In the next chapter are shown history columns used in the default archive.

### Default history columns

Category	Column Name	Value	Unit
<b>Info</b>	Mode	Controller Mode (page 435)	-
<b>Controller I/O</b>	VBat	Battery Voltage (page 430)	V
<b>Bus Left</b>	Pbl	Bus Left Import P (page 402)	kW
	Pbl1	Bus Left Import P L1 (page 402)	kW
	Pbl2	Bus Left Import P L2 (page 402)	kW
	Pbl3	Bus Left Import P L3 (page 402)	kW
	Qbl	Bus Left Import Q (page 402)	kVAr
	Qbl1	Bus Left Import Q L1 (page 403)	kVAr
	Qbl2	Bus Left Import Q L2 (page 403)	kVAr
	Qbl3	Bus Left Import Q L3 (page 403)	kVAr
	PFbl	Bus Left Power Factor (page 404)	-
	LChbl	Bus Left Load Character (page 404)	-
	PFbl1	Bus Left Power Factor L1 (page 405)	-
	LChbl1	Bus Left Load Character L1 (page 405)	-
	PFbl2	Bus Left Power Factor L2 (page 405)	-
	LChbl2	Bus Left Load Character L2 (page 405)	-
	PFbl3	Bus Left Power Factor L3 (page 406)	-
	LChbl3	Bus Left Load Character L3 (page 406)	-
	Frqbl	Bus Left Frequency (page 407)	Hz
	Vbl1	Bus Left Voltage L1-N (page 408)	V
	Vbl2	Bus Left Voltage L2-N (page 408)	V
	Vbl3	Bus Left Voltage L3-N (page 408)	V
	Vbl12	Bus Left Voltage L1-L2 (page 408)	V
	Vbl23	Bus Left Voltage L2-L3 (page 408)	V
	Vbl31	Bus Left Voltage L3-L1 (page 409)	V
	Ibl1	Mains Current L1 (page 410)	A
	Ibl2	Mains Current L2 (page 410)	A
	Ibl3	Mains Current L3 (page 410)	A
<b>Bus Right</b>	Frqbr	Bus Right Frequency (page 412)	Hz
	Vbr1	Bus Right Voltage L1-N (page 412)	V

Category	Column Name	Value	Unit
	Vbr2	Bus Right Voltage L2-N (page 412)	V
	Vbr3	Bus Right Voltage L3-N (page 412)	V
	Vbr12	Bus Right Voltage L1-L2 (page 412)	V
	Vbr23	Bus Right Voltage L2-L3 (page 413)	V
	Vbr31	Bus Right Voltage L3-L1 (page 413)	V
<b>Controller I/O</b>	Ain1	CU-AIN-01 (page 430)	-
	Ain2	CU-AIN-02 (page 430)	-
	Ain3	CU-AIN-03 (page 430)	-
	Ain4	CU-AIN-04 (page 431)	-
	BIN	Binary Inputs (page 431)	-
<b>Power Management</b>	BOUT	Binary Outputs (page 432)	-
	PFgs	Total Running Power Factor (page 429)	-
	LChgs	Total Running Load Character (page 429)	-
<b>Info</b>	FVST	Forced Value Status (page 439)	-

## 5.4.12 Exercise Timers

Mode Once .....	129
Mode Daily .....	130
Mode Weekly .....	131
Monthly mode .....	132
Mode Short period .....	135

The exercise (general-purpose) timers are intended for scheduling of any operations. Main purpose of these timers for BTB is using them in PLC.

The function of each timer can be changed by respective Timer Function setpoint. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The following timer functions are available:

- Disabled - The Timer is disabled.
- Manual On - The Timer is disabled but his binary output is activated (can be used for testing purposes).
- No Func - There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.
- Mode OFF - The binary output of the Timer is internally connected to the Remote OFF binary input.

The activation condition of each Timer is configured via respective Timer Setup setpoint.

Each Timer has its LBO Exercise Timer which is closed regardless of chosen timer function once the Timer is activated. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled. The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.

See the list of related setpoints and LBOs below.

Related setpoints for choosing of the timer function:

- **Timer 1 Function (page 371)**

Related setpoints for the timer setup:

- **Timer 1 Setup (page 372)**



- > Timer 2 Function (page 373)
- > Timer 3 Function (page 375)
- > Timer 4 Function (page 377)
- > Timer 5 Function (page 379)
- > Timer 6 Function (page 381)
- > Timer 7 Function (page 383)
- > Timer 8 Function (page 385)
- > Timer 9 Function (page 387)
- > Timer 10 Function (page 389)
- > Timer 11 Function (page 391)
- > Timer 12 Function (page 393)
- > Timer 2 Setup (page 374)
- > Timer 3 Setup (page 376)
- > Timer 4 Setup (page 378)
- > Timer 5 Setup (page 380)
- > Timer 6 Setup (page 382)
- > Timer 7 Setup (page 384)
- > Timer 8 Setup (page 386)
- > Timer 9 Setup (page 388)
- > Timer 10 Setup (page 390)
- > Timer 11 Function (page 391)
- > Timer 12 Setup (page 394)

Related LBOs:

- > Exercise Timer 1 (page 567)
- > Exercise Timer 2 (page 568)
- > Exercise Timer 3 (page 568)
- > Exercise Timer 4 (page 568)
- > Exercise Timer 5 (page 569)
- > Exercise Timer 6 (page 569)
- > Exercise Timer 7 (page 569)
- > Exercise Timer 9 (page 570)
- > Exercise Timer 9 (page 570)
- > Exercise Timer 10 (page 570)
- > Exercise Timer 11 (page 571)
- > Exercise Timer 12 (page 571)

**Note:** This manual shows step by step guide only for Timer 1 setup because the procedure is same for the all timers.

### Available modes of each timer:

<b>Once</b>	This is a single shot mode. The timer will be activated only once at preset date/time for preset duration.
<b>Daily</b>	The timer is activated every "x-th" day. The day period "x" is adjustable. Weekends can be excluded. E.g. the timer can be adjusted to every 2nd day excluding Saturdays and Sundays.
<b>Weekly</b>	The timer is activated every "x-th" week on selected weekdays. The week period "x" is adjustable. E.g. the timer can be adjusted to every 2nd week on Monday and Friday.
<b>Monthly</b>	The timer is activated every "x-th" month on the selected day. The requested day can be selected either as "y-th" day in the month or as "y-th" weekday in the month. E.g. the timer can be adjusted to every 1st month on 1st Tuesday.
<b>Short period</b>	The timer is repeated with adjusted period (hh:mm). The timer duration is included in the period.

## Mode Once

### Set-up via IntelliConfig

To set-up timer via IntelliConfig go to the setpoint ribbon, setpoint group scheduler and setpoint **Timer 1 Setup** (page 372).

**Note:** Setpoint **Timer 1 Setup** (page 372) is visible only if setpoint **Timer 1 Function** (page 371) has any other value than disabled.



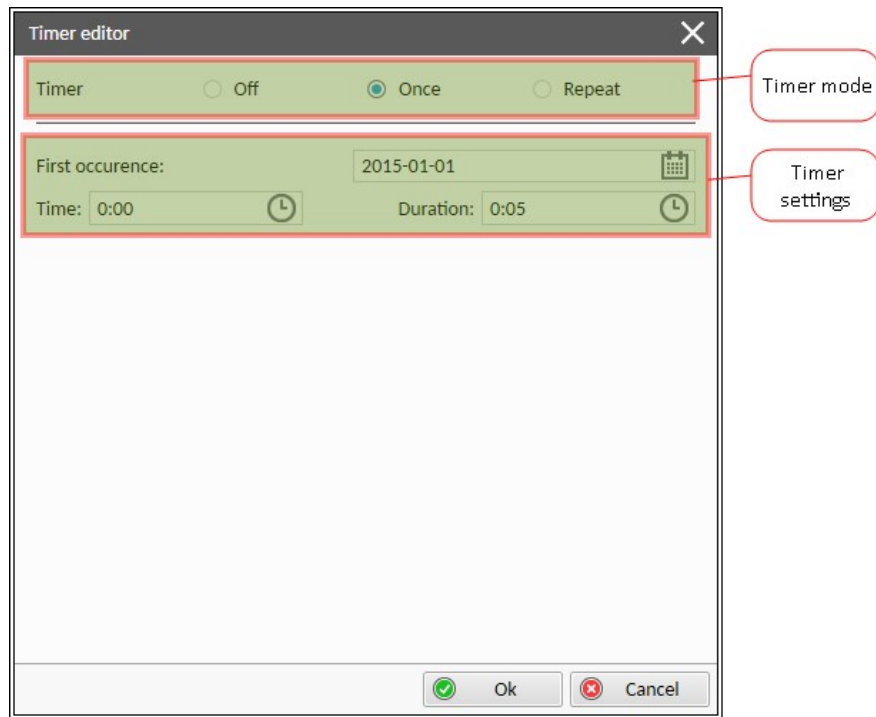


Image 5.64 Mode Once - IntelliConfig

In timer mode select Once. In timer settings adjust date and time of occurrence of timer. Also adjust the duration of timer.

### Set-up via external display

Navigate to the Scheduler setpoint group. Select the function of timer via **Timer 1 Function (page 371)** setpoint. Then go to **Timer 1 Setup (page 372)** and press enter button.

**Note:** Use left and right arrow to move in a single row. Use up and down arrow to adjust time or date. Use enter button for confirmation.

⬅ back to Exercise Timers

## Mode Daily

### Set-up via IntelliConfig

To set-up timer via IntelliConfig go to the setpoint ribbon, setpoint group scheduler and setpoint **Timer 1 Setup (page 372)**

**Note:** Setpoint **Timer 1 Setup (page 372)** is visible only if setpoint **Timer 1 Function (page 371)** has any other value than disabled.

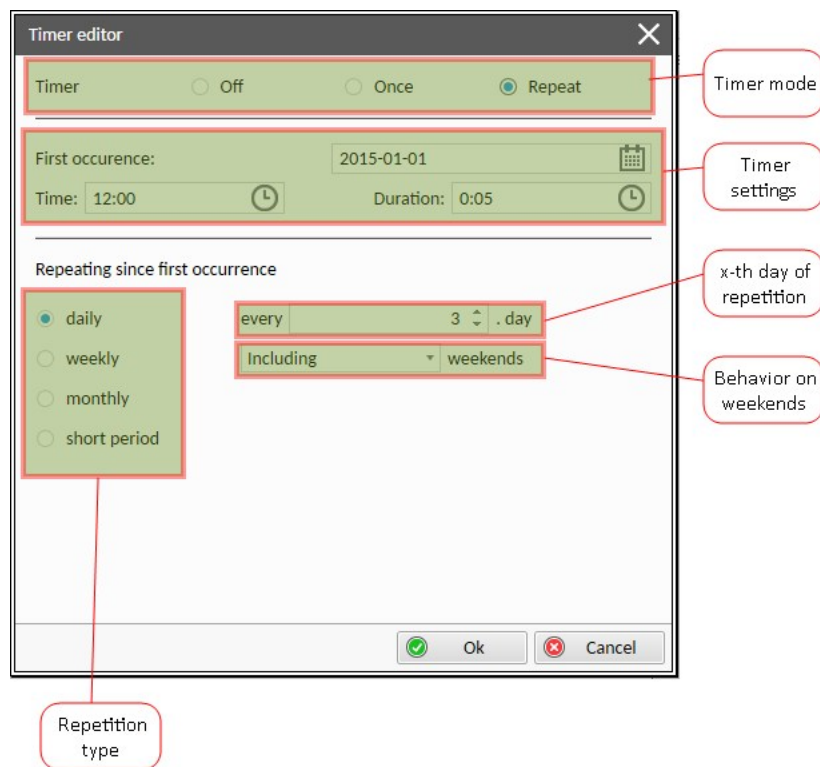


Image 5.65 Daily mode - IntelliConfig

In timer mode select Repeat. In repetition type select Daily. In timer settings adjust date and time of first occurrence of timer. Also adjust the duration of each occurrence of timer. Than select the x-th day of repetition and behavior of timer on weekends.

**Example:** On image example first start of timer will be 2015-01-01 at 12:00. Duration will be 5 minutes. Timer will be again activated every 3rd day at 12:00 for 5 minutes including weekends.

### Set-up via external display

Navigate to the Scheduler setpoint group. Select the function of timer via **Timer 1 Function (page 371)** setpoint. Then go to **Timer 1 Setup (page 372)** and press enter button.

Select mode Repeat and confirm it. After that, you will set the first occurrence date, time of occurrence and duration. Select Daily occurrence, set amount of days between occurrences and decide which behavior shall be applied during weekends.

**Note:** Use left and right arrow to move in a single row. Use up and down arrow to adjust time or date. Use enter button for confirmation.

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## Mode Weekly

### Set-up via IntelliConfig

To set-up timer via IntelliConfig go to the setpoint ribbon, setpoint group scheduler and setpoint **Timer 1 Setup (page 372)**.

**Note:** Setpoint **Timer 1 Setup (page 372)** is visible only if setpoint **Timer 1 Function (page 371)** has any other value than disabled.

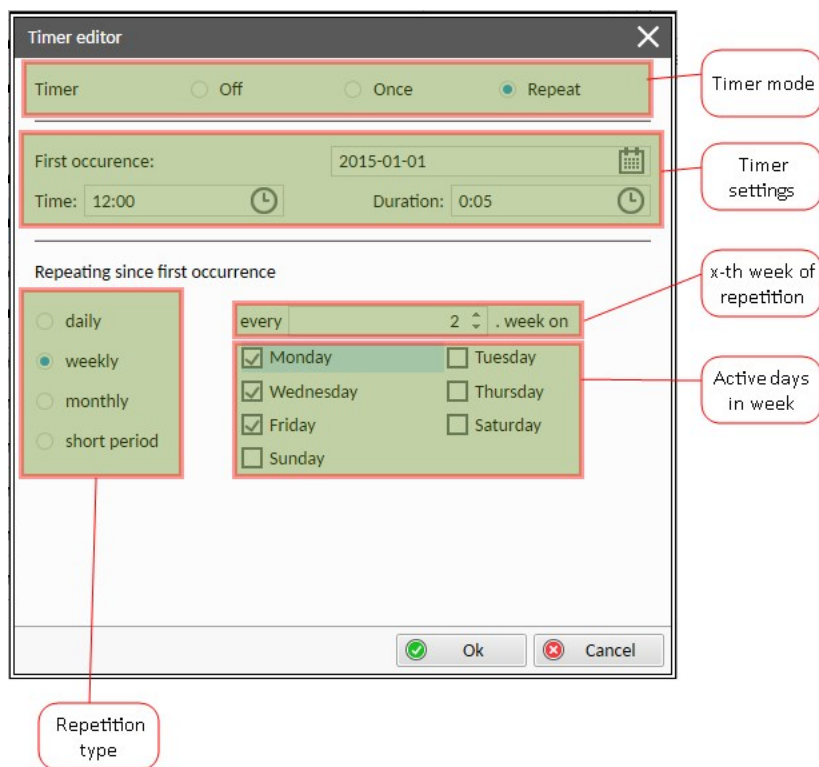


Image 5.66 Mode Weekly - Intelliconfig

In timer mode select Repeat. In repetition type select Weekly. In timer settings adjust date and time of first occurrence of timer. Also adjust the duration of each occurrence of timer. Than select the x-th week of repetition and days when timer should be active.

**Example:** On image example first start of timer will be 2015-01-12 at 12:00. Duration will be 5 minutes. Timer will be again activated every 2nd week on Monday, Wednesday and Friday at 12:00 for 5 minutes.

### Set-up via external display

Navigate to the Scheduler setpoint group. Select the function of timer via **Timer 1 Function (page 371)** setpoint. Then go to **Timer 1 Setup (page 372)** and press enter button. Select mode Repeat and confirm it. After that, you will set the first occurrence date, time of occurrence and duration. Select Weekly occurrence, set amount of weeks between occurrences and select days which will be timer triggered (use arrows left, right for activating/deactivating of day and arrow up, down for moving to another day).

**Note:** Use left and right arrow to move in a single row. Use up and down arrow to adjust time or date. Use enter button for confirmation.

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## Monthly mode

### Set-up via Intelliconfig

To set-up timer via Intelliconfig go to the setpoint ribbon, setpoint group scheduler and setpoint **Timer 1 Setup (page 372)**.

**Note:** Setpoint **Timer 1 Setup (page 372)** is visible only if setpoint **Timer 1 Function (page 371)** has any other value than disabled.

There are two types of monthly repetition. First of them is based on repeating one day in month.

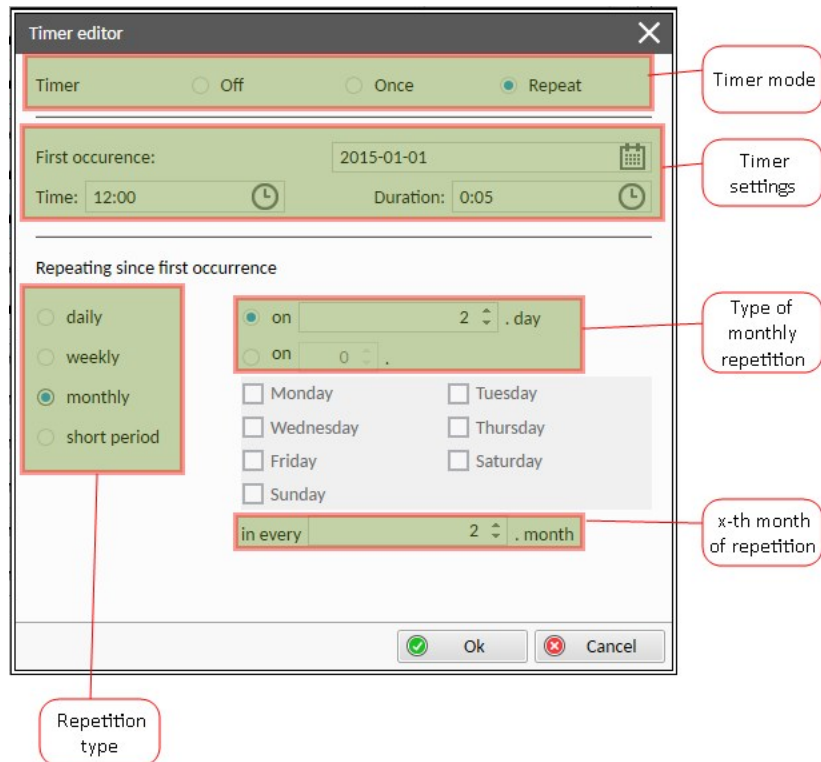


Image 5.67 Mode Monthly - IntelliJConfig

In timer mode select Repeat. In repetition type select Monthly. In timer settings adjust date and time of first occurrence of timer. Also adjust the duration of each occurrence of timer. Than select the type of monthly repetition and the x-th day of repetition. Than select the x-th month of repetition.

**Example:** On image example first start of timer will be 2015-01-02 at 12:00. Duration will be 5 minutes. Timer will be again activated every 2nd day in 2nd month at 12:00 for 5 minutes.

Second type of monthly repetition is based on repeating days in week in month.

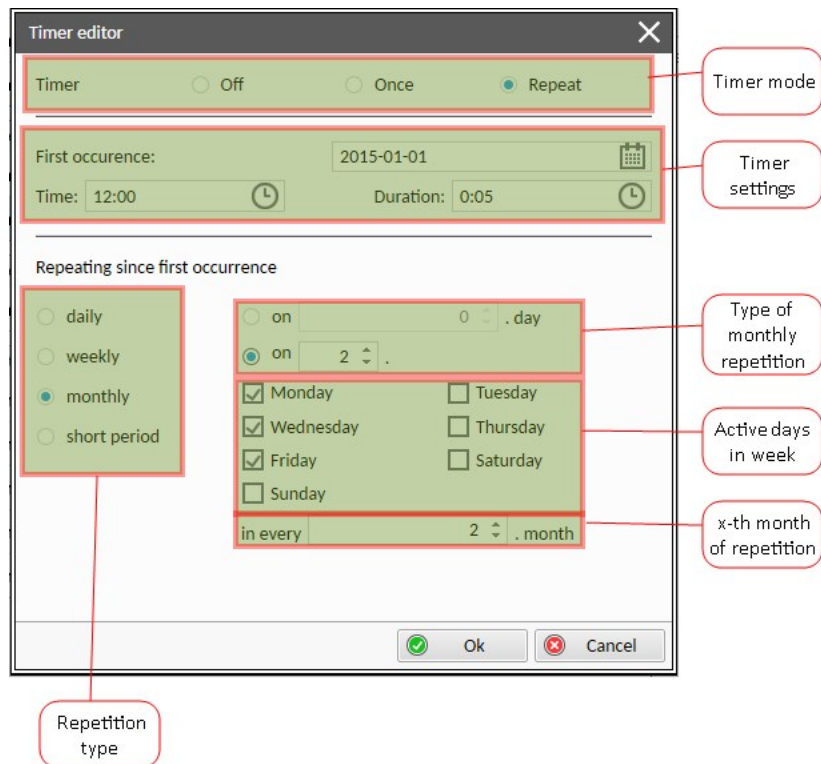


Image 5.68 Mode Monthly - Intelliconfig

In timer mode select Repeat. In repetition type select Monthly. In timer settings adjust date and time of first occurrence of timer. Also adjust the duration of each occurrence of timer. Than select the type of monthly repetition, the x-th week of repetition and days in week. Than select the x-th month of repetition.

**Example:** On image example first start of timer will be 2015-01-05 at 12:00. Duration will be 5 minutes. Timer will be again activated every 2nd week in 2nd month on Monday, Wednesday and Friday at 12:00 for 5 minutes.

### Set-up via external display

There are two types of monthly repetition. First of them is based on repeating one day in month.

Navigate to the Scheduler setpoint group. Select the function of timer via **Timer 1 Function (page 371)** setpoint. Then go to **Timer 1 Setup (page 372)** and press enter button. Select mode Repeat and confirm it. After that, you will set the first occurrence date, time of occurrence and duration. Select Monthly occurrence, then Daily and choose which day in a month will be timer triggered. Set amount of months between occurrences and confirm the selection

Second type of monthly repetition is based on repeating days in week in month.

Navigate to the Scheduler setpoint group. Select the function of timer via **Timer 1 Function (page 371)** setpoint. Than go to **Timer 1 Setup (page 372)** and press enter button. Select mode Repeat and confirm it. After that, you will set the first occurrence date, time of occurrence and duration. Select Monthly occurrence, then Weekly and choose which week and week days in a month will be timer triggered. Set amount of months between occurrences and confirm the selection

**Note:** Select mode Repeat and confirm it. After that, you will set the first occurrence date, time of occurrence and duration.

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## Mode Short period

### Set-up via IntelliConfig

To set-up timer via IntelliConfig go to the setpoint ribbon, setpoint group scheduler and setpoint **Timer 1 Setup** (page 372).

**Note:** Setpoint **Timer 1 Setup** (page 372) is visible only if setpoint **Timer 1 Function** (page 371) has any other value than disabled.

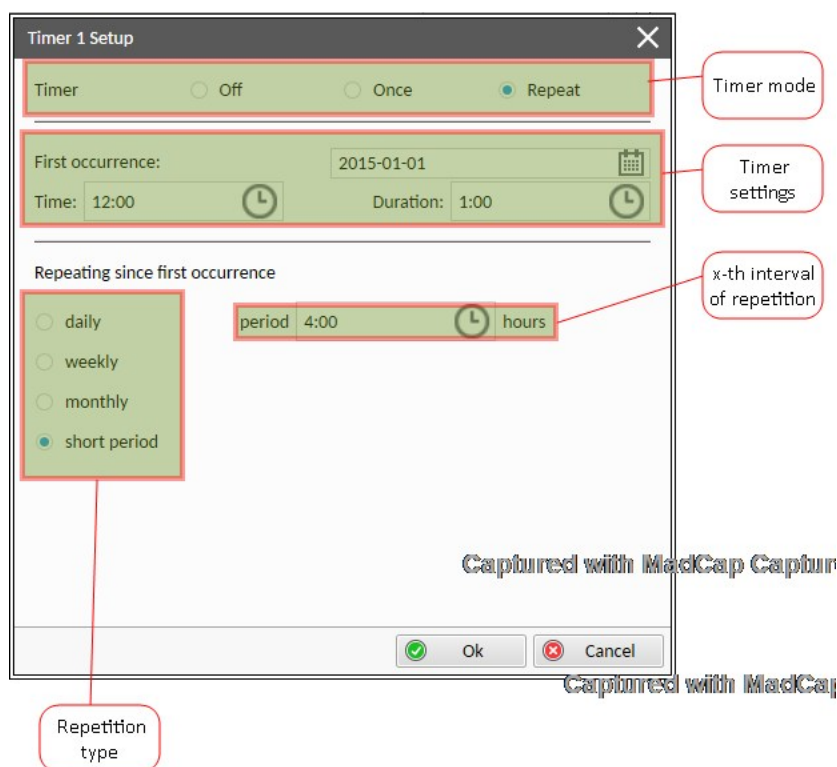


Image 5.69 Mode Short period - IntelliConfig

In timer mode select Repeat. In repetition type select Short period. In timer settings adjust date and time of first occurrence of timer. Also adjust the duration of each occurrence of timer. Then select the interval of repetition (shorter than 1 day).

**Example:** On image example first start of timer will be 2015-01-01 at 12:00. Duration will be 1 hours. Timer will be again activated every 4th hour for 1 hour.

### Set-up via external display

Navigate to the Scheduler setpoint group. Select the function of timer via **Timer 1 Function** (page 371) setpoint. Then go to **Timer 1 Setup** (page 372) and press enter button. Select mode Repeat and confirm it. After that, you will set the first occurrence date, time of occurrence and duration. Select Period occurrence, then set period of repetition (shorter than 1 day).

**Note:** Select mode Repeat and confirm it. After that, you will set the first occurrence date, time of occurrence and duration.

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## 5.4.13 Firewall

The firewall function allows to restrict the access to the controller application services (ComAp/TCP server, MODBUS/TCP server etc.), to the specific computers, or networks using **Ethernet 1 (page 17)** and **Ethernet 2 (page 18)** ports. The firewall can be enabled by the setpoint IP Firewall in the **Group: ETH Interface 1 - Trusted (page 326)** and **Group: ETH Interface 2 - Untrusted (page 331)**. The firewall settings is made in the IntelliConfig: Control → Controller Configuration → Others → Firewall.

**Example:**

**Adress:** 192.168.1.0

**Netmask:** 255.255.255.0

**Port:** 23

Any computer with IP address from the network range 192.168.1.0 - 192.168.1.255 can connect to ComAp/TCP server (= connect to the controller with IntelliConfig via Ethernet).

**Example:**

**Adress:** 192.168.1.100

**Netmask:** 255.255.255.255

**Port:** 502

Only the single computer with IP address 192.168.1.100 can connect to MODBUS/TCP server

**IMPORTANT: When enabling the firewall, if the rules are not set up properly and the connection is made remotely, loss of connection can happen.**

# 5.4.14 Forced Value

This function allows forcing of preconfigured value into selected setpoints via activation of LBI. Each LBI can force only one value into one setpoint. There are 32 LBIs - **FORCED VALUE INPUT 01 (PAGE 545) ... FORCED VALUE INPUT 32 (PAGE 551)**. You can see current states of all LBIs in value **Forced Value Status (page 439)**. Setpoints for which is Forced Value already configured are marked with gray arrow in IntelliConfig and on display.

**Note:** LBIs can be renamed during configuration. We suggest you to rename them based on used function.

**IMPORTANT:** You cannot change value of setpoint which has active Forced Value function.

## Force Value Indication

If the setpoint is forced by another setpoint then the icon (double right arrow) is displayed just behind the setpoint value.

- > Green Icon - Forcing is active
- > Grey Icon - Force Value is set to the specific setpoint and forcing is inactive

### InteliVision 5.2

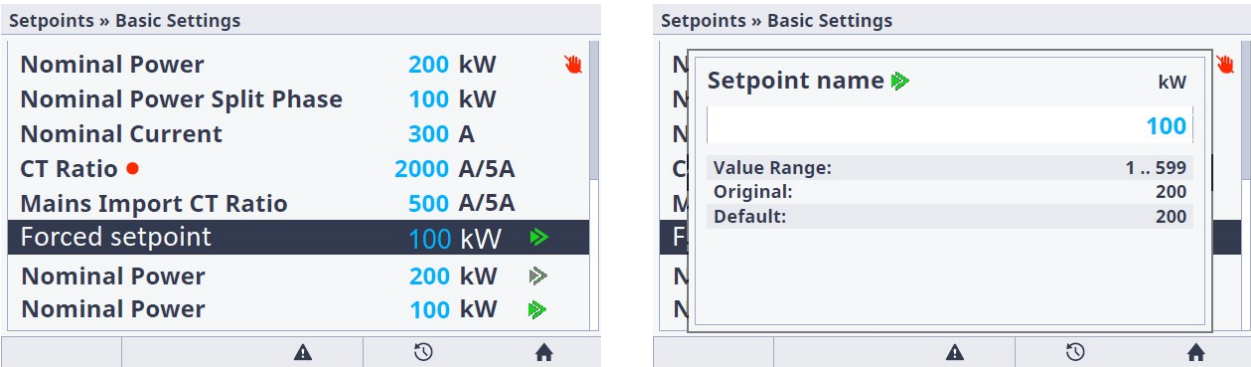


Image 5.70 : Force Value and Protected Setpoint Indication

### InteliConfig



Image 5.71 : Force Value Indication in IntelliConfig

**Note:** Setpoints that are currently being forced their arrow turns to green color and they also have the option for writing of different value manually disabled.



### 5.4.15 Hot Swap Redundancy

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**IMPORTANT: This is a premium function which requires SW Key in order to be used!**

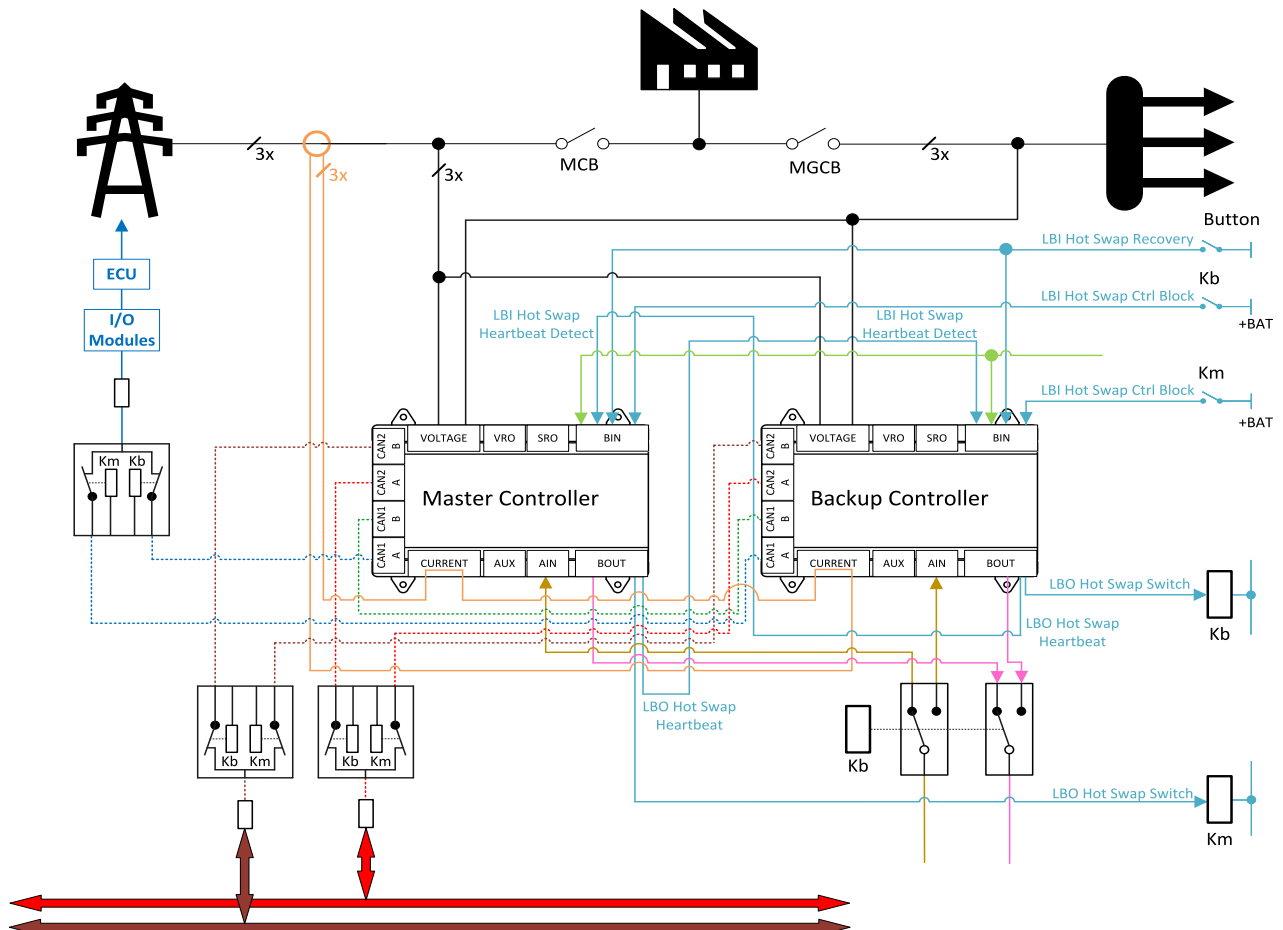
**Hot Swap Redundancy** is a feature designed to increase the reliability of the control system. Its principle is based on the fact that the control system consists of two pair controllers, "MASTER" and "BACKUP". The BACKUP controller is ready to take over the control of the System anytime when MASTER controller fails.

**Assumptions:** We assume that both pair controllers have the same information about the controlled system that they obtain through their inputs and communication lines. This information is supplemented by so-called synchronization data, which the MASTER controller sends via the Hot Swap Synchronization Line. The second fundamental assumption is that both controllers have the same configuration in terms of control functions.

**Detection of failure of the pair controller and speed of the transition:** The BACKUP controller evaluates the competence of the MASTER controller via a heartbeat signal. Due to its high frequency BACKUP is able to detect MASTER failure quickly enough to be able to respond in a way that the entire system does not register the transition to BACKUP at all. This usually happens approximately in 3 ms. The LBO Hot Swap Heart Beat of MASTER controller must be interconnected with the LBI Hot Swap Heart Beat Detect of the pair BACKUP controller and vice versa. So, both controllers monitor each other and they are ready to respond accordingly.

## Essential signals and wiring diagram

**Note:** This is a set of recommendations to ensure maximum reliability of the Hot Swap system. The actual configuration may vary from case to case.



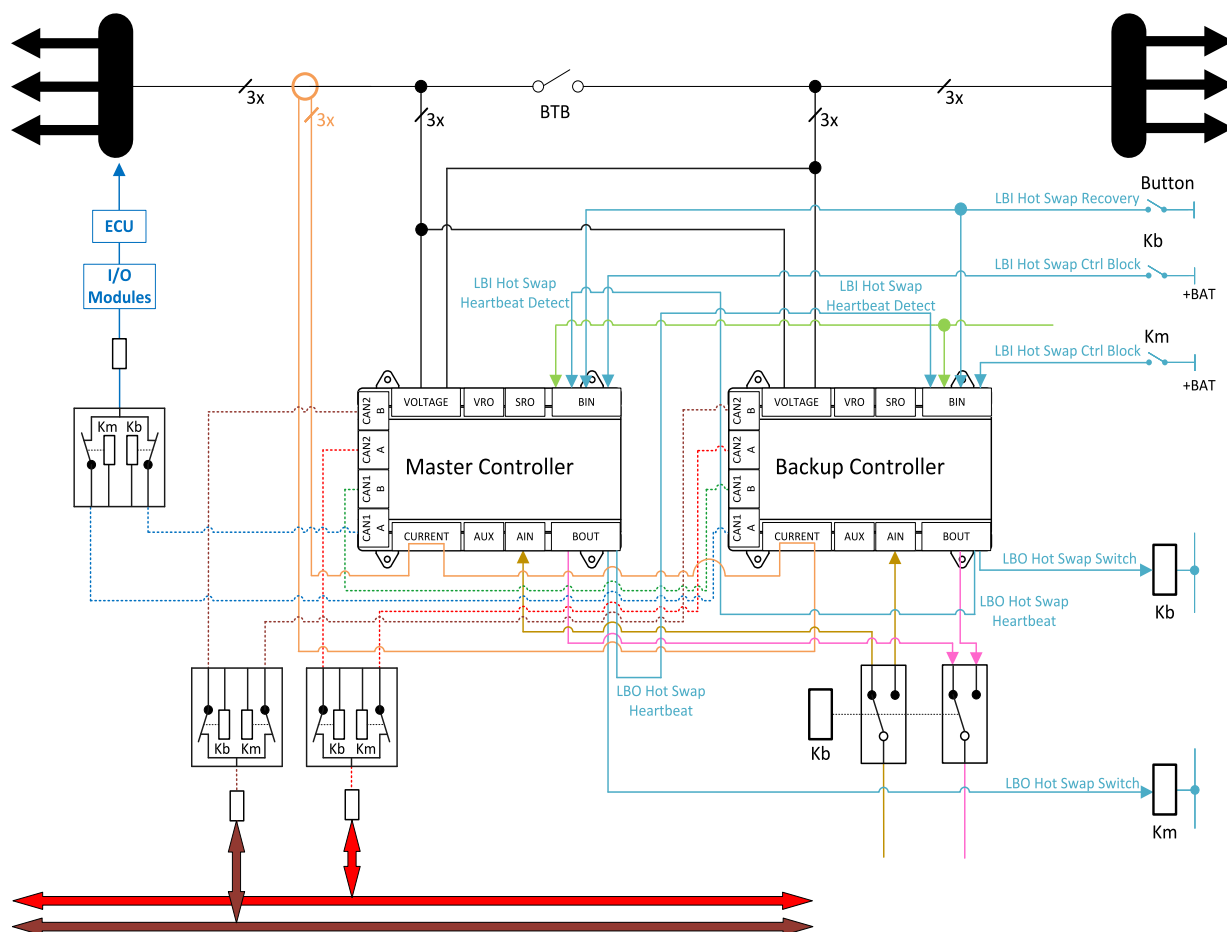


Image 5.72 Hot Swap Redundancy wiring diagram with

- **Polarity of binary inputs:** The polarity of the Hot Swap Heartbeat pulse signal requires that the controller binary inputs has to be set to the "Pull Down" configuration.

### Hot Swap Heartbeat and other control signals

- **Hot Swap Heartbeat** - The LBO HOT SWAP HEARTBEAT (PAGE 572) of MASTER controller must be interconnected with the LBI HOT SWAP HEARTBEAT DETECT (PAGE 553) of the pair BACKUP controller and vice versa.
- **Hot Swap Switch** - The function of Hot Swap necessarily requires the configuration of the LBO HOT SWAP SWITCH (PAGE 573) signal on the armature of relay Km / Kb , which ensures turn over or disconnection of technology inputs / outputs and communication lines. It is possible to use multiple pole relays and combine more control signals together or use a number of independent relays powered by a common physical output of the controller. Then it is necessary to keep the maximum permissible load of one output, or to divide the LBO HOT SWAP SWITCH (PAGE 573) function among several physical binary outputs. Alternatively use one central Hot Swap Switch relay designed to supply all other control relays.
- **The Hot Swap functionality necessarily requires** the configuration of the LBI HOT SWAP CTRL BLOCK (PAGE 552) input on both paired controllers. The input is to be handled by the LBO HOT SWAP SWITCH (PAGE 573) signal of the pair controller and ensures the switching of the controller that has been evaluated as defective to a state where it cannot effect the technology control.

**IMPORTANT:** It is recommended to use high speed relays (eg. SSR) with switching delays <1ms for disconnection of communication lines and technology inputs/outputs.

## Interconnection of inputs and outputs of Hot Swap pair controllers

- Configuration of inputs to polarity "Pull Down" in combination, where inputs and outputs of controllers are interconnected further requires galvanic separation with optocouplers or connection of anti-series diodes to controller outputs. For more information see **Binary Inputs (page 59)** and **Binary Outputs (page 60)**.

## Powering

- We recommend a 24V power supply system for the Hot Swap system. The MASTER and BACKUP controllers should be powered from an independent source.

## Binary inputs

- The binary inputs (with the exception of the control binary inputs of the Hot Swap function) always lead to both pair controllers at the same time, in the same position without the need of separation by relays. It is recommended to separate the inputs by diodes to avoid wrong input activation when one controller is switched off - see **Binary Inputs on page 59**.
- The binary inputs must be set to "Pull Down" polarity on both controllers.

## Binary outputs

- It is strongly recommend to connect the binary outputs controlling the technology via a pair of relays with a disconnecting function. This ensures that a controller that is defective cannot disturb the operation of the application under any circumstances.

## Analog inputs

- The analog inputs must be connected via paired relays with a switching function. The exception is the configuration where the analog inputs are set as voltage 0-10 V.

## Analog outputs

- The analog outputs controlling the technology, namely AOUT1 and AOUT2, must be connected via a pair of relays with a switching function.

## Communication lines

- Technological lines CAN1A (ECU and I/O modules), CAN2A (Intercontroller Communication), CAN2B (Redundant Intercontroller Communication). These lines are recommended to be connected to both pair controllers via relays with disconnecting function. Relays have to be as close to the CAN terminals as possible, so the star connection of the CAN bus is avoided. See the illustrative picture for the Intercontroller CAN:

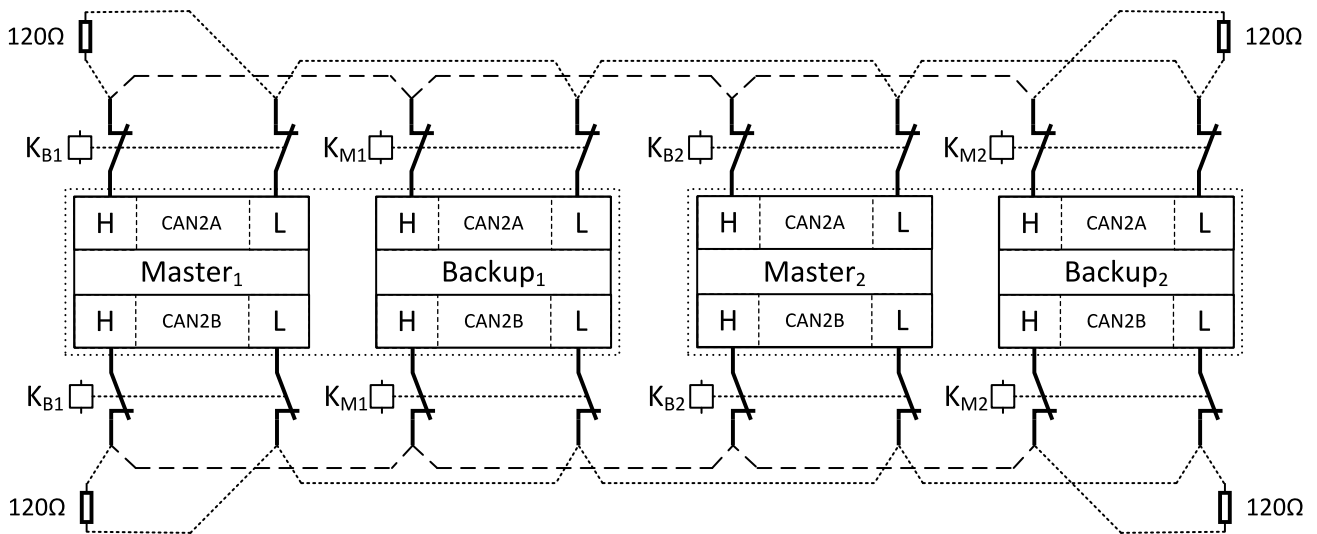


Image 5.73 Intercontroller CAN connection diagram.

**Note:** CAN bus have to be terminated on the relay level (see the image above), so the line is terminated correctly if any controller is disconnected from the bus.

- Ethernet 1, Ethernet 2 and Ethernet 3 are connected to both controllers in the classic way at the same time.
- RS485 (Modbus Server/Master communication) is connected to both controllers in the classic way at the same time. Both pair controllers has different device address on this line. In case of connection via RS485 there is no possibility to use hotswap. It is not possible to read from two devices and write at the same time.

**Note:** In complex applications (e.g. IntelliMains performing the Load Control of the system) where Hot Swap recovery during the run of the gensets is required, it is recommended to wire essential signals (e.g. LBI Remote Start/Stop) physically. Synchronization of CAN2A/CAN2B lines after the recovery is not as fast as using physical signals.

## Hot Swap Synchronisation Line

- MASTER AND BACKUP has to be interconnected via so called Hot Swap Synchronisation Line. Actually it is point to point interconnecting of CAN1B communication ports via this synchronization is performed. Even in the event of a failure of this line, BACKUP is ready to take control of the system, but a completely smooth transition can no longer be guaranteed.

## Display

- The Hot Swap system does not support a common display for both paired controllers. Each controller is equipped with its own display.

## Fault Reset

- The Fault Reset button signal is propagated from the controller which is currently in active role to the controller which is currently in listening mode via the Hot Swap Synchronisation Line.

## Alternative configuration with disconnection of the MASTER controller from the power supply:

- Wiring and configuration described above is recommended however it may follow the specific requirements of the installation. Instead of using disconnecting relays, it is also possible to disconnect the MASTER controller completely from the power supply. However, the shutdown of the MASTER controller is then bit slower and there is a higher risk of unwanted intervention of the faulty MASTER controller in the control process. In this case, it is not possible to perform a system recovery without a hard reset of both controllers at one time. We do not recommend this connection, however, the above recommended connection can be extended by disconnecting the MASTER controller from the power supply.

### 🔍 back to Hot Swap Redundancy

## Hot Swap – step by step

If we have a ready HW configuration according to the diagram, we can proceed to put the Hot Swap function into operation. In this chapter, we will walk you through all the steps to run up the Hot Swap system and explain how to solve several problems that you could be heading.

### The configuration and commissioning of the Hot Swap system:

1. **SW key**
  - a. The Hot Swap function is conditioned by software licence - SW Key. The appropriate SW Key must be inserted to the setpoint **SW Key (page 252)**.
2. **Base configuration**
  - a. Check that the signals **LBO HOT SWAP HEARTBEAT (PAGE 572)** and **LBH HOT SWAP HEARTBEAT DETECT (PAGE 553)** are properly configured – crosswired between MASTER and BACKUP.
  - b. It is also necessary to configure the **LBO HOT SWAP SWITCH (PAGE 573)** signal and the **LBH HOT SWAP CTRL BLOCK (PAGE 552)** signal to the corresponding binary output / input - again crosswired between MASTER and BACKUP.
  - c. These signals can be configured for any binary output and binary input of the controller (they must not be configured on peripheral or virtual modules). The binary inputs must be configured in "Pull Down" mode. This polarity must then be taken into account when designing the entire control system. Failure to comply with this configuration causes that the Hot Swap function is not working and it is Disabled.
  - d. If any mandatory LBH or LBO is not correctly configured the alarm **Wrn Hot Swap Configuration Incorrect (page 663)** is activated.
  - e. Power up both controllers at the same time.
3. **Setting of the setpoints**
  - a. Set the setpoint **Hot Swap Redundancy (page 253)** = Master on the controller that is to perform the MASTER role, and set this setpoint = Backup on the controller in the BACKUP role. MASTER and BACKUP share the same address, set the setpoint **CAN Controller Address (page 316)** in the same way. Pay attention, changing the settings of all the above setpoints will not take effect until both controllers are power cycled. Verify the configuration and settings by setting the system to the "default state", ie the MASTER controls the system, the BACKUP is ready to take over the control.
  - b. In case of using two sets of I/O modules (modules redundancy), set the setpoint **Hot Swap Redundancy (page 253)** = Master + Modules Redundancy for MASTER controller and Backup + Modules Redundancy for BACKUP controller. The rest stays the same as above.
4. **From the point of view of the control system**

We want the hot swap system to behave as one device - one control system. For this reason, we set the

CAN Address on the Intercontroller CAN line Setpoint **CAN Controller Address (page 316)** on the MASTER and on the BACKUP controller identically. This ensures a smooth transition in terms of Load / Var sharing, Powermanagement and virtual peripheries. On the contrary, from the point of view of monitoring, it is necessary to distinguish both devices from each other. The address for Monitoring via RS485 is set using the setpoint **Terminal Comm Address (page 316)**. This communication line is therefore permanently connected to both controllers and it is not necessary to switch it over the pair controllers.

#### 5. **Resetting the Hot Swap System to the default state**

It is possible to reset the system by power-cycling of both controllers. Disconnect the power supply from both pair controllers, first connect the power supply to the MASTER controller, then connect the power supply to the BACKUP controller. If the base configuration is OK, the alarmlist on the MASTER or BACKUP should not contain any alarm related to Hot Swap. Check the value **Hot Swap Redundancy Status (page 441)**, to confirm that the Hot Swap system is in the default state. The basic check of the default state can be easily performed by changing the Controller Mode on MASTER controller. Controller mode can be changed only from the MASTER controller. BACKUP then only reflects this state and it is not possible to change its Controller Mode directly.

#### 6. **Hot Swap Recovery**

If the **Wrn Master Controller Failed (page 664)** or **Wrn Backup Controller Failed (page 639)** alarm is present in the Alarmlist of one of the controllers, it means that the pair controller was not detected correctly according to the Hot Swap Heartbeat signal. The cause is probably a faulty configuration or wrong wiring. Check the wiring and configuration of the **LBO HOT SWAP HEARTBEAT (PAGE 572)** and **LBH HOT SWAP HEARTBEAT DETECT (PAGE 553)** signals. If everything is OK, reset the Hot Swap system. This can be achieved without the need to restart both controllers using the **LBH HOT SWAP RECOVERY (PAGE 553)**. The LBH responds to the edge, so a pulse needs to be applied to inputs of the both controllers at one time.

**Note:** *It is not possible to perform the recovery if any level 2 alarm is present in the alarm list.*

#### 7. **Performing the Hot Swap function**

If the Hot Swap system is in the default state, we will perform a Hot Swap function test. Interrupt the Hot Swap Heart Beat signal leading from the MASTER to BACKUP. The alarm **Wrn Master Controller Failed (page 664)** appears in the alarm list of the BACKUP controller and BACKUP actively takes over the control of the system. In all consequences it means that:

- a. BACKUP activates the **LBO HOT SWAP SWITCH (PAGE 573)**, which controls all relays according to the diagram. The MASTER is disconnected from all critical lines and signals and the other signals (Analog inputs and Analog Outputs) are switched to the BACKUP controller. At the same time, with this signal, the Master controller is switched to the so-called Listening Mode using its **LBH HOT SWAP CTRL BLOCK (PAGE 552)**. This mode ensures that the MASTER will be silenced on the CAN communication lines and thus will not collide with the data that is already being sent by BACKUP for this purpose.
- b. At this point, BACKUP switches from listening mode to Talking Mode, thus representing the Hot Swap system on CAN communication lines.
- c. Have a look at value Hot Swap Redundancy Status. The individual signals now correspond to a situation where the system has successfully entered a state where BACKUP is in the role of who controls the system.

**Note:** In case of using two sets of I/O modules (modules redundancy): Failure of one of the Master's CAN modules causes the Hot Swap – the Backup controller takes over the control of the system. Failure of one of the Backup's CAN modules causes: Master considers Backup to be dead (therefore the Backup is no longer available for the Hot Swap function).

#### 8. Smooth transition to Backup

When the System is running or is loaded while the MASTER controller fails, then the BACKUP should take over the control of the System smoothly without any bumps on the frequency, voltage and power values, even in dynamic states such as loading, unloading or ongoing synchronization. BACKUP will ensure a smooth transition in the following aspects:

- a. ECU communication
- b. Serving of CAN peripheral modules
- c. Serving of virtual peripheries - Distributed and Shared signals
- d. Communication on Intercontroller line - Load Sharing / Var Sharing

#### 9. Hot Swap Synchronization Line

The states of the state automat, Controller Mode, ECU data and controller outputs are synchronized via the Hot Swap Synchronization Line between MASTER and BACKUP controller. In case of synchronization failure on the Hot Swap Synchronisation Line, BACKUP loses data needed for the smooth transition. If this happens, BACKUP is internally switched to Emergency Manual mode, where it is still able to take over control of the system, but a smooth transition can not be guaranteed. The failure of the Hot Swap Synchronisation Line is accompanied by the following alarms:

- a. **Wrn Hot Swap Data Synchro Fail (page 664)** - takes place on both the MASTER and the BACKUP controller in the event of a communication failure on this line. This status is also indicated in the Hot Swap Redundancy Status value.

#### 10. Shared setpoints

All setpoints prefixed by "#" character - Due to the identical CAN address of the MASTER and the BACKUP controller, there is a problem with writing Shared setpoints and it takes these consequences. If we consider that the Hot Swap system is in the default state then:

- a. Inserting a shared setpoint to the BACKUP controller will not be reflected in any of the other controllers on the CAN (even not in its pair MASTER controller).
- b. Inserting a shared setpoint in the MASTER controller will be reflected in all controllers on the CAN except for its paired BACKUP controller.

**IMPORTANT: Ensuring the synchronicity of shared setpoints must be ensured by the operator!**

#### 11. Time synchronization

Synchronizing shared setpoints, changing the Time setpoint will not be reflected throughout the system. Therefore, time synchronization must again be ensured by the operator. With the advantage it is possible to use the function of time synchronization via SNTP server. This ensures that each controller synchronizes the exact time independently of the other controllers.

#### 🔍 back to Hot Swap Redundancy



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**Note:** This is only quick illustration for I/O configuration, see the IntelliConfig manual for more information about configuration via PC tool IntelliConfig.

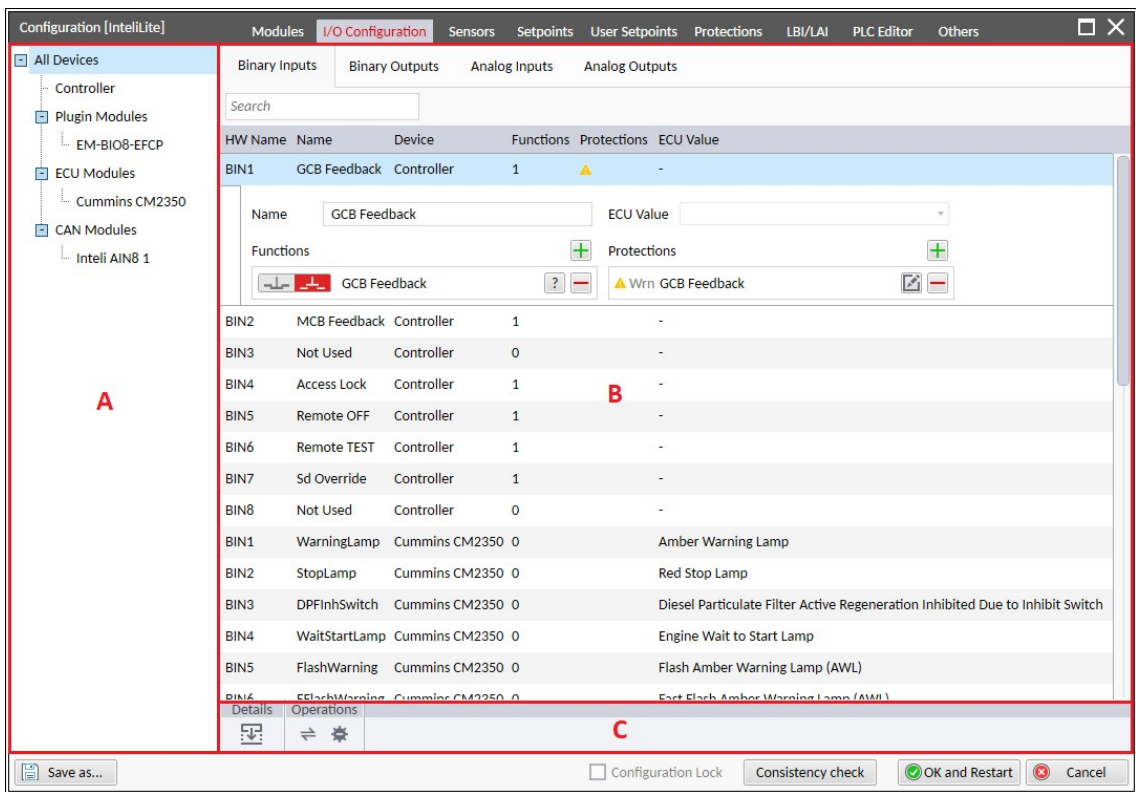


Image 5.74 I/O Configuration window

- A. **Device tree** – contains groups of devices with inputs/outputs to configure
- B. **Configuration panel** – the list of available inputs/outputs related to device tree selection
- C. **Tool bar**
  - > **Expand All Details** - Expands the configuration part of all inputs/outputs
  - > **Transfer IO Configuration** - see Transfer I/O Configuration on page 148
  - > **Remove IO Configuration** - see Remove I/O Configuration on page 149

## Binary Inputs

The configuration of the binary input consists of:





1. **Name** - the name identification of the binary input
2. **ECU Value** - electronic control unit value, available only for ECU devices (otherwise disabled)
3. **Functions** - the set of functions **see Functions Configuration on page 148**
4. **Protections** - the set of protections **see Protections Configuration on page 148**

HW Name	Name	Device	Functions	Protections	ECU Value
BIN1	GCB Feedback	Controller 1			-

Name:

ECU Value:

Functions:  GCB Feedback 


Protections: 

Image 5.75 Binary input configuration

## Binary Outputs



The configuration of the binary output consists of:


1. **Name** - the identification name of the binary output
2. **Source** - the source value for the binary output
3. **Contact Type** - represents the default state of output (Normally Open/Normally Closed)
4. **ECU Value** - electronic control unit value, available only for ECU devices (otherwise disabled)
5. **Protections** - the set of protections **see Protections Configuration on page 148**

HW Name	Name	Device	Source	Contact Type	Protections	ECU Value
BOU1	Starter 1	Controller	Starter 1	Normally Closed		-

Name:

Source:   

Contact Type:  Normally Closed

ECU Value:


Protections: 

Image 5.76 Binary output configuration

## Analog Inputs

The configuration of the analog input consists of:

1. **Name** - the identification name of the analog input
2. **Sensor** - sensor used for the analog input **see Sensor Curves on page 169**
3. **Dimension** - dimension used for analog input (Can be set directly in form if the electronic sensor is configured, otherwise it can be set in sensor configuration.)
4. **Resolution** - resolution used for analog input (Can be set directly in form if the electronic sensor is configured, otherwise it can be set in sensor configuration.)
5. **Sensor Range** - range used for linear sensor (Range for measured values is defined by Offset + Sensor Range)
6. **Offset** - offset used for linear sensor
7. **Bargraph 0%** - lower bargraph limit displayed on the controller display
8. **Bargraph 100%** - upper bargraph limit displayed on the controller display
9. **ECU Value** - electronic control unit value, available only for ECU devices (otherwise disabled)
10. **History Abbreviation** - shortcut used in the History.
11. **Functions** - the collection of functions **see Functions Configuration on page 148**
12. **Protections** - the collection of protections **see Protections Configuration on page 148**

HW Name	AIN8 5	AIN1	Input 1	-	0-250ohm	ohm	0,1	250,0	0,0	0,0
Name	Input 1				Sensor	0-250ohm				
Dimension	ohm				Resolution	0,1				
Sensor Range					Offset	0,0				
Bargraph 0%					Bargraph 100%	250,0				
					History Abbreviation	5AI1				
Functions	Click + to add item				Protections	Click + to add item				

Image 5.77 Analog input configuration using linear sensor

HW Name	Name	Device	Functions	Protections	Sensor	Dimension	Input HW Type	Resolution	Bargraph 0%	Bargraph 100%	ECU Value	History Abbreviation
AIN1	Oil Pressure	Controller 1		⚠	VDO 10 Bar	Bar	0-15k ohm	0,1	0,0	10,0	-	OilP
Name		Oil Pressure			Sensor		VDO 10 Bar					
Dimension		Bar			Resolution		0,1					
Bargraph 0%		0,0			Bargraph 100%		10,0					
ECU Value					History Abbreviation		OilP					
Functions				Protections								
Oil Pressure				⚠ Wrn Oil Pressure ⚠ Sd Oil Pressure								

Image 5.78 Analog input configuration using user sensor

## Analog Outputs

The configuration of the analog output consists of:

1. **Source** - the source value for the analog output
2. **Output Curve** - definition of the transferring output curve
  - a. The output curve is not available if the "No Conversion" parameter is checked.
3. **No Conversion** - Define whether the source value is converted by the output curve or not
4. **PWM Frequency** - setting of the PWM frequency
  - a. The PWM frequency can be set only if the output curve is a type of PWM.
5. **ECU Value** - electronic control unit value, available only for ECU devices (otherwise disabled)






HW Name	Device	Source	Output Curve	No Conversion	PWM Frequency	ECU Value
AOUT1	IGS-PTM 1	RPM	U [0..10V]	<input type="checkbox"/>	200	-
Source		RPM	Output Curve	U [0..10V]		
No Conversion		<input type="checkbox"/>	PWM Frequency		200	
ECU Value						

Image 5.79 Analog output configuration




**IMPORTANT:** Output Curves are in Int16 format (range -32768 to 32767). Therefore if the source value is a decimal value, the range is reduced accordingly.

**Example:** When **Bus Right Frequency (page 412)** (0.001 resolution) is used as a source value, it has to be converted to a lower resolution in PLC (e.g. 0.01) in order to work correctly. Otherwise the upper level of the curve's input would be cut to 32.767.

## Functions Configuration


- > It is possible to assign more functions (Logical Binary Inputs) to the specific input (BIN, AIN)
  - >>  Add new function to the input
  - >>  Remove function from the input
- > For the binary input functions the contact type for each function can be set
  - >>   - Normally Closed/Normally Open
- > Each function (LBI) has the link to the help through button 

## Protections Configuration

- > It is possible to assign one level 1 and level 2 protection to the specific input or output (BINT, BOUT, AIN).
  - >>  Add new protection
  - >>  Remove protection
  - >>  Edit protection

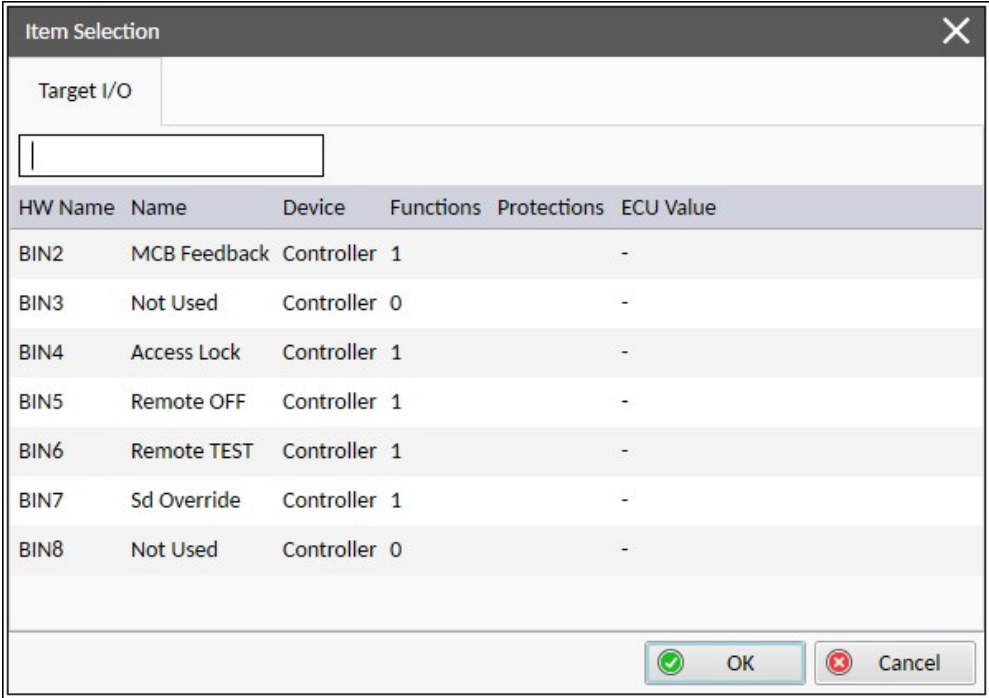
For more information about protections see **Protections on page 195**

## Transfer I/O Configuration

This functionality offers to transfer the whole input/output configuration to another compatible input/output in the same category. The icon  for transfer is available in the bottom toolbar.

After clicking on the transfer icon is displayed window for selecting the target input/output. Offered are only compatible inputs/outputs of the same category. When the required input/output is selected and confirmed by the OK button, the transfer operation starts.

**Note:** The configuration is transferred completely (functions, protections, sensor, PLC configuration) except Modbus definition.




The dialog box titled "Item Selection" contains a "Target I/O" section with a text input field. Below this is a table with the following data:

HW Name	Name	Device	Functions	Protections	ECU Value
BIN2	MCB Feedback	Controller	1		-
BIN3	Not Used	Controller	0		-
BIN4	Access Lock	Controller	1		-
BIN5	Remote OFF	Controller	1		-
BIN6	Remote TEST	Controller	1		-
BIN7	Sd Override	Controller	1		-
BIN8	Not Used	Controller	0		-

At the bottom right of the dialog are "OK" and "Cancel" buttons.

## Remove I/O Configuration

This functionality offers to remove the whole input/output configuration. The icon  for remove is available in the bottom toolbar. The name of input/output is after remove set to "Not Used".

**Note:** The configuration is removed completely (functions, protections, sensor, PLC configuration) except Modbus definition.

### 5.4.17 Modbus Client (Master)

**IMPORTANT: This is a premium function which requires SW Key in order to be used!**

The Controller IntelliMains 1010 BTB SC is equipped by the function of Modbus Client (Master). Actually it means that controller can play the role of the device which initiate the modbus communication, i.e. controller can ask and command other devices being in role of modbus server (slave). In standard terms role of modbus client (master) on modbus TCP or RTU. The communication protocol with server device is a matter of configuration.

## Modbus Client (Master) configuration step by step

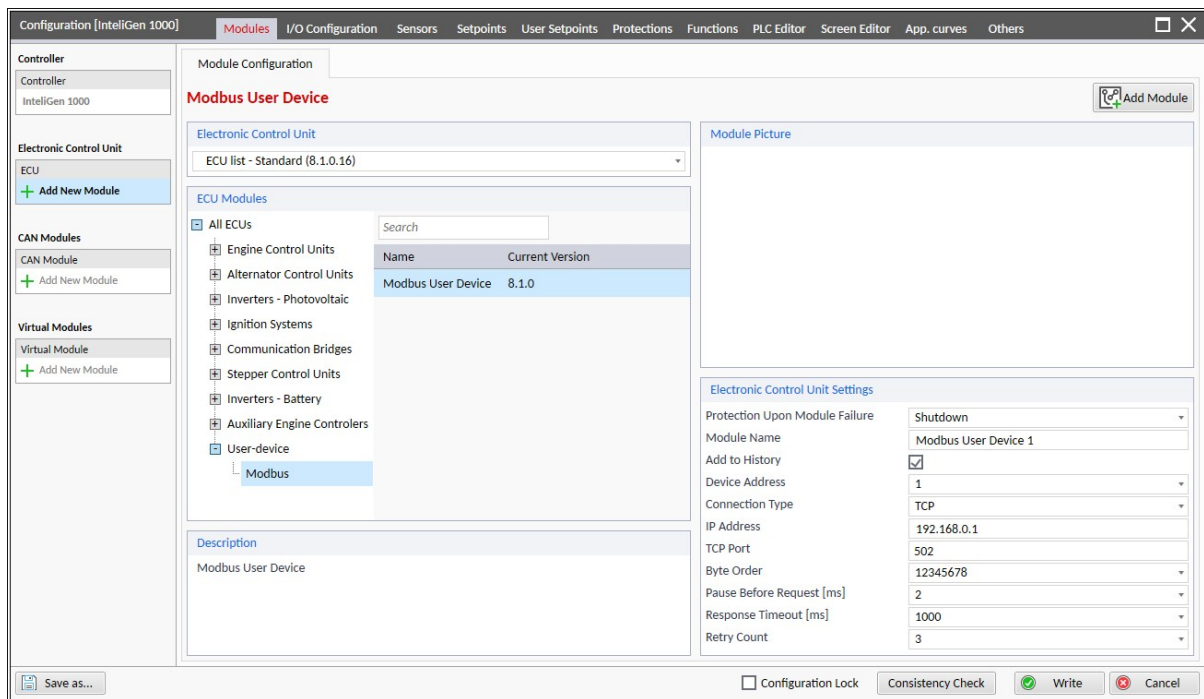
Controller is able to communicate with up to 16 devices at one time. The modbus server device is configured like the ECU module, it is part of Multi ECU configuration. Modbus server devices uses the same pool (resources) for the inputs and outputs as standard ECUs.

The Modbus Client/Master function is conditioned by software license - SW Key which must be inserted in the setpoint **SW Key (page 252)**. If the key is not inserted the function is available only for two modbus registers (inputs or outputs). When more than these two registers are used in the configuration, no registers will be communicated at all and the alarm **ALI SW Key Modbus Master Error (page 674)** is activated.

### User defined Modbus Server Devices

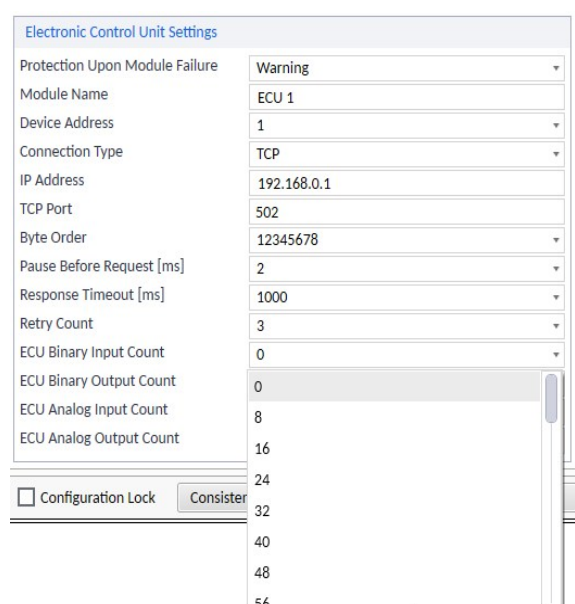
#### 1. Adding Modbus Server Device

Open the Controller Configuration in IntelliConfig, go to section **Modules**, and click on **Add New Module** in **ECU** section. Then under **Electronic Control Unit** select **ECU list - Standard** and choose **User device - Modbus - Modbus User Device** to define your own device definition. Then confirm the settings by pressing the button **Add Module**. Now your modbus server device is added into the configuration.



## 2. Modbus Server Device Settings

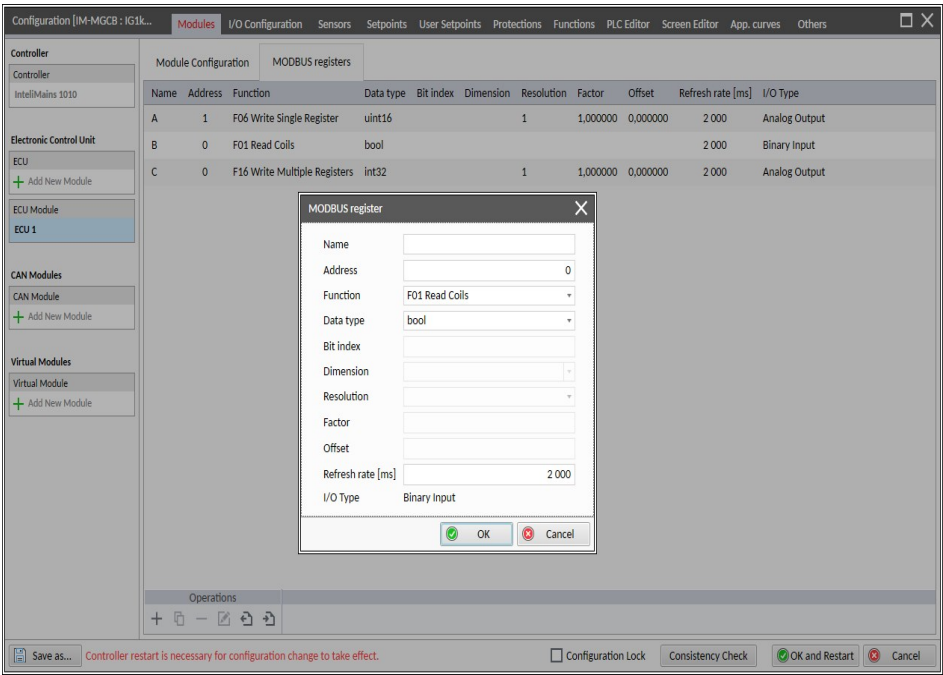
Once the device was added into the configuration you need to edit its setting such as number of each type of Inputs/Outputs, Device Address, etc. Keep in mind that all devices uses inputs and outputs from the limited pool common with ECU. Inserting the "Device address" is required for both Connection Types (Modbus RTU or Modbus TCP).



## 3. MODBUS Registers

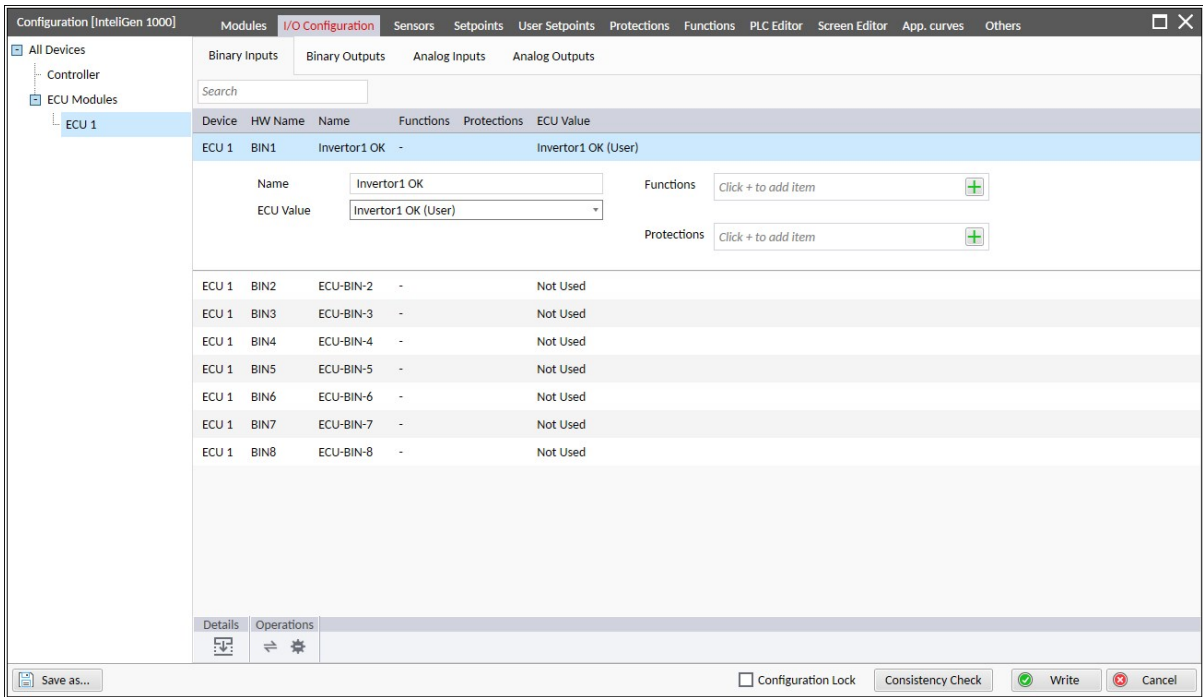
Open the section **MODBUS registers** for editing or creating new registers (datapoints). The list of registers is actually a set of definitions belonging to your specific device and has no direct connection to specific control signals in the controller. So, you can create large set of registers without any limitation. Register definitions for all devices are integrated into the configuration and uploaded into the controller. Therefore there is no need to

share the "original Modbus Device List" containing all registers, when editing the configuration which was not created in your computer.



#### 4. Configuration of Inputs And Outputs

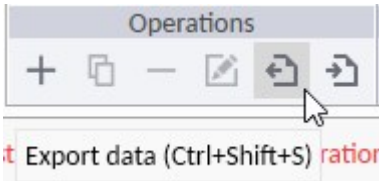
Now, when the definition of your Modbus Server Device was created, go to section **I/O Configuration** and assign the specified registers to inputs and outputs. Then assign the functions for inputs and outputs. You can select from the list of standard logical signals or use your inputs and outputs in the PLC configuration.



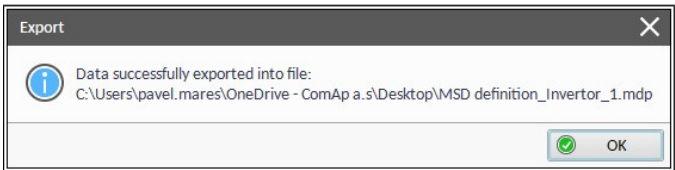
#### 5. Clonning of The Modbus Server Device

When using more then one instance of a specific Modbus Server Device in one configuration, or when needed the Modbus Server Device definition for configuration of another controller, there is a way how to

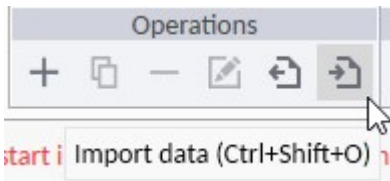
Export and Import the definitions. Go to section **MODBUS registers** in **Modules** and select the icon for exporting data.



Insert the name and select the target folder for exporting data. You will be informed about successful exporting of your device definition.



After that select the icon for importing data in a new configuration.



Select one of your Modbus Server Device definition files and Import it into the configuration for a new instance of your device.

## 5.4.18 Multiple ECU

InteliMains 1010 BTB SC allows you to configure, monitor and control multiple Electronic Control Units (ECUs), such as Breakers and Modbus modules. At this moment there are 16 ECU slots available, each slot can contain one ECU/Modbus Master which settings can be separately configured. ECU can be configured via InteliConfig (Control → Configuration → Modules → Electronic Control Unit).

In order to ensure proper functionality you shall pay extra attention to the ECU settings. ECU address has to be always unique whereas Controller address is required to be set to the same value as **CAN Controller Address (page 316)** of the Controller Unit that sends commands frames to this ECU. Aftertreatment can be enabled only for one ECU, enable it by using a check box.

ECU I/O can be configured in I/O Configuration.

### Controller objects related to ECU

ECU Slot	LBI	LBO	Alarm
1	ECU COMMUNICATION FAIL BLOCK 1 (PAGE 541)	ECU 1 COMM FAIL (PAGE 564)	Wrn ECU 1 Comm Fail (page 658)
2	ECU COMMUNICATION FAIL BLOCK 2 (PAGE 541)	ECU 2 COMM FAIL (PAGE 565)	Wrn ECU 2 Comm Fail (page 658)

3	<b>ECU COMMUNICATION FAIL BLOCK 3 (PAGE 541)</b>	<b>ECU 3 COMM FAIL (PAGE 565)</b>	<b>Wrn ECU 3 Comm Fail (page 658)</b>
4	<b>ECU COMMUNICATION FAIL BLOCK 4 (PAGE 541)</b>	<b>ECU 4 COMM FAIL (PAGE 565)</b>	<b>Wrn ECU 4 Comm Fail (page 658)</b>
5	<b>ECU COMMUNICATION FAIL BLOCK 5 (PAGE 542)</b>	<b>ECU 5 COMM FAIL (PAGE 565)</b>	<b>Wrn ECU 5 Comm Fail (page 659)</b>
6	<b>ECU COMMUNICATION FAIL BLOCK 6 (PAGE 542)</b>	<b>ECU 6 COMM FAIL (PAGE 565)</b>	<b>Wrn ECU 6 Comm Fail (page 659)</b>
7	<b>ECU COMMUNICATION FAIL BLOCK 7 (PAGE 542)</b>	<b>ECU 7 COMM FAIL (PAGE 565)</b>	<b>Wrn ECU 7 Comm Fail (page 659)</b>
8	<b>ECU COMMUNICATION FAIL BLOCK 8 (PAGE 542)</b>	<b>ECU 8 COMM FAIL (PAGE 566)</b>	<b>Wrn ECU 8 Comm Fail (page 660)</b>
9	<b>ECU COMMUNICATION FAIL BLOCK 9 (PAGE 542)</b>	<b>ECU 9 COMM FAIL (PAGE 566)</b>	<b>Wrn ECU 9 Comm Fail (page 660)</b>
10	<b>ECU COMMUNICATION FAIL BLOCK 10 (PAGE 543)</b>	<b>ECU 10 COMM FAIL (PAGE 566)</b>	<b>Wrn ECU 10 Comm Fail (page 660)</b>
11	<b>ECU COMMUNICATION FAIL BLOCK 11 (PAGE 543)</b>	<b>ECU 11 COMM FAIL (PAGE 566)</b>	<b>Wrn ECU 11 Comm Fail (page 660)</b>
12	<b>ECU COMMUNICATION FAIL BLOCK 12 (PAGE 543)</b>	<b>ECU 12 COMM FAIL (PAGE 566)</b>	<b>Wrn ECU 12 Comm Fail (page 661)</b>
13	<b>ECU COMMUNICATION FAIL BLOCK 13 (PAGE 543)</b>	<b>ECU 13 COMM FAIL (PAGE 566)</b>	<b>Wrn ECU 13 Comm Fail (page 661)</b>
14	<b>ECU COMMUNICATION FAIL BLOCK 14 (PAGE 543)</b>	<b>ECU 14 COMM FAIL (PAGE 567)</b>	<b>Wrn ECU 14 Comm Fail (page 661)</b>
15	<b>ECU COMMUNICATION FAIL BLOCK 15 (PAGE 544)</b>	<b>ECU 15 COMM FAIL (PAGE 567)</b>	<b>Wrn ECU 15 Comm Fail (page 662)</b>
16	<b>ECU COMMUNICATION FAIL BLOCK 16 (PAGE 544)</b>	<b>ECU 16 COMM FAIL (PAGE 567)</b>	<b>Wrn ECU 16 Comm Fail (page 662)</b>

For each ECU there is LBO which gets activated when communication issue with respective ECU is detected. For easier detection whether all configured ECUs are communicating, there is LBO **ECU COMM OK (PAGE 567)**. During detected communication issue an alarm is issued for respective ECU. This alarm and all user protections related to respective ECU can be suppressed by appropriate LBI. To suppress all protections of all ECUs use LBI **ECU COMMUNICATION FAIL BLOCK (PAGE 541)**. See table above to find relative LBO, LBI and alarm to respective ECU slot.

All protections which evaluation depends on values from the ECU with communication error are blocked in order to prevent showing of invalid protections in the Alarm list.



# 5.4.19 PLC - Programmable Logic Controller

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The Programmable Logic Controller (PLC) built into the ComAp controllers is generally a simple process unit used for the automation of processes. The major benefit of the PLC is you don't need any extra control devices in your control system. The PLC is tightly integrated with the standard line of controllers. That allows the PLC editor to be a seamless experience directly in the programming software. Flexibility is at the core of ComAp's software design and the PLC meets both simple and complex application requirements while using the same intuitive interface. PLC Editor is a powerful tool that helps you to create your own PLC scheme. It has a user-friendly graphical interface which makes it easy to use.

ComAp PLC Editor has been developed to help you deal with even the most demanding applications. It allows you to add control logic, additional alarm functions, or even new features to meet complex or unique requirements. This easy-to-use PLC Editor means you can customize the way the controller works to match the application precisely without compromise or limitation.

- Intuitive design, visual programming, and easy modification.
- All PLC function blocks can be moved both horizontally and vertically.
- Color-coded and linked to relevant functions.
- Blocks can be organized to reflect the real process flow.
- Groups of blocks can be separated on each sheet to form sub-sets within the design.
- Detailed descriptions of inputs and outputs come complete with useful hints

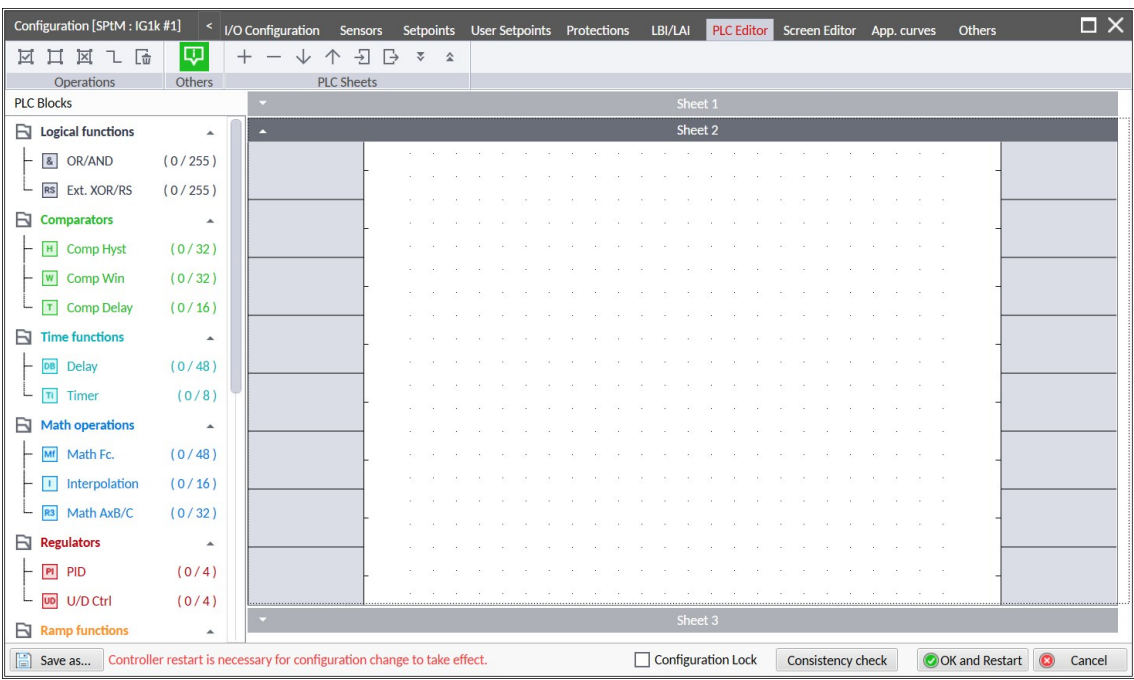


Image 5.81 PLC Editor - main page

## List of available PLC blocks

In the table below you can find all available PLC blocks.

Group	PLC blocks	Number of blocks
Logical	OR/AND (page 595)	128
	XOR/RS (page 597)	128
Comparators	Comp Delay (page 598)	8
	Comp Hyst (page 599)	16
	Comp Win (page 600)	16
Time functions	Delay (page 601)	16
	Timer (page 603)	4
Math Operations	Interpolation (page 605)	8
	AxB/C±D (page 606)	4
	Math Fc. (page 607)	16
Regulators	PID (page 609)	4
	Up/Down Ctrl Block (page 614)	4
Ramp functions	Inc/Dec (page 616)	2
	Mov Avg (page 617)	2
	Ramp (page 618)	4
	Up/Down (page 619)	4
Others	Analog Switch (page 621)	8
	Analog Switch 8 (page 622)	8
	Circuit Breaker (page 624)	1
	Comp. 4 (page 626)	8
	Convert (page 627)	16
	Counter (page 629)	4
	Decomp. 4 (page 630)	8
	Hold (page 632)	4
	Validator (page 633)	4

For more information about PLC blocks go to the chapter **PLC (page 594)**

[🔍 back to PLC - Programmable Logic Controller](#)

## PLC Editor

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The PLC Editor is available in IntelliConfig Control tab: use Control → Controller Configuration → PLC Editor.

### Toolbar

In the upper part of the PLC editor panel there is a toolbar with buttons for working with PLC blocks and PLC sheets.



#### Operations

- > Select all elements in sheets
- > Unselect all selected elements
- > Delete all selected elements
- > Rerote selected items - wiring optimization
- > Delete whole content of currently selected sheet

#### PLC Sheets

- > Add and remove sheets
- > Move selected sheet down and up
- > Import sheet
- > Export selected sheet
- > Expand and Colapse all sheets

#### Others

- > Enable/Disable hints

### 🔍 back to PLC Editor

### Working with sheets

PLC editor supports working with multiple sheets. You can add or delete sheets and move them up and down. Every sheet can be also renamed by double-click on sheet name "Sheet 1". Each sheet can be re-sized according to your needs by dragging the sheet edges. IntelliConfig also supports importing and exporting of the individual sheet.

**Note:** The number of PLC blocks on one PLC sheet is limited to 30 blocks.

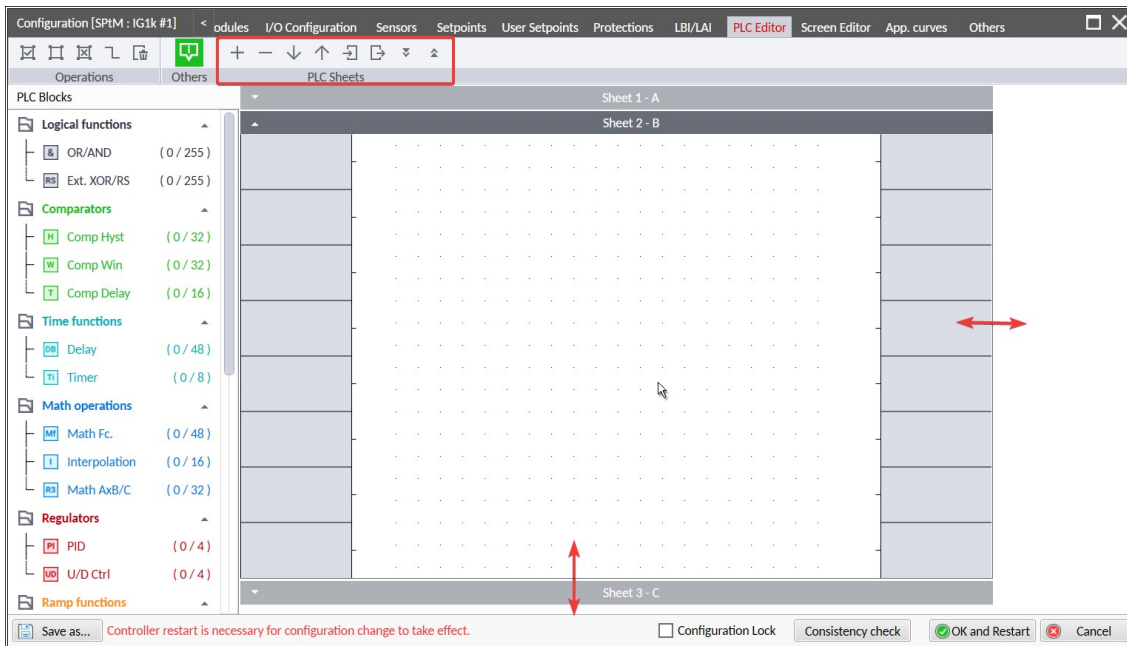


Image 5.82 Adjusting PLC sheet

## back to PLC Editor

### Blocks Selection Tree

On the left side of PLC Editor panel is available PLC blocks selection tree. Blocks are grouped into groups of similar functionality next to the name of each block the number of used /available blocks of that type is indicated in brackets.

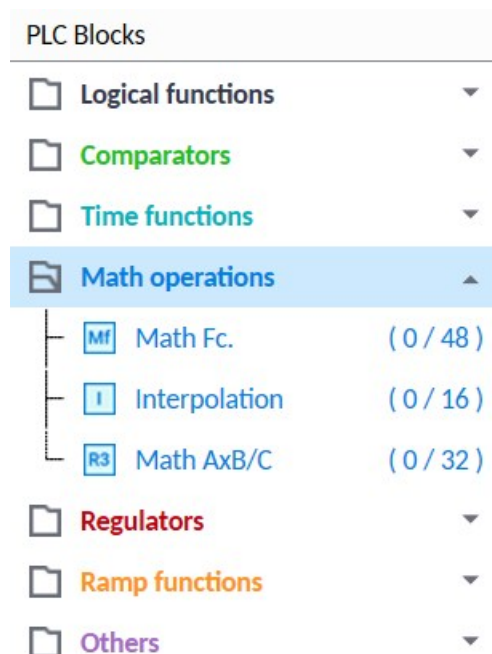


Image 5.83 Blocks selection tree

## back to PLC Editor

## Adding PLC blocks

Adding PLC block is using simple and intuitive drag and drop system. Follow the procedure below to add PLC block.

- Select required PLC block by LMB (left mouse button) from the list of available PLC blocks on the left side and drag it into the sheet.
- Connect the block inputs and outputs by drawing wires in the sheet. It is also possible to connected inputs and outputs via properties of selected PLC block.

**Note:** To delete PLC block just click on it and press delete button. Also delete selection function can be used.

**Note:** To see context help for selected PLC block just press F1 button.

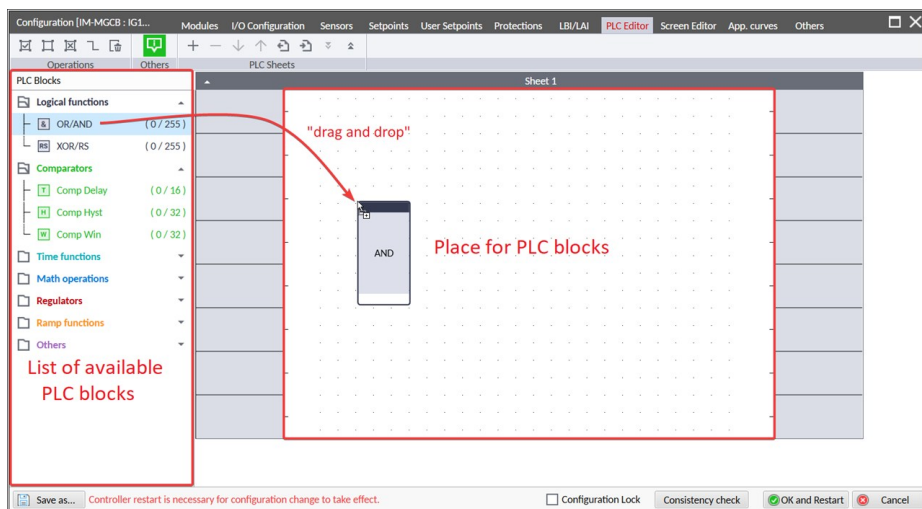
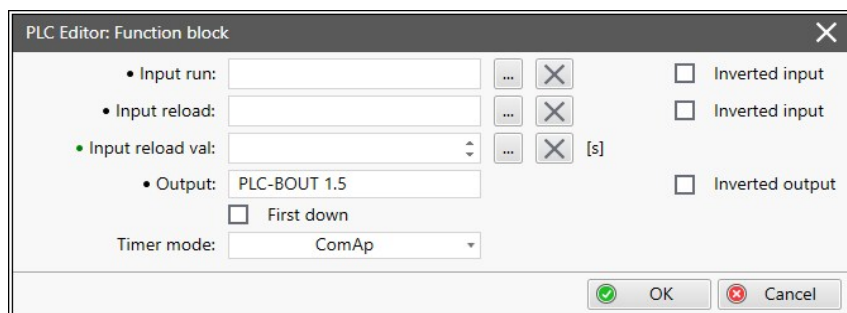
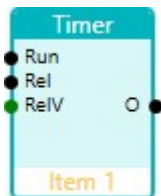


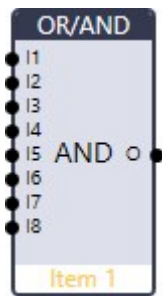
Image 5.84 Adding PLC blocks

🔍 back to PLC Editor

## PLC Block Configuration

Double-click on the block by LMB (left mouse button) to invoke the configuration panel specific for each block type. In general, the definition of the block inputs and outputs is accompanied by some settings of block properties. See **PLC (page 594)** for more information about blocks.





PLC Editor: Function block			
No.	Input		Inv.
1		...	<input type="checkbox"/>
2		...	<input type="checkbox"/>
3		...	<input type="checkbox"/>
4		...	<input type="checkbox"/>
5		...	<input type="checkbox"/>
6		...	<input type="checkbox"/>
7		...	<input type="checkbox"/>
8		...	<input type="checkbox"/>

• Output:  ☐ Inverted output

Function type:

- Selecting the **Inverted input** check box means using negated input when evaluating the block.
- Selecting the **Inverted output** check box means issuing a negated output value after the block has been internally evaluated.
- The binary values can be either controller Values, Setpoints or PLC binary outputs.
- The analog values can be either controller Values, Setpoints, PLC analog outputs or entered as direct constant block values. Non-numeric Setpoint values (e.g. IP address) cannot be used.
- If a variable (binary signal) is connected via wire, the connection appears directly in the field - otherwise the variable (binary signal) can be set using the dialog invoked by the '...' button.
- Specific properties of the block (e.g. function type, mode of operation, etc.) can be set in the corresponding panel object (list box, check box).
- If the block has a variable number of inputs, the '+' button (in the upper left corner) adds an additional input (channel) up to the maximum number of channels. Use 'X' button to remove a channel.

**Note:** If the constants are used (i.e. set by block configuration dialog) they cannot be changed dynamically during PLC execution.

⬅ back to PLC Editor

## Define inputs and outputs

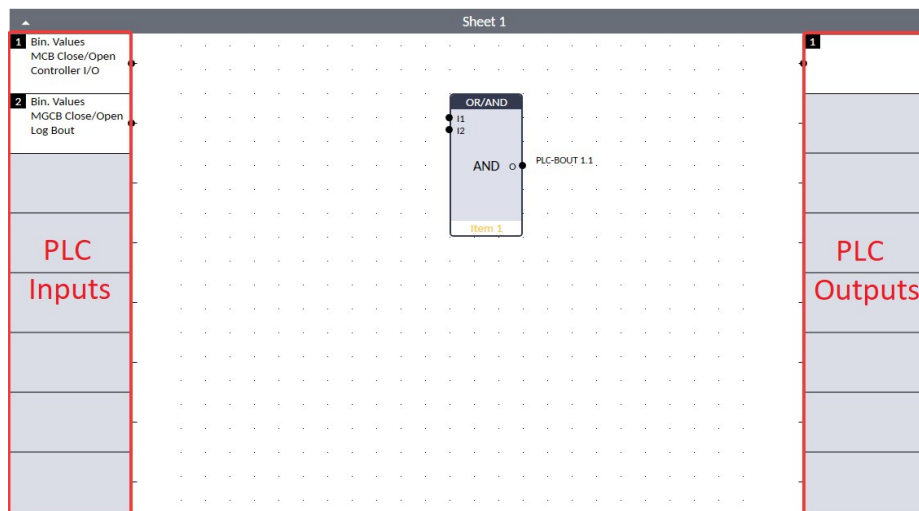


Image 5.85 PLC Inputs and Outputs

### Inputs

Sheet inputs are located at the left side of a sheet. Follow the procedure below to add or edit an input.

- Double-click on a free input position or existing input to add new input or edit the existing one.
- Select the source for the input.
- If you create a binary input, you can select a source from following categories:
  - Bin. Values - this category contains all binary values available in the controller as binary inputs, logical binary outputs etc.
  - PLC Outputs - You can connect any PLC Output to another PLC Input.
- If you create an analog input, you can select a source from following categories:
  - Ana. Values - this category contains all analog values available in the controller as analog inputs, electrical values, values from ECU etc.
  - All Setpoints - this category contains all setpoints of the controller except the dedicated PLC setpoints. Names, resolutions and dimensions of these setpoints can not be modified.

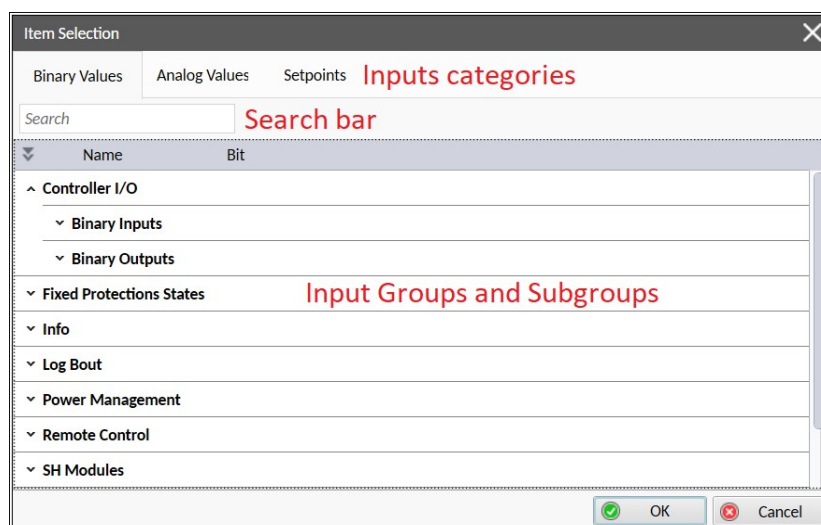


Image 5.86 PLC Inputs

## Outputs

Sheet outputs are located at the right side of a sheet. Follow the procedure below to add or edit an output.

- Double-click on a free output position to add new sheet output (binary or analog).
- Draw the wire from the PLC block output to the PLC output on the right side of the sheet.
- Doubleclick on an already created output to open it's configuration.
- Use the button **+ Connect** to connect the PLC output onto a controller output terminal or a logical binary input.
- Use the button **- Disconnect** to disconnect the PLC output from a controller output terminal or a logical binary input.

**Note:** PLC block output has to be connected to the PLC output to enable configuration of the PLC output.

**Note:** It is necessary to click on the **Connect** button after selecting the output. Otherwise PLC output is not connected to output.

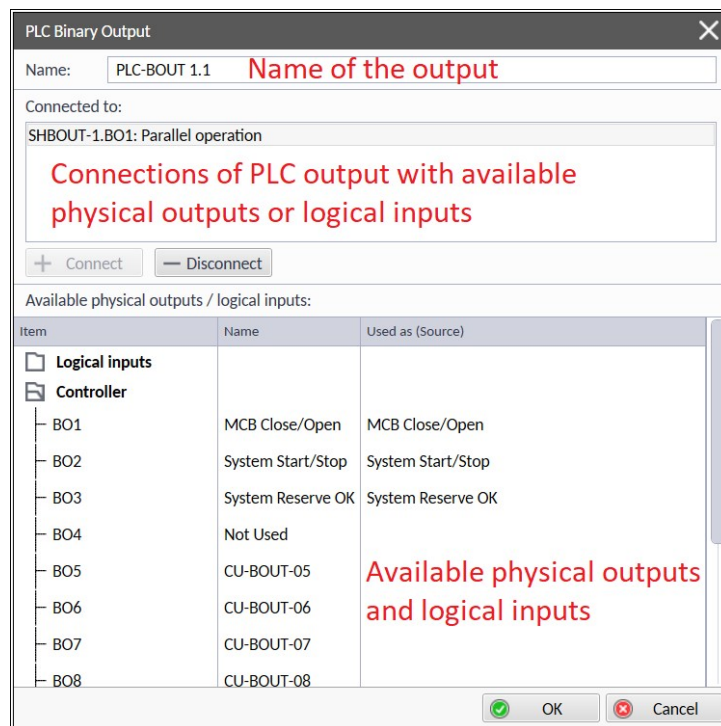


Image 5.87 PLC Outputs

## back to PLC Editor

### Creating wires

Wires can be created between PLC inputs and PLC block inputs, PLC block outputs nad PLC block inputs, or PLC block outputs and PLC outputs.

Follow the procedure below to create wire.

- Locate the mouse pointer over the starting point of the wire (dot). If the area under the mouse pointer is a connection point, the connection point changes to bold dot.
- Press and hold the left mouse button and drag the wire to the destination of required connection point (from dot to dot connection). If you point over a valid connection point, the connection point changes to bold dot.



- Release the left mouse button to create a wire between the two points (dots). The wire is routed automatically.

**Note:** It is possible to make connection only between the outputs and inputs with the same type of value (binary or analog). Binary values are marked by black dot, analog values are marked with green dot.

**Note:** To delete wire just click on it and press delete button. Also delete selection function can be used.

**IMPORTANT:** In case that values on inputs have different decimal numbers than the values are converted and the name of block is displayed as red in the PLC Monitor. It is strongly recommended to fix the configuration = use the signals/values with the same range and decimal numbers.

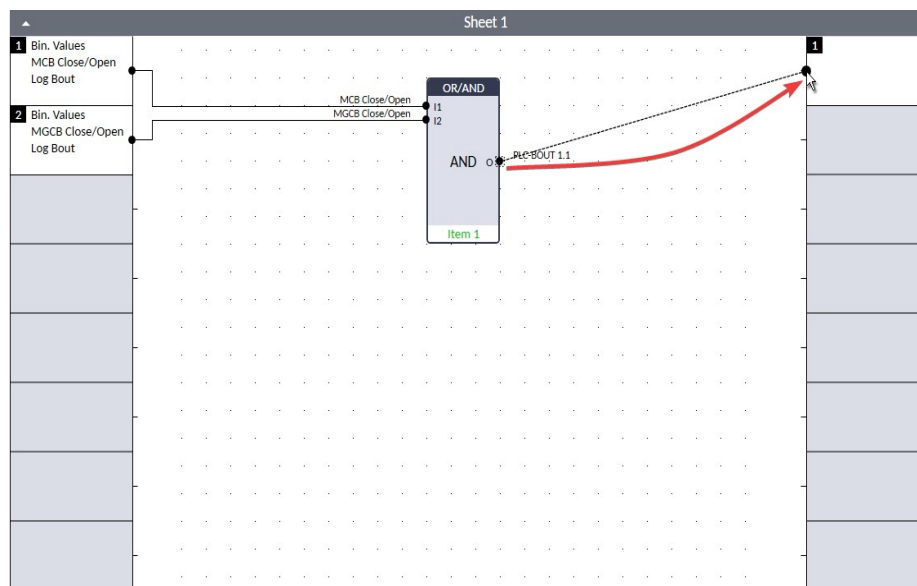


Image 5.88 Wiring PLC blocks

⬅ back to PLC Editor

⬅ back to PLC - Programmable Logic Controller

## PLC logic execution rules

The PLC program is executed every 100 ms (this time is given by the PLC controller system integration) and cannot be changed. PLC execution starts automatically after the ComAp controller is powered on and the firmware initialization is completed. Of course the PLC program can only be executed with valid configuration and/or valid SW key(s) for using the Extended PLC blocks.

The initial values for PLC inputs are given by the respective signals (e.g. actual power value) or determined by the specific PLC block settings.

PLC blocks are executed in the order of the block numbers (Item numbers), that appear in each block. Block numbers are assigned automatically according to the block position on the sheet based on the following scheme.

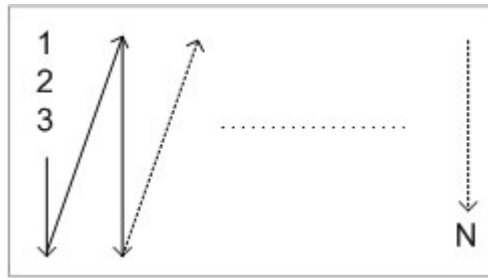
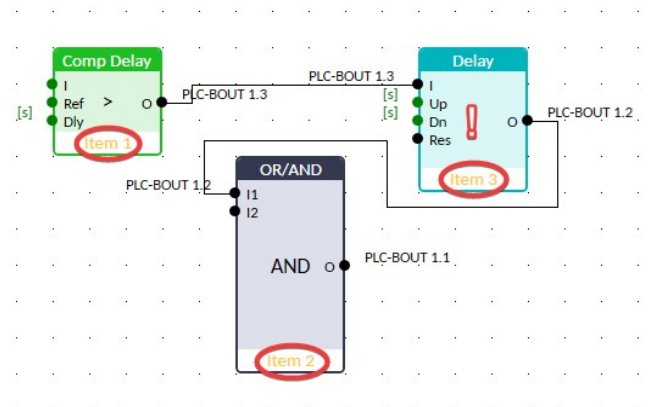
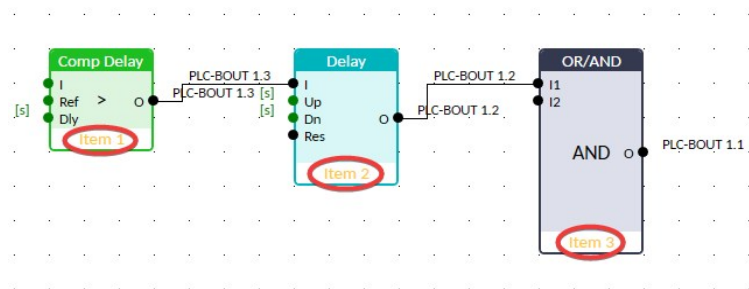


Image 5.89 PLC execution logic

**IMPORTANT:** Please always check that the blocks are ordered correctly, especially if you use direct feedbacks from outputs to inputs within one sheet. Wrong order may lead to incorrect results!



The execution order is Item 1 → Item 2 → Item 3, so in the second case the AND block evaluation will use Timer block output before the update.

## PLC monitor

PLC monitor is a powerful tool for monitoring your PLC. Just click on PLC Monitor button on main IntelliConfig page to see you PLC in the run time. The refresh rate is given by the system integration. The PLC Monitor is available in IntelliConfig Control tab.

PLC monitor supports working with multiple controllers - on the left side of the panel there is a selection tree for choosing the desired controller for PLC monitoring.

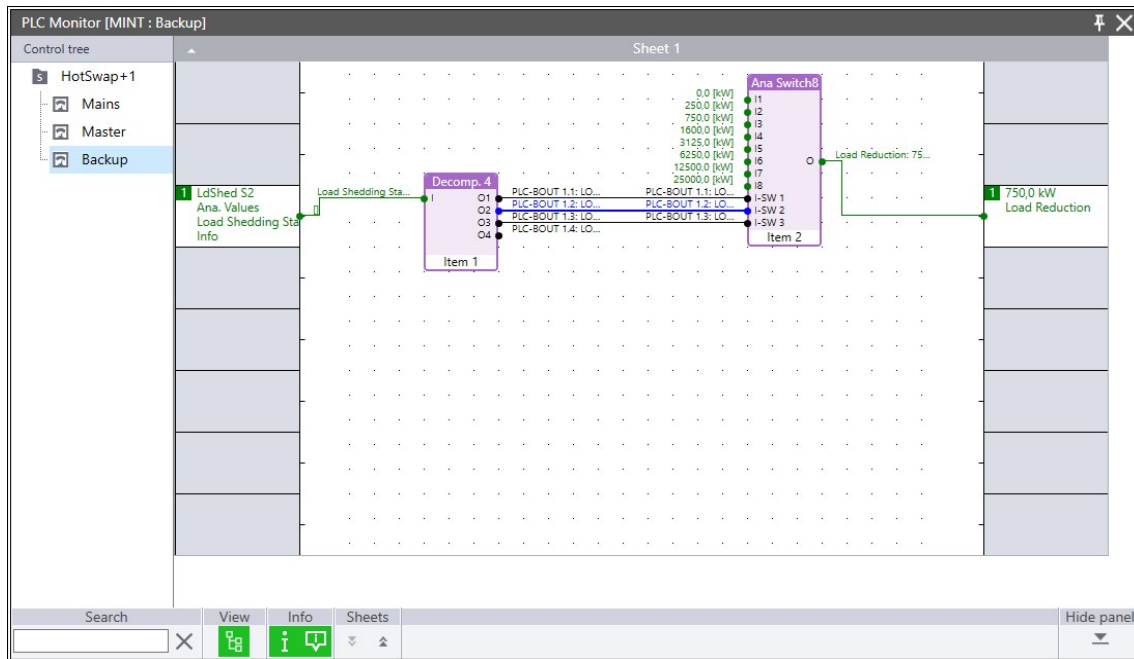


Image 5.90 PLC Monitor panel with multiple controllers

**Note:** In the PLC Monitor it is not possible to modify the PLC, not even the position of the blocks.

Active binary inputs, outputs and wires are blue, analog inputs, outputs and values are green. The values of analog signals (as well as constants set in the blocks configuration) are also visible.

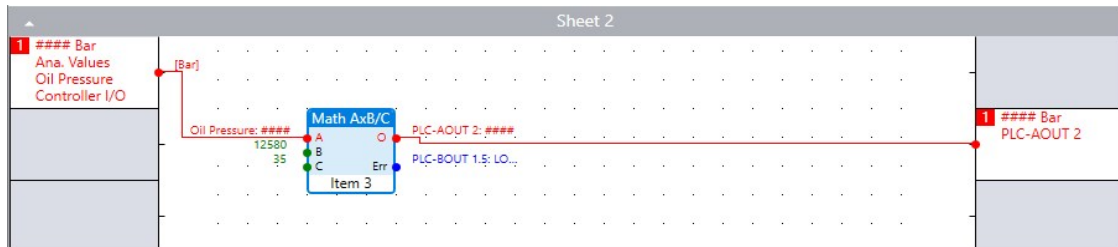


Image 5.91 PLC Monitor sheet with invalid value

**Note:** If the analog signal have an invalid value, the red "####" string is displayed and the connecting wire is also red.

The PLC monitor also supports multi-sheet monitoring - individual sheets can be hidden/expanded using the button in the top title bar.

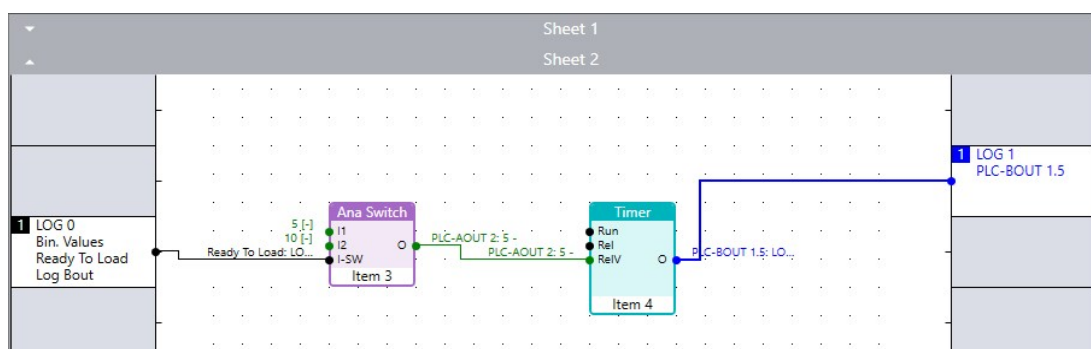


Image 5.92 PLC Monitor with multiple sheets

⬅ back to PLC - Programmable Logic Controller

## Other functions

### Consistency check

This performs a check of the PLC schematic

- for the validity of the block interconnection = all inputs that are in internal design rules marked as mandatory are connected and/or configured
- for the consistency of the dimensions (setting attribute Dimension) and the number of decimal place (setting attribute Resolution) at both ends of the interconnection wire

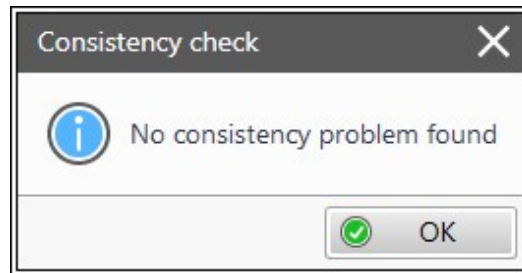


Image 5.93 Consistency Check valid output

Use this function during the design phase to check if all inputs and outputs of PLC block are connected properly, and the design is consistent. The check is also performed automatically when the configuration may be written to controller.

If the Consistency Check detect any problems, all findings will be displayed in the message window.

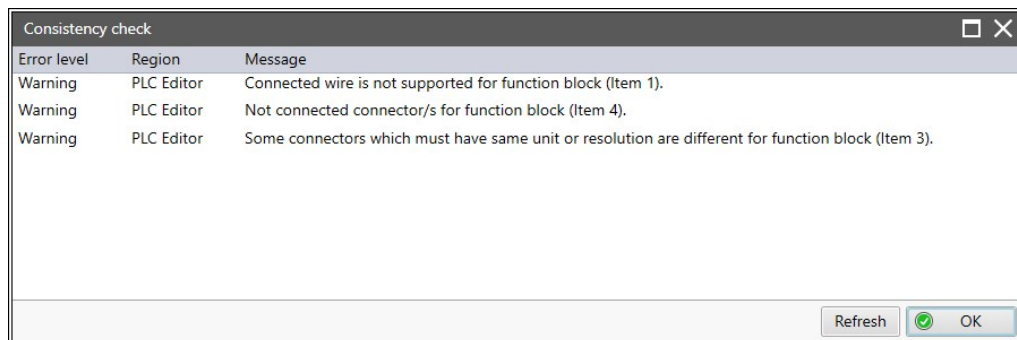


Image 5.94 Consistency Check report output

Message	Meaning	Remedy
Connected wire is not supported for function block (Item X)	Probably Resolution and/or Dimension mismatch on the wire	Use correct Resolution and/or Dimension on both ends of wire
Not connected connector/s for function block (item X)	Mandatory inputs of the block are not connected / configured	Connect and/or configure all mandatory inputs
Some connectors which must have same unit or resolution are different for function block (Item X)	Probably Resolution and/or Dimension mismatch on the wire or on Inputs and/or Output	Use correct Resolution and/or Dimension on both ends of wire of between block inputs and output

**Note:** The Consistency Check checks whole configuration so it can report findings outside the PLC configuration.

### Delete whole content of sheet

Use this function to delete the whole content of sheet (including blocks, wires, inputs, outputs, etc...).

**IMPORTANT: The sheet content is deleted immediately, without confirmation dialog (and there is not any Undo or Redo button)!**

### Hints

Use this function to enable or disable quick hints for blocks (controller help is not affected by this function).

**Note:** Each PLC block has help which is opened by selecting the block and pressing "F1".

## 5.4.20 Power Formats And Units

InteliMains 1010 BTB SC allows users to choose from several Power Formats that affect dimensions in which values and some setpoints are interpreted or adjusted. Power formats and units can be changed with InteliConfig in the following way. Control tab → Controller configuration → Others tab → Units/Power format

Power formats are available in decimal and non decimal format. Units can be changed to metric or US units.

### Units

<b>Metric</b>	20 °C	10.0 bar	11.4 l/h
<b>US</b>	68 °F	145 psi	3.01 gph

### Power Format

<b>Small</b>	0.1 kW / kVA / kVA <sub>r</sub>	1 V
<b>Standard</b>	1 kW / kVA / kVA <sub>r</sub>	1 V
<b>Large HV</b>	0.01 MW / MVA / MVA <sub>r</sub>	0.01 kV
<b>Large LV</b>	0.01 MW / MVA / MVA <sub>r</sub>	1 V

**Note:** Range of some setpoints and values is changed significantly when different Power Formats are selected. Affected setpoint are displayed during selection of power format.

## 5.4.21 Pulse Counters

InteliMains 1010 BTB SC has 4 internal counters 2 of them are physically configured to the specific binary inputs which makes them faster than another 2 "slow" pulse counters which are using LBIs. Value of the each pulse counter is increased by one step whenever the number of pulses counted reaches the value of setpoint Conversion Coefficient Pulse. The fast pulse counters are able to count reliably pulses longer than 10 ms ON / 10 ms OFF whereas the "slow" pulse counters are able to count reliably pulses longer than 200 ms ON / 200 ms OFF.

Conversion setpoint	Value	Binary Input
Conversion Coeff. Fast Pulse 1 (page 369)	Fast Pulse Counter 1 (page 433)	BI9
Conversion Coeff. Fast Pulse 2 (page 369)	Fast Pulse Counter 2 (page 434)	BI10
Conversion Coefficient Pulse 1 (page 370)	Pulse Counter 1 (page 434)	PULSE COUNTER 1 (PAGE 556)
Conversion Coefficient Pulse 2 (page 370)	Pulse Counter 2 (page 434)	PULSE COUNTER 2 (PAGE 556)

**Note:** Value of the internal counters remains even if the controller is unplugged from power.

**Note:** Counter counts leading edges.

## 5.4.22 SD Card Storage

**IMPORTANT:** Only *SanDisk Industrial XI microSD Cards* (vendor order codes *SDSDQAF3-xxxG-XI*) are currently supported.

**Note:** 16 GB Industrial memory card is also available in ComAp portfolio (ComAp product number OT1C16GBXQX)

The controller is equipped with a slot for a possibility of storing large amount of data.

### Formatting process

**IMPORTANT:** It is strongly recommended to perform the formatting of SD Card in OFF mode.

Alarm **ALI SD Card Formatting/Mounting** (page 673) is displayed during the formatting process.

After changing the setpoint **SD Card File System** (page 321) to Format, the controller checks whether the inserted SD card is supported - **ALI SD Card Not Compatible** (page 672) alarm is displayed if it is not. If the formatting is not successful, the value **SD Card Status** (page 438) shows Formatting Failed, the alarm **ALI SD Card Not Compatible** (page 672) is activated, and controller will not try formatting process again **SD Card File System** (page 321) is automatically set to Mounted).

If the formatting is successful, the **SD Card File System** (page 321) is automatically changed to Mounted and the card is ready for operation.

### Mounting the SD Card

For enabling the SD card functions, setpoint **SD Card File System** (page 321) has to be set to option Mount.

**IMPORTANT:** It is strongly recommended to perform the mounting of SD Card in OFF mode.

Alarm **ALI SD Card Formatting/Mounting** (page 673) is displayed during the mounting process.

In case that it is not possible to read or write to the SD Card, alarm **Wrn SD Card Failed** (page 665) is activated. The alarm is also activated in case the SD card is not inserted. See the value **SD Card Status** (page 438) for further information about the fail.

Alarm **ALI SD Card Full** (page 673) is displayed if value SD Card Free Space drops below 10 %.

In case that the card has a wrong file system, alarm **Wrn SD Card File System Failed** (page 665) is displayed. Therefore formatting process should be performed again.

### Unmounting the SD Card

If the setpoint **SD Card File System** (page 321) is set to Unmount, the controller is able to detect the SD card, but it will not do any reading or writing of the data. The **SD Card Status** (page 438) will show Unmount, and in case the card is still in the slot, the alarm **ALI SD Card In Slot** (page 672) is issued.

### Long term history

If an SD Card is successfully mounted, the controller is able to store history records onto the SD Card. This function is activated by adjusting setpoint **Long Term History** (page 322) to Enabled.

Long Term History data are stored in folder named "HISTORY\_SN" when SN is serial number of respective controller that stored the data. Inside this folder there is another folder named "YYMMDDhhmmss" which is created at the moment of switching the setpoint **Long Term History** (page 322) to Enabled. Inside this folder you may find two files:

- SN\_YYMMDDhhmmss.hist - which contains history records.
- SN\_YYMMDDhhmmss.cfg - which contains important related data required in order to elaborate history records.

### Reading the data

1. Download the history records files from your SD card into the PC.
2. Open the IntelliConfig, go to Tools and select Long Term History.
3. In the opened window choose the Input directory (destination of the SN\_YYMMDDhhmmss.hist file) and Output directory.
4. Choose Delimiter parameter and press Start.
5. The file containing the readable data should be created at the Output directory when conversion is finished.

## 5.4.23 Sensor Curves

### Default sensor curves

There are 16 default resistive curves available. The following table provides information on minimum/maximum values of respective sensors. Actual values especially of temperature curves may differ.

Curve	Min X [ $\Omega$ ]	Max X [ $\Omega$ ]	Min Y	Max Y	Units Y
General line 1	0	1	0	1	$\Omega$
General line 2	0	1	0	1	$\Omega$
General line 3	0	1	0	1	$\Omega$
General line 4	0	1	0	1	$\Omega$
General line 5	0	1	0	1	$\Omega$
General line 6	0	1	0	1	$\Omega$
General line 7	0	1	0	1	$\Omega$
General line 8	0	1	0	1	$\Omega$
General line 9	0	1	0	1	$\Omega$
General line 10	0	1	0	1	$\Omega$
General line 11	0	1	0	1	$\Omega$
General line 12	0	1	0	1	$\Omega$
General line 13	0	1	0	1	$\Omega$
General line 14	0	1	0	1	$\Omega$
General line 15	0	1	0	1	$\Omega$
General line 16	0	1	0	1	$\Omega$

**Note:** Curves can be modified via IntelliConfig. In IntelliConfig are also prepared some standard curves.

### Sensor curve HW configuration

InteliMains 1010 BTB SC analog inputs allows you to select Input HW type. Three HW configuration options are available:



- > 0-15 kΩ
- > 0-10 V
- > 0-20 mA passive

Setup controller analog input in this way to use other than the default HW configuration (0-15 kΩ):

1. Start with a sensor configuration and select requested HW configuration

	0-10 V	Bar
0	0,000	0,0
1	1,000	10,0

2. Use the adjusted sensor with an analog input and the requested HW configuration will be used with the analog input automatically. There is no need to use a jumper, configured Input HW type is used by controller automatically.

## 5.4.24 SW Key Features

The controller offers premium features which are unlocked by software key.

The SW key is stored in setpoint **SW Key (page 252)** which is protected against rewriting during configuration update. Value **SW Key Feature List (page 440)** contains actual list of features which requires SW key in order to be used. When there is logical 1 respective function is unlocked and can be used without of limitation.

**Note:** Each SW Key is unique and valid only for specific serial number of a controller.

### Using of SW Key

- Insert your SW Key into setpoint **SW Key (page 252)**
- Restart the controller
- Check value **SW Key Feature List (page 440)** whether functions were unlocked

**Note:** Please contact technical support in case that functions which were supposed to get unlocked after inserting the SW key did not get unlocked

### List of SW Key Features

SW Key Feature	Chapter in the manual	Order Code
Modbus client	<b>Modbus Client (Master) (page 149)</b>	SKMODBCLI01
Hot Swap Redundancy	<b>Hot Swap Redundancy (page 138)</b>	SKHOTSWAP01

## 5.4.25 User Buttons

User Buttons can be used to assign function of user's choice to button on the **External display (page 75)** or like remote switch. There are 32 user buttons and the behavior of each of them can be adjusted by it's relative setpoint.

Each setpoint has these options:

Option	Description
COMMAND	The relative User Button is controlled by command from <b>External display (page 75)</b> .
MAN OFF	The relative User Button is controlled manually via the setpoint. Value of the user button is still 0.
MAN ON	The relative User Button is controlled manually via the setpoint. Value of the user button is still 1. <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button will be 1 until command is received.

### Commands

If relative setpoint is set to COMMAND, the User Button will react to commands sent via button from **External display (page 75)**. Type of command is selected during controller configuration in Screen Editor.

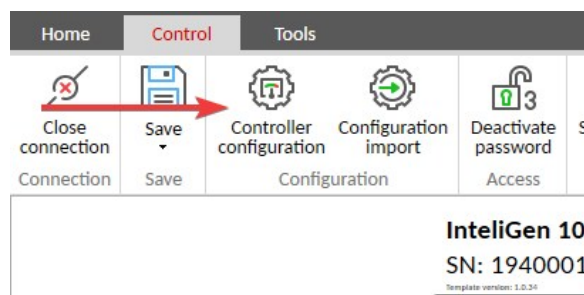
There are following commands:

Command	Description
ON/OFF	While this command is selected, pressing the button negate the actual value of the user button
ON	While this command is selected, pressing the button sets the actual value of the user button to 1. <b>Note:</b> Will not have any effect if the value is already 1.
OFF	While this command is selected, pressing the button sets the actual value of the user button to 0. <b>Note:</b> Will not have any effect if the value is already 0.
Pulse ON	While this command is selected, pressing the button sets the actual value of the user button to 1 for 200 ms. <b>Note:</b> The command reacts only to rising edge of the button.

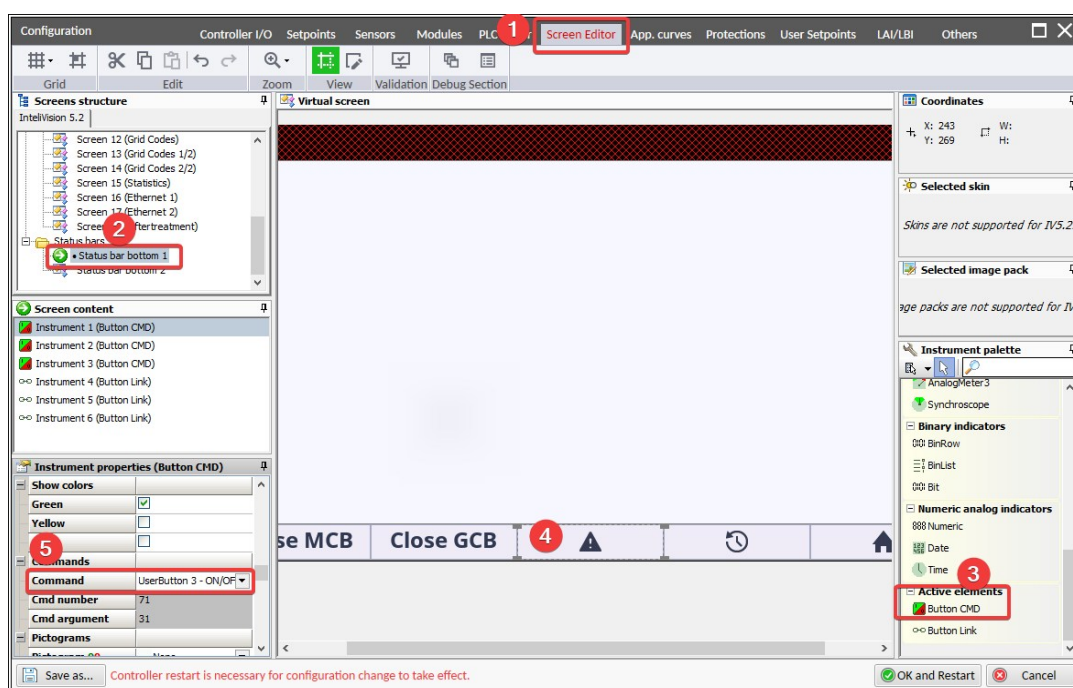
See list of MODBUS comands in chapter **List of commands and arguments (page 221)**.

## Configuration of user button command

To configure Command on User Button, navigate to Configuration in IntelliConfig



1	Select Screen Editor tab
2	Select Status bar
3	Add "Button CMD", for example to position 4
5	Select required user button and COMMAND



## 5.4.26 User Management And Data Access Control

Types of interfaces .....	173
User accounts .....	174
Managing accounts .....	176
Account break protection .....	178
Access to controller data .....	179

- Accessing, monitoring and controlling the device via any communication interface require an user to be logged-in.
- When a task (read data, write data , control) is to be performed the access level of the user who is currently logged-in must be higher or equal to the access level required for the particular task.
- User must have user account defined by the administrator of the controller before the user can log-in into the controller and perform monitoring, control or configuration tasks.

### Types of interfaces

The controller communication interfaces are split into three categories according to what kind of environment the interface is exposed.

#### Trusted

- Are **USB Type B** (page 17) and in the default configuration **Ethernet 1** (page 17) terminals.
- It is expected that these interfaces are operated locally inside a closed environment / infrastructure where additional measures against misuse or attack take place (e.g. physical access limitation).
- Due to nature of this interface less strict cyber-security rules apply at it and that is why Implicit account is introduced here to make working with the controller simpler.

#### Untrusted

- Is in the default configuration **Ethernet 2 (page 18)** terminal.
- This interface is a general-purpose one and it is expected that it may be exposed to public networks, such as Internet, which are not under control of the entity operating the controller.
- Thus, strict cyber-security rules apply for this type of interface.
- The correct user account with password has to be used in order to connect to the controller.
- This interface can be also used for SMTP and SNMP protocols.

## Modbus

- Is in the default configuration **Ethernet 3 (page 18)** terminal.
- This interface is used for **Modbus Client (Master) (page 149)** or server.
- It is expected that this interface is operated locally inside a closed environment / infrastructure where additional measures against misuse or attack take place (e.g. physical access limitation).
- Due to nature of this interface and fact that it is not possible to use it for connection to the controller, less strict cyber-security rules apply at it.

## Connections to ethernet interfaces

Either ComAp clients (InteliConfig, WebSupervisor, WinScope, InteliVision displays, etc.) or Modbus clients can connect to the controller's ethernet interfaces. Number of possible connections is listed in the table below.

Type of interface	ComAp clients	Modbus clients
<b>Trusted</b>	6	3
<b>Untrusted</b>	8	3
<b>Modbus</b>	0	3

**Example:** If **Ethernet 1 (page 17)** = Trusted, **Ethernet 2 (page 18)** = Trusted, **Ethernet 3 (page 18)** = Trusted, then it is possible to connect 6 ComAp clients and 3 Modbus clients on all three ports in sum.

**Example:** If **Ethernet 1 (page 17)** = Trusted, **Ethernet 2 (page 18)** = Untrusted, **Ethernet 3 (page 18)** = Modbus client, then 6 ComAp clients and 3 Modbus clients can be connected to **Ethernet 1 (page 17)**, 8 ComAp clients and 3 Modbus clients can be connected to **Ethernet 2 (page 18)** and 3 Modbus clients can be connected to **Ethernet 3 (page 18)**.

⬅ back to User Management And Data Access Control

## User accounts

User account must be created in the controller by administrator before the particular user can login to the controller.

**Note:** User accounts must be created for each controller separately and manually. It is not possible to transfer the accounts from one controller to another.

User account has following properties:

<b>Username</b>	Consists of 6-15 alphanumeric characters, must contain at least 1 letter. This is the main identifier of the particular user account.
<b>Password</b>	Consists of 6-15 alphanumeric characters, must contain at least 1 letter and 1 digit. This is the password that is used together with user name to authenticate (log-in).
<b>User identifier (UID)</b>	Optional 4-digit identification string which can be used for simplified login at trusted interfaces (e.g. from IntelliVision display when connected via <b>Ethernet 1</b> (page 17)).
<b>PIN</b>	4-digit “password” to be used together with UID.
<b>Access level</b>	Determines <b>Access to controller data</b> (page 179)

## User login

To login to the controller the **username and password must be provided into the login form** of the application (**InteliConfig** (page 20), **WebSupervisor** (page 20), **External display** (page 75) etc.).

Alternatively, at **trusted interfaces**, it is possible to **login using UID and PIN** instead of username and password. This method of login is designed to simplify the login procedure at devices without alphanumeric keyboard (e.g. IntelliVision).

**Note:** The controller is featured with a protection against brute force attack to user account credentials. For details please refer to the - **Account break protection** (page 178)

## Changing password and PIN

The password and/or PIN for currently logged user can be changed. The user must be logged with username and password even if PIN has to be changed.

## Implicit account

The controller has an implicit account with **access level 0**. This account is **automatically logged at a trusted interface** when a connection is established and there is not any other user logged. In practice it means e.g. that IntelliVision can **display measured values and allow changing selected setpoints without an operator needs explicitly to login**.

## Factory default accounts

Each controller comes from the production with one factory default administrator account having following credentials:

**Username:** “administrator”

**Password:** <serial number of the controller>

When the controller is being configured for operation the desired user accounts including the administrator account should be created and then the factory default account must be deleted.

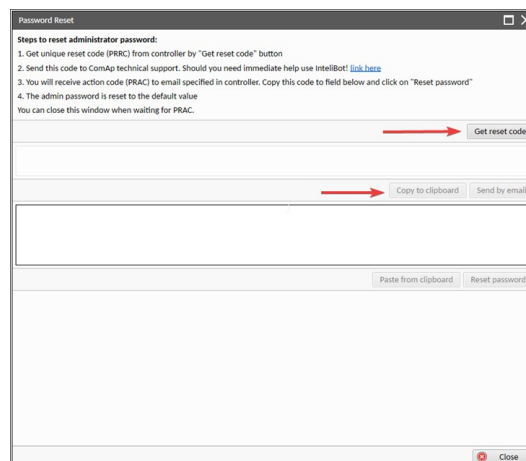
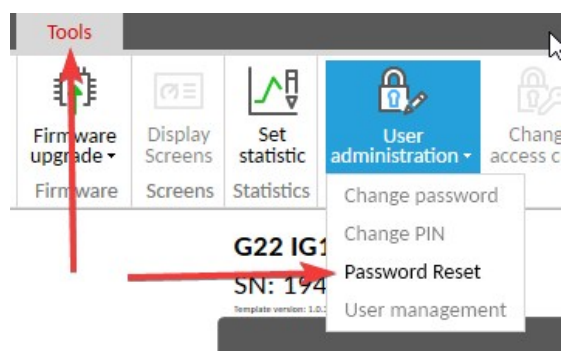
**IMPORTANT:** Adjust the backup e-mail address before you delete the default administrator account. This address is used **as second authentication factor** in password reset request and the password reset action code will be sent to this and only this e-mail address.

**Note:** there must always remain at least one administrator account in the system. The controller will not allow deleting last administrator account.

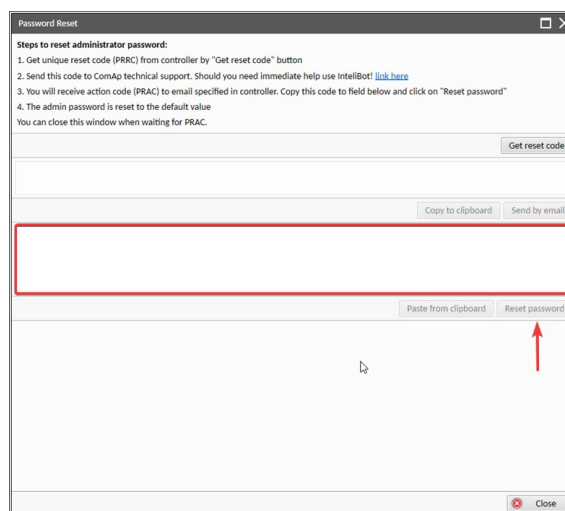
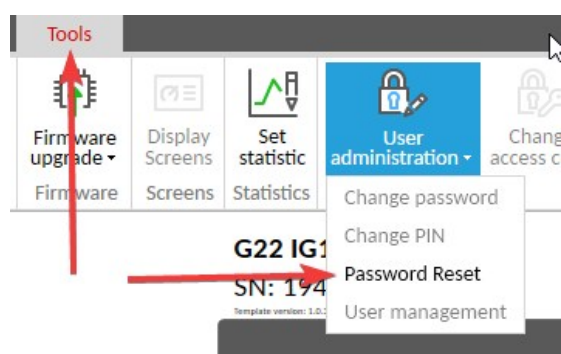
## Reset accounts to factory default

If credentials (username and/or password) for administrator account are lost, it is possible to reset all user accounts to the factory default state.

1. Connect IntelliConfig to the controller
2. Read the Password Reset Request Code (PRRC)



3. You may disconnect from the IntelliConfig now
4. Put the PRRC code into the “IntelliBot” application at <https://www.comap-control.com/support> or e-mail the code to [support@comap-control.com](mailto:support@comap-control.com).
5. A unique, one-time Password Reset Action Code (PRAC) will be sent to the backup e-mail address adjusted in the controller.
6. Connect via IntelliConfig to the controller again
7. Enter the Password Reset Action Code into the appropriate form



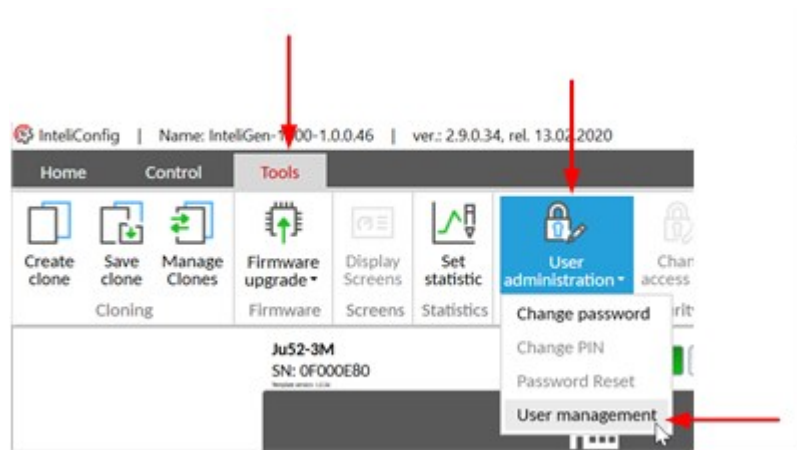
8. Now the user accounts are in factory default state

🔍 back to User Management And Data Access Control

## Managing accounts

User accounts can be managed from IntelliConfig while an online connection to the controller is established. An user with administrator level must be logged with username/password and is prompted to re-enter accounts password before the user management dialog is opened.

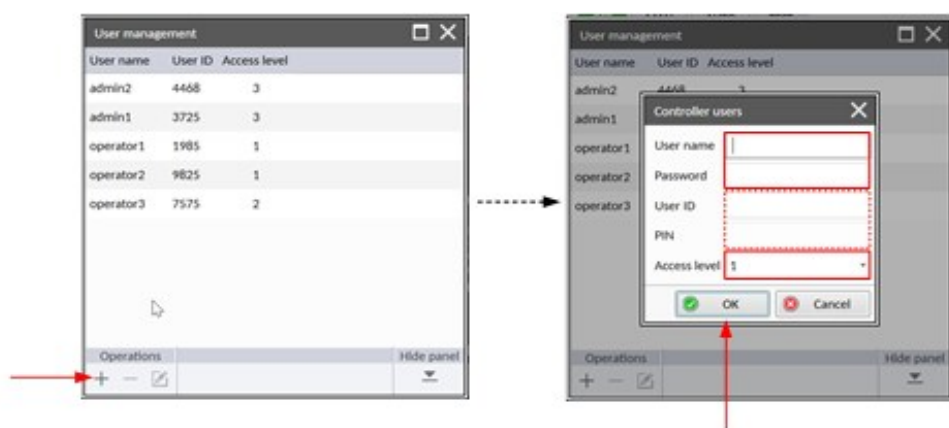
**IMPORTANT: The total available number of accounts in the controller is 30.**



## Adding account

Click on “+” button in the lower left corner of the user management window, then provide the account properties as described in **User accounts (page 174)**.

**Note:** Rules for the User accounts (page 174) credentials apply and some items are optional



## Deleting account

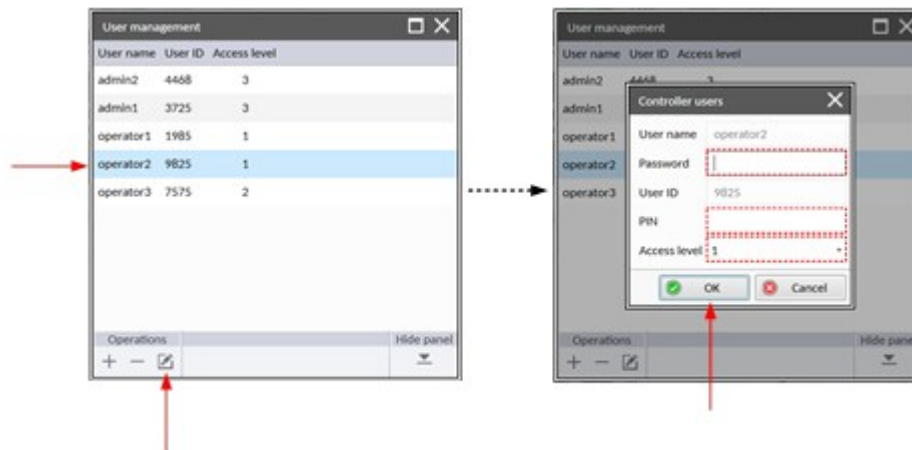
Select the account that has to be deleted and click on “-” button in the lower left part of the user management window.

**Note:** you can not delete your own administrator account unless there is another administrator account present in the controller.

## Deleting account properties

Select the account that has to be deleted and click on “-” button in the lower left part of the user management window. Then modify the desired property or properties. You can modify one or more properties at once.





**Note:** It is not possible to change user name or UID. Instead of this create a new account with the required changes and delete the original one.

🔍 back to User Management And Data Access Control

## Account break protection

The controller is protecting the user accounts against breaking by a brute-force attack, i.e. against breaking into the controller by fast repeating attempts to login with credentials generated from the range of all possible combinations.

If the account break protection detects a possible attack and blocks an account or interface the alarm **Wrn Brute Force Protection Active (page 639)** is activated. The alarm can be used to send an active message (e.g. e-mail) to inform about that situation. The detailed behavior of the controller depends on situation.

### Password protection

1. If an user performs **five consecutive attempts** to login using username/password, providing **correct username** but **incorrect password**, the **respective user account is blocked** for a time period of 1 minute. The attempts count regardless of the interface from which it is performed.
2. During the blocking period it is not possible to login with the respective account (username) from any interface even if correct password is provided.
3. After the blocking period elapsed next attempt to login with the respective account (username) is possible. If this attempt fails again the account is blocked again, now for period of 2 minutes.
4. The points 1-3 repeats further, the blocking period is multiplied by 2 in each next cycle. However, the maximal blocking time is 20 minutes, the blocking time is never higher.

### PIN protection

If an user performs **ten consecutive attempts** to login using UID/PIN, providing **correct UID** but **incorrect PIN**, the user account is permanently blocked for login using UID/PIN. The user must login with username/password and change the PIN to unblock this login method again.

### Interface protection

If anyone performs **twenty consecutive attempts** to login via one particular interface (e.g. **Ethernet 1 (page 17)**) and does not neither provide a valid username nor a valid uid the respective interface is blocked for 2 minutes. During this period it is not possible to use that interface for any login. The blocking period is not progressive in this case.

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## Access to controller data

Every request for reading data from the controller or writing data into it requires an user to be logged and that **user must have access level higher or equal to the access level defined for the particular object and operation.**

There are 4 access levels available (level 0 to level 3). **The level 3 is administrator level** and users who have this level have full control over the controller.

### Reading data

The access level required for reading data from controller is fixedly adjusted to 0. That means **reading of data** (except some system objects) **is available for any user.**

### Writing data

The access level required to **write** (modify) **application setpoints or invoke application commands is configurable** via IntelliConfig.

### Special situations

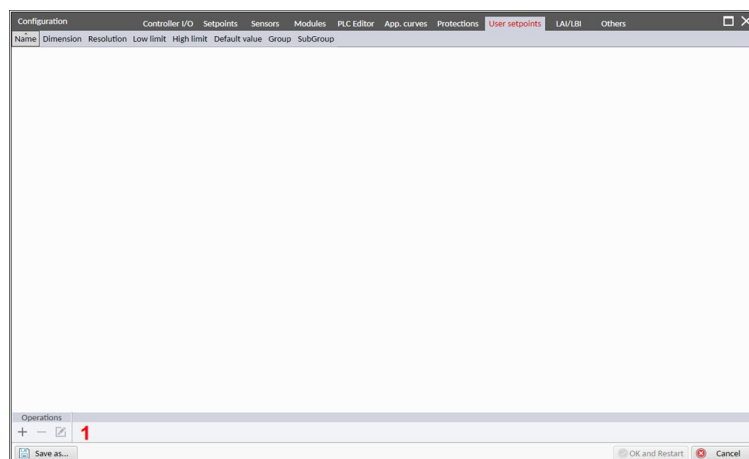
There are several operations that require administrator level:

- > Programming firmware
- > Programming configuration
- > Managing user accounts

 [back to User Management And Data Access Control](#)

## 5.4.27 User Setpoints

Controller allows user to create their own setpoints, edit and delete the created setpoints and choose a group in which the setpoint will be located. Number of setpoints created by user is limited to 2047. All setpoints created by user are located in setpoint group "User setpoints". The Comm. object number (**CO**) can be found via IntelliConfig (Tools tab → Generate Cfg image (COM)). User setpoints can be used to manage User protections and PLC.



**Add** User setpoint



**1**

**Delete** selected User setpoint



**Edit** selected User setpoint



Image 5.95 User setpoints tab in Intelliconfig

Image 5.96 Setting parameters of an user setpoint

## Contents of the user setpoint

<b>Name</b>	<p>Max. 32 characters</p> <p><b>Note:</b> Does not consider duplicities (It is possible to have setpoints with the same name, but it is not recommended.)</p>
<b>Dimension</b>	<p>Can be chosen from a list or</p> <p>User can create their own with a limit of 32 characters.</p>
<b>Resolution</b>	Max. 4 decimal place
<b>Low Limit</b>	Range of the data type INT32 (restricted by resolution).

	Value is set as a constant (can not be set as setpoint). Max. value cannot exceed High Limit.
<b>High Limit</b>	Range of the data type INT32 (restricted by resolution). Value is set as a constant (can not be set as setpoint). Min. value cannot be lower than Low Limit.
<b>Default value</b>	Must be in range between Low and High Limit (restricted by resolution).
<b>Group</b>	Group in which setpoint will be shown.
<b>Subgroup</b>	SubGroup in which setpoint will be shown.

### Available groups and subgroups

The user setpoint can be put into some selected groups and subgroups.

**Note:** Setpoint is always added as last in selected subgroup.

**List of available groups and it's subgroups:**

Group	Subgroup
Process control	User setpoints
Basic Settings	User setpoints
Bus Left Settings	User setpoints
Protections	User setpoints
Bus Right Settings	User setpoints
Power Management	User setpoints
User setpoints	User setpoints

⬆ back to General Functions

## 5.5 Application related functions

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Functions directly related to the Bus application are described in this chapter.

⬆ back to Controller setup

## 5.5.1 Breaker Control

The following power switches are controlled by the controller:

- The Bus Tie Breaker or contactor – BTB

It is possible to use either a motorized circuit breaker or contactor. Below is a list of available control outputs that should fit all types of contactors or breakers. The following rules must be kept to when designing the wiring of power switches:

- The control outputs must be configured and wiring of the power switches must be provided in such a way, that the controller has full control over the breakers – i.e. the controller can open and close the breaker at any time.
- The breaker must respond within time defined by setpoint **Waiting For Breaker Feedback (page 272)** to a close and open command. Special attention should be paid to opening of motorized circuit breakers, as it could take more than 2 seconds on some types. In such cases it is necessary to use an undervoltage coil for fast opening.
- After opening the breaker, there is internal delay for another closing of breaker. Delay is 6 seconds - 5 seconds for OFF coil and 1 second for UV coil. After these 6 seconds, breaker can be closed again. For opening of breaker there is no delay.

### Breaker control outputs

<b>Close/Open</b>	An output for control of a contactor. Its state represents the breaker position requested by the controller. The breaker must react within time defined by setpoint <b>Waiting For Breaker Feedback (page 272)</b> to a close or open command, otherwise an alarm is issued.
<b>ON coil</b>	An output giving a pulse (given by setpoint <b>Waiting For Breaker Feedback (page 272)</b> ) in the moment the breaker has to be closed. The output is intended for control of close coils of circuit breakers.
<b>OFF coil</b>	An output giving a pulse in the moment the breaker has to be opened. The pulse lasts until the feedback deactivates, but at least for time given by setpoint <b>Waiting For Breaker Feedback (page 272)</b> . The output is intended for control of open coils of circuit breakers.
<b>UV coil</b>	The BTB and PVCB UV coil output is active when the controller is switched on. The output is deactivated for at least 2 seconds in the moment the breaker has to be switched off. The output is intended for control of undervoltage coils of circuit breakers.

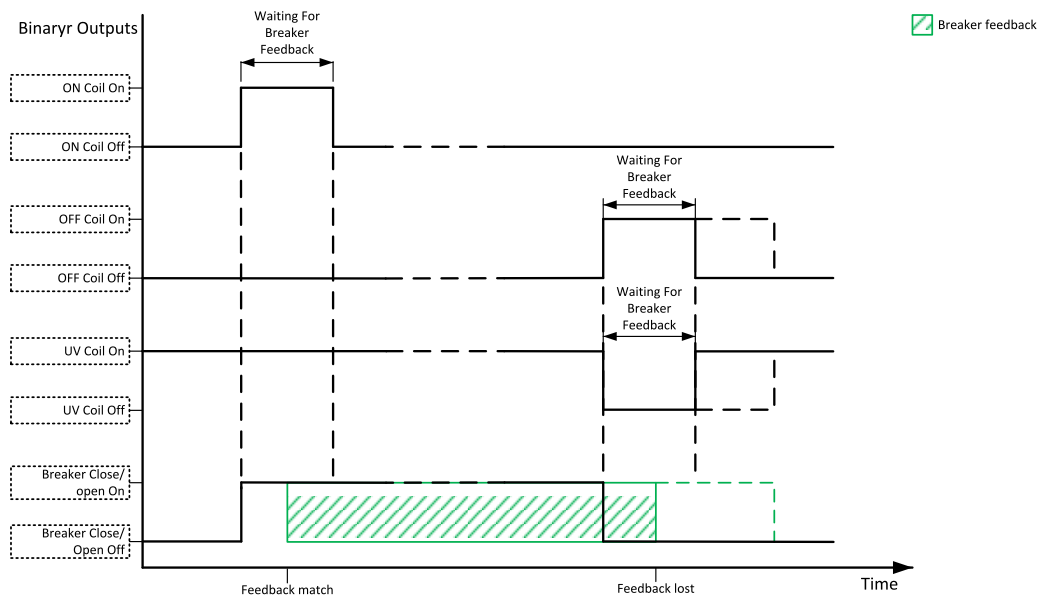


Image 5.97 Breaker control outputs

## Breaker fail detection

Breaker fail detection is based on binary output breaker close/open comparing with binary input breaker feedback. If breaker feedback is not configured and breaker control mode is internal, the alarm will be activated always when the change of the breaker close/open will not be followed by breaker feedback.

There are three different alarm types, see following diagrams.

- When binary output breaker close/open is in steady state and breaker feedback is changed the breaker fail is detected immediately without delay.

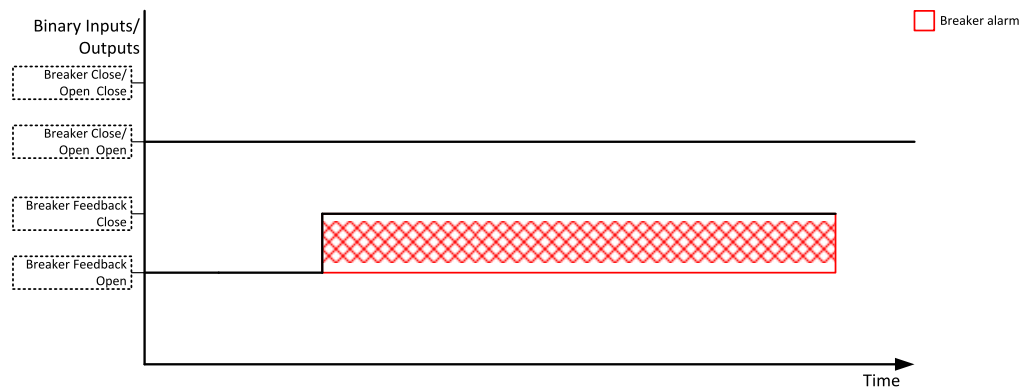


Image 5.98 Breaker fail - breaker close/open in steady position - open

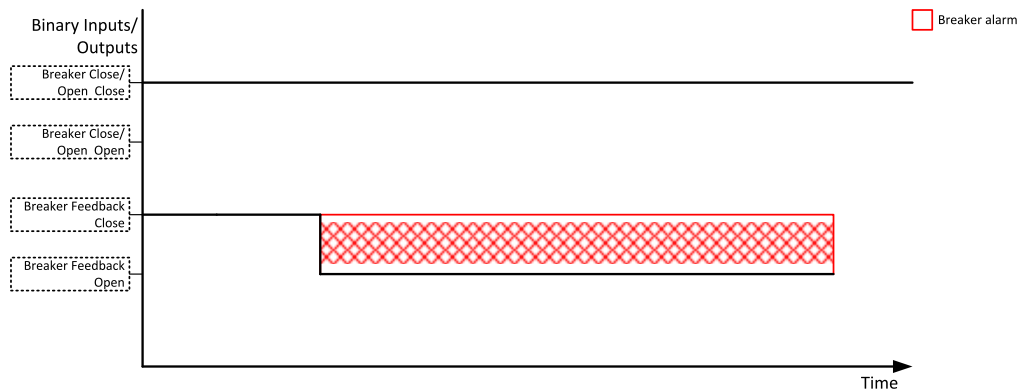


Image 5.99 Breaker fail - breaker close/open in steady position - close

- When binary output breaker close/open is opened, there is waiting time for feedback defined by setpoint **Waiting For Breaker Feedback (page 272)**. If feedback doesn't match, the alarm **Hst BTB Fail To Open (page 691)** is issued.

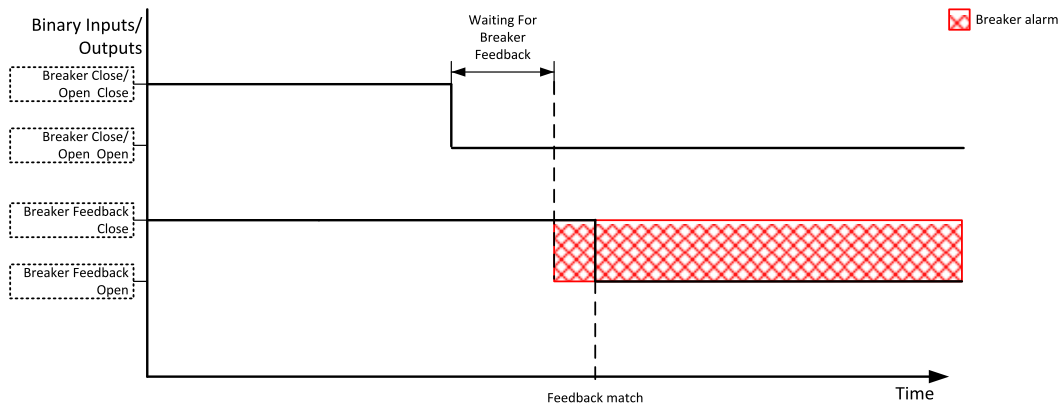


Image 5.100 Breaker fail - breaker close/open opens

- When binary output breaker close/open is closed there is waiting time for feedback defined by setpoint **Waiting For Breaker Feedback (page 272)**. If the feedback doesn't match the output, close/open is opened and closed again after delay defined by setpoint **Delay Between Closing Attempts (page 271)**. If feedback doesn't match after number of tries defined by setpoint **Attempts To Close Breaker (page 271)** and **Waiting For Breaker Feedback (page 272)** delay elapsed, the alarm **Hst BTB Fail To Close (page 690)** is issued.

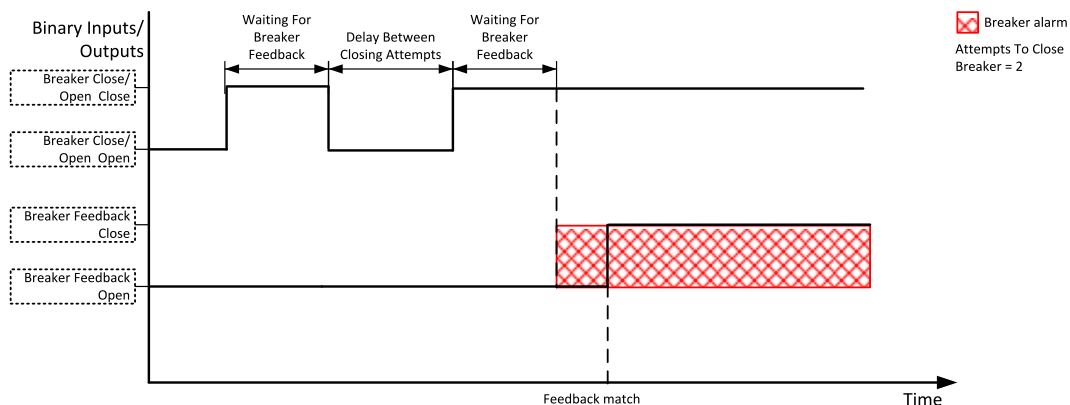


Image 5.101 Breaker fail - breaker close/open closes

**Note:** In case of using both feedbacks (standard and negative), both of them have to be in correct position, otherwise breaker fail is issued after 500 ms.

## 5.5.2 Bus Import Measurement

The Bus measurement can be measured by dedicated CT terminals or by analog inputs, and it is divided to **Bus Measurement P** (page 275) and **Bus Measurement Q** (page 276).

### Bus Measurement P

- If **Bus Measurement P** (page 275) = Bus CT then **Bus Left Import P** (page 402) is counted from the current which is measured on **⑩ MAINS (BUS-L) CURRENT** (page 42) .
- If **Bus Measurement P** (page 275) = Analog Input then **Bus Left Import P** (page 402) is taken from LAI **BUS MEASUREMENT P** (PAGE 581). Bus current can still be measured if **Bus Measurement Q** (page 276) = Bus CT.
- If **Bus Measurement P** (page 275) = None then **Bus Left Import P** (page 402) is not counted because there is no current measurement.

### BusMeasurement Q

- If **Bus Measurement Q** (page 276) = BusCT then **Bus Left Import Q** (page 402) is counted from the current which is measured on **⑩ MAINS (BUS-L) CURRENT** (page 42) .
- If **Bus Measurement Q** (page 276) = Analog Input then **Bus Left Import Q** (page 402) is taken from the LAI **BUS MEASUREMENT P** (PAGE 581). Bus current can be still measured if **Bus Measurement P** (page 275) = Bus CT.
- If **Bus Measurement Q** (page 276) = None then **Bus Left Import Q** (page 402) is not counted because there is no current measurement.

## 5.5.3 Connecting To Load

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Connecting to load (closing BTB) depends on the measured Bus Left and Bus Right voltage. In case one of the side of BTB is without power (Bus Left or Bus Right voltage is below 2 % of nominal voltage) the connecting to dead bus is applied, in other case the synchronization process is needed. See more information about synchronization process in chapter **Synchronization** (page 186).

### Connecting To Dead Bus

#### BTB

Behavior of connecting to dead bus is adjusted by the setpoint **Dead Bus Closing** (page 270) which defined whether the BTB can be automatically closed to the deadbus or not.

**Note:** There is also a protection of "Bus power loss sensing". The "Bus Measurement Error" is detected when the BTB is closed and the bus parameters are out of limit for 20s. Bus Measurement Error can be disabled by setpoint.



## Synchronization

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### Synchronization Commands

There are 3 synchronization commands called Run, Permissive, and Check, each one has its own LBI for the activation. If more than 1 command is activated while breaker is opened, the synchronization will be blocked and alarm appear in the alarm list. Synchronization is also blocked if any synchronization command is activated together with the LBI **BREAKER TRIP (PAGE 538)**.

Check and Run commands are influenced by the setpoint **Voltage Matching (page 263)**. The voltage matching can be used to block voltage regulation loop during synchronization so only frequency is regulated to match the window.

Permissive and Run commands are influenced by the setpoint **Auto Re-synchronize (page 263)** which can be used to enable automatic synchronization activation (breaker closure) after breaker is externally opened while synchronization command is still active. If this option is disabled the synchronization command must be deactivated and activated again.

Synchronization commands are used only for breaker closing, if the command is deactivated after breaker closure the breaker will remain closed. To open a breaker you must activate LBI **BREAKER TRIP (PAGE 538)**. If **BREAKER TRIP (PAGE 538)** was not activated yet (Gen-set i running in Minimal Power), the **BREAKER TRIP (PAGE 538)** must be cycled (activated and deactivated) to open breaker.

### Synchronization Check

Check synchronization is activated via LBI **SYNCHRONIZATION CHECK (PAGE 557)**. This synchronization will only regulate frequency and voltage to match the window but it will not send command to close the breaker. This synchronization can be used for test purposes.

### Synchronization Permissive

Permissive synchronization is activated via LBI **SYNCHRONIZATION PERMISSIVE (PAGE 557)**. This is a passive synchronization so regulation loops are not used to get frequency and voltage to match the window. The **Rated Change** can be used to manually regulate voltage and frequency to match the synchronization window. When the synchronization window is matched the breaker is automatically closed.

### Synchronization Run

Run synchronization is activated via LBI **SYNCHRONIZATION RUN (PAGE 557)**. This is a standard synchronization which will regulate frequency and voltage to match the window and close the breaker. Synchronization process is described in the following chapter.

### Synchronization Process

It is possible to influence the behavior of the controller and limit the process of synchronization. Following setpoints have influence to synchronization process:

- **Mains Coupling (page 272)**
- **Synchronization R to Mains (page 267)**
- **Synchronization L to Mains (page 268)**
- **Synchronization R to L (page 268)**
- **Synchronization L to R (page 269)**

- > Dead Bus Closing (page 270)
- > BTB Opening (page 269)
- > Voltage Matching (page 263)
- > Auto Re-synchronize (page 263)
- > Mains Coupling (page 272)
- > Synchronization R to Mains (page 267)
- > Synchronization L to Mains (page 268)
- > Synchronization R to L (page 268)
- > Synchronization L to R (page 269)
- > Dead Bus Closing (page 270)
- > BTB Opening (page 269)

### Voltage match 321

This value consists of 3 bits which are filled separately with logical 0 or logical 1 based on Bus Left Voltage and Bus Right Voltage of respective phases during synchronization.

**Note:** Based on *Connection type (page 244)* this value may either relates to Ph-N or to Ph-Ph values.

Connection type (page 244)	Relates to
3Ph4Wire	Ph-Ph
High Leg D	
3Ph3Wire	
SplitPhase	Ph-N
MonoPhase	

#### > 1st Bit, logical 1 when:

$$L1 : \left| \frac{\text{Bus Right Voltage } L1-N}{\text{Bus Right Nominal Voltage } Ph-N} - \frac{\text{Bus Left Voltage } L1-N}{\text{Bus Left Nominal Voltage } Ph-N} \right| \times 100 \leq \text{Voltage Window}$$

$$L1 - L2 : \left| \frac{\text{Bus Right Voltage } L1-L2}{\text{Bus Right Nominal Voltage } Ph-Ph} - \frac{\text{Bus Left Voltage } L1-L2}{\text{Bus Left Nominal Voltage } Ph-Ph} \right| \times 100 \leq \text{Voltage Window}$$

#### > 2nd Bit, logical 1 when:

$$L2 : \left| \frac{\text{Bus Right Voltage } L2-N}{\text{Bus Right Nominal Voltage } Ph-N} - \frac{\text{Bus Left Voltage } L2-N}{\text{Bus Left Nominal Voltage } Ph-N} \right| \times 100 \leq \text{Voltage Window}$$

$$L2 - L3 : \left| \frac{\text{Bus Right Voltage } L2-L3}{\text{Bus Right Nominal Voltage } Ph-Ph} - \frac{\text{Bus Left Voltage } L2-L3}{\text{Bus Left Nominal Voltage } Ph-Ph} \right| \times 100 \leq \text{Voltage Window}$$

#### > 3rd Bit, logical 1 when:

$$L3 : \left| \frac{\text{Bus Right Voltage } L3-N}{\text{Bus Right Nominal Voltage } Ph-N} - \frac{\text{Bus Left Voltage } L3-N}{\text{Bus Left Nominal Voltage } Ph-N} \right| \times 100 \leq \text{Voltage Window}$$

$$L3 - L1 : \left| \frac{\text{Bus Right Voltage } L3-L1}{\text{Bus Right Nominal Voltage } Ph-Ph} - \frac{\text{Bus Left Voltage } L3-L1}{\text{Bus Left Nominal Voltage } Ph-Ph} \right| \times 100 \leq \text{Voltage Window}$$

**IMPORTANT:** Bits are counted from right to left!

### Synchronization via BTB

BTB controller controls the synchronization process. The behavior of synchronization process depends on power sources of Bus Left and Bus Right.

Bus Left \ Bus Right	Dead bus	Buss	Mains	Buss + Mains
Dead bus	<b>BTB Opening (page 269)</b>	<b>Dead Bus Closing (page 270)</b>		
Buss	<b>Dead Bus Closing (page 270)</b>	<b>Synchronization R to L (page 268)</b> <b>Synchronization L to R (page 269)</b>	<b>Synchronization L to R (page 269)</b> <b>Synchronization L to Mains (page 268)</b>	
Mains		<b>Synchronization R to L (page 268)</b> <b>Synchronization R to Mains (page 267)</b>	<b>Mains Coupling (page 272)</b>	
Buss + Mains				

### Synchronization without Mains

In case there are only Gen-sets on both sides, setpoint **Synchronization R to L (page 268)** or **Synchronization L to R (page 269)** has to be enabled in order to allow synchronization.

### Synchronization with Mains on one side

In case there are only Buss on one side and Mains or Buss on second side, setpoint **Synchronization R to L (page 268)** / **Synchronization L to R (page 269)** or **Synchronization R to Mains (page 267)** / **Synchronization L to Mains (page 268)** has to be enabled in order to allow synchronization.

### Synchronization with Mains on both sides

In case there are Mains or Mains + Buss on both sides, setpoint **Mains Coupling (page 272)** has to be enabled in order to allow close BTB breaker.

🔍 back to Synchronization

## Synchronization Types

There are two types of synchronization. Type of synchronization is adjusted via setpoint **Synchronization Type (page 262)**.

### Phase Match

The phase match synchronization consists of voltage matching and frequency/angle matching. The maximum duration of synchronization is given by the setpoint **Synchronization Timeout (page 264)**. If the synchronization is not successful within this period of time, the **Hst Synchronization Fail (page 691)** alarm will be issued.

### Voltage matching

The Bus Left or Bus Right voltage is regulated to match the Bus Right or Bus Left voltage with tolerance given by the setpoint **Voltage Window (page 264)**. The regulation is adjusted by the setpoints **Voltage Gain (page 274)** and **Voltage Int (page 275)**.

### Frequency/angle matching

The Bus Left or Bus Right frequency is regulated to match the Bus Right or Bus Left frequency first. The frequency regulation loop is active (setpoints **Frequency Gain (page 273)** and **Frequency Int (page 273)**). Once the frequency is matched, the regulation loop is switched to match the angle (setpoint **Angle Gain (page 274)**). When the angle is matched with tolerance +/- **Phase Window (page 265)** for a time given by the setpoint **Dwell Time (page 265)** and the voltage is matched too, then the BTB is closed.

**Note:** The matching loop will continue to run even if the BTB close command has been already issued until the controller receives **BTB FEEDBACK** (PAGE 539) or **Hst BTB Fail To Close** (page 690) alarm occurs. After the feedback has been received, the control loops are switched to load and power factor loops respectively to load and power factor sharing.

## Slip Synchronization

The slip synchronizing is based on frequency/angle matching. The maximum duration of synchronizing is given by the setpoint **Synchronization Timeout** (page 264). If the synchronizing is not successful within this period of time, the **Hst Synchronization Fail** (page 691) alarm will be issued.

The Bus Left or Bus Right frequency is regulated to match the Bus Right or Bus Left frequency + **Slip Frequency** (page 266) value and the window is set by setpoint **Slip Frequency Window** (page 266). When the Bus Left or Bus Right frequency reaches (Bus Right or Bus Left Frequency + Slip frequency) value regulation loop is stopped (output is frozen at the actual value). If the Bus frequency remains inside the window for the time longer than setpoint **Dwell Time** (page 265) the controller will allow BTB closing. The controller calculates periodically so called preclosing angle (based on the actual value **Slip Frequency** (page 411) and CB closing delay given by the setpoint **BTB Latency** (page 267)). When the preclosing angle is reached the controller issues CB closing command. The breaker will close and CB feedback confirms that to the controller. When the breaker is closed the controller goes to parallel and activates regulation loops again (parallel to Mains regulation loop).

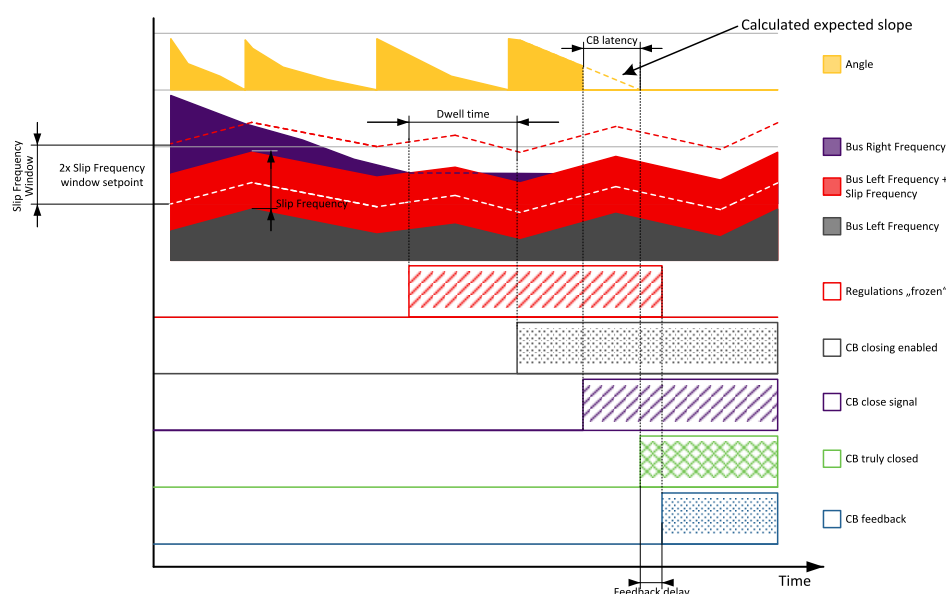


Image 5.102 Slip synchronization

Whenever the **Bus Right Frequency** (page 412) leaves off the **Slip Frequency Window** (page 266) (either because of **Bus Right Frequency** (page 412), **Bus Left Frequency** (page 407) or setpoint **Slip Frequency Window** (page 266) changes) the controller will reactivate frequency regulation loop and try to reach the target value again. The **Synchronization Timeout** (page 264) timer runs regardless of this while whole slip synchronization process is repeated. If the **Bus Right Frequency** (page 412) reaches the target frequency again the regulations are frozen and if the **Bus Right Frequency** (page 412) remains in the window for the time longer than setpoint **Dwell Time** (page 265) the controller will continue in the standard sequence as seen in the previous case. \*If the **Synchronization Timeout** (page 264) elapses the controller will immediately stop synchronization and issue alarm **Hst Synchronization Fail** (page 691).

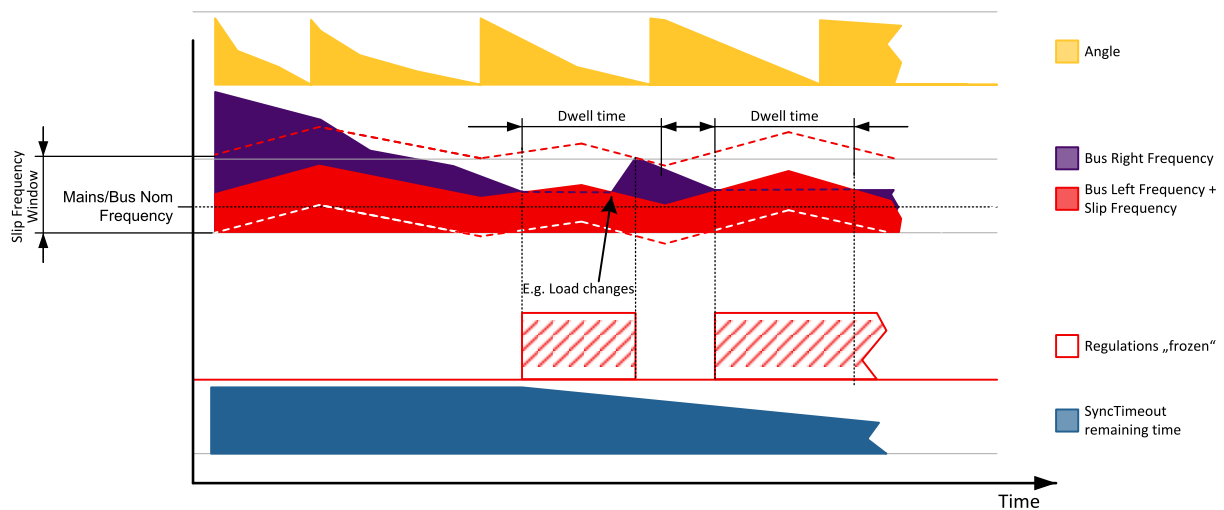


Image 5.103 Slip synchronization

The window is limited by the actual measured **Bus Left Frequency** (page 407) if one of the window limits is below this value (e.g. for setting where setpoint **Slip Frequency** (page 411) is set to 0.1Hz and setpoint **Slip Frequency Window** (page 266) is set to 0.5Hz).

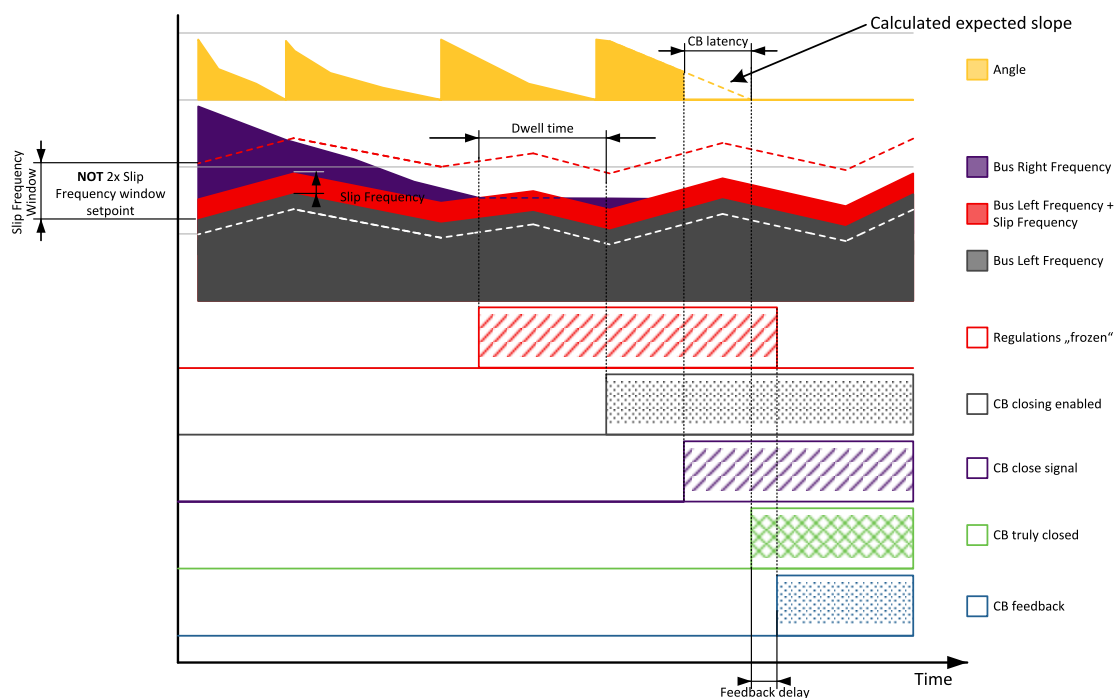


Image 5.104 Slip synchronization

Slip synchronization has a dead band. When the dead band is reached the frequency regulation is disabled. Once it is disabled it will be enabled again only when the frequency goes out of the slip frequency window. Dead band is introduced to allow the controller to detect the match.

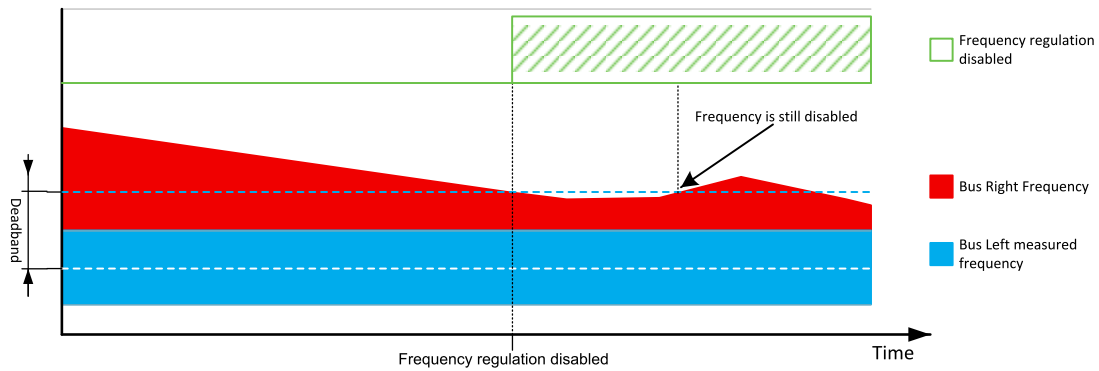
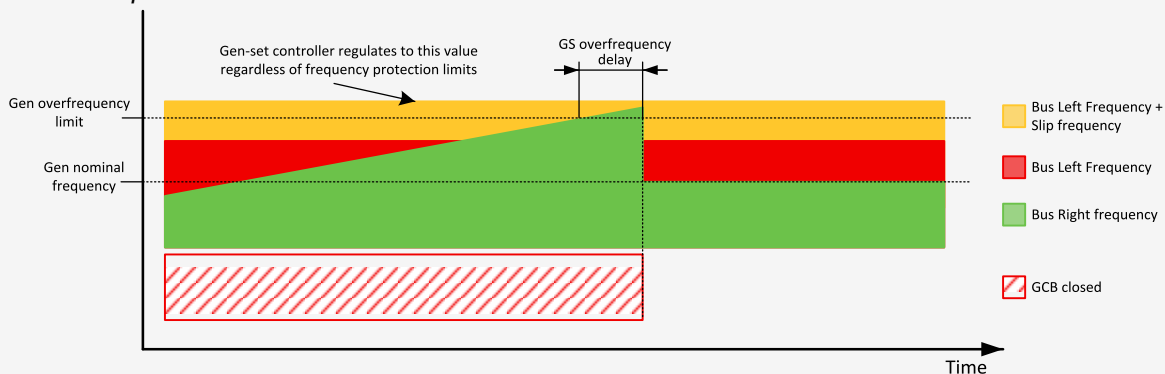


Image 5.105 Slip synchronization - deadband

**Note:** Due to the nature of this function it is possible that in limit cases the controller will regulate the Bus Left or Bus Right frequency outside of protection limits. Example: Bus Left frequency is high but within its protection limits (e.g. 50.9 Hz, limit is 51 Hz). **Slip Frequency (page 266)** is set to 0.5Hz. This will cause regulation loop of the controller can push the Bus Right frequency to 51.4 Hz and eventually the controller will issue overfrequency alarm. It is recommended to set the setpoint **Slip Frequency (page 266)** as low as possible that still enables succesfull synchronization. This minimizes the risk of this problem happening. Furthermore when slip synchronization is used it is recommended to set Bus Left Frequency protection limits to more rigid values than the Bus Right frequency protection limits. In this case the setpoint **Slip Frequency (page 266)** can be set to 0.1Hz and the Bus Left Frequency overfrequency protection limit is set to 50.9Hz instead of 51Hz. This will ensure that problematic state cannot be reached.



🔍 back to Synchronization

## 5.5.4 Control Groups

**Note:** This chapter is relevant for all ComAp controllers working in Multiple Island-Parallel operation.

The physical group of the controllers (i.e. the site) can be separated into smaller logical groups, which can work independently even if they are interconnected by the CAN2 bus. The logical groups are intended to reflect the real topology of the site when the site is divided into smaller groups separated from each other by bus-tie breakers. If the bus-tie breakers are closed the sub-groups have to work as one large group (system) and if the bus-tie breakers are open, the sub-groups have to work independently.

- The group which the particular controller belongs to is adjusted by the Control Group in related non BTB controllers. Use the default setting 1 with all controllers, if there is no bus-tie breaker.
- The information which groups are currently linked together is being distributed via the CAN. Each controller can provide information about one BTB breaker. The breaker position is detected by the input function *GroupLink* (i.e. this input is to be connected to the breaker feedback).

- > The two groups which are connected together by the BTB, are defined with parameters **Group Link L** (page 255) and **Group Link R** (page 256).
- > Controller sends via **CAN2A** (page 17) (**CAN2B** (page 17)) bus information that controllers from groups *Group Link L* and *Group Link R* are linked together.
- > A history record is written into every controller that is affected by the group link whenever the BTB is closed / opened (control groups are linked / unlinked).

**Note:** The "group link" function is independent on the group, where the controller itself belongs to. The controller can provide "group link" information about any two groups and it may not belong to one of the groups.

- > All controllers in linked groups cooperate with each other and perform Load sharing and VAR sharing together. The mentioned functions are performed independently in each group, when the groups are separated.

**Example:** 4 controllers separated by a BTB breaker into two groups of 2. The BTB position is detected by the controllers 2 and 3. The reason, why there are 2 controllers used for detection of the BTB position, is to have a redundant source of the group link information, if the primary source (controller) is switched off.

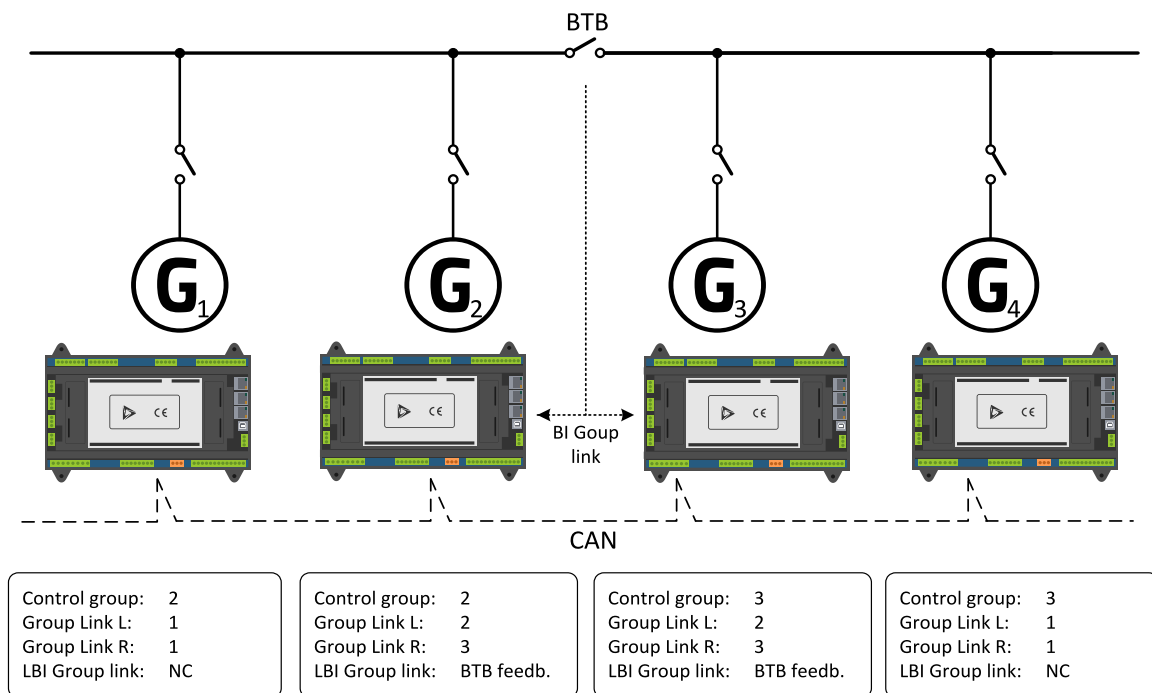


Image 5.106 Example of control groups

Once the BTB breaker is closed, the control groups 2 and 3 become new group 2+3. Load sharing and VAR sharing are performed within newly established group 2+3.

### 5.5.5 Electric state machine

State	Description
<b>Init</b>	Initialization of the controller. The application is not active yet.
<b>Synchro Check</b>	Controller is synchronizing, breaker close command is blocked.
<b>Synchro Perm</b>	Controller is in passive synchronization mode, breaker close command will be issued

	once synchronization windows is matched.
<b>Synchro Run</b>	Controller is synchronizing, breaker close command will be issued once synchronization window is matched.
<b>BTB Off</b>	BTB is opened. LBO <b>BTB Close/Open</b> is not active and LBI <b>BTB Feedback</b> is not active either.
<b>BTB On</b>	BTB is closed. LBO <b>BTB Close/Open</b> is active and LBI <b>BTB Feedback</b> is active as well.

## 5.5.6 Logical Sequence and Control

### Synchronization

There are 3 commands for synchronization called Run, Permissive, and Check. Synchronization Run will regulate frequency and voltage to match the window and close the breaker. Permissive synchronization is passive so regulations are not used to get frequency and voltage to match the window. Check synchronization will only regulate frequency and voltage to match the window but it will not send command to close the breaker. Synchronizations are available only if breaker is opened and there is healthy voltage/frequency. If dead bus is detected the command for breaker closing is sent immediately. If multiple synchronization commands are active while breaker is opened the synchronization is blocked and alarm synchronization blocked appear in the alarm list. Synchronization commands are used only for breaker closing, if the command is deactivated after breaker closure the breaker will remain closed.

#### > Related LBI:

- >> SYNCHRONIZATION CHECK (PAGE 557)
- >> SYNCHRONIZATION PERMISSIVE (PAGE 557)
- >> SYNCHRONIZATION RUN (PAGE 557)


### Breaker Trip (BTB)

BTB is opened immediately without unloading if LBI Breaker Trip is activated. If Breaker Trip is active all Synchronization commands are ignored and alarm Synchronization Blocked is shown in the alarm list.

#### > Related LBI:

- >> BREAKER TRIP (PAGE 538)

## 5.5.7 Operating Modes

The operating mode can be selected by pressing Left and Right buttons  on the front panel/display, by changing the **Controller mode (page 250)** setpoint, or by activating respective LBI.

**Note:** If the setpoint is configured as password-protected, the correct password must be entered prior to attempting to change the mode.

The following binary inputs can be used to force one respective operating mode independent of the mode setpoint selection:

- > Remote OFF (page 556)
- > Remote MAN (page 556)

If the respective input is active the controller will change the mode to the respective position according to the active input. If multiple inputs are active, the mode will be changed according to priorities of the inputs. The



priorities match the order in the list above. If all inputs are deactivated, the mode will return to the original position given by the setpoint.

## PRG MODE

In the programming mode the controller will stay in **Not Ready** state, and controller commands cannot be issued (all System and breaker related functions will be blocked).

**Note:** CU is restarted after configuration or FW is written to it. If the CU is not in the PRG mode, configuration or FW cannot be written to it.

## RUN MODE

In the run mode the controller will listen to the commands from the external PLC. The controller behavior is given by activated LBIs and the setpoint settings.

**Note:** The controller can close BTB automatically according to the settings in the **Subgroup: BTB Control (page 267)** if bus voltages are within the limits.

## 5.5.8 Output Control - Frequency

The frequency control output is used to control the frequency (speed) of the Buss presented on the bus. The frequency regulation is realized through the frequency control. The frequency request is internal value of the regulator which is transformed to range 0 .. 100 % of the **Loadsharing Output (page 429)** which comes out of the controller via communication line. Gen-set controller accepts this value and transform this to his speed control output.

### Frequency/Load Control Adjustment

**IMPORTANT:** Prior to Speed/Frequency/Load control adjustment, the Voltage/PF control has to be adjusted.

#### Frequency & Synchronization Adjustment

Frequency and Angle control loop is active during synchronization process.

1. Set the **Frequency Gain (page 273)** to 0 and start the system in MAN Mode.
2. Change the Gen-set's Speed Bias a little bit to get different frequency than Mains frequency.
3. Set **Angle Gain (page 274)** to 0 and start the synchronization by pressing BTB ON/OFF button. BTBLED starts to flash to indicate synchronization. To stop synchronization press again BTBON/OFF.
4. Adjust **Frequency Gain (page 273)** to unstable frequency control and decrease value by 30 % to insure stable performance.
5. Adjust **Frequency Int (page 273)** to stable (fast and smooth) frequency control and change Gen-sets's Speed Bias back to original vlaue.
6. Synchroscope movement on the controller measure screen should slow down and stop (in any position, because **Angle Gain (page 274)** control is off).
7. Set **Angle Gain (page 274)**. Synchroscope on the controller measure screen should move slowly and stop in "up" position. Set **Angle Gain (page 274)** to unstable value (synchroscope swings) and decrease value by 30 % to insure stable performance.
8. Now your frequency regulation loop setup is done.

### 5.5.9 Output Control - Voltage

The voltage control output is used to control the voltage of the system. The voltage regulation is realized through the voltage control. The voltage request is internal value of the regulator which is transformed to range 0...100% of the **Varsharing Output (page 429)** which comes out of the controller via communication line. Gen-set controller accept this value and transform this to its AVR control output.

#### Voltage control adjustment

##### Voltage Adjustment

1. Set **Voltage Gain (page 274)**, **Voltage Int (page 275)** to 0 .
2. Start the System without load.
3. Change the Voltage Regulator Bias on the Gen-set little bit to get different voltage than mains voltage.
4. Start the synchronization by LBI **SYNCHRONIZATION CHECK (PAGE 557)** voltage should be frozen.
5. Increase **Voltage Gain (page 274)** to unstable voltage control and decrease value by 30 % to insure stable performance.
6. Adjust **Voltage Int (page 275)** to stable (fast and smooth) voltage control.
7. Now your voltage regulation loop setup is done.

### 5.5.10 Protections

Protection types .....	196
Protection activation .....	198
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InteliMains 1010 BTB SC combines **Fixed protections (page 198)** with **User protections (page 202)** which allows users to configure their own protections to any analog or binary input. Multiple protections can be configured on each analog input, number of configured protections are not limited. Only **one** protection of **1st level** and/or **one** protection of **2nd level** can be configured on logical binary output. The maximum number of configured **User protections (page 202)** is limited to 200. The maximum number of configured **fast User protections (page 202)** is limited to 50.

## Protection types

### Level 1 Protections

- ✓ LBO COMMON ALARM LEVEL 1 (PAGE 563)
- ✓ LBO COMMON ALARM ACTIVE LEVEL 1 (PAGE 562)
- ✗ Action: CB open

Name	Warning	Alarm Only	History Record Only	Alarm List Indication	Alarm List + History Record Indication
Abbreviation	Wrn	Al	Hst	ALI	AHI
Alarm List indication	✓	✓	✗	✓	✓
History record	✓	✗	✓	✗	✓
Fault Reset needed	✓	✓	✗	✗	✗
LBO Alarm activation	✓	✓	✗	✗	✗
LBO Horn activation	✓	✓	✗	✗	✗
Common LBO	COMMON WARNING (PAGE 564)	COMMON ALARM ONLY (PAGE 563)	COMMON HISTORY RECORD (PAGE 563)	✗	✗

## Level 2 Protections

- ✓ **LBO COMMON ALARM LEVEL 2 (PAGE 563)**; except **Bus Left Protection**
- ✓ **LBO COMMON ALARM ACTIVE LEVEL 2 (PAGE 563)** ; except **Bus Left Protection**

Name	Breaker Open*	Breaker Open + FltRes
Abbreviation	BP	BPR
Alarm List indication	✗	✓
History record	✓	✓
Fault Reset needed	✗	✓
Action: CB open	✓	✓
LBO Alarm activation	✗	✓
LBO Horn activation	✗	✓
Common LBO	COMMON BREAKER OPEN (PAGE 564)	COMMON BREAKER OPEN + FLTRES (PAGE 564)

\* This protection type has selectable behavior (Passive / Active). See the setpoint **BP Protection Behavior (page 296)** for more information.

List of Fixed Protections with selectable behavior (selected behavior is applied to all of these protections):

- None, BP protection type is not used for fixed protections.

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## Protection activation

The table below shows the availability of conditions for analog and binary values

Type	Name of activation	Protection is activated if value is
Analog	Over Limit	over limit
	Over Limit+Fls	over limit or in fault state
	Under Limit	under limit
	Under Limit+Fls	under limit or in fault state
	Fls only	in fault state
Binary	True	logical 1
	TrueOrFls	logical 1 or in fault state*
	False	logical 0
	FalseOrFls	logical 0 or in fault state*

\* Fault state can occur if there is loss of communication with configured CAN module.

 [back to Protections](#)

## Protection blocking

It is possible to configure one Protection Blocking to any **User protections (page 202)**. This function is used to block certain protections when their function is unwanted or meaningless. Each user protection has an option to set the blocking condition.

The blocking conditions can be also applied on the **Fixed protections (page 198)**.

### General protections

Each of the LBI Protection Force Disable 1 is paired with an option of protection condition "Force Block 1–3" and can be used for Blocking / Disabling of protections, however on user defined protections the option causes protection Blocking instead of Disabling.

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## Fixed protections

Some selected fixed protections has an option to DISABLE the protection.

The setting is done by using the setpoint which is associated to the fixed protection. Each setpoint offers these options.

### Setpoint options

Alarms	Fixed Protection States
Enable	Protection is enabled
Disable	Protection is blocked
<b>PROTECTION FORCE DISABLE 1 (PAGE 554)</b> <b>PROTECTION FORCE DISABLE 2 (PAGE 555)</b> <b>PROTECTION FORCE DISABLE 3 (PAGE 555)</b>	Disabling of the protection can be forced by LBI

## Bus Right protections

	Protection	Alarms / Protection name	Fixed Protection States
	Bus Right >V Protection (page 306)	<a href="#">Hst Bus Right &gt;V L1-N (page 685)</a> <a href="#">Hst Bus Right &gt;V L2-N (page 685)</a> <a href="#">Hst Bus Right &gt;V L3-N (page 685)</a> <a href="#">Hst Bus Right &gt;V L1-L2 (page 686)</a> <a href="#">Hst Bus Right &gt;V L2-L3 (page 686)</a> <a href="#">Hst Bus Right &gt;V L3-L1 (page 686)</a>	FIXED PROTECTIONS STATES 1 (PAGE 587)
	Bus Right <V Protection (page 307)	<a href="#">Hst Bus Right &lt;V L1-N (page 686)</a> <a href="#">Hst Bus Right &lt;V L2-N (page 687)</a> <a href="#">Hst Bus Right &lt;V L3-N (page 687)</a> <a href="#">Hst Bus Right &lt;V L1-L2 (page 687)</a> <a href="#">Hst Bus Right &lt;V L2-L3 (page 687)</a> <a href="#">Hst Bus Right &lt;V L3-L1 (page 688)</a>	FIXED PROTECTIONS STATES 1 (PAGE 587)
	Bus Right V Unbalance Protection (page 307)	<a href="#">Hst Bus Right V Unbalance Ph-N (page 688)</a> <a href="#">Hst Bus Right V Unbalance Ph-Ph (page 689)</a>	FIXED PROTECTIONS STATES 1 (PAGE 587)
Frequency	Bus Right >f Protection (page 313)	<a href="#">Hst Bus Right &gt;f (page 688)</a>	FIXED PROTECTIONS STATES 1 (PAGE 587)

## Bus Right protections

	Protection	Alarms / Protection name	Fixed Protection States
	Bus Right <f Protection (page 314)	Hst Bus Right <f (page 688)	FIXED PROTECTIONS STATES 1 (PAGE 587)
Others	<b>Phase Rotation</b> <i>Note: This protection monitors phases rotation and compares it with Phase Rotation (page 249), in case of inconsistency, proper alarm is activated</i>	ALI Bus Right Ph Rotation Opposite (page 670)	-
	<b>Inverted Phase</b> <i>Note: This protection monitors phases inversion and in case of inconsistency of all phases, proper alarm is activated</i> <i>Note: This protection can not be disabled.</i>	ALI Bus Right Ph L1 Inverted (page 669) ALI Bus Right Ph L2 Inverted (page 670) ALI Bus Right Ph L3 Inverted (page 670)	-

Table 5.1 Bus Right protections

## Bus Left protections

	Protection	Alarms / Protection name	Fixed Protection States
Voltage	Bus Left >>V Protection (page 302)	Hst Bus Left >>V L1-N (page 677) Hst Bus Left >>V L2-N (page 678) Hst Bus Left >>V L3-N (page 678) Hst Bus Left >>V L1-L2 (page 678) Hst Bus Left >>V L2-L3 (page 679) Hst Bus Left >>V L3-L1 (page 679)	FIXED PROTECTIONS STATES 2 (PAGE 588)
	Bus Left >V Protection (page 300)	Hst Bus Left >V L1-N (page 676) Hst Bus Left >V L2-N (page 676) Hst Bus Left >V L3-N (page 676) Hst Bus Left >V L1-L2 (page 676) Hst Bus Left >V L2-L3 (page 677) Hst Bus Left >V L3-L1 (page 677)	FIXED PROTECTIONS STATES 1 (PAGE 587) FIXED PROTECTIONS STATES 2 (PAGE 588)
	Bus Left <V Protection (page 303)	Hst Bus Left <V L1-N (page 679) Hst Bus Left <V L2-N (page 680) Hst Bus Left <V L3-N (page 680) Hst Bus Left <V L1-L2 (page 680) Hst Bus Left <V L2-L3 (page 680) Hst Bus Left <V L3-L1 (page 681)	FIXED PROTECTIONS STATES 1 (PAGE 587) FIXED PROTECTIONS STATES 2 (PAGE 588)
	Bus Left <<V Protection (page 304)	Hst Bus Left <<V L1-N (page 681) Hst Bus Left <<V L2-N (page 681) Hst Bus Left <<V L3-N (page 682) Hst Bus Left <<V L1-L2 (page 682) Hst Bus Left <<V L2-L3 (page 682) Hst Bus Left <<V L3-L1 (page 683)	FIXED PROTECTIONS STATES 2 (PAGE 588)
	Bus Left V Unbalance Protection (page 305)	Hst Bus Left V Unbalance Ph-N (page 684) Hst Bus Left V Unbalance Ph-Ph (page 685)	FIXED PROTECTIONS STATES 1 (PAGE 587)
Frequency	Bus Left >>f Protection (page 310)	Hst Bus Left >>f (page 683)	FIXED PROTECTIONS STATES 2 (PAGE 588)
	Bus Left >f Protection (page 309)	Hst Bus Left >f (page 683)	FIXED PROTECTIONS STATES 2 (PAGE 588)
	Bus Left <f Protection (page 311)	Hst Bus Left <f (page 684)	FIXED PROTECTIONS STATES 2 (PAGE 588)
	Bus Left <<f Protection	Hst Bus Left <<f (page 684)	FIXED PROTECTIONS



## Bus Left protections

	Protection	Alarms / Protection name	Fixed Protection States
	(page 312)		STATES 2 (PAGE 588)
Current	Short Circuit Protection (page 298)	<b>BOR Short Circuit (page 694)</b>	FIXED PROTECTIONS STATES 2 (PAGE 588)
	IDMT Bus Left >A Protection (page 298)	<b>BOR IDMT Bus Left &gt;A (page 694)</b>	FIXED PROTECTIONS STATES 2 (PAGE 588)
	Current Unbalance Protection (page 300)	<b>BOR Current Unbalance (page 694)</b>	FIXED PROTECTIONS STATES 1 (PAGE 587)
Power	IDMT Overload Protection (page 296)	<b>IDMT Overload (page 694)</b>	FIXED PROTECTIONS STATES 2 (PAGE 588)

Table 5.2 Bus Left protections

## User protections

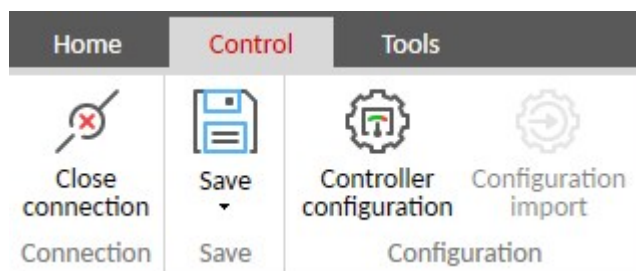
Source upon which the protection is configured can be selected. It can be any analog value or binary state.

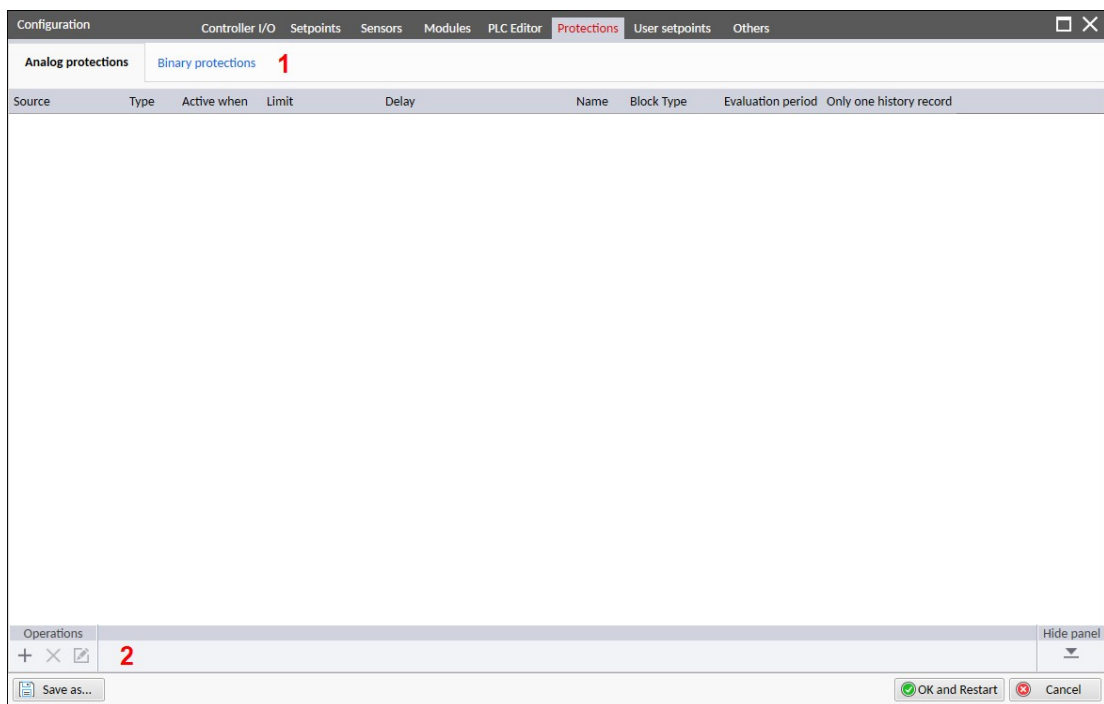
### Source




Analog values	Binary states
<ul style="list-style-type: none"> <li>&gt; Analog inputs <ul style="list-style-type: none"> <li>&gt;&gt; Controller, Modules</li> </ul> </li> <li>&gt; Values <ul style="list-style-type: none"> <li>&gt;&gt; Measured values, Application, PLC, Shared I/O</li> <li>&gt;&gt; Modbus server, Modbus Master</li> </ul> </li> <li>&gt; Statistics</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Binary inputs <ul style="list-style-type: none"> <li>&gt;&gt; Controller, Modules, Shared I/O</li> <li>&gt;&gt; Modbus server, Modbus Master</li> </ul> </li> <li>&gt; Binary outputs <ul style="list-style-type: none"> <li>&gt;&gt; PLC</li> </ul> </li> <li>&gt; Protection states</li> <li>&gt; LBOs</li> </ul>

### Configuration of protections in IntelliConfig

Control tab → Controller configuration → Protections tab → Analog / Binary protections





1	Select the desired protections to be configured (Analog protections / Binary protections).
2	<p><b>Add</b> protection by clicking on the  icon</p> <p><b>Delete</b> selected protection by clicking on the  icon.</p> <p><b>Edit</b> selected protection by clicking on the  icon.</p>

## Adding analog protection

The screenshot shows the 'Analog Protection' dialog box with the following fields and annotations:

- Source Value:** A text input field containing the number '1'.
- Type / Level:** A dropdown menu showing 'Warning' with a yellow triangle icon and the number '2'.
- Custom Name:** A text input field containing 'Wrn' and the number '3'.
- Active When:** A dropdown menu showing 'Over Limit' and the number '4'.
- Block Type:** A dropdown menu showing 'All the time' and the number '5'.
- History Record:** A dropdown menu showing 'Always' and the number '6'.
- Evaluation Period:** A dropdown menu showing 'Standard (0.1 s)' and the number '7'.
- Protection State:** A checkbox that is currently unchecked, with the number '8'.
- Limit:** A section header.
- Limit Source:** A text input field containing the number '9'.
- Delay:** A section header.
- Delay Source:** A text input field containing the number '10'.

At the bottom of the dialog are 'OK' and 'Cancel' buttons.

1	Selecting the input source <b>see User protections on page 202</b>
2	Selecting the protection type <b>see Protection types on page 196</b>
3	Text input for Alarm / History message
4	Selecting the protection activation <b>see Protection activation on page 198</b>
5	Selecting the block type <b>see Protection blocking on page 198</b>
6	Selecting if the occurrence of a protection is recorded every time or only once after a Fault Reset.
7	Selecting the evaluation period

8	If <b>Protection State</b> is checked the protection is then shown in the <b>Values</b> in the group <b>User Protection States</b> .
9	<p>Selecting the input for limit.</p> <p>Setpoints must have the correct resolution and dimension as protection source value.</p> <ul style="list-style-type: none"> <li>➤ Existing setpoint</li> <li>➤ New user setpoint</li> <li>➤ Existing user setpoint</li> </ul> <p>Prefix is added to the name based on protection type / level</p>
10	<p>Selecting the input for delay.</p> <p>Setpoints must have the correct resolution <b>0.1</b> and dimension <b>[s]</b></p> <ul style="list-style-type: none"> <li>➤ Existing setpoint</li> <li>➤ New user setpoint</li> <li>➤ Existing user setpoint</li> </ul> <p>Prefix is added to the name based on protection type / leve</p>

## Adding binary protection

The screenshot shows the 'Binary Protection' dialog box with the following fields and annotations:

- Source Value:** A text input field containing '1'.
- Type / Level:** A dropdown menu showing 'Warning' with a yellow triangle icon, annotated with '2'.
- Custom Name:** A text input field containing 'Wrn', annotated with '3'.
- Active When:** A dropdown menu showing 'True', annotated with '4'.
- Block Type:** A dropdown menu showing 'All the time', annotated with '5'.
- History Record:** A dropdown menu showing 'Always', annotated with '6'.
- Protection State:** A checkbox that is currently unchecked, annotated with '7'.
- Delay:** A section containing a 'Source' text input field with '8' inside, and several icons (dots, square, circle, question mark) to its right.

At the bottom of the dialog are 'OK' and 'Cancel' buttons.

1	Selecting the input source <b>see User protections on page 202</b>
2	Selecting the protection type <b>see Protection types on page 196</b>
3	Text input for Alarm / History message
4	Selecting the protection activation <b>see Protection activation on page 198</b>
5	Selecting the block type <b>see Protection blocking on page 198</b>

6	Selecting if the occurrence of a protection is recorded every time or only once after a Fault Reset.
7	If <b>Protection State</b> is checked the protection is then shown in setpoints under the group <b>User setpoints</b> .
8	<p>Selecting the input for delay.</p> <p>Setpoints must have the correct resolution <b>0.1</b> and dimension <b>[s]</b></p> <ul style="list-style-type: none"> <li>&gt; Existing setpoint</li> <li>&gt; New user setpoint</li> <li>&gt; Existing user setpoint</li> </ul>

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## Protection states

Protection states is a new feature introduced in IntelliMains 1010 BTB SC, which helps with better management of alarms. Until now, you could only use LBO **ALARM** (PAGE 560) which did not specify what is going on. Protection states work in similar way, like any other LBO. The difference is, that protection state gets active only when there is specific alarm present in the alarm list. Thanks to this, you can create PLC logic, which will react to specific alarms only.

### Fixed protection states

Important **Fixed protections** (page 198) have a protection state. The protection state is (usually) named exactly as the alarm. Fixed protection states are in a group of 32.

#### > Protection states groups:

- >> **FIXED PROTECTIONS STATES 1** (PAGE 587)
- >> **FIXED PROTECTIONS STATES 2** (PAGE 588)
- >> **FIXED PROTECTIONS STATES 3** (PAGE 589)
- >> **FIXED PROTECTIONS STATES 4** (PAGE 590)

### User protections states

During the **Configuration of protections in IntelliConfig** (page 202), you can decide whether you want to add user protection state for the protection. The name is exactly same as the alarm's message.

When you're adding user protection state, it will try to fill in gaps (if there are any present) in an actual list of **User Protection States** (page 591), if there is no gap, it will be automatically added to the end. User protection states are in a group of 32 with maximally 10 groups i.e. 320 user protection states are available.

**Note:** Group of User protection states is showed only when there is at least 1 protection state in it.

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## 5.5.11 Regulation Loops

### Regulation loops overview

#### Regulation loops overview

Loop type	Related setpoints	Related Operation
Frequency	Frequency Gain (page 273) Frequency Int (page 273)	Synchronization
Voltage	Voltage Gain (page 274) Voltage Int (page 275)	Synchronization
Angle regulation	Angle Gain (page 274)	Phase Match Synchronization

Frequency, Load sharing, Load regulation loops have one common output = **Loadsharing Output (page 429)** which is sent to controllers through CAN. The value of this output is always composed from the contribution of each of the regulation loops.

Voltage, PF, VAR sharing have one common output = **Varsharing Output (page 429)** which is sent to controllers through CAN. The value of this output is always composed from the contribution of each of the regulation loop.

**Note:** All regulation loops are PID, but only PI components are visible as setpoints.

### Adjustment of regulation loops

The regulation loops have two adjustable factors: P-factor and I-factor (except angle regulation loop, which has P-factor only). The P-factor (gain) influences the stability and overshoot of the regulation loop and the I-factor (int) influences the steady-state error as well as the settling time. See the picture below for typical responses of a PI regulation loop.

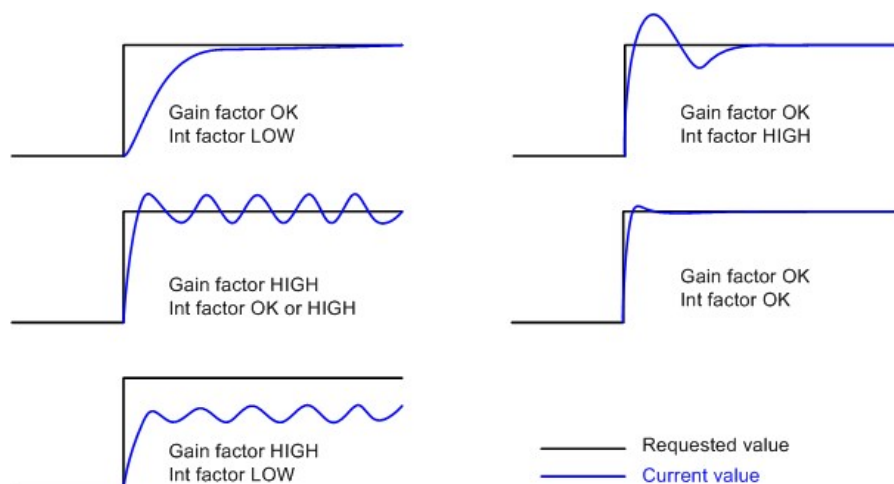


Image 5.107 Typical responses of PI regulator

For manual tuning of a control loop use following method:

- Set both the I-factor and P-factor to 0.
- Increase the P-factor slightly until the system starts to oscillate.

- Adjust the P-factor back to approx. one half of the value where the oscillations started.
- Increase the I-factor slightly to achieve optimal resulting response.

**IMPORTANT: Be ready to press emergency stop button in case the regulation loop would start to behave unacceptable while it is being adjusted.**

## 5.5.12 Voltage Phase Sequence Detection

Controller detects phase sequence on both voltage terminals. This protection is important after controller installation to avoid wrong voltage phase connection. The phase sequence is adjusted via setpoint **Phase Rotation** (page 249).

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# 6 Communication

6.1 PC .....	210
6.2 Connection to 3rd party systems .....	213

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## 6.1 PC

6.1.1 Direct communication .....	210
6.1.2 Remote communication .....	211

### 6.1.1 Direct communication

Computer can be connected to IntelliMains1010 BTB SC via USB, RS485 or ethernet interface.

#### Connection via USB

USB A to B cable can be used for communication via USB ports. The IntelliMains1010 BTB SC is using Human Interface Devices (HID) protocol which support auto detection of the connected HW. The USB is not industrial interface and it is not recommended to use it for long term purposes because of interference which can cause lost of communication.

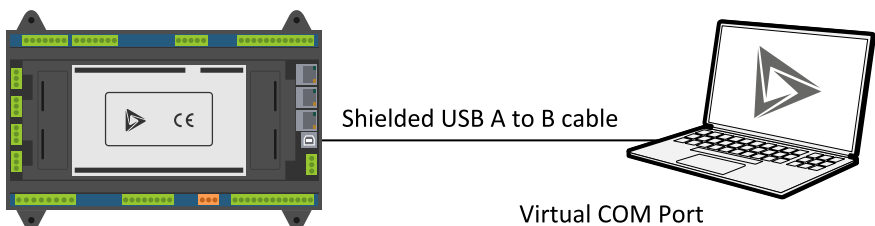


Image 6.1 Shielded USB type A cable is used

#### Connection via RS485

On board RS485 connector can be used for communication via RS485 connection. This interface uses **RS485 Modbus Mode (page 317)** port of the controller. It is also possible to use RS485-USB convertor.

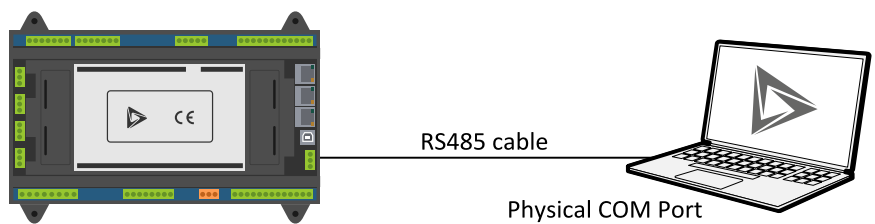


Image 6.2 Built-in RS485 is used

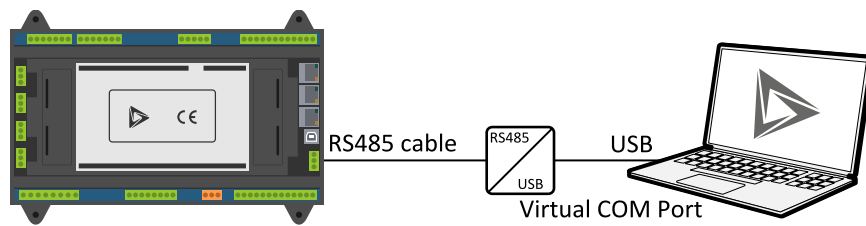


Image 6.3 RS485 and USB is used

## Connection via Ethernet

Ethernet Cat5/Cat6 cable fitted with the RJ45 connector can be used for communication via Ethernet. Controllers in local network are automatically detected by IntelConfig PC tool. For the direct connection it is recommended to use **Trusted (page 173)** interface which is in default configured to port **Ethernet 1 (page 17)**. This communication is more reliable than the USB because it is more robust against interference.

**Note:** It is necessary to use manual IP address on both PC and controller if there is no device which will provide DHCP.

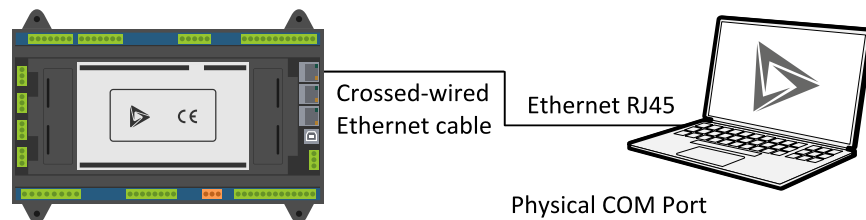


Image 6.4 Ethernet cable is used

⬅ back to Communication

### 6.1.2 Remote communication

The IntelMains1010 BTB SC can be connected also remotely via built-in ethernet ports. For remote connection the **Untrusted (page 173)** interface which is in default configured to port **Ethernet 2 (page 18)** should be used.

#### Ethernet LAN connection

Direct IP LAN connection is intended to be used to connect more than one controller at the same time while controllers are connected to the local are network (LAN). For LAN connections, it is recommended to use **Trusted (page 173)** interface which is in default configured to port Ethernet 1. If there is not any device which would provide DHCP for the LAN the static (manual) IP address must be used.

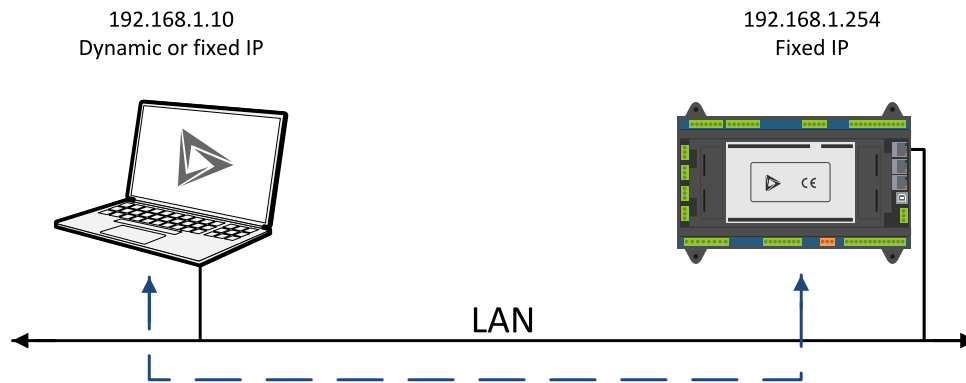


Image 6.5 Ethernet LAN connection

## Setting-up static IP address

This settings is related to **Group: ETH Interface 1 - Trusted (page 326)**, **Group: ETH Interface 2 - Untrusted (page 331)** and **Group: ETH Interface 3 - Modbus (page 349)**.

There are two basic ways how to setup static IP address for remote ethernet connection. The first way is to switch the Ethernet to manual IP address mode. Adjust the setpoint IP Address Mode to Manual option. In this moment values for related Ethernet port are immediately changed to the default or previously setup values of setpoints IP Address, Subnet Mask, Gateway IP, DNS IP, etc. If you are using this Ethernet port for connection to the controller you will lost the connection.

If this method is used several basic rules should be kept to avoid conflicts with the remaining network infrastructure:

- The static IP used in the controller must be selected in accordance with the local network in which the controller is connected.
- The static IP used in the controller must be excluded from the pool of addresses which is assigned by DHCP server, which is in charge of the respective local network.
- The local infrastructure must generally allow using devices with manually assigned IP addresses.
- There must not be any other device using the same static IP address. This can be tested from a computer connected to the same network using "ping <required\_ip\_address>" command issued from the command line. The IP address is not occupied if there is not any response to the ping command.

**Note:** The list above contains only basic rules. Other specific restrictions/rules may take place depending on the local network security policy, technology used, topology etc.

The second way is to switch the Ethernet to manual IP address mode. Adjust the setpoint IP Address Mode to Manual option. In this moment values for related Ethernet port are immediately changed to values given by the DHCP server for the LAN. If you are using this Ethernet port for connection to the controller you will lost the connection. It is possible to configure the DHCP server to assign always the same IP address (i.e. static IP address) to the particular controller according to it's MAC address.

## Internet WAN connection

WAN connection is intended to be used to connect the controller using the internet. It is recommended to use Ethernet 2 (untrusted interface) for remote connection using internet.

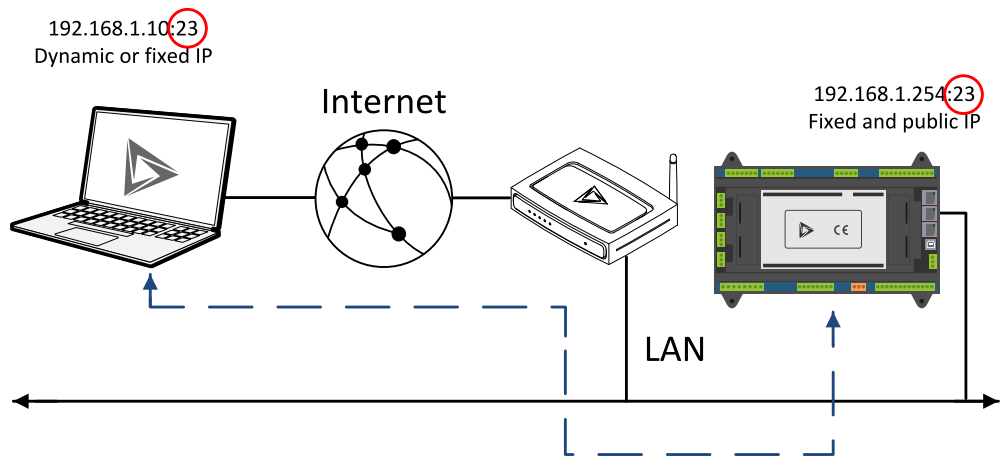


Image 6.6 Ethernet WAN connection

## Public static IP

If public static IP connection is to be used from the Internet, the IP address, which is entered into the client computer, must be static and public in scope of the Internet.

If the controller is connected to Internet via a local ethernet network then in most cases port forwarding must be created from the public IP address of the network gateway to the local IP address of the controller at the port specified for ComAp protocol. Different port numbers can be used to create multiple port forwarding rules in the same local network.

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# 6.2 Connection to 3rd party systems

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6.2.2 Modbus-RTU, Modbus/TCP .....	215

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## 6.2.1 SNMP

SNMP is an UDP-based client-server protocol used for providing data and events into a supervisory system (building management system). The controller plays the role of a "SNMP Agent" while the supervisory system plays the role of a "SNMP Manager".

➤ Supported versions – SNMP v1 and SNMP v2c

The SNMP Agent function is to be enabled by the setpoint **SNMP Agent (page 343)**. The setpoints **SNMP RD Community String (page 344)** and **SNMP WR Community String (page 344)** in the same group can be used to customize the "community strings" for the read and write operations which have function like "passwords". All requests sent from the SNMP Manager have to contain community string which match with the community string adjusted in the controller otherwise the controller refuses the operation.

## MIB table

The "MIB table" (Management Information Base) is a table which gives to the Manager description of all objects provided by the Agent.

- The MIB table is specific for each controller type and configuration
- The MIB table is to be exported from the controller configuration using IntelliConfig
- Controllers with identical firmware and configuration share also identical MIB table, however if the configuration and/or firmware is not identical the MIB table is different and must be exported separately for each controller.

The root node of the MIB table of IntelliLite controller is enterprises.comapProjekt.il, which is 1.3.6.1.4.1.28634.14. Under this node there are following sub-nodes :

- Notifications group (SMI v2 only) contains definitions of all notification-type objects that the Agent may send to the Manager.
- GroupRdFix contains read-only objects that exist in all controller regardless of the firmware version/type and configuration.
- GroupRdCfg contains read-only objects that depend on the firmware version/type and configuration.
- GroupWrFix contains read-write objects that exist in all controller regardless of the firmware version/type and configuration.
- GroupWrCfg contains read-write objects that depend on the firmware version/type and configuration.
- GroupW contains write-only objects.
- NotificationData group contains objects that are accessible only as bindings of the notification messages.

## SMI version

In IntelliConfig the MIB table may be exported in two different formats – SMI v1 and SMI v2. The format which shall be used for export depends on the SNMP Manager and SMI version that it does support.

Typically, SMI v1 is used for SNMP v1 and vice versa, but it is not a rule and SMI v2 may be also used for SNMP v1.

## SNMP reserved objects

Name	OID	Access	Data type	Meaning
pfActionArgument	groupWrFix.24550	read,write	Gauge32	Writing: command argument Reading: command return value
pfActionCommand	groupW.24551	write	Integer32	Command code 1)
pfPassword	groupW.24524	write	Integer32	Password

1) For list of commands, arguments and description of the procedure of invoking commands see the description of the MODBUS protocol.

## SNMP notifications

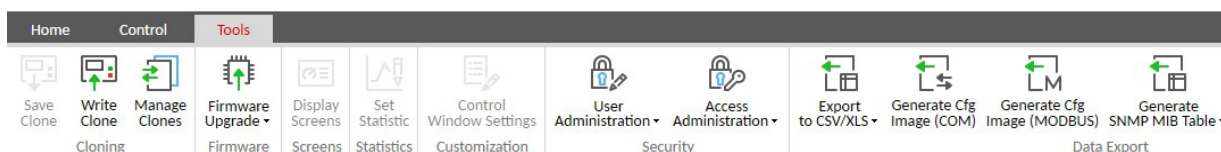
Except the request-response communication model, in which the communication is controlled by the Manager, there are also messages that the Agent sends without any requests. These messages are called „Notifications“ and inform the Manager about significant events occurred in the Agent.

The controller can send notifications to two different SNMP Managers (two different IP addresses). The addresses are to be adjusted in the **Group: ETH Interface 2 - Untrusted (page 331)** by the setpoints **SNMP Traps IP Address 1 (page 344)** and **SNMP Traps IP Address 2 (page 345)**. If the Manager address is not adjusted the particular notification channel is off. The controller will send the notifications in format adjusted by the setpoint **SNMP Trap Format (page 343)**.

- Each notification (kind of event) is identified by a unique identifier (Trap ID in SNMPv1 or Notification OID in SNMPv2). This unique identifier gives the specific meaning to the notification message, e.g. Protection 1. level - Fuel Level - alarm activated.
- All possible notifications and their identifiers are listed in the MIB table.
- The notification message also contains controller name, serial number and textual description of the event.

## 6.2.2 Modbus-RTU, Modbus/TCP

To generate the Modbus register list, click on **Generate Cfg Image (MODBUS)** button in the Tools ribbon.



Modbus protocol is used for integration of the controller into a building management system or for remote monitoring via 3rd party monitoring tools.

- Modbus-RTU can be used via **RS 485 (page 42)**. The serial speed for Modbus-RTU communication is adjusted by the setpoint **RS485 Modbus Speed (page 317)** and the serial mode is adjusted by the setpoint **RS485 Modbus Mode (page 317)**. Only 1 client can be connected at once through this type of connection.
- Modbus/TCP (Modbus server) can be used with the **Ethernet 1 (page 17) / Ethernet 2 (page 18) / Ethernet 3 (page 18)**. Up to 3 clients can be connected simultaneously through each Ethernet interface. The Modbus Server must be activated by the appropriate setpoint **Modbus Server** related to the respective Ethernet interface. Timeout after which controller would terminate an inactive connection (when client is not sending any requests) is set by setpoint **ComAp Client Inactivity Timeout (page 348)**.

**Note:** Setpoint **Modbus Client Inactivity Timeout (page 352)** is common for both **Ethernet 1 (page 17)**, **Ethernet 2 (page 18)** and **Ethernet 3 (page 18)** interfaces.

**DO NOT READ ALARM LIST FROM MORE THAN 1 CLIENT! LOSS OF INFORMATION MAY OCCUR.**

Modbus, Modbus/TCP protocol can be used simultaneously with direct Ethernet connection and the SNMP agent.

**Note:** Recommended timeout for Modbus client is 300 ms.

**IMPORTANT: Do not use setpoints for real-time control from super-ordinate systems. Frequent repeated writing of setpoints would cause the history file getting overwritten and losing important records.**

In the image below you can see the topology using all 3 Ethernet ports. The ETH1 is used for Modbus Server, connection of displays (IV5.2), or it can be also used for remote LAN connection. The ETH2 is used for remote connection using the internet (WAN). The ETH3 is used for Modbus Client which is connected to the LAN.

In the image below you can see the topology using all 3 Ethernet ports with one Modbus Client. The ETH1 is used for connection of displays (IV5.2) or it can be also used for remote LAN connection. The ETH2 is used for remote connection using the internet (WAN). The ETH3 is used for Modbus Server and Client which are connected to the LAN with Modbus Devices.

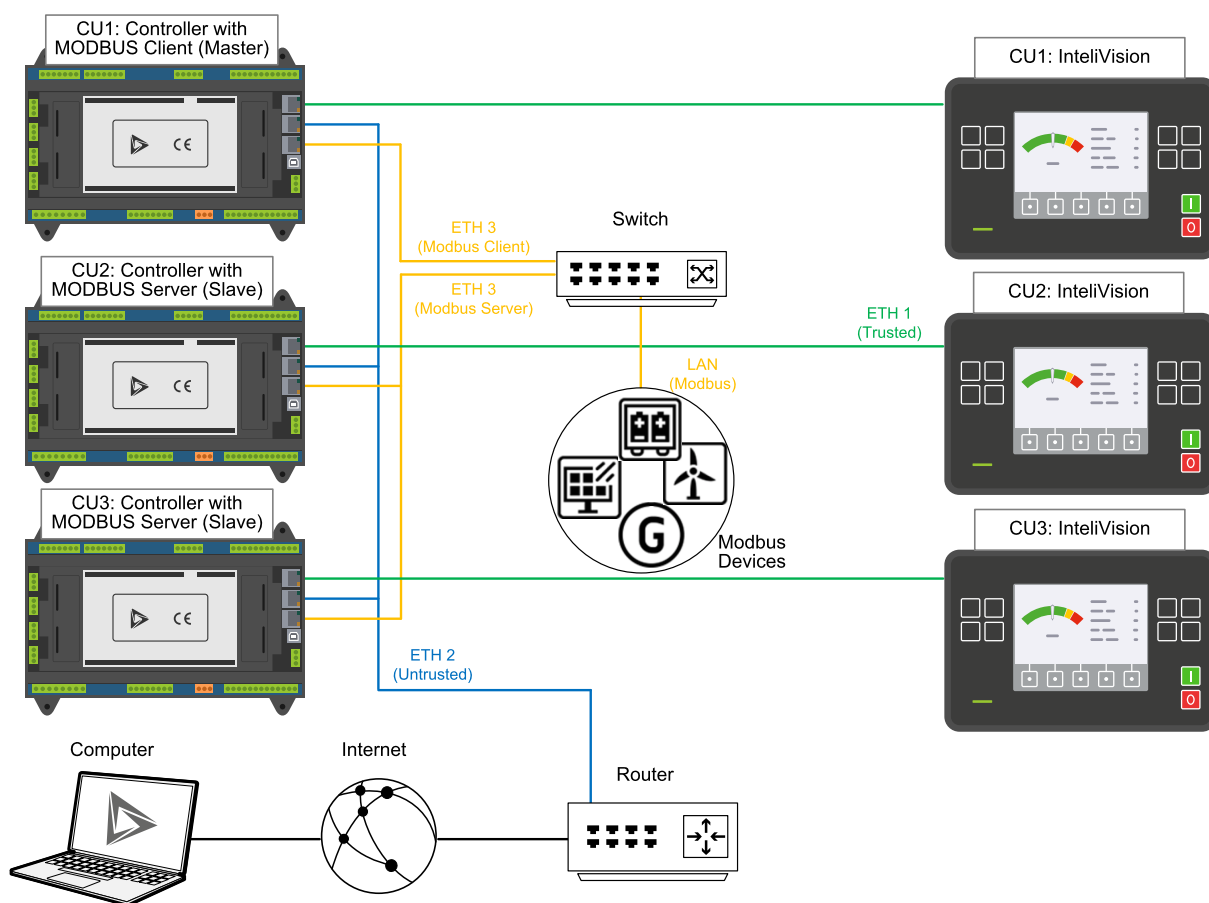


Image 6.7 Advanced Ethernet Topology With One Modbus Client

In the image below you can see the topology using all 3 Ethernet ports with multiple Modbus Clients (CU 1 is the first level client, CU 2 and CU 3 are second level clients). The ETH1 is used for Modbus Server, connection of displays (IV5.2), or it can be also used for remote LAN connection. The ETH2 is used for remote connection using the internet (WAN). The ETH3 is used for Modbus Clients which are connected between CU 1 and other CUs, and between other CUs and Modbus Devices.

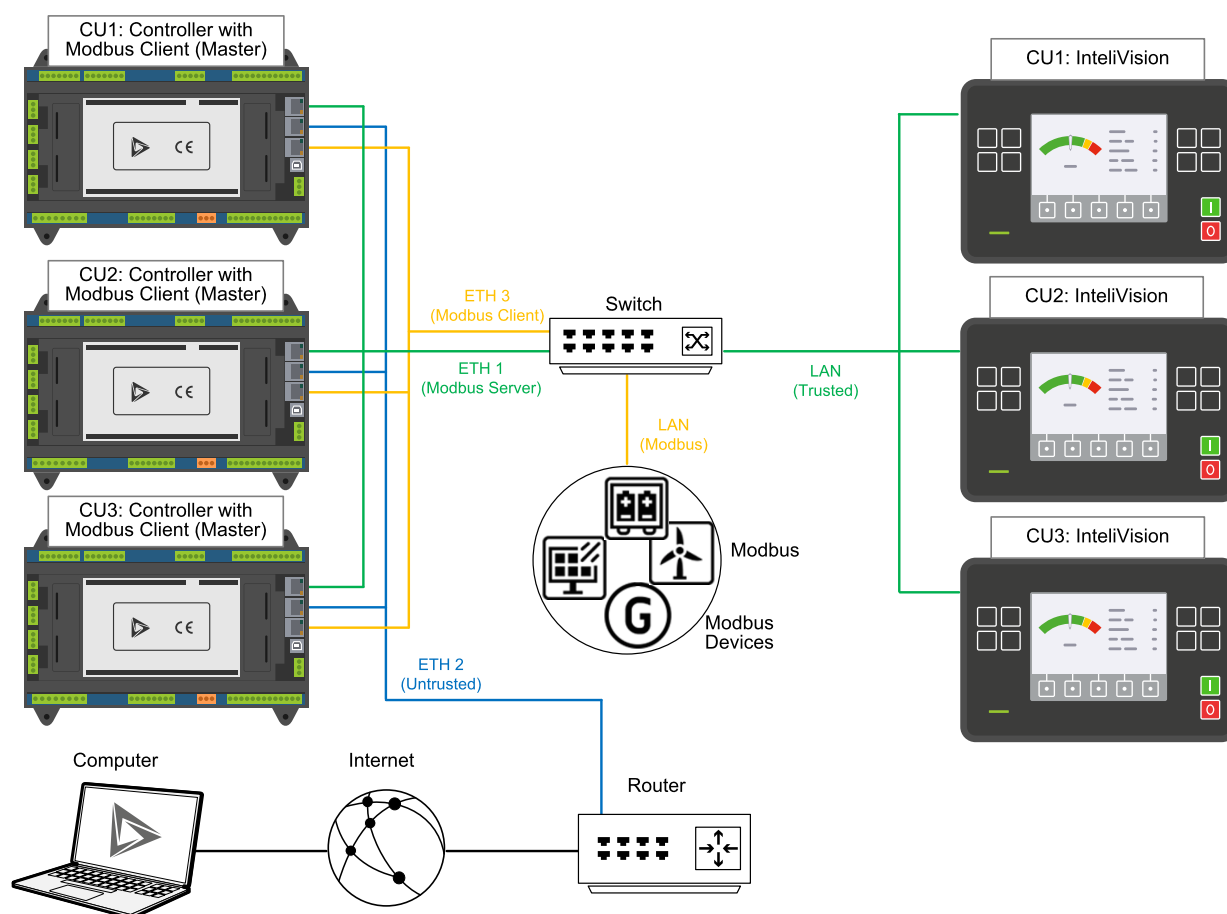


Image 6.8 Advanced Ethernet Topology With Multiple Modbus Clients

**Note:** The IP address of each device in the same network must vary.

**Note:** IntelliVision 5.2 is used for illustrative purposes, the same wiring diagrams apply for all supported displays mentioned in *Displays* (page 21).

## Address space

The object address space is separated into several areas as described in the table below. The actual mapping of specific controller data objects to specific Modbus addresses, which depends on configuration, can be exported into a text file from the appropriate controller archive using IntelliConfig. There are several special registers with fixed meaning (reserved registers) which are listed in a separate table in this chapter.

Modbus address	Meaning	Access	MODICON object type	Modbus function
0000 .. 0999	Binary objects	Read only	Discrete Inputs	Read: 01, 02
1000 .. 2999	Values	Read only	Input Registers	Read: 03, 04
3000 .. 3999	Setpoints	Read/Write	Holding Registers	Read: 03, 04 Write: 06, 16
4200 .. 7167	Reserved registers	Read/Write, depends on each specific register	Input Registers Holding Registers	Read: 03, 04 Write: 06, 16



## Configurable part of the map

The contents of the configurable part of the map is specified in the configuration table. It can be changed by the customer as well as exported in a human-readable format using the configuration tool.

### Discrete inputs

The discrete inputs are read-only objects located in the address range 0-999. The source ComAp objects for discrete inputs can be:

- Single bit of any value of any binary type.
- Protection (e.g. 2nd-level protection of the state "xyz"). The input is high if the protection is active regardless of if it is configured or not.

### Input registers

The input registers are read-only numeric values located in the address range 1000-2999. The source ComAp objects can be:

- Any controller value of any data type. The mapping of the particular data type into registers is described in **Mapping data types to registers (page 218)**.

### Holding registers

The holding registers are read-write numeric values located in the address range 3000-3999. The source ComAp objects can be:

- Any controller setpoint of a primitive data type. The mapping of the particular data type into registers is described in **Mapping data types to registers (page 218)**.

**Note:** Setpoint must be configured with access level 0 to allow writing it via MODBUS.

## Mapping data types to registers

As there are multiple data types in the controller but only one data type in MODBUS (the register, which is 2 byte long), a mapping table is necessary to compose and decompose the MODBUS messages correctly.

Data type	Meaning	Number of registers	Data mapping
Integer8	1-byte signed integer	1	MSB = sign extension LSB = value
Unsigned8	1-byte unsigned integer	1	MSB = 0 LSB = value
Integer16	2-byte signed integer	1	MSB = value, MSB LSB = value, LSB
Unsigned16	2-byte unsigned integer	1	MSB = value, MSB LSB = value, LSB
Integer32	4-byte signed integer	2	MSB1 = value, byte 3 (MSB) LSB1 = value, byte 2 MSB2 = value, byte 1 LSB2 = value, byte 0 (LSB)
Unsigned32	4-byte unsigned integer	2	MSB1 = value, byte 3 (MSB)

Data type	Meaning	Number of registers	Data mapping
			LSB1 = value, byte 2 MSB2 = value, byte 1 LSB2 = value, byte 0 (LSB)
Binary8	8-bit binary value	1	MSB = 0 LSB = value, bits 0-7
Binary16	16-bit binary value	1	MSB = value, bits 8-15 LSB = value, bits 0-7
Binary32	32-bit binary value	2	MSB1 = value, bits 24-31 LSB1 = value, bits 16-23 MSB2 = value, bits 8-15 LSB2 = value, bits 0-7
Char	1-byte ASCII character	1	MSB = 0 LSB = ASCII value of the character
StrList	Index into a list of strings	1	MSB = 0 LSB = index into the list
ShortStr	Zero-terminated string of max 15 ASCII characters.	8	MSB1 = ASCII value of the 1. character LSB1 = ASCII value of the 2. character MSB2 = ASCII value of the 3. character LSB2 = ASCII value of the 4. character ...
LongStr	Zero-terminated string of max 31 ASCII characters.	16	MSB1 = ASCII value of the 1. character LSB1 = ASCII value of the 2. character MSB2 = ASCII value of the 3. character LSB2 = ASCII value of the 4. character ...
Date	Date (dd-mm-yy)	2	MSB1 = BCD (dd) LSB1 = BCD (mm) MSB2 = BCD (yy) LSB2 = 0
Time	Time (hh-mm-ss)	2	MSB1 = BCD (hh) LSB1 = BCD (mm) MSB2 = BCD (ss) LSB2 = 0
Alarm	An item of the Alarmlist	27	MSB1 = reserved for future use LSB1 = reserved for future use MSB2 = Alarm level *) LSB2 = Alarm status **) MSB3 = alarm string ***)

Data type	Meaning	Number of registers	Data mapping
			LSB3 = alarm string MSB4 = alarm string LSB5 = alarm string ...

\*) 1 .. level 1 (yellow), 2 .. level 2 (red)

\*\*) Bit0 – alarm is active, Bit1 – alarm is confirmed

\*\*\*) String encoding is UTF-8

## Error codes (exception codes)

Exception code is returned by the controller (server) if the query sent from the client could not be completed successfully.

The controller responds with the error codes in as follows:

- 01 – Illegal function is returned if an incompatible type of operation is applied for a specific object, e.g. if function 03 is applied to a binary object.
- 02 – illegal address is returned if the client tries to perform an operation with a object address that is not related to any existing object or that is located inside an object which is composed by multiple addresses (registers).
- 04 – device error is returned in all other erroneous situations. More detailed specification of the problem can be consequently obtained by reading the registers 4205 – 4206.

## Reserved registers

There are several registers with specific meaning. These registers are available in all controllers regardless of the configuration.

Register addresses	Number of registers	Access	Data type	Meaning
4200 - 4201	2	read/write	Time	RTC Time in BCD code
4202 - 4203	2	read/write	Date	RTC Date in BCD code
4204	1	read/write	Unsigned8	Index of the language that is used for text data provided by Modbus (e.g. alarmlist messages).
4205 - 4206	2	read	Unsigned32	Last application error. To be read after the device returns the exception code 04. It contains specific information about the error.
4207 - 4208	2	read/write	Unsigned32	Writing: command argument Reading: command return value
4209	1	write	Unsigned16	Command code
4210	1	-	-	Not implemented
4211	1	write	Unsigned16	Password
4212 - 4213	2	read	Unsigned32	Communication status

Register addresses	Number of registers	Access	Data type	Meaning
4214	1	read	Unsigned8	Number of items in the Alarmlist
4215 - 4241	27	read	Alarm	1. record in alarm list
4242 - 4268	27	read	Alarm	2. record in alarm list
4269 - 4295	27	read	Alarm	3. record in alarm list
4296 - 4322	27	read	Alarm	4. record in alarm list
4323 - 4349	27	read	Alarm	5. record in alarm list
4350 - 4376	27	read	Alarm	6. record in alarm list
4377 - 4403	27	read	Alarm	7. record in alarm list
4404 - 4430	27	read	Alarm	8. record in alarm list
4431 - 4457	27	read	Alarm	9. record in alarm list
4458 - 4484	27	read	Alarm	10. record in alarm list
4485 - 4511	27	read	Alarm	11. record in alarm list
4512 - 4538	27	read	Alarm	12. record in alarm list
4539 - 4565	27	read	Alarm	13. record in alarm list
4566 - 4592	27	read	Alarm	14. record in alarm list
4593 - 4619	27	read	Alarm	15. record in alarm list
4620 - 4646	27	read	Alarm	16. record in alarm list
5000	1	read/write	Int16	<b>RemoteControl2B 1 (page 455)</b>
5001	1	read/write	Int16	<b>RemoteControl2B 2 (page 456)</b>
5002	1	read/write	Int16	<b>RemoteControl2B 3 (page 456)</b>
5003	1	read/write	Int16	<b>RemoteControl2B 4 (page 456)</b>
5004	1	read/write	Int16	<b>RemoteControl2B 5 (page 456)</b>
5005	1	read/write	Int16	<b>RemoteControl2B 6 (page 457)</b>
5006	1	read/write	Int16	<b>RemoteControl2B 7 (page 457)</b>
5007	1	read/write	Int16	<b>RemoteControl2B 8 (page 457)</b>
5100 - 5101	2	read/write	Int32	<b>RemoteControl4B 1 (page 457)</b>
5102 - 5103	2	read/write	Int32	<b>RemoteControl4B 2 (page 458)</b>
5104 - 5105	2	read/write	Int32	<b>RemoteControl4B 3 (page 458)</b>
5106 - 5107	2	read/write	Int32	<b>RemoteControl4B 4 (page 458)</b>
5200	1	read/write	Binary16	<b>RemoteControlBin (page 458)</b>

## List of commands and arguments

**IMPORTANT:** Only commands configured with access level 0 can be invoked via Modbus.

"Commands" are used to invoke a specific action in the controller via the communication channel. The list of available actions is in the table below. The general procedure of writing a command via Modbus is as follows:

1. Write the command argument into the registers 44208-44209 (register addresses 4207-4208). Use function 16.
2. Write the command code into the register 44210 (register address 4209). Use function 6.

3. (Optional) Read the command return value from the registers 44208-44209 (register addresses 4207-4208). Use function 3.
4. If the command was executed the return value is as listed in the table. If the command was accepted but there was an error during execution the return value indicates the reason:
  - a. 0x00000001 – invalid argument
  - b. 0x00000002 – command refused (e.g. controller not in MAN, breaker can not be closed in the specific situation etc.)

Command code	Action	Argument
Mode cmd 0x03	PRG Mode	0x0000 0000
	RUN Mode	0x0003 0000
Access lock 0x197	Remove Access lock	0x0010 0000
	Set Access lock	0x0020 0000

User Buttons 1 .. 8 0x0047	User Button 1: Pulse	0x000A 0000
	User Button 1: ON/OFF	0x000B 0000
	User Button 1: ON	0x000C 0000
	User Button 1: OFF	0x000D 0000
	User Button 2: Pulse	0x0014 0000
	User Button 2: ON/OFF	0x0015 0000
	User Button 2: ON	0x0016 0000
	User Button 2: OFF	0x0017 0000
	User Button 3: Pulse	0x001E 0000
	User Button 3: ON/OFF	0x001F 0000
	User Button 3: ON	0x0020 0000
	User Button 3: OFF	0x0021 0000
	User Button 4: Pulse	0x0028 0000
	User Button 4: ON/OFF	0x0029 0000
	User Button 4: ON	0x002A 0000
	User Button 4: OFF	0x002B 0000
	User Button 5: Pulse	0x0032 0000
	User Button 5: ON/OFF	0x0033 0000
	User Button 5: ON	0x0034 0000
	User Button 5: OFF	0x0035 0000
	User Button 6: Pulse	0x003C 0000
	User Butto 6: ON/OFF	0x003D 0000
	User Button 6: ON	0x003E 0000
	User Button 6: OFF	0x003F 0000
	User Button 7: Pulse	0x0046 0000
	User Button 7: ON/OFF	0x0047 0000
	User Button 7: ON	0x0048 0000
	User Button 7: OFF	0x0049 0000
	User Button 8: Pulse	0x0050 0000
	User Button 8: ON/OFF	0x0051 0000
	User Button 8: ON	0x0052 0000
	User Button 8: OFF	0x0053 0000

User Buttons 9 .. 16 0x0048	User Button 9: Pulse	0x005A 0000
	User Button 9: ON/OFF	0x005B 0000
	User Button 9: ON	0x005C 0000
	User Button 9: OFF	0x005D 0000
	User Button 10: Pulse	0x0064 0000
	User Button 10: ON/OFF	0x0065 0000
	User Button 10: ON	0x0066 0000
	User Button 10: OFF	0x0067 0000
	User Button 11: Pulse	0x006E 0000
	User Button 11: ON/OFF	0x006F 0000
	User Button 11: ON	0x0070 0000
	User Button 11: OFF	0x0071 0000
	User Button 12: Pulse	0x0078 0000
	User Button 12: ON/OFF	0x0079 0000
	User Button 12: ON	0x007A 0000
	User Button 12: OFF	0x007B 0000
	User Button 13: Pulse	0x0082 0000
	User Button 13: ON/OFF	0x0083 0000
	User Button 13: ON	0x0084 0000
	User Button 13: OFF	0x0085 0000
	User Button 14: Pulse	0x008C 0000
	User Butto 14: ON/OFF	0x008D 0000
	User Button 14: ON	0x008E 0000
	User Button 14: OFF	0x008F 0000
	User Button 15: Pulse	0x0096 0000
	User Button 15: ON/OFF	0x0097 0000
	User Button 15: ON	0x0098 0000
	User Button 15: OFF	0x0099 0000
	User Button 16: Pulse	0x00A0 0000
	User Button 16: ON/OFF	0x00A1 0000
	User Button 16: ON	0x00A2 0000
	User Button 16: OFF	0x00A3 0000

User Buttons 17 .. 24 0x00A8	User Button 17: Pulse	0x00AA 0000
	User Button 17: ON/OFF	0x00AB 0000
	User Button 17: ON	0x00AC 0000
	User Button 17: OFF	0x00AD 0000
	User Button 18: Pulse	0x00B4 0000
	User Button 18: ON/OFF	0x00B5 0000
	User Button 18: ON	0x00B6 0000
	User Button 18: OFF	0x00B7 0000
	User Button 19: Pulse	0x00BE 0000
	User Button 19: ON/OFF	0x00BF 0000
	User Button 19: ON	0x00C0 0000
	User Button 19: OFF	0x00C1 0000
	User Button 20: Pulse	0x00C8 0000
	User Button 20: ON/OFF	0x00C9 0000
	User Button 20: ON	0x00CA 0000
	User Button 20: OFF	0x00CB 0000
	User Button 21: Pulse	0x00D2 0000
	User Button 21: ON/OFF	0x00D3 0000
	User Button 21: ON	0x00D4 0000
	User Button 21: OFF	0x00D5 0000
	User Button 22: Pulse	0x00DC 0000
	User Butto 22: ON/OFF	0x00DD 0000
	User Button 22: ON	0x00DE 0000
	User Button 22: OFF	0x00DF 0000
	User Button 23: Pulse	0x00E6 0000
	User Button 23: ON/OFF	0x00E7 0000
	User Button 23: ON	0x00E8 0000
	User Button 23: OFF	0x00E9 0000
	User Button 24: Pulse	0x00F0 0000
	User Button 24: ON/OFF	0x00F1 0000
	User Button 24: ON	0x00F2 0000
	User Button 24: OFF	0x00F3 0000



User Buttons 25 .. 32 0x00A9	User Button 25 Pulse	0x00FA 0000
	User Button 25 ON/OFF	0x00FB 0000
	User Button 25 ON	0x00FC 0000
	User Button 25 OFF	0x00FD 0000
	User Button 26: Pulse	0x0104 0000
	User Button 26: ON/OFF	0x010540 0000
	User Button 26: ON	0x010640 0000
	User Button 26: OFF	0x010740 0000
	User Button 27: Pulse	0x0101E 0000
	User Button 27: ON/OFF	0x010F 0000
	User Button 27: ON	0x0110 0000
	User Button 27: OFF	0x0111 0000
	User Button 28: Pulse	0x0118 0000
	User Button 28: ON/OFF	0x0119 0000
	User Button 28: ON	0x011A 0000
	User Button 28: OFF	0x011B 0000
	User Button 29: Pulse	0x0122 0000
	User Button 29: ON/OFF	0x0123 0000
	User Button 29: ON	0x0124 0000
	User Button 29: OFF	0x0125 0000
	User Button 30: Pulse	0x012C 0000
	User Butto 30: ON/OFF	0x012D 0000
	User Button 30: ON	0x012E 0000
	User Button 30: OFF	0x012F 0000
	User Button 31: Pulse	0x0136 0000
	User Button 31: ON/OFF	0x0137 0000
	User Button 31: ON	0x0138 0000
	User Button 31: OFF	0x0139 0000
	User Button 32: Pulse	0x0140 0000
	User Button 32: ON/OFF	0x0141 0000
	User Button 32: ON	0x0142 0000
	User Button 32: OFF	0x0143 0000

\* This action is an equivalent of pressing the front panel button

## Modbus RTU examples

### > Reading of Battery voltage

» Export table of values from IntelliConfig

Table: Values									
Allowed MODBUS functions: 03, 04									
Register (s)	Com.Obj.	Name	Dimension	Type	Len	Dec	Min	Max	Group
<b>01036</b>	8213	<b>BatteryVoltage</b>	<b>V</b>	Integer	2	<b>1</b>	0	400	Controller I/O

Request: (Numbers in Hex)							
01	03	04	1D	00	01	15	3C
Controller address	Modbus function	Register address 041D <sub>hex</sub> <b>1053<sub>dec</sub></b>		Number of registers		CRC	

Response: (Numbers in Hex)						
01	03	02	00	F0	B8	00
Controller address	Modbus function	Length of data 02 <sub>hex</sub> 2 bytes read	Data 00F0 <sub>hex</sub> <b>240<sub>dec</sub></b>		CRC	

We read value 240 from register 01036. From table of modbus registers we get dimension of read value and "Dec". Dec=1 means shift one decimal place to the right. So battery voltage is **24.0 V**.

## > Reading Nominal power

» Export table of values from InteliConfig

Table: Values									
Allowed MODBUS functions: 03, 04									
Register (s)	Com.Obj.	Name	Dimension	Type	Len	Dec	Min	Max	Group
<b>01228</b>	9018	<b>Nominal Bus Import</b>	<b>kW</b>	Integer	2	<b>0</b>	0	32767	Basic Settings

Request: (Numbers in Hex)							
01	03	04	CC	00	01	45	05
Controller address	Modbus function	Register address 04CC <sub>hex</sub> 1228 <sub>dec</sub>		Number of registers		CRC	

Response: (Numbers in Hex)						
01	03	02	00	C8	B9	D2
Controller address	Modbus function	Length of data 02 <sub>hex</sub> 2 bytes read	Data 00C8 <sub>hex</sub> <b>200</b> <sub>dec</sub>		CRC	

Read nominal power is 200 kW.

➤ **Reading all binary inputs as modbus register**

Table: Values									
Allowed MODBUS functions: 03, 04									
Register (s)	Com.Obj.	Name	Dimension	Type	Len	Dec	Min	Max	Group
<b>01068</b>	8235	<b>Binary Inputs</b>		Binary#2	2	<b>0</b>	-	-	Controller I/O

Request: (Numbers in Hex)							
01	03	04	2C	00	01	44	F3
Controller address	Modbus function	Register address 042C <sub>hex</sub> 1068 <sub>dec</sub>		Number of registers		CRC	

Response: (Numbers in Hex)						
01	03	02	00	12	38	49
Controller address	Modbus function	Length of data 02 <sub>hex</sub> 2 bytes read	Data 0012 <sub>hex</sub> <b>00010010</b> <sub>bin</sub>		CRC	

Binary inputs is 00010010. It means Binary input 2 and binary input 5 are active.

**Note:** You can use Modbus function 4 instead of 3, rest of data remain same (CRC differs).

## > Reading specific binary inputs

Table: Binaries						
Allowed MODBUS functions: 01, 02						
Addresses Modbus Addr. Prot. Addr.	Source = Value = State	C.O.# State #	Name of Value Name of State	Bit #	Bit Name Activated by protection (s):	Group
00000	Value	8235	Binary Inputs	0	BTB Feedback	Controller I/O
00001	Value	8235	Binary Inputs	1	CU-BIN-2	Controller I/O
00002	Value	8235	Binary Inputs	2	CU-BIN-3	Controller I/O

We will read state of BTB Feedback binary input.

Request: (Numbers in Hex)							
01	01	00	01	00	01	AC	0A
Controller address	Modbus function	Register address 0001 <sub>hex</sub> 0001 <sub>dec</sub>		Number of registers		CRC	

Response: (Numbers in Hex)					
01	01	01	01	90	48
Controller address	Modbus function	Length of data 01 <sub>hex</sub> 1 byte read		Data 01 <sub>hex</sub> active	CRC

The readed data is 01, it means this binary input is active.

**Note:** You can use Modbus function 2 instead of 1, rest of data remains same (CRC differs).

## > Nominal Power – writing

Table: Setpoints									
Allowed MODBUS functions: 03, 04, 06, 16									
Register (s)	Com.Obj.	Name	Dimension	Type	Len	Dec	Min	Max	Group
<b>03008</b>	8276	<b>Nominal Power</b>	<b>kW</b>	Unsigned	2	<b>0</b>	1	5000	Basic Settings

Request: (Numbers in Hex)							
01	06	0B	C0	00	64	8A	39
Controller address	Modbus function	Register address 0BC0 <sub>hex</sub> = <b>3008</b> <sub>dec</sub>		Data 0064 <sub>hex</sub> = <b>100</b> <sub>dec</sub>		CRC	

Response: (Numbers in Hex)							
01	06	0B	C0	00	00	8B	D2
Controller address	Modbus function	Register address 0BC0 <sub>hex</sub> = <b>3008</b> <sub>dec</sub>		Allways zero		CRC	

Written setpoint nominal power is 100 kW.

## > CRC calculation

The check field allows the receiver to check the validity of the message. The check field value is the Cyclical Redundancy Check (CRC) based on the polynomial  $x^{16}+x^{15}+x^2+1$ . CRC is counted from all message bytes preceding the check field.

Online CRC calculator: <http://www.lammertbies.nl/comm/info/crc-calculation.html> Use CRC-16 (Modbus)

Write LSB first.

For writing nominal power 100 kW the CRC is calculated from this data: 01060BC00064<sub>hex</sub>

🔍 back to Connection to 3rd party systems

# 7 Technical data

## Power supply

Power supply range	8-36 V DC
Power consumption	16 W
RTC battery	Replaceable, type CR1632 3V
Fusing power	8 A
Consumption	2.5 A Controller + 10 x 0.5 A BOUs
Fusing E-STOP	1.2 A
Max. Heat Dissipation	16 W

## Operating conditions

Operating temperature	-40 °C to +70 °C
Storage temperature	-40 °C to +80 °C
Operating humidity (norm 60068-2-30)	25/55°C, 48hours,95 % non-condensing (EN 60068-2-30)
Protection degree	IP20
Vibration	5-25 Hz, $\pm 1.6$ mm 25-100 Hz, $a = 4$ g
Shocks	$a = 500$ m/s <sup>2</sup>
Surrounding air temperature rating 70 °C.	
Suitable for pollution degree 2.	

## AC Current measurement

Measurement inputs	3ph Mains (Bus Left) current 1ph Bus (Bus Right) current (Auxiliary current)
Measurement range	1 A / 5 A
Maximum continuous current	2 A / 10 A
Allowed overload	18 A for 15 sec.
Accuracy	$\pm 3$ mA / $\pm 15$ mA for 0.0 to 0.4 A / 0.0 to 2.0 A 0.75 % of value for 0.4 to 1.0 A / 2.0 to 5.0 A
Frequency range	40-70 Hz (accuracy 0.002 %)
Input impedance	0.68 M $\Omega$ ph-ph , 0.34 M $\Omega$ ph-n

## AC Voltage measurement

Measurement inputs	3ph-n Mains (Bus Left) voltage 3ph-n Bus (Bus Right) voltage
Measurement range	115 V ph-N / 200 V ph-ph suitable also for VTs output 231 V ph-N / 400 V ph-ph UL, cUL: 346 V ph-N / 600 V ph-ph
Linear measurement and protection range (maximal voltage)	433 V ph-N / 750 V ph-ph
Accuracy	0.25 %
Frequency range	40-70 Hz (accuracy 0.002 %)
Input impedance	0.72 M $\Omega$ ph-ph , 0.36 M $\Omega$ ph-n
Measurement category CAT III, overvoltage category III	

## E-Stop

Physically disconnects BO 1 & BO 2 from power supply.
---

## Binary inputs

Number	12, non-isolated
Close/Open indication	0-2 V DC close contact 6-36 V DC open contact
Configurable	Pull-up / Pull-down
Pulse input	Bin 9 and 10 max. 50 Hz

## Binary outputs

Number	12, non-isolated
Max. current	0.5 A
Switching to	Positive supply terminal

## Analog inputs

Number	4, switchable (R/U/I)
Range	R = 0-10000 $\Omega$ ; U = 0-10 V; I = 0-20 mA
Accuracy	R: 2 % from value for 0-250 $\Omega$
	R: 4% from value for 250-2500 $\Omega$
	R: 6 % from value for 5000-10000 $\Omega$
	U: 1% from value $\pm 100$ mV
	I: 1% from value $\pm 200$ $\mu$ A

## Analog output 1

Protection	Reinforced isolation
Type	Switchable: U $\pm 10$ V, I $\pm 20$ mA, PWM: 0 V/5 V
Accuracy	U: 1 % from value $\pm 100$ mV
	I: 1 % from value $\pm 200$ $\mu$ A

## Analog output 2

Protection	Basic isolation
Type	Switchable: U $\pm 10$ V, I $\pm 20$ mA, PWM: 0 V/5 V
Accuracy	U: 1 % from value $\pm 100$ mV
	I: 1 % from value $\pm 200$ $\mu$ A

## Communications

USB Device	Basic isolation, USB type B
RS 485	Basic isolation
ETH1 ETH2 ETH3	10/100 Mbit
CAN 1A CAN 2A CAN 1B CAN 2B	Basic isolation, 1000/250/50 kbps , nominal impedance 120 $\Omega$
Protocols	Modbus RTU/TCP SNMP V1/V2c/V3

## Weight

Controller	750 g
Package	920 g

Controller handles 300 million records into the History, which represents roughly 1 record per second during 9,5 years. Shall be the History recording faster, the controller lifetime will become smaller.



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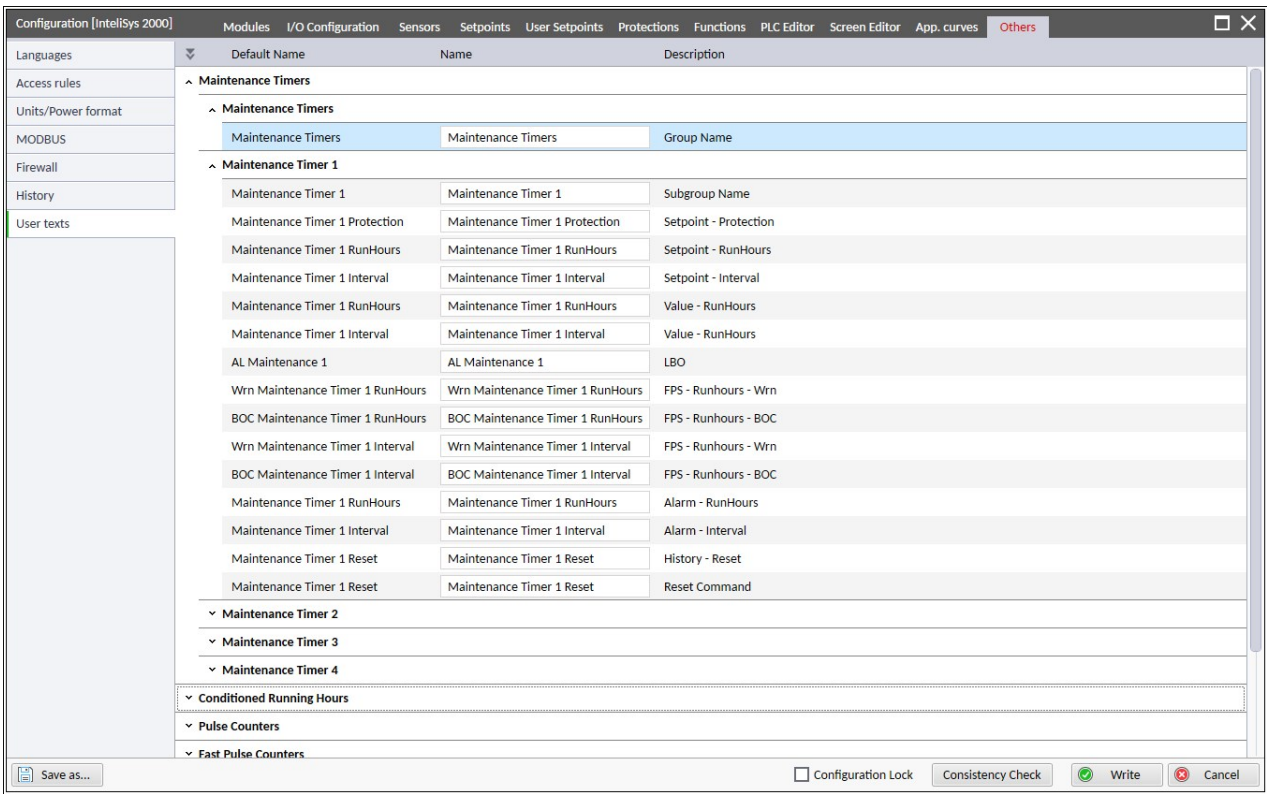
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# 8.1.2 Renameable controller objects

It is possible to rename some controller objects in IntelliConfig under **Controller Configuration -> Others -> User texts** tab. The User texts include communication objects, group names, subgroup names, alarms, etc. The user can name those objects according his needs.



## 8.1.3 Setpoints

### What setpoints are:

Setpoints are analog, binary or special data objects which are used for adjusting the controller to the specific environment. Setpoints are organized into groups according to their meaning. Setpoints can be adjusted from the controller front panel, PC, MODBUS, etc.

All setpoints can be protected by a password against unauthorized changes. Password protection can be assigned to the setpoints during the configuration procedure.

**IMPORTANT: Do not write setpoints repeatedly (e.g. power control from a PLC by repeated writing of baseload setpoint via Modbus). The setpoints are stored in FRAM memory, which is designed to withstand up to  $10^{14}$  read/write cycles without risk of damage or data loss, but it may become damaged, when the allowed number of reading/writing cycles is exceeded.**

For full list of setpoints go to the chapter **List of setpoints (page 237)**.

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## Group: Basic settings

### Subgroup: Name

#### Controller Name

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	InteliMains1010 BTB SC	Force value	NO
Step	[-]		
Comm object	8637	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
User defined name, used for the controller identification at remote phone or mobile connection. Controller Name is maximally 15 characters long and can be entered using InteliConfig or from controller's configuration menu.			

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### Subgroup: Power settings

#### Nominal Bus Import


Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	1 .. 32 000 [kW] (depends on the selected <b>Power Formats And Units (page 166)</b> )		
Default value	200 kW (depends on the selected <b>Power Formats And Units (page 166)</b> )	Force value	YES
Step	1 kW (depends on the selected <b>Power Formats And Units (page 166)</b> )		
Comm object	8276	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Nominal power imported from the Bus.			

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## Subgroup: Current settings

### Nominal Current

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	1 .. 10000 [A]		
Default value	350A	Force value	YES
Step	1 A		
Comm object	8275	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Current limit for current protections and maximal continuous current.			

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### Bus Left CT Ratio Prim

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	1 .. 15000 [A]		
Default value	500 A	Force value	NO
Step	1 A		
Comm object	8274	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint defines the primary range of the current transformer used for the Bus Left current measurement.			
<b>Note:</b> The setpoint is applied on all three phases of the Bus Left current.			
<b>Note:</b> The CT is usually described by this definition: <b>CT Ratio Prim / CT Ratio Sec</b> : Example: 100/5, 500/5, 1000/1			

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## Bus Left CT Ratio Sec

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	/5A or /1A [-]		
Default value	/5A	Force value	NO
Step	[-]		
Comm object	10556	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint defines the secondary range of the current transformer used for the Bus Left current measurement.			
<b>Note:</b> This setpoint is applied on all three phases of the Bus Left current.			
<b>Note:</b> The CT is usually described by this definition: <b>CT Ratio Prim / CT Ratio Sec</b> : Example: 100/5, 500/5, 1000/1			

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## Subgroup: Voltage settings

### Connection type

Setpoint group	Basic settings	Related FW	1.1.0						
Range [units]	3ph4Wire / High Leg D / 3ph3Wire / SplitPhase / MonoPhase [-]								
Default value	3Ph4Wire [-]	Force value	NO						
Step	[-]								
Comm object	11628	Related applications	BTB						
Config level	Standard								
Setpoint visibility	Always								
Description									
This setpoint defines connection type of the installation.									
<table><tr><td>3Ph4Wire</td><td>Grounded Star (Grounded Wye) connection – 3PY Three phase voltage measurement L1,L2,L3 with 120° phase shift 3x CT (Current Transformer)</td></tr><tr><td>High Leg D</td><td>High Leg Delta connection Three phase voltage measurement L1,L2,L3 3x CT (Current Transformer)</td></tr><tr><td>3Ph3Wire</td><td>Ungrounded Delta connection Open Delta Ungrounded Wye Corner-Grounded Delta Split Phase Delta</td></tr></table>				3Ph4Wire	Grounded Star (Grounded Wye) connection – 3PY Three phase voltage measurement L1,L2,L3 with 120° phase shift 3x CT (Current Transformer)	High Leg D	High Leg Delta connection Three phase voltage measurement L1,L2,L3 3x CT (Current Transformer)	3Ph3Wire	Ungrounded Delta connection Open Delta Ungrounded Wye Corner-Grounded Delta Split Phase Delta
3Ph4Wire	Grounded Star (Grounded Wye) connection – 3PY Three phase voltage measurement L1,L2,L3 with 120° phase shift 3x CT (Current Transformer)								
High Leg D	High Leg Delta connection Three phase voltage measurement L1,L2,L3 3x CT (Current Transformer)								
3Ph3Wire	Ungrounded Delta connection Open Delta Ungrounded Wye Corner-Grounded Delta Split Phase Delta								

	Three phase voltage measurement L1,L2,L3 with 120° phase shift No neutral is available 3x CT (Current Transformer)
SplitPhase	Double Delta connection Split Phase Two phase voltage measurement L1,L2 with 180° phase shift 2x CT (Current Transformer)
Mono Phase	Single phase voltage measurement L1-N 1x CT (Current Transformer)

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### Bus Right AC Bus Nominal Voltage Ph-N

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	10 .. 34641 [V]		
Default value	277 V	Force value	YES
Step	1 V		
Comm object	8277	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only ifConnection type (page 244) != High Leg D or Connection type (page 244) != MonoPhase		
Description			
Nominal Bus Right voltage (phase to neutral).			

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### Bus Right Nominal Voltage Ph-Ph

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	10 .. 60000 [V]		
Default value	480 V	Force value	YES
Step	1 V		
Comm object	11657	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Nominal Bus Right voltage (phase to phase).			

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## Bus LeftAC Shore Nominal Voltage Ph-N

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	10 .. 34641 [V]		
Default value	277 V	Force value	YES
Step	1 V		
Comm object	9888	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only ifConnection type (page 244) != High Leg D or Connection type (page 244) != MonoPhase		
Description			
Nominal Bus Left voltage (phase to neutral).			

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## Bus Left Nominal Voltage Ph-Ph

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	10 .. 60000 [V]		
Default value	480 V	Force value	YES
Step	1 V		
Comm object	9907	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Nominal Bus Left voltage (phase to phase).			

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## Bus Left VT Ratio

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	0.01 .. 6000.00 [V/V]		
Default value	1.00 V/V	Force value	NO
Step	0.01 V/V		
Comm object	20281	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the converting ratio of the voltage meas transformer used on ① MAINS (BUS-L) VOLTAGE			
Note: This setpoint is applied on all three phases of Bus Left voltage.			

**Example:**

- No VT is in use - voltage conversion is 1/1  
Bus Left VT Ratio = 1.00
- VT 22kV/100V - voltage conversion is 22000/100  
Bus Left VT Ratio = 220.00
- VT 3.3kV/110V - voltage conversion is 3300/110  
Bus Left VT Ratio = 30.00

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## Bus Left Voltage Input Range Select

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	200V / 400V / 600V [-]		
Default value	600 V	Force value	YES
Step	[-]		
Comm object	10662	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the range of Ph-Ph <b>AC Voltage measurement settings (page 16)</b> on the ① <b>MAINS (BUS-L) VOLTAGE</b> .			
<i><b>Note:</b> It is possible to accurately measure Ph-Ph voltage which is maximally 25 % above the selected range. So the maximal accurately measured voltage for the controller is 433 V Ph-N / 750 V Ph-Ph with the selected range 600 V.</i>			
<i><b>Note:</b> If MonoPhase wiring is used the ranges are approximately corresponding to 116 V, 231 V, and 346 V Ph-N.</i>			
<b>IMPORTANT:</b> The range has to be set to fit the expected range of the AC voltage.			

⬅ back to List of setpoints

## Bus Right VT Ratio

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	0.01 .. 6000.00 [V/V]		
Default value	1.00 V/V	Force value	NO
Step	0.01 V/V		
Comm object	20282	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the converting ratio of the voltage meas transformer used on <b>② BUS (BUS-R) VOLTAGE</b>			

**Note:** This setpoint is applied on all three phases of Bus Right voltage.

**Example:**

- No VT is in use - voltage conversion is 1/1  
Bus Right VT Ratio = 1.00
- VT 22kV/100V - voltage conversion is 22000/100  
Bus Right VT Ratio = 220.00
- VT 3.3kV/110V - voltage conversion is 3300/110  
Bus Right VT Ratio = 30.00

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## Bus Right Voltage Input Range

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	200V / 400V / 600V [-]		
Default value	600 V	Force value	YES
Step	[-]		
Comm object	10663	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the range of Ph-Ph <b>AC Voltage measurement settings (page 16)</b> on the <b>Ⓢ BUS (BUS-R) VOLTAGE</b> .			
<i><b>Note:</b> It is possible to accurately measure Ph-Ph voltage which is maximally 25 % above the selected range. So, the maximal accurately measured voltage for the controller is 433 V Ph-N / 750 V Ph-Ph with the selected range 600 V.</i>			
<i><b>Note:</b> If MonoPhase wiring is used the ranges are approximately corresponding to 116 V, 231 V, and 346 V Ph-N.</i>			
<b>IMPORTANT:</b> The range has to be set to fit the expected range of the AC voltage.			

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## Bus Right Dead Level

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	0.0 .. 13.0 [%] of Bus Right AC Bus Nominal Voltage Ph-N (page 245) and Bus Right Nominal Voltage Ph-Ph (page 245)		
Default value	6.5 % of Bus Right AC Bus Nominal Voltage Ph-N (page 245) and Bus Right Nominal Voltage Ph-Ph (page 245)	Force value	NO
Step	0.1 % of Bus Right AC Bus Nominal Voltage Ph-N (page 245) and Bus Right Nominal Voltage Ph-Ph (page 245)		

Comm object	14473	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint defines the percentage voltage level below which is Bus Right considered as dead.			

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## Bus Left Dead Level

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	0.0 .. 13.0 [%] of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Default value	6.5 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)	Force value	YES
Step	0.1 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Comm object	14474	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint defines the percentage voltage level below which is Bus Left considered as dead.			

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## Subgroup: Phase Rotation

### Phase Rotation

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	Clockwise / Counterclockwise [-]		
Default value	Clockwise	Force value	YES
Step	[-]		
Comm object	15122	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjust the phase sequence of voltage terminals.			

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## Subgroup: Frequency settings

### Nominal Frequency

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	33.00 .. 520.00 [Hz]		
Default value	60,00 Hz	Force value	YES
Step	0.01 Hz		
Comm object	8278	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Nominal frequency of system (usually 50 or 60 Hz).			

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## Subgroup: Controller settings

### Controller mode

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	PRG / RUN [-]		
Default value	OFF	Force value	NO
Step	[-]		
Comm object	8315	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint can be used for changing the controller's mode remotely, e.g. via Modbus.			
InteliConfig: Use the mode selector on the main screen for changing the mode from the front panel.			

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## Power On Mode

Setpoint group	Basic settings	Related FW	1.1.0				
Range [units]	Previous / PRG [-]						
Default value	Previous	Force value	NO				
Step	[-]						
Comm object	13000	Related applications	BTB				
Config level	Advanced						
Setpoint visibility	Always						
Description							
This setpoint adjusts controller mode after power on of controller.							
<table><tr><td>Previous</td><td>Controller is switched into the last mode before power off.</td></tr><tr><td>PRG</td><td>Controller is switched into PRG mode.</td></tr></table>				Previous	Controller is switched into the last mode before power off.	PRG	Controller is switched into PRG mode.
Previous	Controller is switched into the last mode before power off.						
PRG	Controller is switched into PRG mode.						
<p><b>Note:</b> Remote modes - In case that some LBI remote mode is activated during power on of controller than this LBI has higher priority than this setpoint - controller mode is forced into mode selected via LBI. After deactivation of LBI, controller is switched into value selected via setpoint Power On Mode</p>							

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## Horn Timeout

Setpoint group	Basic settings	Related FW	1.1.0						
Range [units]	Disabled = 0; 1 .. 600; Horn Reset [s]								
Default value	10 s	Force value	NO						
Step	1 s								
Comm object	8264	Related applications	BTB						
Config level	Advanced								
Setpoint visibility	Always								
Description									
This setpoint affects horn's behavior.									
<table><tr><td>Disabled</td><td>Horn sound is disabled e.g. LBO HORN (PAGE 572) is never activated</td></tr><tr><td>1 .. 600 [s]</td><td>Timeout for LBO HORN (PAGE 572). Output opens after this time elapses</td></tr><tr><td>Horn Reset</td><td>LBO HORN (PAGE 572) is active until button Horn Reset is pressed.</td></tr></table>				Disabled	Horn sound is disabled e.g. LBO HORN (PAGE 572) is never activated	1 .. 600 [s]	Timeout for LBO HORN (PAGE 572). Output opens after this time elapses	Horn Reset	LBO HORN (PAGE 572) is active until button Horn Reset is pressed.
Disabled	Horn sound is disabled e.g. LBO HORN (PAGE 572) is never activated								
1 .. 600 [s]	Timeout for LBO HORN (PAGE 572). Output opens after this time elapses								
Horn Reset	LBO HORN (PAGE 572) is active until button Horn Reset is pressed.								
<b>Note:</b> Horn timeout starts again from the beginning if any new alarm appears before previous Horn timeout has elapsed.									

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## Fail Safe Binary State

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	Log0 / Log1 / Last Valid State [-]		
Default value	Last Valid State	Force value	YES
Step	[-]		
Comm object	21215	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of all binary inputs while the received value is invalid (communication lost). Changes of the setpoint will not be applied on peripherals which are already in fail safe binary state.			
Log0		The value is logical zero.	
Log1		The value is logical one.	
Last Valid State		The value is replaced by last valid state.	

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## SW Key

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	31 characters [-]		
Default value	AUTO	Force value	NO
Step	[-]		
Comm object	24258	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint is designed for SW Key which unlocks premium features.			

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## User Logging Record

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	Enabled / Disabled		
Default value	Enabled	Force value	NO
Step	[-]		
Comm object	23885	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables recording of user login in/out to the controller history.			
<div><b>Example:</b> The fallowing records will be shown in the history if enabled: User with user index (0) loegged in via ETH.</div>			

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## Subgroup: Controller Redundancy

### Hot Swap Redundancy

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	Disabled / Master / Backup [-]		
Default value	Disabled	Force value	YES
Step	-		
Comm object	16716	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of <b>Hot Swap Redundancy (page 138)</b> function.			
Disabled	Hot Swap Redundancy function is disabled.		
Master	Hot Swap Redundancy function is enabled and the controller acts as the Master device.		
Backup	Hot Swap Redundancy function is enabled and the controller acts as the Backup device.		

Note: Hot Swap Redundancy function can be enabled only if you have correct SW Key (page 252).

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## Subgroup: Battery Protections

### Battery Undervoltage

Setpoint group	Basic settingsBasic settings	Related FW	1.1.0
Range [units]	8.0 V .. <b>Battery Overvoltage (page 254)</b> [V]		
Default value	18.0 V	Force value	NO
Step	0.1 V		
Comm object	8387	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Warning threshold for low battery voltage.			

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### Battery Overvoltage

Setpoint group	Basic settingsBasic settings	Related FW	1.1.0
Range [units]	Battery Undervoltage (page 254) .. 40.0 [V]		
Default value	36.0 V	Force value	NO
Step	0.1 V		
Comm object	9587	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Warning threshold for high battery voltage.			

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## Battery Under And Overvoltage Delay

Setpoint group	Basic settingsBasic settings	Related FW	1.1.0
Range [units]	0 .. 600 [s]		
Default value	5 s	Force value	NO
Step	1 s		
Comm object	8383	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Delay for which battery voltage can be out of range given by setpoints <b>Battery Undervoltage (page 254)</b> and <b>Battery Overvoltage (page 254)</b> . After this delay elapses, appropriate alarm ( <b>AHI Battery Undervoltage (page 675)</b> or <b>AHI Battery Overvoltage (page 674)</b> ) is activated.			

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## Subgroup: Group Settings

### Group Link L

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	1 .. 32 [-]		
Default value	1 [-]	Force value	YES
Step	1 [-]		
Comm object	10590	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to select which group is located at the left side of the group link breaker. (bus tie breaker). If this particular controller is not used for the group link function, adjust this setpoint to 1.			

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## Group Link R

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	1 .. 32 [-]		
Default value	2 [-]	Force value	YES
Step	1 [-]		
Comm object	10591	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to select which group is located at the right side of the group link breaker. (bus tie breaker). If this particular controller is not used for the group link function, adjust this setpoint to 1.			

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## Subgroup: Time & Date

### Time

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	HH:MM:SS [-]		
Default value	0:0:0	Force value	NO
Step	[-]		
Comm object	24554	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Real time clock adjustment.			

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### Date

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	YYYY-MM-DD [-]		
Default value	2017-01-01	Force value	NO
Step	[-]		
Comm object	24553	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Actual date adjustment.			

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## Time Stamp Act

Setpoint group	Scheduler	Related FW	1.1.0						
Range [units]	Disabled / Condition / Always [-]								
Default value	Enabled	Force value	NO						
Step	[-]								
Comm object	10532	Related applications	BTB						
Config level	Standard								
Setpoint visibility	Always								
Description									
This setpoint adjusts the behavior of periodic history records.									
<table><tr><td>Disabled</td><td>Periodic history records are disabled.</td></tr><tr><td>Condition</td><td>Periodic history records are enabled. Records are written to the history according to the setpoint Time Stamp Period if LBI Time Stamp Act is activated.</td></tr><tr><td>Always</td><td>Periodic history records are enabled. Records are written to the history according to setpoint Time Stamp Period.</td></tr></table>				Disabled	Periodic history records are disabled.	Condition	Periodic history records are enabled. Records are written to the history according to the setpoint Time Stamp Period if LBI Time Stamp Act is activated.	Always	Periodic history records are enabled. Records are written to the history according to setpoint Time Stamp Period.
Disabled	Periodic history records are disabled.								
Condition	Periodic history records are enabled. Records are written to the history according to the setpoint Time Stamp Period if LBI Time Stamp Act is activated.								
Always	Periodic history records are enabled. Records are written to the history according to setpoint Time Stamp Period.								

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## Time Stamp Period

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	Off / 1 .. 240 [min]		
Default value	60 min	Force value	YES
Step	1 min		
Comm object	8979	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Time interval for periodic history records.			

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## Time Zone

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	GMT-12:00 .. GMT+13:00 [hours]		
Default value	GMT+1:00	Force value	NO
Step	[-]		
Comm object	24366	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to select the time zone where the controller is located. See your computer time zone setting (click on the time indicator located in the rightmost position of the Windows task bar) if you are not sure about your time zone.			
<b>Note:</b> <i>If the time zone is not selected properly the active e-mails may contain incorrect information about sending time, which may result in confusion when the respective problem actually occurred.</i>			

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## DST Switching Mode

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	Disabled / Auto / Manual		
Default value	Auto	Force value	NO
Step	[-]		
Comm object	20250	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoints is used to enable or disable daylight saving time.</p> <ul style="list-style-type: none"><li>&gt; <b>AUTO</b> - activation / deactivation of the DST, and changing of the RTC Time value accordingly is performed automatically by the controller. The user always sees valid local time without any action from his side.</li><li>&gt; <b>MANUAL</b> - activation, and deactivation of the DST is performed manually by the user via the setpoint Time mode. Changing of the RTC Time value accordingly is then performed automatically by the controller. So the user does not need to readjust the RTC time, he only needs to select the proper <b>Time Mode (page 259)</b>.</li><li>&gt; <b>DISABLED</b> - Time mode is fixedly set to STD and the function does not perform any changes of RTC time.</li></ul>			

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## Time Mode

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	STD / DST		
Default value	DST	Force value	NO
Step	[-]		
Comm object	20249	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if DST Switching Mode = Manual		
Description			
In manual <b>DST Switching Mode (page 258)</b> this input is used to adjust the actual time mode. If DST Switching Mode is set to any other option, this input is not taken into account.			

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## DST Period Rule

Setpoint group	Basic settings	Related FW	1.1.0
Range [units]	Australia / Chile / Europe / Mexico / New Zealand / Paraguay / US/Canada		
Default value	US/Canada	Force value	NO
Step	[-]		
Comm object	20251	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if DST Switching Mode = Auto		
Description			
Selection of the rule that will be applied for the calculation of the DST validity period.			

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## Subgroup: Shared Setpoints

### #System Baseload

Setpoint group	Frequency/Load Control	Related FW	1.1.0
Range [units]	0 .. 32 000 [kW] (depends on the selected <b>Power Formats And Units (page 166)</b> )		
Default value	25 kW (depends on the selected <b>Power Formats And Units (page 166)</b> )	Force value	NO
Step	1 kW (depends on the selected <b>Power Formats And Units (page 166)</b> )		
Comm object	8775	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Required total active power of the controller group in parallel to mains operation in Baseload mode.			
<b>Note:</b> The # setpoints are shared with all controllers on site.			
<b>Note:</b> The # setpoints are shared with all controllers on site via intercontroller CAN line.			

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### #System Power Factor

Setpoint group	Load/VAR Control	Related FW	1.1.0
Range [units]	0,60 .. 1,20 [-]		
Default value	1,00 [-]	Force value	NO
Step	0,01 [-]		
Comm object	8776	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Required total power factor of the controller group in parallel to mains operation in PF Control BASE mode.			
<b>Note:</b> If the setpoint value is >1 the Total RunningBus Right Load Character is C, if the setpoint value is <0 the Total RunningBus Right Load Character is L.			
<b>Note:</b> The # setpoints are shared with all controllers on site via intercontroller CAN line.			

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## #System Base Q

Setpoint group	Load/VAR Control	Related FW	1.1.0
Range [units]	-32 000 .. 32 000 [kVAr] (depends on the selected <b>Power Formats And Units</b> (page 166))		
Default value	0 kVAr (depends on the selected <b>Power Formats And Units</b> (page 166))	Force value	NO
Step	1 kVAr (depends on the selected <b>Power Formats And Units</b> (page 166))		
Comm object	16407	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Required total reactive power of the controller group in parallel to mains operation in Q Control BASE mode.			
<b>Note:</b> The # setpoints are shared with all controllers on site via intercontroller CAN line.			

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## Group: Synchronization

### Subgroup: Synchronization

#### Synchronization Type

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	PhaseMatch / SlipSynchr [-]		
Default value	PhaseMatch	Force value	YES
Step	[-]		
Comm object	14802	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the type of <b>Synchronization (page 186)</b> .			
➤ PhaseMatch			
This type of synchronization is based on voltage and phase shift match. Limits are adjusted via setpoints <b>Voltage Window (page 264)</b> and <b>Phase Window (page 265)</b> . When voltage and phase shift match the breaker close command is sent after <b>Dwell Time (page 265)</b> is elapsed.			
➤ SlipSynchr			
This type of synchronization regulates the voltage to match <b>Voltage Window (page 264)</b> and <b>Bus Right Frequency (page 412)</b> to match the <b>Bus Left Frequency (page 407) + Slip Frequency (page 266)</b> . When this frequency is reached, <b>Dwell Time (page 265)</b> starts to be counted down and when elapses, breaker close command is sent.			
<b>IMPORTANT: The breaker close command is sent in advance due to breaker latency which is set via setpoint BTB Latency (page 267).</b>			
<b>Note:</b> Synchronization is not allowed if there is any already synchronized Mains Controller in the control group.			

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## Voltage Matching

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	Enabled/Disabled [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	8645	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines whether voltage regulation will be enabled during synchronization.</p> <p>➤ <b>Enabled:</b> Voltage matching during the Run or Check synchronization types is allowed.</p> <p>➤ <b>Disabled:</b> Voltage matching during synchronization is not allowed. Voltage regulation is frozen during active synchronization.</p> <p><i><b>Note:</b> Disabled option is suitable for adjusting the voltage using a potentiometer directly on AVR.</i></p>			

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## Auto Re-synchronize

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	Enabled/Disabled [-]		
Default value	Disabled	Force value	YES
Step	[-]		
Comm object	19661	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint defines what will happen if the breaker is opened and the command for synchronization / breaker closure is still active.			
<div><div>&gt;</div><div><b>Enabled:</b> If synchronism is lost / breaker is opened and LBI <b>SYNCHRONIZATION RUN (PAGE 557)</b> or <b>SYNCHRONIZATION PERMISSIVE (PAGE 557)</b> is still active the controller will activate synchronization again.</div></div>			
<div><div>&gt;</div><div><b>Disabled:</b> If synchronism is lost / breaker is opened and LBI for synchronization is still active the controller will not activate synchronization again until the currently activated LBI is deactivated and any synchro LBI is activated again.</div></div>			

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## Synchronization Timeout

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	1 .. 1800 [s] / No Timeout		
Default value	60 s	Force value	YES
Step	1 s		
Comm object	8657	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the maximum duration of <b>Synchronization</b> (page 186).			
<i><b>Note:</b> If this setpoint is adjusted to No Timeout then automatic restart of synchronization occurs every 180s. This method helps to synchronize successfully even in difficult conditions.</i>			

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## Voltage Window

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	0,0 .. 100,0 [%]		
Default value	10,0 %	Force value	YES
Step	0,1 %		
Comm object	8650	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the maximal voltage difference between respective phases of Bus Left and Bus Right for <b>Synchronization</b> (page 186). ( <b>Bus Right Voltage L1-N</b> (page 412), <b>Bus Left Voltage L1-N</b> (page 408), <b>Bus Right Voltage L2-N</b> (page 412), <b>Bus Left Voltage L2-N</b> (page 408), ...)			

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Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	-120 .. 120 [°]		
Default value	0 °	Force value	YES
Step	1 °		
Comm object	9578	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to compensate phase shift which is caused by transformer.			

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## Phase Window

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	0 .. 90 [°]		
Default value	10 °	Force value	YES
Step	1 °		
Comm object	8652	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Synchronization Type (page 262)</b> = PhaseMatch		
Description			
<p>This setpoint adjusts the maximal <b>Slip Angle (page 411)</b> for <b>Synchronization (page 186)</b>.</p> <p>In order to disable breaker close command, adjust this setpoint to 0. Synchronization procedure will be active for <b>Synchronization Timeout (page 264)</b> or until breaker is closed from an external device.</p>			

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## Dwell Time

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	0,0 .. 25,0 [s]		
Default value	0,3 s	Force value	YES
Step	0,1 s		
Comm object	8653	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
The period of time that the phase angle difference must be within <b>Phase Window (page 265)</b> and voltage difference within <b>Voltage Window (page 264)</b> before the breaker is closed.			

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## Slip Frequency

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	-0,50 .. 0,50 [Hz]		
Default value	-0,25 Hz	Force value	YES
Step	0,01 Hz		
Comm object	14798	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Synchronization Type (page 262)</b> = SlipSynchr		
Description			
This setpoint adjusts the required <b>Bus Right Frequency (page 412)</b> during synchronization while <b>Synchronization Type (page 262)</b> = SlipSynchr.			
<i><b>Note:</b> Required <b>Bus Right Frequency (page 412)</b> = <b>Bus Left Frequency (page 407)</b> + <b>Slip Frequency</b>.</i>			

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## Slip Frequency Window

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	0,01 .. 0,50 [Hz]		
Default value	0,15 Hz	Force value	YES
Step	0,01 Hz		
Comm object	14799	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Synchronization Type (page 262)</b> = SlipSynchr		
Description			
Window of slip frequency for slip synchronization ( <b>Synchronization Type (page 262)</b> = SlipSynchr).			

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## BTB Latency

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	20 .. 1 000 [ms]		
Default value	80 ms	Force value	YES
Step	1 ms		
Comm object	14801	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Synchronization Type (page 262)</b> = SlipSynchr		
Description			
Latency of BTB.			
<b>IMPORTANT: This setpoint is enable, when Synchronization Type (page 262) has Split Synchro value</b>			

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## Subgroup: BTB Control

### Synchronization R to Mains

Setpoint group	Process Control	Related FW	1.1.0				
Range [units]	Enabled / Disabled [-]						
Default value	Enabled	Force value	NO				
Step	[-]						
Comm object	16047	Related applications	BTB				
Config level	Standard						
Setpoint visibility	Always						
Description							
This setpoint defines the direction of the BTB synchronization.							
<table><tr><td>Disabled</td><td>It is forbidden to synchronize the Bus Right to Bus Left if there is mains on left side.</td></tr><tr><td>Enabled</td><td>It is allowed to synchronize the Bus Right to Bus Left if there is mains on left side.</td></tr></table>				Disabled	It is forbidden to synchronize the Bus Right to Bus Left if there is mains on left side.	Enabled	It is allowed to synchronize the Bus Right to Bus Left if there is mains on left side.
Disabled	It is forbidden to synchronize the Bus Right to Bus Left if there is mains on left side.						
Enabled	It is allowed to synchronize the Bus Right to Bus Left if there is mains on left side.						

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## Synchronization L to Mains

Setpoint group	Process Control	Related FW	1.1.0				
Range [units]	Enabled / Disabled [-]						
Default value	Enabled	Force value	NO				
Step	[-]						
Comm object	16048	Related applications	BTB				
Config level	Standard						
Setpoint visibility	Always						
Description							
This setpoint defines the direction of the BTB synchronization.							
<table><tr><td>Disabled</td><td>It is forbidden to synchronize the Bus Left to Bus Right if there is mains on right side.</td></tr><tr><td>Enabled</td><td>It is allowed to synchronize the Bus Right to Bus Left if there is mains on left side.</td></tr></table>				Disabled	It is forbidden to synchronize the Bus Left to Bus Right if there is mains on right side.	Enabled	It is allowed to synchronize the Bus Right to Bus Left if there is mains on left side.
Disabled	It is forbidden to synchronize the Bus Left to Bus Right if there is mains on right side.						
Enabled	It is allowed to synchronize the Bus Right to Bus Left if there is mains on left side.						

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## Synchronization R to L

Setpoint group	Process Control	Related FW	1.1.0				
Range [units]	Enabled / Disabled [-]						
Default value	Enabled	Force value	NO				
Step	[-]						
Comm object	16049	Related applications	BTB				
Config level	Standard						
Setpoint visibility	Always						
Description							
This setpoint defines the direction of the BTB synchronization.							
<table><tr><td>Disabled</td><td>It is forbidden to synchronize the Bus Right Gensets to Bus Left Gensets.</td></tr><tr><td>Enabled</td><td>It is allowed to synchronize the Bus Right Gensets to Bus Left Gensets.</td></tr></table>				Disabled	It is forbidden to synchronize the Bus Right Gensets to Bus Left Gensets.	Enabled	It is allowed to synchronize the Bus Right Gensets to Bus Left Gensets.
Disabled	It is forbidden to synchronize the Bus Right Gensets to Bus Left Gensets.						
Enabled	It is allowed to synchronize the Bus Right Gensets to Bus Left Gensets.						

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## Synchronization L to R

Setpoint group	Process Control	Related FW	1.1.0				
Range [units]	Enabled / Disabled [-]						
Default value	Enabled	Force value	NO				
Step	[-]						
Comm object	16050	Related applications	BTB				
Config level	Standard						
Setpoint visibility	Always						
Description							
This setpoint defines the direction of the BTB synchronization.							
<table><tr><td>Disabled</td><td>It is forbidden to synchronize the Bus Left Gensets to Bus Right Gensets.</td></tr><tr><td>Enabled</td><td>It is allowed to synchronize the Bus Left Gensets to Bus Right Gensets.</td></tr></table>				Disabled	It is forbidden to synchronize the Bus Left Gensets to Bus Right Gensets.	Enabled	It is allowed to synchronize the Bus Left Gensets to Bus Right Gensets.
Disabled	It is forbidden to synchronize the Bus Left Gensets to Bus Right Gensets.						
Enabled	It is allowed to synchronize the Bus Left Gensets to Bus Right Gensets.						

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## BTB Opening

Setpoint group	Process Control	Related FW	1.1.0
Range [units]	Enabled / Disabled [-]		
Default value	Enabled	Force value	NO
Step	[-]		
Comm object	14028	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint defines whether the BTB is automatically opened when both sides are dead.			
Disabled	BTB will not be automatically opened when both sides (Bus Left and Bus Right) are dead.		
Enabled	BTB is automatically opened when both sides (Bus Left and Bus Right) are dead.		

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## Dead Bus Closing

Setpoint group	Process Control	Related FW	1.1.0
Range [units]	Disabled / Left To Right / Right To Left / Both [-]		
Default value	Enabled	Force value	NO
Step	[-]		
Comm object	11038	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint defines whether the BTB might be closed to deadbus .			
Disabled	Closing to dead bus is forbidden. Controller does not close breaker unless there is voltage on both sides.		
Left To Right	Closing to dead bus is allowed only if there is healthy voltage on Bus Left or both sides.		
Right To Left	Closing to dead bus is allowed only if there is healthy voltage on Bus Right or both sides.		
Both	Closing to dead bus is allowed if at least one of the buses is healthy, it does not matter whether Bus Left or Bus Right.		

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## Subgroup: Breaker Control Mode

### BTB Control Mode

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	Internal / External [-]		
Default value	Internal	Force value	YES
Step	[-]		
Comm object	9873	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts control mode of BTB.			
Internal	The BTB breaker is controlled by controller. The controller accepts the opening of BTB from the external device (Bus relay). When the BTB is opened externally then: ➤ The event "BTB opened Externally" is recorded in history log Incorrect reaction of the <b>BTB FEEDBACK (PAGE 539)</b> to internal BTB Close/Open command causes <b>Hst BTB Fail (page 689)</b>		
	External		
External	Controller does not control the BTB at all. The BTB is controlled externally, when the <b>BTB FEEDBACK (PAGE 539)</b> gets changed, then the event "BTB Opened" or		

	<p>"BTB Closed" is recorded to the history log.</p> <p>Controller always accepts the <b>BTB FEEDBACK (PAGE 539)</b> without of issuing any alarm.</p> <p>The controller informs the superordinate system about the status of the breaker automaton using the signals</p> <p>➤ <b>LBO SYNCHRONIZATION (PAGE 578)</b></p>
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## Attempts To Close Breaker

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	1 .. 5 [-]		
Default value	2	Force value	NO
Step	1 [-]		
Comm object	19885	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the amount of attempts the controller performs when a breaker is requested to be closed.			
<div>Example: If the breaker feedback is not received at the end of the attempt, an alarm is not issued, unless it was the last attempt to close the breaker.</div>			

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## Delay Between Closing Attempts

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	20 .. 60 [s]		
Default value	20 [s]	Force value	NO
Step	1 [s]		
Comm object	19883	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the delay between breaker closing attempts the controller performs when a breaker is requested to be closed. Delay is one second longer than you set here due breaker's safety.			
<div>Example: If this setpoint is set to 10 seconds, the delay between another attempt to close the breaker will be 11 seconds.</div>			

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## Waiting For Breaker Feedback

Setpoint group	Synchronization	Related FW	1.1.0
Range [units]	1 .. 60 [s]		
Default value	2	Force value	YES
Step	1 [-]		
Comm object	19884	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the length of breaker closing attempt.			
<div><b>Example:</b> When set to 10s, the LBO <b>BTB ON COIL</b> (PAGE 576) is set for 10 s.</div>			

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## Mains Coupling

Setpoint group	Synchronization	Related FW	1.1.0				
Range [units]	Enabled / Disabled [-]						
Default value	Disabled	Force value	YES				
Step	[-]						
Comm object	11037	Related applications	BTB				
Config level	Standard						
Setpoint visibility	Always						
Description							
This setpoint defines how the controller cooperates with other mains controllers in the system where common busbar is supplied from multiple mains incomers.							
<table><tr><td>Disabled</td><td>It is forbidden to close the BTB if mains voltage is connected to the both sides of the BTB.</td></tr><tr><td>Enabled</td><td>It is allowed to close BTB if mains voltage is connected to the both sides of the BTB.</td></tr></table>				Disabled	It is forbidden to close the BTB if mains voltage is connected to the both sides of the BTB.	Enabled	It is allowed to close BTB if mains voltage is connected to the both sides of the BTB.
Disabled	It is forbidden to close the BTB if mains voltage is connected to the both sides of the BTB.						
Enabled	It is allowed to close BTB if mains voltage is connected to the both sides of the BTB.						

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## Subgroup: Frequency Regulation Loop

### Frequency Gain

Setpoint group	Frequency/Load Control	Related FW	1.1.0
Range [units]	0,00 .. 200,00 [-]		
Default value	10,00 [-]	Force value	YES
Step	0,01 [-]		
Comm object	8715	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the gain factor (P-factor) of the frequency control PI loop.			
Note: See the chapter <i>Regulation Loops (page 208)</i> for more information.			

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### Frequency Int

Setpoint group	Frequency/Load Control	Related FW	1.1.0
Range [units]	0,10 .. 60,00 [s]		
Default value	2,00 [s]	Force value	YES
Step	0,01 [s]		
Comm object	8716	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the integration factor (I-factor) of the frequency control PI loop.			
Note: See the chapter <i>Regulation Loops (page 208)</i> for more information.			

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## Angle Gain

Setpoint group	Frequency/Load Control	Related FW	1.1.0
Range [units]	0,00 .. 200,00 [-]		
Default value	10,00 [-]	Force value	YES
Step	0,01 [-]		
Comm object	8718	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used for adjusting of the gain factor (P-factor) of the phase angle P-control loop.			
<b>Note:</b> During synchronization, first the frequency loop is started to match the System frequency with the mains or bus and after that the phase angle loop is started to match the phase angle.			
<b>Note:</b> See the chapter <i>Regulation Loops</i> (page 208) for more information.			

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## Subgroup: Voltage Regulation Loop

### Voltage Gain

Setpoint group	Load/VAR Control	Related FW	1.1.0
Range [units]	0.00 .. 200.00 [-]		
Default value	10.00 [-]	Force value	YES
Step	0.01 [-]		
Comm object	8501	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the gain factor (P-factor) of the voltage control PI loop.			
Note: See the chapter <b>Regulation Loops</b> (page 208) for more information.			

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## Voltage Int

Setpoint group	Load/VAR Control	Related FW	1.1.0
Range [units]	0.10 .. 60.00 [s]		
Default value	2.00 [s]	Force value	YES
Step	0.01 [s]		
Comm object	8720	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the integration factor (I-factor) of the voltage control PI loop.			
Note: See the chapter <i>Regulation Loops</i> (page 208) for more information.			

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### Group: Bus Left Settings

#### Subgroup: Bus Power Measurement

## Bus Measurement P

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	None / Bus CT / Analog Input [-]		
Default value	None	Force value	NO
Step	[-]		
Comm object	10599	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
Defines source value of the <b>Bus Left Import P (page 402)</b> .			
None	The value <b>Bus Left Import P (page 402)</b> is not measured.		
Bus CT	The value <b>Bus Left Import P (page 402)</b> is measured via Bus CTs which isare located on phase L1, L2 and L3.		
Analog Input	The value <b>Bus Left Import P (page 402)</b> is measured via analog input, accordingly LAI: <b>BUS MEASUREMENT P (PAGE 581)</b> .		

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## Bus Measurement Q

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	None / Bus CT / Analog Input [-]		
Default value	None	Force value	NO
Step	[-]		
Comm object	10598	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
Defines source value of the <b>Bus Left Import Q (page 402)</b> .			
None	The value <b>Bus Left Import Q (page 402)</b> is not measured.		
Bus CT	The value <b>Bus Left Import Q (page 402)</b> is measured via Bus CTs which are located on phase L1, L2 and L3.		
Analog Input	The value <b>Bus Left Import Q (page 402)</b> is measured via analog input, accordingly LAI: <b>BUS MEASUREMENT Q (PAGE 581)</b> .		

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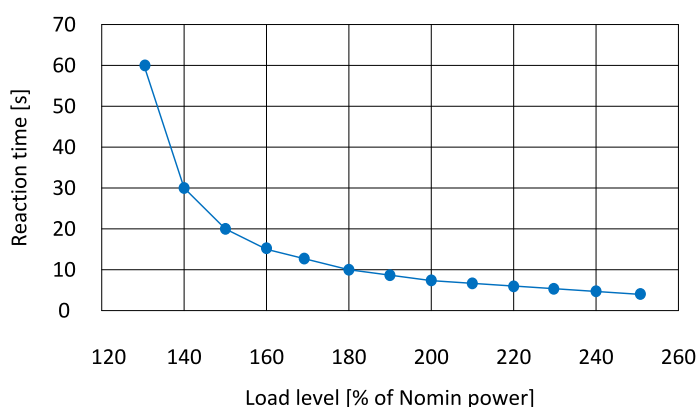
### Subgroup: Overload Protection

#### 2POverload Start Evaluation Level

Setpoint group	Bus Left Settings	Related FW	1.1.0																				
Range [units]	100 .. 200 [%] of Nominal Bus Import (page 242)																						
Default value	120 % of Nominal Bus Import (page 242)	Force value	YES																				
Step	1 % of Nominal Bus Import (page 242)																						
Comm object	8280	Related applications	BTB																				
Config level	Standard																						
Setpoint visibility	Always																						
Description																							
This setpoint adjusts the relative power level, where the thermal overload protection starts to be evaluated. See setpoint <b>IDMT Overload Protection (page 296)</b> for complete explanation of the protection.																							
<table><tr><th>Load level</th><th>Reaction time [s]</th><th></th><th></th></tr><tr><td>100</td><td>no reaction</td><td><b>2POvrldStEvDel</b></td><td>5 s</td></tr><tr><td>110</td><td>no reaction</td><td><b>OverldStrtEval</b></td><td>120 %</td></tr><tr><td>120</td><td>600</td><td></td><td></td></tr><tr><td>130</td><td>60</td><td></td><td></td></tr></table>				Load level	Reaction time [s]			100	no reaction	<b>2POvrldStEvDel</b>	5 s	110	no reaction	<b>OverldStrtEval</b>	120 %	120	600			130	60		
Load level	Reaction time [s]																						
100	no reaction	<b>2POvrldStEvDel</b>	5 s																				
110	no reaction	<b>OverldStrtEval</b>	120 %																				
120	600																						
130	60																						

140	30
150	20
160	15
170	12
180	10
190	8.6
200	7.5
210	6.7
220	6
230	5.5
240	5
250	4.6

$$\text{Reaction time [s]} = \frac{2\text{POvrlStEvDel} * \text{OverldStrtEval}}{\text{MainsActivePower [\%]} - \text{OverldStrtEval}}$$



The reaction time of the thermal overload protection is not fixed and is specified by the parameter **2POverload Start Evaluation Delay (page 277)**.

**Note:** Maximum reaction time is 3600 s after this time the protection is tripped.

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## 2POverload Start Evaluation Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.1 .. 600.0 [s]		
Default value	5.0 s	Force value	YES
Step	0.1 s		
Comm object	8281	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		

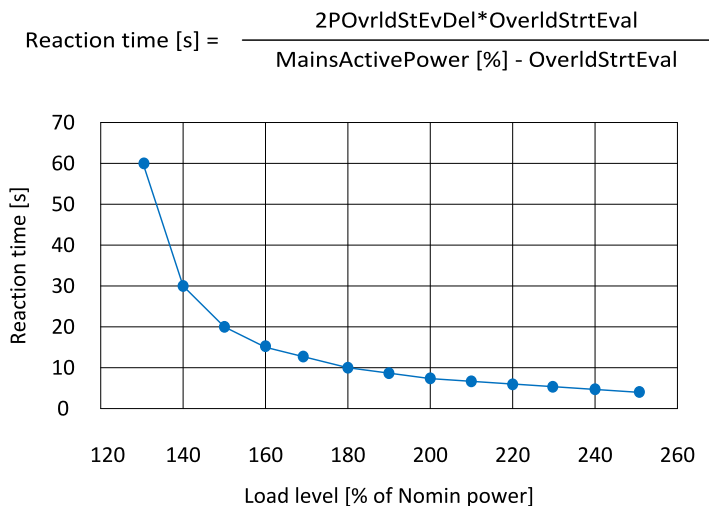
### Description

This setpoint adjusts the default delay for the thermal overload protection. See setpoint **IDMT Overload Protection (page 296)** for complete explanation of the protection.

Load level	Reaction time [s]
100	no reaction
110	no reaction
120	3600 (max. value)
130	60
140	30
150	20
160	15

**2POvrlStEvDel**      5 s  
**OverldStrtEval**      120 %

170	12
180	10
190	8.6
200	7.5
210	6.7
220	6
230	5.5
240	5
250	4.6



The reaction time of the thermal overload protection is not fixed; it depends on how much is the load above the limit of **2POverload Start Evaluation Level (page 276)**. The higher is the load the shorter the reaction time will be.

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## Subgroup: Current Protection

### Short Circuit

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	100 .. 500 [%] of Nominal Current (page 243)		
Default value	150 % of Nominal Current (page 243)	Force value	NO
Step	1 % of Nominal Current (page 243)		
Comm object	8282	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative current threshold level for <b>Short Circuit Protection (page 298)</b> .			

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## Short Circuit Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 10.00 [s]		
Default value	0 s	Force value	NO
Step	0.01 s		
Comm object	9991	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Short Circuit Protection (page 298)</b> .			

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## IDMT Bus Left >A Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	1.0 .. 600.0 [s]		
Default value	4.0 s	Force value	NO
Step	0.1 s		
Comm object	8283	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		

### Description

This setpoint adjusts the delay for **IDMT Bus Left >A Protection (page 298)**.

IDMT curve shape selection. IDMT Overcurrent Delay is a reaction time of IDMT protection for 200% overcurrent  $I_{Bus\ Left} = 2 \times \text{Nominal Current}$  (**page 243**)

IDMT is "very inverse" over current protection. Reaction time is not constant but depends on over current level according to the following formula:

$$\text{Reaction Time} = \frac{\text{Overcurrent IDMT Delay} * \text{Nominal Current}}{I_{gen} * \text{Nominal Current}}$$

**Note:** Reaction time is limited to 3600 s = 60 minutes. IDMT protection is not active for Reaction time values longer than 60 minutes.

$I_{Bus\ Right}$  is maximal value of all measured phases of Bus Left current.

Table 7.1 EXAMPLE of Reaction time for different over current levels

	Overcurrent IDMT Delay	Overcurrent		
		≤ 100 %	101 %	110 %
Reaction time	0,2 s	No action	20 s	2 s
	2 s	No action	200 s	20 s
	20 s	No action	2000 s	200 s

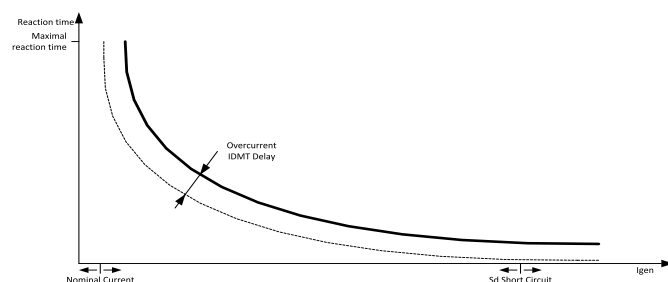


Image 7.1 IDMT Overcurrent Delay

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## Current Unbalance

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	1 .. 200 [%] of Nominal Bus Import (page 242)		
Default value	50 % of Nominal Bus Import (page 242)	Force value	NO
Step	1 % of Nominal Bus Import (page 242)		
Comm object	8284	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Only if Connection type (page 244) != MonoPhase		
Description			
This setpoint specifies the relative current threshold level for Current Unbalance Protection (page 300).			

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## Current Unbalance Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.0 .. 600.0 [s]		
Default value	5.0 s	Force value	NO
Step	0.1 s		
Comm object	8285	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Only if <b>Connection type (page 244)</b> != MonoPhase		
Description			
This setpoint specifies the delay for <b>Current Unbalance Protection (page 300)</b> .			

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## Subgroup: Bus Left Voltage Protections

### Bus Left >V

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	100.0 .. Bus Left >>V (page 282) of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246) [%]		
Default value	110.0 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)	Force value	YES
Step	0.1 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Comm object	8305	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative voltage threshold level for Bus Left >V Protection (page 300).			
<b>Note:</b> Bus Left Voltage L1-N (page 408), Bus Left Voltage L2-N (page 408), Bus Left Voltage L3-N (page 408), Bus Left Voltage L1-L2 (page 408), Bus Left Voltage L2-L3 (page 408) and Bus Left Voltage L3-L1 (page 409) are used for this protection.			

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### Bus Left >V Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 600.00 [s]		
Default value	5.00 s	Force value	YES
Step	0.01 s		
Comm object	8306	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &gt;V Protection (page 300)</b> .			

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## Bus Left >V Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.0 .. 30.0 [%] of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Default value	0.0 [%] of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>	Force value	NO
Step	0.1 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Comm object	14132	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &gt;V Protection (page 300)</b> .			

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## Bus Left >>V

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	Bus Left >V (page 281) .. 130.0 [%] of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Default value	120.0 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)	Force value	YES
Step	0.1 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Comm object	11345	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative voltage threshold level for Bus Left >>V Protection (page 302).			
<b>Note:</b> Bus Left Voltage L1-N (page 408), Bus Left Voltage L2-N (page 408), Bus Left Voltage L3-N (page 408), Bus Left Voltage L1-L2 (page 408), Bus Left Voltage L2-L3 (page 408) and Bus Left Voltage L3-L1 (page 409) are used for this protection.			

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## Bus Left >>V Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 600.00 [s]		
Default value	0.10 s	Force value	YES
Step	0.01 s		
Comm object	11347	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &gt;&gt;V Protection (page 302)</b> .			

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## Bus Left >>V Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.0 .. 30.0 [%] of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Default value	0.0 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>	Force value	YES
Step	0.1 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Comm object	14133	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &gt;&gt;V Protection (page 302)</b> .			

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## Bus Left <V

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	Bus Left <<V (page 285) .. 99.0 [%] of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Default value	60 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)	Force value	YES
Step	1 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Comm object	8307	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative voltage threshold level for Bus Left <V Protection (page 303).			
<b>Note:</b> Bus Left Voltage L1-N (page 408), Bus Left Voltage L2-N (page 408), Bus Left Voltage L3-N (page 408), Bus Left Voltage L1-L2 (page 408), Bus Left Voltage L2-L3 (page 408) and Bus Left Voltage L3-L1 (page 409) are used for this protection.			

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## Bus Left <V Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 600.00 [s]		
Default value	1.50 s	Force value	YES
Step	0.01 s		
Comm object	8308	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &lt;V Protection (page 303)</b> .			

◀ back to List of setpoints

## Bus Left <V Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.0 .. 50.0 [%] of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Default value	0.0 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>	Force value	YES
Step	0.1 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Comm object	14130	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &lt;V Protection (page 303)</b> .			

◀ back to List of setpoints

## Bus Left <<V

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	10.0 .. Bus Left <V (page 284) [%] of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Default value	30.0 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)	Force value	YES
Step	0.1 % of Bus LeftAC Shore Nominal Voltage Ph-N (page 246) and Bus Left Nominal Voltage Ph-Ph (page 246)		
Comm object	11346	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative voltage threshold level for Bus Left <<V Protection (page 304).			
<b>Note:</b> Bus Left Voltage L1-N (page 408), Bus Left Voltage L2-N (page 408), Bus Left Voltage L3-N (page 408), Bus Left Voltage L1-L2 (page 408), Bus Left Voltage L2-L3 (page 408) and Bus Left Voltage L3-L1 (page 409) are used for this protection.			

◀ back to List of setpoints

## Bus Left <<V Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 600.00 [s]		
Default value	0.10 s	Force value	YES
Step	0.01 s		
Comm object	11348	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &lt;&lt;V Protection (page 304)</b> .			

[back to List of setpoints](#)

## Bus Left <<V Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.0 .. 50.0 [%] of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Default value	0.0 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>	Force value	YES
Step	0.1 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Comm object	14131	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &lt;&lt;V Protection (page 304)</b> .			

[back to List of setpoints](#)

## Bus Left V Unbalance

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	1 .. 200 [%] of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Default value	10 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>	Force value	YES
Step	1 % of <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> and <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b>		
Comm object	8446	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative voltage threshold level for <b>Bus Left V Unbalance Protection (page 305)</b> .			

◀ back to List of setpoints

## Bus Left V Unbalance Delay


Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 600.00 [s]		
Default value	2.00 s	Force value	YES
Step	0.01 s		
Comm object	8447	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left V Unbalance Protection (page 305)</b> .			

◀ back to List of setpoints

## Subgroup: Bus Left Frequency Protection


### Bus Left >f

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 ..Bus Left >>f (page 289) [Hz]		
Default value	1.50 Hz	Force value	YES
Step	0.01 Hz		
Comm object	8310	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts maximal accepted frequency for <b>Bus Left &gt;f Protection (page 309)</b> .			

 [back to List of setpoints](#)

### Bus Left >f Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 1000.00 [s]		
Default value	5.00 s	Force value	YES
Step	0.01 s		
Comm object	16632	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &gt;f Protection (page 309)</b> .			

 [back to List of setpoints](#)

### Bus Left >f Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 2.50 [Hz]		
Default value	0.00 Hz	Force value	YES
Step	0.01 Hz		
Comm object	14134	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &gt;f Protection (page 309)</b> .			

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## Bus Left >>f

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	Bus Left >f (page 288) .. 10.00 [Hz]		
Default value	2.50 Hz	Force value	YES
Step	0.01 Hz		
Comm object	11349	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts maximal accepted frequency for <b>Bus Left &gt;&gt;f Protection (page 310)</b> .			

◀ back to List of setpoints

## Bus Left >>f Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 1000.00 [s]		
Default value	0.00 s	Force value	YES
Step	0.01 s		
Comm object	16628	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &gt;&gt;f Protection (page 310)</b> .			

◀ back to List of setpoints

## Bus Left >>f Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 2.50 [Hz]		
Default value	0.00 Hz	Force value	YES
Step	0.01 Hz		
Comm object	16076	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &gt;&gt;f Protection (page 310)</b> .			

◀ back to List of setpoints



## Bus Left <f

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	Bus Left <<f (page 291) .. 0.00 [Hz]		
Default value	-1.50 Hz	Force value	YES
Step	0.01 Hz		
Comm object	14587	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts minimal accepted frequency for <b>Bus Left &lt;f Protection (page 311)</b> .			

◀ back to List of setpoints

## Bus Left <f Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 1000.00 [s]		
Default value	5.00 s	Force value	YES
Step	0.01 s		
Comm object	16633	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &lt;f Protection (page 311)</b> .			

◀ back to List of setpoints

## Bus Left <f Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 2.50 [Hz]		
Default value	0.00 Hz	Force value	YES
Step	0.01 Hz		
Comm object	14135	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &lt;f Protection (page 311)</b> .			

◀ back to List of setpoints

## Bus Left <<f

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	-10.00 .. Bus Left <f (page 290) [Hz]		
Default value	-2.50 Hz	Force value	YES
Step	0.01 Hz		
Comm object	16483	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts maximal accepted frequency for <b>Bus Left &lt;&lt;f Protection (page 312)</b> .			

◀ back to List of setpoints

## Bus Left <<f Delay

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 1000.00 [s]		
Default value	0.00 s	Force value	YES
Step	0.01 s		
Comm object	16630	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Left &lt;&lt;f Protection (page 312)</b> .			

◀ back to List of setpoints

## Bus Left <<f Hys

Setpoint group	Bus Left Settings	Related FW	1.1.0
Range [units]	0.00 .. 2.50 [Hz]		
Default value	0.00 Hz	Force value	YES
Step	0.01 Hz		
Comm object	16555	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts the hysteresis for return from <b>Bus Left &lt;&lt;f Protection (page 312)</b> .			

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## Group: Bus Right Settings

### Subgroup: Bus Right Voltage Protection

#### Bus Right >V

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	100 .. 200 of <b>Bus Right AC Bus Nominal Voltage Ph-N (page 245)</b> and <b>Bus Right Nominal Voltage Ph-Ph (page 245)</b> [%]		
Default value	120 % of <b>Bus Right AC Bus Nominal Voltage Ph-N (page 245)</b> and <b>Bus Right Nominal Voltage Ph-Ph (page 245)</b>	Force value	YES
Step	1 % of <b>Bus Right AC Bus Nominal Voltage Ph-N (page 245)</b> and <b>Bus Right Nominal Voltage Ph-Ph (page 245)</b>		
Comm object	8291	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative voltage threshold level for <b>Bus Right &gt;V Protection (page 306)</b> .  <i>Note: Bus Right Voltage L1-N (page 412), Bus Right Voltage L2-N (page 412), Bus Right Voltage L3-N (page 412), Bus Right Voltage L1-L2 (page 412), Bus Right Voltage L2-L3 (page 413) and Bus Right Voltage L3-L1 (page 413) are used for this protection.</i>			

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#### Bus Right >V Delay

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	0.01 .. 600 [s]		
Default value	5.00 s	Force value	YES
Step	0.01 s		
Comm object	8292	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Right &gt;V Protection (page 306)</b> .			

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## Bus Right <V

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	20 .. 99 [%] of Bus Right AC Bus Nominal Voltage Ph-N (page 245) and Bus Right Nominal Voltage Ph-Ph (page 245)		
Default value	90 % of Bus Right AC Bus Nominal Voltage Ph-N (page 245) and Bus Right Nominal Voltage Ph-Ph (page 245)	Force value	YES
Step	1 % of Bus Right AC Bus Nominal Voltage Ph-N (page 245) and Bus Right Nominal Voltage Ph-Ph (page 245)		
Comm object	8293	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the relative voltage threshold level for Bus Right <V Protection (page 307).			
<i>Note: Bus Right Voltage L1-N (page 412), Bus Right Voltage L2-N (page 412), Bus Right Voltage L3-N (page 412), Bus Right Voltage L1-L2 (page 412), Bus Right Voltage L2-L3 (page 413) and Bus Right Voltage L3-L1 (page 413) are used for this protection.</i>			

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## Bus Right <V Delay

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	0.01 .. 600.00 [s]		
Default value	5.00 s	Force value	YES
Step	0.01 s		
Comm object	16417	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Right &lt;V Protection (page 307)</b> .			

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## Bus Right V Unbalance

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	1 .. 200 [%]		
Default value	10 %	Force value	YES
Step	1 %		
Comm object	8288	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Only if <b>Connection type (page 244)</b> != MonoPhase		
Description			
This setpoint specifies the relative voltage threshold level for <b>Bus Right V Unbalance Protection (page 307)</b> .			

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## Bus Right V Unbalance Delay

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	0.01 .. 600.00 [s]		
Default value	3.00 s	Force value	YES
Step	0.01 s		
Comm object	8289	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Connection type (page 244)</b> != MonoPhase		
Description			
This setpoint specifies the delay for <b>Bus Right V Unbalance Protection (page 307)</b> .			

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## Subgroup: Frequency Protection

### Bus Right >f

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	0.00 .. 5.00 [Hz]		
Default value	1.50 Hz	Force value	YES
Step	0.01 Hz		
Comm object	8296	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts maximal accepted frequency for <b>Bus Right &gt;f Protection (page 313)</b> .			
<b>Note:</b> $f_{max} = \textit{Nominal Frequency (page 250)} + \textit{Bus Right >f}$			

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## Bus Right >f Delay

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	0.01 .. 600.0 [s]		
Default value	5.00 s	Force value	YES
Step	0.01 s		
Comm object	8297	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Right &gt;f Protection (page 313)</b> .			

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## Bus Right <f

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	0.00 .. 5.00 [Hz]		
Default value	1.50 Hz	Force value	YES
Step	0.01 Hz		
Comm object	14588	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts maximal accepted frequency for <b>Bus Right &lt;f Protection (page 314)</b> .			
<b>Note:</b> $f_{min}$ = <b>Nominal Frequency (page 250)</b> - <i>Bus Right &lt;f</i>			

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## Bus Right <f Delay

Setpoint group	Bus Right Settings	Related FW	1.1.0
Range [units]	0.01 .. 600.0 [s]		
Default value	5.00 s	Force value	YES
Step	0.01 s		
Comm object	16423	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint specifies the delay for <b>Bus Right &lt;f Protection (page 314)</b> .			

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## Group: Protections

### Subgroup: BP Protection Behavior

#### BP Protection Behavior

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Passive / Active [-]		
Default value	Passive	Force value	YES
Step	[-]		
Comm object	19545	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint defines the behavior of Bus Protection. This protection type is used only for user protections.			
<div><div>&gt;</div><div><b>Passive:</b> Protection will only block synchronization and breaker closing if triggered.</div></div>			
<div><div>&gt;</div><div><b>Active:</b> Protection will block synchronization and breaker closing, and it will also open the breaker if triggered.</div></div>			

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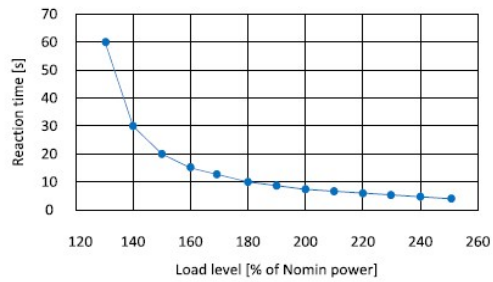
### Subgroup: Overload Protection

#### IDMT Overload Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	13231	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables or disables IDMT Overload protection.			
Behavior of protection is adjusted via setpoints <b>2POverload Start Evaluation Level (page 276)</b> and <b>2POverload Start Evaluation Delay (page 277)</b> . This protection activates alarm <b>IDMT Overload (page 694)</b> .			
The reaction time is calculated by this formula:			
$\text{Reaction time} = \frac{2\text{POverload Start Evaluation Level} \times 2\text{Poverload Start Evaluation Delay}}{\frac{\text{Bus Left } P}{\text{Nominal Power}} \times 100 \times 2\text{Poverload Start Evaluation Level}}$			
IMPORTANT: If this protection is disabled, the BTB cannot be closed.			

Load level	Reaction time [s]
100	no reaction
110	no reaction
120	3600
130	60
140	30
150	20
160	15
170	12
180	10
190	8.6
200	7.5
210	6.7
220	6
230	5.5
240	5
250	4.6

2POverload Start Evaluation Level = 120 %  
2POverload Start Evaluation Delay = 5 s



#### Setpoint options:

- > Enabled / Disabled: Protection is enabled / disabled.
- > Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI  
**PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) /  
PROTECTION FORCE DISABLE 3 (PAGE 555).**

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## Subgroup: Current Protection

### Short Circuit Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	15665	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables or disables Short Circuit protection.			
Behavior of protection is adjusted via setpoints <b>Short Circuit Protection (page 298)</b> and <b>Short Circuit Delay (page 279)</b> . When value of <b>Mains Current L1 (page 410)</b> , <b>Mains Current L2 (page 410)</b> and <b>Mains Current L3 (page 410)</b> related to <b>Nominal Current (page 243)</b> cross over <b>Short Circuit (page 278)</b> for time longer than <b>Short Circuit Delay (page 279)</b> alarm <b>BOR Short Circuit (page 694)</b> is activated.			
Setpoint options:			
➤ Enabled / Disabled: Protection is enabled / disabled.			
➤ Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554)</b> / <b>PROTECTION FORCE DISABLE 2 (PAGE 555)</b> / <b>PROTECTION FORCE DISABLE 3 (PAGE 555)</b> .			
<b>IMPORTANT: If this protection is disabled, the BTB cannot be closed.</b>			

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### IDMT Bus Left >A Protection

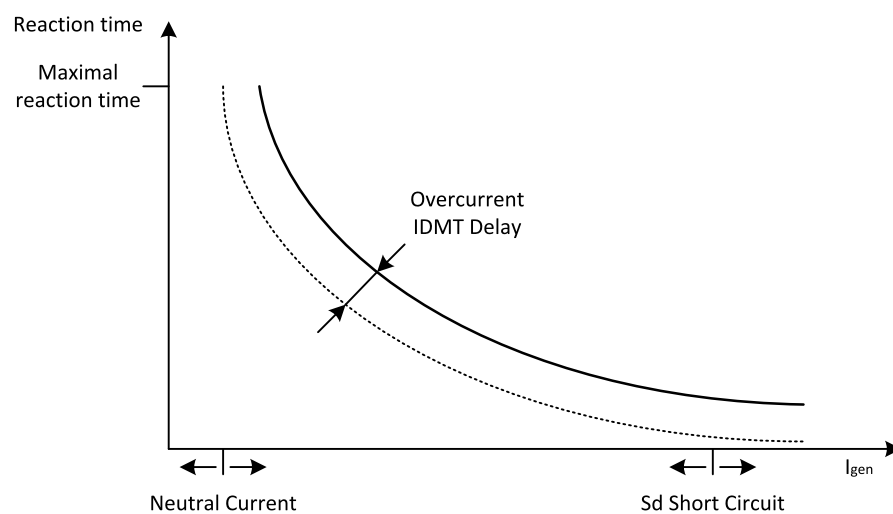
Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	15666	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables or disables IDMT Bus Left >A Protection.			
Behavior of protection is adjusted via setpoints <b>IDMT Bus Left &gt;A Delay (page 279)</b> . This protection activates alarm <b>BOR IDMT Bus Left &gt;A (page 694)</b> .			
The reaction time is calculated by this formula:			

$$\text{Reaction time} = \frac{\text{IDMT Bus Left} > A \text{ Delay} \times \text{Nominal Current}}{I_{\text{bus}} - \text{Nominal Current}}$$

$I_{\text{Bus Left}}$  = Maximum (Mains Current L1 (page 410), Mains Current L2 (page 410) and Mains Current L3 (page 410))

**Note:** Reaction time is limited to 3600 s = 60 minutes. IDMT protection is not active for Reaction time values longer than 60 minutes.

	Overcurrent IDMT Delay	Overcurrent		
		≤100 %	101 %	110 %
Reaction Time	0.2 s	No action	20 s	2 s
	2 s	No action	200 s	20 s
	20 s	No action	2000 s	200 s



#### Setpoint options:

- > Enabled / Disabled: Protection is enabled / disabled.
- > Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI  
**PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) /  
PROTECTION FORCE DISABLE 3 (PAGE 555).**

**IMPORTANT:** If this protection is disabled, the BTB cannot be closed.

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## Current Unbalance Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	15667	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		

### Description

This setpoint enables or disables Current Unbalance Protection.

Protection is enabled. Behavior of protection is adjusted via setpoints **Current Unbalance (page 280)** and **Current Unbalance Delay (page 280)**. When relative difference between Bus Left currents is over setpoint **Current Unbalance (page 280)** for time longer than **Current Unbalance Delay (page 280)** alarm **BOR Current Unbalance (page 694)** is activated.

**IMPORTANT:** Behavior of this protection is influenced by setpoint Connection type (page 244)

Connection type (page 244)	Compared values (maximum difference)
3Ph4Wire	(Mains Current L1 (page 410), Mains Current L2 (page 410), Mains Current L3 (page 410))
High Leg D	
3Ph3Wire	
SplitPhase	
MonoPhase	No protection is evaluated.

### Setpoint options:

- Enabled / Disabled: Protection is enabled / disabled.
- Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555).

**IMPORTANT:** If this protection is disabled, the BTB cannot be closed.

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## Subgroup: Voltage Protection

### Bus Left >V Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES

Step	[-]																
Comm object	20806	Related applications	BTB														
Config level	Advanced																
Setpoint visibility	Always																
Description																	
This setpoint enables or disables Bus Left >V Protection.																	
Behavior of protection is adjusted via setpoints <b>Bus Left &gt;V (page 281)</b> , <b>Bus Left &gt;V Delay (page 281)</b> and <b>Bus Left &gt;V Hys (page 282)</b> . When Bus Left voltage exceeds limit set by <b>Bus Left &gt;V (page 281)</b> for period longer than <b>Bus Left &gt;V Delay (page 281)</b> relevant history records is written to the history and BTB is opened if:																	
<div><div>&gt;</div> <b>Controller mode (page 250) = OFF</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = MAN</b> and <b>Breaker state (page 436) = ParalOper</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = AUTO</b></div>																	
Return from Bus Left >V can have hysteresis set by <b>Bus Left &gt;V Hys (page 282)</b> .																	
<table><tr><th>Value</th><th>History Record</th></tr><tr><td><b>Bus Left Voltage L1-N (page 408)</b></td><td><b>HST BUS LEFT &gt;V L1-N (PAGE 676)</b></td></tr><tr><td><b>Bus Left Voltage L2-N (page 408)</b></td><td><b>HST BUS LEFT &gt;V L2-N (PAGE 676)</b></td></tr><tr><td><b>Bus Left Voltage L3-N (page 408)</b></td><td><b>HST BUS LEFT &gt;V L3-N (PAGE 676)</b></td></tr><tr><td><b>Bus Left Voltage L1-L2 (page 408)</b></td><td><b>HST BUS LEFT &gt;V L1-L2 (PAGE 676)</b></td></tr><tr><td><b>Bus Left Voltage L2-L3 (page 408)</b></td><td><b>HST BUS LEFT &gt;V L2-L3 (PAGE 677)</b></td></tr><tr><td><b>Bus Left Voltage L3-L1 (page 409)</b></td><td><b>HST BUS LEFT &gt;V L3-L1 (PAGE 677)</b></td></tr></table>				Value	History Record	<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &gt;V L1-N (PAGE 676)</b>	<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &gt;V L2-N (PAGE 676)</b>	<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &gt;V L3-N (PAGE 676)</b>	<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &gt;V L1-L2 (PAGE 676)</b>	<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &gt;V L2-L3 (PAGE 677)</b>	<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &gt;V L3-L1 (PAGE 677)</b>
Value	History Record																
<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &gt;V L1-N (PAGE 676)</b>																
<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &gt;V L2-N (PAGE 676)</b>																
<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &gt;V L3-N (PAGE 676)</b>																
<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &gt;V L1-L2 (PAGE 676)</b>																
<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &gt;V L2-L3 (PAGE 677)</b>																
<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &gt;V L3-L1 (PAGE 677)</b>																
Setpoint options:																	
<div><div>&gt;</div> Enabled / Disabled: Protection is enabled / disabled.</div> <div><div>&gt;</div> Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)</b>.</div>																	

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## Bus Left >>V Protection

Setpoint group	Protections	Related FW	1.1.0														
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]																
Default value	Enabled	Force value	YES														
Step	[-]																
Comm object	20805	Related applications	BTB														
Config level	Advanced																
Setpoint visibility	Always																
Description																	
This setpoint enables or disables Bus Left >>V Protection.																	
Behavior of protection is adjusted via setpoints <b>Bus Left &gt;&gt;V (page 282)</b> , <b>Bus Left &gt;&gt;V Delay (page 283)</b> and <b>Bus Left &gt;&gt;V Hys (page 283)</b> . When Bus Left voltage exceeds limit set by <b>Bus Left &gt;&gt;V (page 282)</b> for period longer than <b>Bus Left &gt;&gt;V Delay (page 283)</b> relevant history records is written to the history and BTB is opened if:																	
<div><div>&gt;</div> <b>Controller mode (page 250) = OFF</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = MAN</b> and <b>Breaker state (page 436) = ParalOper</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = AUTO</b></div>																	
Return from Bus Left >>V can have hysteresis set by <b>Bus Left &gt;&gt;V Hys (page 283)</b> .																	
<table><tr><td>Value</td><td>History Record</td></tr><tr><td><b>Bus Left Voltage L1-N (page 408)</b></td><td><b>HST BUS LEFT &gt;&gt;V L1-N (PAGE 677)</b></td></tr><tr><td><b>Bus Left Voltage L2-N (page 408)</b></td><td><b>HST BUS LEFT &gt;&gt;V L2-N (PAGE 678)</b></td></tr><tr><td><b>Bus Left Voltage L3-N (page 408)</b></td><td><b>HST BUS LEFT &gt;&gt;V L3-N (PAGE 678)</b></td></tr><tr><td><b>Bus Left Voltage L1-L2 (page 408)</b></td><td><b>HST BUS LEFT &gt;&gt;V L1-L2 (PAGE 678)</b></td></tr><tr><td><b>Bus Left Voltage L2-L3 (page 408)</b></td><td><b>HST BUS LEFT &gt;&gt;V L2-L3 (PAGE 679)</b></td></tr><tr><td><b>Bus Left Voltage L3-L1 (page 409)</b></td><td><b>HST BUS LEFT &gt;&gt;V L3-L1 (PAGE 679)</b></td></tr></table>				Value	History Record	<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L1-N (PAGE 677)</b>	<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L2-N (PAGE 678)</b>	<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L3-N (PAGE 678)</b>	<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L1-L2 (PAGE 678)</b>	<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L2-L3 (PAGE 679)</b>	<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &gt;&gt;V L3-L1 (PAGE 679)</b>
Value	History Record																
<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L1-N (PAGE 677)</b>																
<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L2-N (PAGE 678)</b>																
<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L3-N (PAGE 678)</b>																
<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L1-L2 (PAGE 678)</b>																
<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &gt;&gt;V L2-L3 (PAGE 679)</b>																
<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &gt;&gt;V L3-L1 (PAGE 679)</b>																
Setpoint options:																	
<div><div>&gt;</div> Enabled / Disabled: Protection is enabled / disabled.</div> <div><div>&gt;</div> Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)</b>.</div>																	

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## Bus Left <V Protection

Setpoint group	Protections	Related FW	1.1.0														
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]																
Default value	Enabled	Force value	YES														
Step	[-]																
Comm object	20807	Related applications	BTB														
Config level	Advanced																
Setpoint visibility	Always																
Description																	
This setpoint enables or disables Bus Left <V Protection.																	
Behavior of protection is adjusted via setpoints <b>Bus Left &lt;V (page 284)</b> , <b>Bus Left &lt;V Delay (page 284)</b> and <b>Bus Left &lt;V Hys (page 285)</b> . When Bus Left voltage drops bellow limit set by <b>Bus Left &lt;V (page 284)</b> for period longer than <b>Bus Left &lt;V Delay (page 284)</b> relevant history records is written to the history and BTB is opened if:																	
<div><div>&gt;</div> <b>Controller mode (page 250) = OFF</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = MAN</b> and <b>Breaker state (page 436) = ParalOper</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = AUTO</b></div>																	
Return from Bus Left <V can have hysteresis set by <b>Bus Left &lt;V Hys (page 285)</b> .																	
<table><tr><td>Value</td><td>History Record</td></tr><tr><td><b>Bus Left Voltage L1-N (page 408)</b></td><td><b>HST BUS LEFT &lt;V L1-N (PAGE 679)</b></td></tr><tr><td><b>Bus Left Voltage L2-N (page 408)</b></td><td><b>HST BUS LEFT &lt;V L2-N (PAGE 680)</b></td></tr><tr><td><b>Bus Left Voltage L3-N (page 408)</b></td><td><b>HST BUS LEFT &lt;V L3-N (PAGE 680)</b></td></tr><tr><td><b>Bus Left Voltage L1-L2 (page 408)</b></td><td><b>HST BUS LEFT &lt;V L1-L2 (PAGE 680)</b></td></tr><tr><td><b>Bus Left Voltage L2-L3 (page 408)</b></td><td><b>HST BUS LEFT &lt;V L2-L3 (PAGE 680)</b></td></tr><tr><td><b>Bus Left Voltage L3-L1 (page 409)</b></td><td><b>HST BUS LEFT &lt;V L3-L1 (PAGE 681)</b></td></tr></table>				Value	History Record	<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &lt;V L1-N (PAGE 679)</b>	<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &lt;V L2-N (PAGE 680)</b>	<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &lt;V L3-N (PAGE 680)</b>	<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &lt;V L1-L2 (PAGE 680)</b>	<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &lt;V L2-L3 (PAGE 680)</b>	<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &lt;V L3-L1 (PAGE 681)</b>
Value	History Record																
<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &lt;V L1-N (PAGE 679)</b>																
<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &lt;V L2-N (PAGE 680)</b>																
<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &lt;V L3-N (PAGE 680)</b>																
<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &lt;V L1-L2 (PAGE 680)</b>																
<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &lt;V L2-L3 (PAGE 680)</b>																
<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &lt;V L3-L1 (PAGE 681)</b>																
Setpoint options:																	
<div><div>&gt;</div> Enabled / Disabled: Protection is enabled / disabled.</div> <div><div>&gt;</div> Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)</b>.</div>																	

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## Bus Left <<V Protection

Setpoint group	Protections	Related FW	1.1.0														
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]																
Default value	Enabled	Force value	YES														
Step	[-]																
Comm object	20808	Related applications	BTB														
Config level	Advanced																
Setpoint visibility	Always																
Description																	
This setpoint enables or disables Bus Left <<V Protection.																	
Behavior of protection is adjusted via setpoints <b>Bus Left &lt;&lt;V (page 285)</b> , <b>Bus Left &lt;&lt;V Delay (page 286)</b> and <b>Bus Left &lt;&lt;V Hys (page 286)</b> . When Bus Left voltage drops bellow limit set by <b>Bus Left &lt;&lt;V (page 285)</b> for period longer than <b>Bus Left &lt;&lt;V Delay (page 286)</b> relevant history records is written to the history and BTB is opened if:																	
<div><div>&gt;</div> <b>Controller mode (page 250) = OFF</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = MAN</b> and <b>Breaker state (page 436) = ParalOper</b></div> <div><div>&gt;</div> <b>Controller mode (page 250) = AUTO</b></div>																	
Return from Bus Left <<V can have hysteresis set by <b>Bus Left &lt;&lt;V Hys (page 286)</b> .																	
<table><tr><td>Value</td><td>History Record</td></tr><tr><td><b>Bus Left Voltage L1-N (page 408)</b></td><td><b>HST BUS LEFT &lt;&lt;V L1-N (PAGE 681)</b></td></tr><tr><td><b>Bus Left Voltage L2-N (page 408)</b></td><td><b>HST BUS LEFT &lt;&lt;V L2-N (PAGE 681)</b></td></tr><tr><td><b>Bus Left Voltage L3-N (page 408)</b></td><td><b>HST BUS LEFT &lt;&lt;V L3-N (PAGE 682)</b></td></tr><tr><td><b>Bus Left Voltage L1-L2 (page 408)</b></td><td><b>HST BUS LEFT &lt;&lt;V L1-L2 (PAGE 682)</b></td></tr><tr><td><b>Bus Left Voltage L2-L3 (page 408)</b></td><td><b>HST BUS LEFT &lt;&lt;V L2-L3 (PAGE 682)</b></td></tr><tr><td><b>Bus Left Voltage L3-L1 (page 409)</b></td><td><b>HST BUS LEFT &lt;&lt;V L3-L1 (PAGE 683)</b></td></tr></table>				Value	History Record	<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L1-N (PAGE 681)</b>	<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L2-N (PAGE 681)</b>	<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L3-N (PAGE 682)</b>	<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L1-L2 (PAGE 682)</b>	<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L2-L3 (PAGE 682)</b>	<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &lt;&lt;V L3-L1 (PAGE 683)</b>
Value	History Record																
<b>Bus Left Voltage L1-N (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L1-N (PAGE 681)</b>																
<b>Bus Left Voltage L2-N (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L2-N (PAGE 681)</b>																
<b>Bus Left Voltage L3-N (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L3-N (PAGE 682)</b>																
<b>Bus Left Voltage L1-L2 (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L1-L2 (PAGE 682)</b>																
<b>Bus Left Voltage L2-L3 (page 408)</b>	<b>HST BUS LEFT &lt;&lt;V L2-L3 (PAGE 682)</b>																
<b>Bus Left Voltage L3-L1 (page 409)</b>	<b>HST BUS LEFT &lt;&lt;V L3-L1 (PAGE 683)</b>																
Setpoint options:																	
<div><div>&gt;</div> Enabled / Disabled: Protection is enabled / disabled.</div> <div><div>&gt;</div> Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)</b>.</div>																	

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## Bus Left V Unbalance Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20798	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		

### Description

This setpoint enables or disables Bus Left V Unbalance Protection.

Behavior of protection is adjusted via setpoints **Bus Left V Unbalance (page 287)** and **Bus Left V Unbalance Delay (page 287)**. When relative difference between Bus Left current is over setpoint **Bus Left V Unbalance (page 287)** for time longer than **Bus Left V Unbalance Delay (page 287)** alarm **Hst Bus Left V Unbalance Ph-N (page 684)** or **Hst Bus Left V Unbalance Ph-Ph (page 685)** is activated.

**IMPORTANT:** Behavior of this protection is influenced by setpoint Connection type (page 244)

Connection type (page 244)	Compared values (maximum difference)
3Ph4Wire	<b>Bus Left Voltage L1-N (page 408), Bus Left Voltage L2-N (page 408) and Bus Left Voltage L3-N (page 408)</b> OR <b>Bus Left Voltage L1-L2 (page 408), Bus Left Voltage L2-L3 (page 408) and Bus Left Voltage L3-L1 (page 409)</b>
High Leg D	<b>Bus Left Voltage L1-L2 (page 408), Bus Left Voltage L2-L3 (page 408) and Bus Left Voltage L3-L1 (page 409)</b>
3Ph3Wire	<b>Bus Left Voltage L1-L2 (page 408), Bus Left Voltage L2-L3 (page 408) and Bus Left Voltage L3-L1 (page 409)</b>
SplitPhase	<b>Bus Left Voltage L1-N (page 408), Bus Left Voltage L2-N (page 408) and Bus Left Voltage L3-N (page 408)</b>
MonoPhase	No protection is evaluated.

### List of History Records

HstBus Left V Unbalance Ph-N

HstBus Left V Unbalance Ph-Ph

### Setpoint options:

- > Enabled / Disabled: Protection is enabled / disabled.
- > Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI **PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)**.

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## Bus Right >V Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20818	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables or disables Bus Right >V Protection.			
Protection is enabled. Behavior of protection is adjusted via setpoints <b>Bus Right &gt;V (page 292)</b> and <b>Bus Right &gt;V Delay (page 292)</b> . When Bus Right voltage exceeds limit set by <b>Bus Right &gt;V (page 292)</b> for time longer than <b>Bus Right &gt;V Delay (page 292)</b> appropriate alarm is activated.			
Value		Alarm	
Bus Right Voltage L1-N (page 412)		Hst Bus Right >V L1-N (page 685)	
Bus Right Voltage L2-N (page 412)		Hst Bus Right >V L2-N (page 685)	
Bus Right Voltage L3-N (page 412)		Hst Bus Right >V L3-N (page 685)	
Bus Right Voltage L1-L2 (page 412)		Hst Bus Right >V L1-L2 (page 686)	
Bus Right Voltage L2-L3 (page 413)		Hst Bus Right >V L2-L3 (page 686)	
Bus Right Voltage L3-L1 (page 413)		Hst Bus Right >V L3-L1 (page 686)	
Setpoint options:			
➤ Enabled / Disabled: Protection is enabled / disabled.			
➤ Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555).			
IMPORTANT: If this protection is disabled, the BTB cannot be closed.			

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## Bus Right <V Protection

Setpoint group	Protections	Related FW	1.1.0														
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]																
Default value	Enabled	Force value	YES														
Step	[-]																
Comm object	20819	Related applications	BTB														
Config level	Advanced																
Setpoint visibility	Always																
Description																	
This setpoint enables or disables Bus Right <V Protection.																	
Behavior of protection is adjusted via setpoints <b>Bus Right &lt;V (page 293)</b> and <b>Bus Right &lt;V Delay (page 293)</b> When Bus Right voltage drops below limit set by <b>Bus Right &lt;V (page 293)</b> for time longer than <b>Bus Right &lt;V Delay (page 293)</b> appropriate alarm is activated.																	
<table><tr><td>Value</td><td>Alarm</td></tr><tr><td>Bus Right Voltage L1-N (page 412)</td><td>Hst Bus Right &lt;V L1-N (page 686)</td></tr><tr><td>Bus Right Voltage L2-N (page 412)</td><td>Hst Bus Right &lt;V L2-N (page 687)</td></tr><tr><td>Bus Right Voltage L3-N (page 412)</td><td>Hst Bus Right &lt;V L3-N (page 687)</td></tr><tr><td>Bus Right Voltage L1-L2 (page 412)</td><td>Hst Bus Right &lt;V L1-L2 (page 687)</td></tr><tr><td>Bus Right Voltage L2-L3 (page 413)</td><td>Hst Bus Right &lt;V L2-L3 (page 687)</td></tr><tr><td>Bus Right Voltage L3-L1 (page 413)</td><td>Hst Bus Right &gt;V L3-L1 (page 686)</td></tr></table>				Value	Alarm	Bus Right Voltage L1-N (page 412)	Hst Bus Right <V L1-N (page 686)	Bus Right Voltage L2-N (page 412)	Hst Bus Right <V L2-N (page 687)	Bus Right Voltage L3-N (page 412)	Hst Bus Right <V L3-N (page 687)	Bus Right Voltage L1-L2 (page 412)	Hst Bus Right <V L1-L2 (page 687)	Bus Right Voltage L2-L3 (page 413)	Hst Bus Right <V L2-L3 (page 687)	Bus Right Voltage L3-L1 (page 413)	Hst Bus Right >V L3-L1 (page 686)
Value	Alarm																
Bus Right Voltage L1-N (page 412)	Hst Bus Right <V L1-N (page 686)																
Bus Right Voltage L2-N (page 412)	Hst Bus Right <V L2-N (page 687)																
Bus Right Voltage L3-N (page 412)	Hst Bus Right <V L3-N (page 687)																
Bus Right Voltage L1-L2 (page 412)	Hst Bus Right <V L1-L2 (page 687)																
Bus Right Voltage L2-L3 (page 413)	Hst Bus Right <V L2-L3 (page 687)																
Bus Right Voltage L3-L1 (page 413)	Hst Bus Right >V L3-L1 (page 686)																
Setpoint options:																	
➤ Enabled / Disabled: Protection is enabled / disabled.																	
➤ Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555).																	
IMPORTANT: If this protection is disabled, the BTB cannot be closed.																	

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## Bus Right V Unbalance Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	15669	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			

This setpoint enables or disables Bus Right V Unbalance Protection.

Behavior of protection is adjusted via setpoints **Bus Right V Unbalance (page 294)** and **Bus Right V Unbalance Delay (page 294)**. When relative difference between Bus Right voltages is over setpoint **Bus Right V Unbalance (page 294)** for time longer than **Bus Right V Unbalance Delay (page 294)** alarm **Hst Bus Right V Unbalance Ph-N (page 688)** or **Hst Bus Right V Unbalance Ph-Ph (page 689)** is activated.

**IMPORTANT:** Behavior of this protection is influenced by setpoint **Connection type (page 244)**

Connection type (page 244)	Compared values (maximum difference)
3Ph4Wire	Bus Right Voltage L1-N (page 412), Bus Right Voltage L2-N (page 412) and Bus Right Voltage L3-N (page 412) OR Bus Right Voltage L1-L2 (page 412), Bus Right Voltage L2-L3 (page 413) and Bus Right Voltage L3-L1 (page 413)
High Leg D	Bus Right Voltage L1-L2 (page 412), Bus Right Voltage L2-L3 (page 413) and Bus Right Voltage L3-L1 (page 413)
3Ph3Wire	Bus Right Voltage L1-L2 (page 412), Bus Right Voltage L2-L3 (page 413) and Bus Right Voltage L3-L1 (page 413)
SplitPhase	Bus Right Voltage L1-N (page 412), Bus Right Voltage L2-N (page 412) and Bus Right Voltage L3-N (page 412)
MonoPhase	No protection is evaluated.

**Setpoint options:**

- > Enabled / Disabled: Protection is enabled / disabled.
- > Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555).

**IMPORTANT:** If this protection is disabled, the BTB cannot be closed.

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## Subgroup: Frequency Protection

### Bus Left >f Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20802	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
<p>This setpoint adjusts the behavior Bus Left &gt;f Protection.</p> <p>Behavior of protection is adjusted via setpoints <b>Bus Left &gt;f (page 288)</b>, <b>Bus Left &gt;f Delay (page 288)</b> and <b>Bus Left &gt;f Hys (page 288)</b>. When <b>Bus Left Frequency (page 407)</b> exceeds maximal accepted frequency for period longer than <b>Bus Left &gt;f Delay (page 288)</b> alarm <b>HST BUS LEFT &gt;F (PAGE 683)</b> is activated.</p> <ul style="list-style-type: none"><li>&gt; <b>Controller mode (page 250) = OFF</b></li><li>&gt; <b>Controller mode (page 250) = MAN</b> and <b>Breaker state (page 436) = ParalOper</b></li><li>&gt; <b>Controller mode (page 250) = AUTO</b></li></ul> <p>Return from Bus Left &gt;f can have hysteresis set by <b>Bus Left &gt;f Hys (page 288)</b>.</p> <p><b>Note:</b> <math>f_{max} = \text{Nominal Frequency (page 250)} + \text{Bus Left &gt;f (page 288)}</math></p> <p><b>Setpoint options:</b></p> <ul style="list-style-type: none"><li>&gt; Enabled / Disabled: Protection is enabled / disabled.</li><li>&gt; Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)</b>.</li></ul>			

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## Bus Left >>f Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20801	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
<p>This setpoint adjusts the behavior Bus Left &gt;&gt;f Protection.</p> <p>Behavior of protection is adjusted via setpoints <b>Bus Left &gt;&gt;f</b> (page 289), <b>Bus Left &gt;&gt;f Delay</b> (page 289) and <b>Bus Left &gt;&gt;f Hys</b> (page 289). When <b>Bus Left Frequency</b> (page 407) exceeds maximal accepted frequency for period longer than <b>Bus Left &gt;&gt;f Delay</b> (page 289) alarm <b>HST BUS LEFT &gt;&gt;F</b> (PAGE 683) is activated.</p> <ul style="list-style-type: none"><li>&gt; <b>Controller mode</b> (page 250) = OFF</li><li>&gt; <b>Controller mode</b> (page 250) = MAN and <b>Breaker state</b> (page 436) = ParalOper</li><li>&gt; <b>Controller mode</b> (page 250) = AUTO</li></ul> <p>Return from Bus Left &gt;&gt;f can have hysteresis set by <b>Bus Left &gt;&gt;f Hys</b> (page 289).</p> <p><b>Note:</b> <math>f_{max} = \text{Nominal Frequency (page 250)} + \text{Bus Left &gt;&gt;f (page 289)}</math></p> <p><b>Setpoint options:</b></p> <ul style="list-style-type: none"><li>&gt; Enabled / Disabled: Protection is enabled / disabled.</li><li>&gt; Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1</b> (PAGE 554) / <b>PROTECTION FORCE DISABLE 2</b> (PAGE 555) / <b>PROTECTION FORCE DISABLE 3</b> (PAGE 555).</li></ul>			

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## Bus Left <f Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20803	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
<p>This setpoint adjusts the behavior Bus Left &lt;f Protection.</p> <p>Behavior of protection is adjusted via setpoints <b>Bus Left &lt;f (page 290)</b>, <b>Bus Left &lt;f Delay (page 290)</b> and <b>Bus Left &lt;f Hys (page 290)</b>. When <b>Bus Left Frequency (page 407)</b> drops below minimal accepted frequency for period longer than <b>Bus Left &lt;f Delay (page 290)</b> alarm <b>HST BUS LEFT &lt;F (PAGE 684)</b> is activated.</p> <ul style="list-style-type: none"><li>➤ <b>Controller mode (page 250) = OFF</b></li><li>➤ <b>Controller mode (page 250) = MAN</b> and <b>Breaker state (page 436) = ParalOper</b></li><li>➤ <b>Controller mode (page 250) = AUTO</b></li></ul> <p>Return from Bus Left &lt;f can have hysteresis set by <b>Bus Left &lt;f Hys (page 290)</b>.</p> <p><b>Note:</b> <math>f_{min}</math> = Nominal Frequency (page 250) - Bus Left &lt;f (page 290)</p>			
Setpoint options:			
<ul style="list-style-type: none"><li>➤ Enabled / Disabled: Protection is enabled / disabled.</li><li>➤ Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)</b>.</li></ul>			

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## Bus Left <<f Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20804	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
<p>This setpoint adjusts the behavior Bus Left &lt;&lt;f Protection.</p> <p>Behavior of protection is adjusted via setpoints <b>Bus Left &lt;&lt;f</b> (page 291), <b>Bus Left &lt;&lt;f Delay</b> (page 291) and <b>Bus Left &lt;&lt;f Hys</b> (page 291). When <b>Bus Left Frequency</b> (page 407) drops below minimal accepted frequency for period longer than <b>Bus Left &lt;&lt;f Delay</b> (page 291) alarm <b>HST BUS LEFT &lt;&lt;F</b> (PAGE 684) is activated.</p> <ul style="list-style-type: none"><li>&gt; <b>Controller mode</b> (page 250) = OFF</li><li>&gt; <b>Controller mode</b> (page 250) = MAN and <b>Breaker state</b> (page 436) = ParalOper</li><li>&gt; <b>Controller mode</b> (page 250) = AUTO</li></ul> <p>Return from Bus Left &lt;&lt;f can have hysteresis set by <b>Bus Left &lt;&lt;f Hys</b> (page 291).</p> <p><b>Note:</b> <math>f_{min}</math> = Nominal Frequency (page 250) - Bus Left &lt;&lt;f (page 291)</p>			
Setpoint options:			
<ul style="list-style-type: none"><li>&gt; Enabled / Disabled: Protection is enabled / disabled.</li><li>&gt; Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1</b> (PAGE 554) / <b>PROTECTION FORCE DISABLE 2</b> (PAGE 555) / <b>PROTECTION FORCE DISABLE 3</b> (PAGE 555).</li></ul>			

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## Bus Right >f Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20809	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables or disables Bus Right >f Protection.			
Behavior of protection is adjusted via setpoints <b>Bus Right &gt;f (page 294)</b> and <b>Bus Right &gt;f Delay (page 295)</b> . When <b>Bus Right Frequency (page 412)</b> exceeds maximal accepted frequency for period longer than <b>Bus Right &gt;f Delay (page 295)</b> alarm <b>Hst Bus Right &gt;f (page 688)</b> is activated.			
<b>Note:</b> $f_{max} = \text{Nominal Frequency (page 250)} + \text{Bus Right >f (page 294)}$			
Setpoint options:			
<b>&gt;</b> Enabled / Disabled: Protection is enabled / disabled.			
<b>&gt;</b> Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555)</b> .			
<b>IMPORTANT:</b> If this protection is disabled, the BTB cannot be closed.			

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## Bus Right <f Protection

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	20810	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables or disables Bus Right <f Protection.			
Behavior of protection is adjusted via setpoints <b>Bus Right &lt;f (page 295)</b> and <b>Bus Right &lt;f Delay (page 295)</b> . When <b>Bus Right Frequency (page 412)</b> drops below minimal accepted frequency for period longer than <b>Bus Right &lt;f Delay (page 295)</b> alarm <b>Hst Bus Right &lt;f (page 688)</b> is activated.			
<b>Note:</b> $f_{min} = \text{Nominal Frequency (page 250)} + \text{Bus Right <f (page 295)}$			
Setpoint options:			
➤ Enabled / Disabled: Protection is enabled / disabled.			
➤ Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI PROTECTION FORCE DISABLE 1 (PAGE 554) / PROTECTION FORCE DISABLE 2 (PAGE 555) / PROTECTION FORCE DISABLE 3 (PAGE 555).			
IMPORTANT: If this protection is disabled, the BTB cannot be closed.			

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## Subgroup: Bus Meas Error

### Bus Meas Error

Setpoint group	Protections	Related FW	1.1.0
Range [units]	Enabled / Disabled / Protection Force Disable 1 / Protection Force Disable 2 / Protection Force Disable 3 [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	10558	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint enables or disables Bus Measurement Error protection.			
Alarm <b>Bus Meas Error (page 689)</b> is activated if controller detects a mismatch between the expected and currently measured voltage on the bus for period longer than 20 s. Mismatch means that measured voltage is lower/higher than <b>Bus Left Dead Level (page 249)</b> or <b>Bus Right Dead Level (page 248)</b> , although the controller receives information about closed/opened breaker.			
<b>Setpoint options:</b>			
➤ Enabled / Disabled: Protection is enabled / disabled.			
➤ Protection Force Disable 1 / 2 / 3: Protection is enabled or disabled by the state of LBI <b>PROTECTION FORCE DISABLE 1 (PAGE 554)</b> / <b>PROTECTION FORCE DISABLE 2 (PAGE 555)</b> / <b>PROTECTION FORCE DISABLE 3 (PAGE 555)</b> .			
<b>IMPORTANT: If this protection is disabled, the BTB cannot be closed.</b>			

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## Group: Communication Settings

### Subgroup: Controller Address

#### CAN Controller Address

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	1 .. 64 [-]		
Default value	1 [-]	Force value	NO
Step	1 [-]		
Comm object	23999	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts Controller's CAN Address which is used for <b>CAN Intercontroller Communication (page 120)</b> .			
This type of communication is used to share information between other ComAp controllers via CAN interface ( <b>Communication peripherals (page 17)</b> ).			
<b>Note:</b> Each controller connected via CAN has to have unique address, i.e. maximally 64 controllers can be connected together.			
<b>Note:</b> There is an exception, if the function <b>Hot Swap Redundancy (page 138)</b> is used, the Master and Backup controllers has to have same address because they act like one controller unit for the rest of the site.			

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#### Terminal Comm Address

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	1 .. 32 [-]		
Default value	1 [-]	Force value	NO
Step	1 [-]		
Comm object	24019	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts Controller's Terminal Address which is used for communication with other devices using terminals ETH1, ETH2, and RS485 ( <b>Communication peripherals (page 17)</b> ). This type of communication is used fore remote or local connection of the computer (InteliConfig), Display, Modbus Server, etc.			

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## Subgroup: RS485 Settings

### RS485 Modbus Speed

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	9600 / 19200 / 38400 / 57600 / 115200 [bps]		
Default value	9600 bps	Force value	NO
Step	[-]		
Comm object	24141	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts communication speed of <b>Modbus-RTU, Modbus/TCP (page 215)</b> .			

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### RS485 Modbus Mode


Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	8N1 / 8N2 / 8E1 [-]		
Default value	8N1	Force value	NO
Step	[-]		
Comm object	24020	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts communication mode of <b>Modbus-RTU, Modbus/TCP (page 215)</b> .			
<b>Possible options</b>			
8N1	8 data bits, 1 stop bit, no parity		
8N2	8 data bits, 2 stop bits, no parity		
8E1	8 data bits, 1 stop bit, even parity		

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## Subgroup: History Settings

### LB/UART Log

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	Disabled / Enabled [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	11327	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables/disables logging of connection/disconnection of each remote terminal. The record is written to the history.			
<b>Note:</b> The terminal is disconnected automatically after 1 min of inactivity and next communication request from the same terminal is considered as a new connection. When logging is enabled in certain conditions the history may be filled up with large number of records related to the communication and important record may be overwritten quite fast.			
Disabled	Logging is disabled.		
Enabled	Logging is enabled. Connection/Disconnection over ETH1, ETH2 or USB (Communication peripherals (page 17)) causes history log. <b>Note:</b> Connection over USB is recognized after reading of/writing to a communication object.		

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## Subgroup: Intercontroller Settings

### CAN Intercontroller Comm Redundancy

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	Enabled / Disabled [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	24026	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables or disables <b>CAN Intercontroller Communication Redundancy (page 121)</b> .			
<b>Note:</b> In case that there is a mismatch between this setpoint and actual state of ⓘ <b>CAN2B (page 41)</b> alarm <b>ALI Redundant CAN Error (page 672)</b> is activated.			

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## CAN Intercontroller Comm Mode

<b>Setpoint group</b>	Communication Settings	<b>Related FW</b>	1.1.0
<b>Range [units]</b>	32C / 16C / 8C / 64C CAN FD / 32C CAN FD / 8C CAN FD [-]		
<b>Default value</b>	8C	<b>Force value</b>	NO
<b>Step</b>	[-]		
<b>Comm object</b>	24499	<b>Related applications</b>	BTB
<b>Config level</b>	Standard		
<b>Setpoint visibility</b>	Always		

### Description

This setpoint selects the mode of intercontroller communication. Options 32C or 8C are necessary to use in order to ensure the communication between IntelliMains1010 BTB SC and older controllers such as IGS-NT, IG2GSC, IG200, IG500. Options 64C CAN FD, 32C CAN FD and 8C CAN FD are compatible only with controllers which support the CAN FD communication.

**Note:** It is strongly recommended to use CAN FD modes if all controllers on-site support the CAN FD communication.

Mode	Arbitration Bit-Rate	Data Bit-Rate	Maximal Bus Length	Max Bus Length With Repeater
32C	250 kbit	250 kbit	200 m	800 m
16C	125 kbit	125 kbit	400 m	1600 m
8C	50 kbit	50 kbit	900 m	3600 m
64C CAN FD	250 kb	2 Mbit	200 m	Not tested
32C CAN FD	125 kb	1 Mbit	400 m	Not tested
8C CAN FD	50 kb	400 kbit	900 m	Not tested

**IMPORTANT:** All controllers communicating on common CAN have to use the same mode of this setpoint.

**IMPORTANT:** All changes made to the setpoint takes effect after the restart of the controller.

**Note:** In case that there is a mismatch between this setpoint and value **CAN Intercontroller Comm Mode** (page 437), alarm **ALI CAN Mode Inconsistency** (page 671) is activated.

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## CAN Intercontroller Empty Check

Setpoint group	Communication Settings	Related FW	1.1.0				
Range [units]	Enabled / Disabled [-]						
Default value	Disabled	Force value	YES				
Step	[-]						
Comm object	9921	Related applications	BTB				
Config level	Standard						
Setpoint visibility	Always						
Description							
This setpoint enable or disable CAN2 Intercontroller Empty Check.							
<table><tr><td>Disabled</td><td>Detection of CAN Intercontroller Empty Check is disabled.</td></tr><tr><td>Enabled</td><td>Detection of CAN Intercontroller Empty Check is enabled. If controller does not see any other controller on the⑥ CAN2A (page 41) or⑦ CAN2B (page 41) theWrn CAN2 Empty (page 640) will be activated.</td></tr></table>				Disabled	Detection of CAN Intercontroller Empty Check is disabled.	Enabled	Detection of CAN Intercontroller Empty Check is enabled. If controller does not see any other controller on the⑥ CAN2A (page 41) or⑦ CAN2B (page 41) theWrn CAN2 Empty (page 640) will be activated.
Disabled	Detection of CAN Intercontroller Empty Check is disabled.						
Enabled	Detection of CAN Intercontroller Empty Check is enabled. If controller does not see any other controller on the⑥ CAN2A (page 41) or⑦ CAN2B (page 41) theWrn CAN2 Empty (page 640) will be activated.						

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## Subgroup: SD Card Settings

### SD Card File System

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	Unmount / Mount / Format [-]		
Default value	Unmount	Force value	NO
Step	[-]		
Comm object	23997	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint determines whether the SD card is mounted, unmounted, or should be formatted. After formatting, the setpoint is automatically switched to the mount option. If the setpoint is set to unmount no interaction with the SD card is allowed, the controller will only detect that the SD card is inserted.			
IMPORTANT: This setpoint has to be set to Mount in order to allow any writing function to the SD card.			

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## Long Term History

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	Disabled / Enabled [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	23995	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables/disables writing of long term history onto the SD card.			
Note: Setpoint SD Card File System (page 321) - has to be adjusted to Mount.			
Disabled	Long Term History is not written onto the SD card.		
Enabled	Long Term History is written onto the SD card.		

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## Subgroup: CAN1 ECU/IO Modules Split

### CAN1 ECU/IOModules Split

Setpoint group	Communication Settings	Related FW	1.1.0
Range [units]	Disabled/Enabled		
Default value	Disabled	Force value	NO
Step	-		
Comm object	17339	Related applications	BTB
Config level	Standard		
Setpoint visibility	When setpoint <b>Hot Swap Redundancy (page 253)</b> = Disabled		
Description			
This setpoint allows to change the behavior on CAN1 communication terminals.			
By default, CAN1A terminal is used for communication with ECU and IO Modules, CAN1B terminal is used for <b>Hot Swap Redundancy (page 138)</b> . By enabling this setpoint, the CAN1A terminal can be used only for ECU, the CAN1B can be used only for IO Modules.			
<b>Note:</b> In case that <b>CAN1 ECU/IOModules Split (page 322)</b> is enabled, the <b>Hot Swap Redundancy (page 138)</b> is disabled (and vice versa).			

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## Group: ETH Port Configuration

### Ethernet port 1

Setpoint group	ETH Port Configuration	Related FW	1.1.0
Range [units]	Trusted Interface / Untrusted Interface / Modbus Interface / Trusted Mirroring / Untrusted Mirroring / Modbus Mirroring [-]		
Default value	Trusted Interface	Force value	NO
Step	[-]		
Comm object	23873	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to select the interface type on ethernet slot 1.			
<b>Trusted Interface</b> - It is expected that these interfaces are operated locally inside a closed environment / infrastructure where additional measures against misuse or attack take place (e.g. physical access limitation). Due to nature of this interface less strict cybersecurity rules apply at it and that is why Implicit account is introduced here to make working with the controller simpler.			
<b>Untrusted Interface</b> - This interface is a general-purpose one and it is expected that it may be exposed to public networks, such as Internet, which are not under control of the entity operating the controller. Thus, strict cybersecurity rules apply for this type of interface.			
<b>Modbus Interface</b> - This type of interface is used for Modbus communication. It is not possible to connect to the controller using this interface.			
<b>Trusted Mirroring/Untrusted Mirroring/Modbus Mirroring</b> - If mirroring mode is selected for a socket, the switch will be configured that except sending traffic belonging normally to that socket, it will also copy to that socket all traffic from other sockets assigned to the same network.			
<b>Note:</b> Only one socket can be adjusted to mirroring function. If multiple sockets are adjusted to mirroring function the alarm ALI Ethernet Port Inconsistency will be still displayed after the CU restart.			

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## Ethernet port 2

Setpoint group	ETH Port Configuration		Related FW	1.1.0
Range [units]	Trusted Interface / Untrusted Interface / Modbus Interface / Trusted Mirroring / Untrusted Mirroring / Modbus Mirroring [-]			
Default value	Trusted Interface	Force value		NO
Step	[-]			
Comm object	23872	Related applications		BTB
Config level	Standard			
Setpoint visibility	Always			
Description				
This setpoint is used to select the interface type on ethernet slot 2.				
<b>Trusted Interface</b> - It is expected that these interfaces are operated locally inside a closed environment / infrastructure where additional measures against misuse or attack take place (e.g. physical access limitation). Due to nature of this interface less strict cybersecurity rules apply at it and that is why Implicit account is introduced here to make working with the controller simpler.				
<b>Untrusted Interface</b> - This interface is a general-purpose one and it is expected that it may be exposed to public networks, such as Internet, which are not under control of the entity operating the controller. Thus, strict cybersecurity rules apply for this type of interface.				
<b>Modbus Interface</b> - This type of interface is used for Modbus communication. It is not possible to connect to the controller using this interface.				
<b>Trusted Mirroring/Untrusted Mirroring/Modbus Mirroring</b> - If mirroring mode is selected for a socket, the switch will be configured that except sending traffic belonging normally to that socket, it will also copy to that socket all traffic from other sockets assigned to the same network.				
<b>Note:</b> Only one socket can be adjusted to mirroring function. If multiple sockets are adjusted to mirroring function the alarm ALI Ethernet Port Inconsistency will be still displayed after the CU restart.				

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## Ethernet port 3

Setpoint group	ETH Port Configuration		Related FW	1.1.0
Range [units]	Trusted Interface / Untrusted Interface / Modbus Interface / Trusted Mirroring / Untrusted Mirroring / Modbus Mirroring [-]			
Default value	Modbus Interface	Force value	NO	
Step	[-]			
Comm object	23871	Related applications	BTB	
Config level	Standard			
Setpoint visibility	Always			
Description				
This setpoint is used to select the interface type on ethernet slot 3.				
<b>Trusted Interface</b> - It is expected that these interfaces are operated locally inside a closed environment / infrastructure where additional measures against misuse or attack take place (e.g. physical access limitation). Due to nature of this interface less strict cybersecurity rules apply at it and that is why Implicit account is introduced here to make working with the controller simpler.				
<b>Untrusted Interface</b> - This interface is a general-purpose one and it is expected that it may be exposed to public networks, such as Internet, which are not under control of the entity operating the controller. Thus, strict cybersecurity rules apply for this type of interface.				
<b>Modbus Interface</b> -This type of interface is used for Modbus communication. It is not possible to connect to the controller using this interface.				
<b>Trusted Mirroring/Untrusted Mirroring/Modbus Mirroring</b> - If mirroring mode is selected for a socket, the switch will be configured that except sending traffic belonging normally to that socket, it will also copy to that socket all traffic from other sockets assigned to the same network.				
<b>Note:</b> Only one socket can be adjusted to mirroring function. If multiple sockets are adjusted to mirroring function the alarm ALI Ethernet Port Inconsistency will be still displayed after the CU restart.				

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## Group: ETH Interface 1 - Trusted

### Subgroup: TCP/IP Settings

#### IP Address Mode

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
Range [units]	Manual / Automatic / Disabled [-]		
Default value	Automatic	Force value	YES
Step	[-]		
Comm object	24063	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to select the method how the ethernet connection is adjusted on <b>Ethernet 1 (page 17)</b> .			
Manual:	Manual: The Ethernet connection is fixed by means of the setpoints <b>IP Address (page 327)</b> , <b>Subnet Mask (page 327)</b> , <b>Gateway IP (page 328)</b> . This method should be used for a classic Ethernet or internet connection. When this type of connection opens, the controller is specified by its IP address. This means that it would be inconvenient if the IP address were not fixed (static).		
Automatic:	The Ethernet connection settings is obtained automatically from the DHCP server. The obtained settings is shown in related values. If the process of obtaining the settings from the DHCP server is not successful, the values <i>000.000.000.000</i> are shown.		
Disabled:	The Ethernet terminal is disabled.		
<b>IMPORTANT: When the mode is switched from Automatic to Manual the TCP/IP settings will be changed to the values in the related setpoints. In case you are using Ethernet 1 to connect the CU you will be disconnected. Turn off the setpoint hiding function to manually change the TCP/IP settings to same values obtained via DHCP so you will not be disconnected when changing mode.</b>			

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## IP Address

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	192.168.1.1	Force value	NO
Step	[-]		
Comm object	24061	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 326) = Manual		
Description			
<p>The setpoint is used to select the method how the IP Address is adjusted on <b>Ethernet 1 (page 17)</b>.</p> <p>If <b>IP Address Mode (page 326)</b> = Manual, this setpoint is used to adjust the IP address of the <b>Ethernet 1 (page 17)</b> interface of the controller. Ask your IT specialist for help with this setting.</p> <p>If <b>IP Address Mode (page 326)</b> = Automatic this setpoint is inactive. The IP address is assigned by the DHCP server.</p>			
<b>Note:</b> Only valid IP address can be inserted.			

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## Subnet Mask

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	255.255.255.0	Force value	NO
Step	[-]		
Comm object	24059	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 331) = Manual		
Description			
<p>The setpoint is used to select the method how the Subnet Mask is adjusted on <b>Ethernet 1 (page 17)</b>.</p> <p>If <b>IP Address Mode (page 326)</b> = Manual, this setpoint is used to adjust the Subnet Mask. Ask your IT specialist for help.</p> <p>If <b>IP Address Mode (page 326)</b> = Automatic this setpoint is inactive. The Subnet Mask is assigned by the DHCP server.</p>			
<b>Note:</b> Only valid IP address can be inserted.			

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## Gateway IP

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	192.168.1.1	Force value	NO
Step	[-]		
Comm object	24057	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 326) = Manual		
Description			
<p>This setpoint is used to select the method how the Gateway IP is adjusted on <b>Ethernet 1 (page 17)</b> .</p> <p>If <b>IP Address Mode (page 326)</b> = Manual, this setpoint is used to adjust the IP address of the gateway of the network segment where the controller is connected.</p> <p>If <b>IP Address Mode (page 326)</b> = Automatic this setpoint is used to display the gateway IP which has been assigned by the DHCP server.</p> <p>A gateway is a device which connects the respective segment with the other segments and/or the internet.</p>			
<b>Note:</b> Only valid IP address can be inserted.			

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## IP Firewall

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0				
Range [units]	Enabled / Disabled [-]						
Default value	Disabled	Force value	NO				
Step	[-]						
Comm object	24029	Related applications	BTB				
Config level	Standard						
Setpoint visibility	Always						
Description							
This setpoints enables or disables the built-in <b>Firewall (page 136)</b> functionality for <b>Ethernet 1 (page 17)</b> .							
<table><tr><td>Disabled:</td><td>The firewall function is switched off</td></tr><tr><td>Enabled:</td><td>The firewall function is switched on.</td></tr></table>				Disabled:	The firewall function is switched off	Enabled:	The firewall function is switched on.
Disabled:	The firewall function is switched off						
Enabled:	The firewall function is switched on.						
<b>IMPORTANT: Loss of connection can happen when enabling the firewall and using remote connection via Internet</b>							

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## Subgroup: Modbus Server Settings

### Modbus Server

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
Range [units]	Disabled / Enabled [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	24034	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables or disables Modbus communication via <b>Ethernet 1 (page 17)</b> .			

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### Modbus Client Inactivity Timeout

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
	ETH Interface 2 - Untrusted		
	ETH Interface 3 - Modbus		
Range [units]	0 .. 65535 [s]		
Default value	60 s	Force value	NO
Step	1 s		
Comm object	24097	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Modbus connection (TCP socket) is closed by controller, if a Modbus client does not communicate for this time.			
Note: This setpoint is shared with other Modbus Client Inactivity Timeout setpoints.			

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## Subgroup: ComAp Client Settings

### Direct Connection Port

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
Range [units]	0 .. 65535 [-]		
Default value	23 [-]	Force value	YES
Step	1 [-]		
Comm object	24035	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This port is used to listen for an incoming TCP connection on <b>Ethernet 1 (page 17)</b> .			

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### ComAp Client Inactivity Timeout

Setpoint group	ETH Interface 1 - TrustedETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 65535 [s]		
Default value	60 s	Force value	YES
Step	1 s		
Comm object	24098	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Connection (TCP socket) is closed by controller, if a client (e.g. IntelliConfig) does not communicate for this time. This timeout applies to both direct and AirGate connection.			
<b>Note:</b> This setpoint is shared with <b>ComAp Client Inactivity Timeout (page 330)</b> .			

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## Group: ETH Interface 2 - Untrusted

### Subgroup: TCP/IP Settings

#### IP Address Mode

Setpoint group	ETH Interface 2 - Untrusted Ethernet	Related FW	1.1.0
Range [units]	Manual / Automatic / Disabled [-]		
Default value	Automatic	Force value	NO
Step	[-]		
Comm object	24259	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to select the method how the ethernet connection is adjusted on <b>Ethernet 2 (page 18)</b> .			
Manual:	The Ethernet connection is fixed by means of the setpoints <b>IP Address (page 332)</b> , <b>Subnet Mask (page 332)</b> , <b>Gateway IP (page 333)</b> , <b>DNS IP Address 1 (page 334)</b> , <b>DNS IP Address 2 (page 335)</b> . This method should be used for a classic Ethernet or internet connection. When this type of connection opens, the controller is specified by its IP address. This means that it would be inconvenient if the IP address were not fixed (static).		
Automatic:	The Ethernet connection settings is obtained automatically from the DHCP server. The obtained settings is shown in related values. If the process of obtaining the settings from the DHCP server is not successful, the values <i>000.000.000.000</i> are shown.		
Disabled:	The Ethernet terminal is disabled.		
<b>IMPORTANT:</b> When the mode is switched from Automatic to Manual the TCP/IP settings will be changed to the values in the related setpoints. In case you are using Ethernet 2 to connect the CU you will be disconnected. Turn off the setpoint hiding function to manually change the TCP/IP settings to same values obtained via DHCP so you will not be disconnected when changing mode.			

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## IP Address

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	192.168.2.254	Force value	NO
Step	[-]		
Comm object	24376	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 331) = Manual		
Description			
<p>The setpoint is used to select the method how the IP Address is adjusted on <b>Ethernet 2 (page 18)</b>.</p> <p>If <b>IP Address Mode (page 331)</b> = Manual, this setpoint is used to adjust the IP address of the <b>Ethernet 2 (page 18)</b> interface of the controller. Ask your IT specialist for help with this setting.</p> <p>If <b>IP Address Mode (page 331)</b> = Automatic this setpoint is inactive. The IP address is assigned by the DHCP server.</p>			
<b>Note:</b> Only valid IP address can be inserted.			

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## Subnet Mask

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	255.255.255.0	Force value	NO
Step	[-]		
Comm object	24375	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 331) = Manual		
Description			
<p>The setpoint is used to select the method how the Subnet Mask is adjusted on <b>Ethernet 2 (page 18)</b>.</p> <p>If <b>IP Address Mode (page 331)</b> = Manual this setpoint is used to adjust the Subnet Mask. Ask your IT specialist for help with this setting.</p> <p>If <b>IP Address Mode (page 331)</b> = Automatic this setpoint is inactive. The Subnet Mask is assigned by the DHCP server.</p>			
<b>Note:</b> Only valid IP address can be inserted.			

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## Gateway IP

<b>Setpoint group</b>	ETH Interface 2 - Untrusted	<b>Related FW</b>	1.1.0
<b>Range [units]</b>	0 .. 15 characters [-]		
<b>Default value</b>	192.168.2.1	<b>Force value</b>	NO
<b>Step</b>	[-]		
<b>Comm object</b>	24373	<b>Related applications</b>	BTB
<b>Config level</b>	Standard		
<b>Setpoint visibility</b>	Only if <b>IP Address Mode (page 331)</b> = Manual		
<b>Description</b>			
<p>This setpoint is used to select the method how the Gateway IP is adjusted.</p> <p>If <b>IP Address Mode (page 331)</b> = Manual, this setpoint is used to adjust the Gateway IP address of the <b>Ethernet 2 (page 18)</b> interface of the controller. Ask your IT specialist for help with this setting.</p> <p>If <b>IP Address Mode (page 331)</b> = Automatic this setpoint is inactive. The Gateway IP address is assigned by the DHCP server.</p> <p>A gateway is a device which connects the respective segment with the other segments and/or Internet.</p> <p><b>Note:</b> Only valid IP address can be inserted.</p>			

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## IP Firewall

<b>Setpoint group</b>	ETH Interface 2 - Untrusted Ethernet	<b>Related FW</b>	1.1.0				
<b>Range [units]</b>	Disabled / Enabled [-]						
<b>Default value</b>	Disabled	<b>Force value</b>	NO				
<b>Step</b>	[-]						
<b>Comm object</b>	24092	<b>Related applications</b>	BTB				
<b>Config level</b>	Standard						
<b>Setpoint visibility</b>	Always						
<b>Description</b>							
This setpoints enables or disables the built-in <b>Firewall (page 136)</b> functionality for <b>Ethernet 2 (page 18)</b> .							
<table><tr><td>Disabled:</td><td>The firewall function is switched off</td></tr><tr><td>Enabled:</td><td>The firewall function is switched on.</td></tr></table>				Disabled:	The firewall function is switched off	Enabled:	The firewall function is switched on.
Disabled:	The firewall function is switched off						
Enabled:	The firewall function is switched on.						
<b>IMPORTANT: Loss of connection can happen when enabling the firewall and using remote connection via Internet</b>							

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## DNS Mode

<b>Setpoint group</b>	ETH Interface 2 - Untrusted Ethernet	<b>Related FW</b>	1.1.0
<b>Range [units]</b>	Manual / Automatic [-]		
<b>Default value</b>	Automatic	<b>Force value</b>	
<b>Step</b>	[-]		
<b>Comm object</b>	24101	<b>Related applications</b>	BTB
<b>Config level</b>	Standard		
<b>Setpoint visibility</b>	Only if <b>IP Address Mode (page 331)</b> = Automatic		
<b>Description</b>			
This setpoint enables to enter DNS server addresses for <b>Ethernet 2 (page 18)</b> manually, even with the <b>IP Address Mode (page 331)</b> set to Automatic.			
<b>Automatic:</b>	DNS server addresses are automatically obtained from a DHCP server.		
<b>Manual:</b>	<b>DNS IP Address 1 (page 334)</b> and <b>DNS IP Address 2 (page 335)</b> can be adjusted manually. Use this option to resolve e.g. internet access policy related issue, if local DNS server addresses automatically obtained from a DHCP server do not work		

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## DNS IP Address 1

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	8.8.8.8	Force value	NO
Step	[-]		
Comm object	24362	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 331) = Manual OR (IP Address Mode (page 331) = Automatic AND DNS Mode (page 334) = Manual)		
Description			
This setpoint allows to set DNS IP Address 1 for Ethernet 2 (page 18) manually.			
Note: Only valid IP address can be inserted.			

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## DNS IP Address 2

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	4.4.4.4	Force value	NO
Step	[-]		
Comm object	24331	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 331) = Manual OR (IP Address Mode (page 331) = Automatic AND DNS Mode (page 334) = Manual)		
Description			
This setpoint allows to set DNS IP Address 2 for Ethernet 2 (page 18) manually.			
Note: Only valid IP address can be inserted.			

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## Subgroup: AirGate Settings

### AirGate Connection

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Disabled / Enabled [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	24365	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables or disables <b>AirGate connection (page 112)</b> function.			

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## AirGate Address

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 31 characters [-]		
Default value	global.airgate.link	Force value	NO
Step	[-]		
Comm object	24364	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used for entering the domain name or IP address of the AirGate server. Use the free AirGate server provided by ComAp at global.airgate.link.			

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## AirGate Port

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 65535 [-]		
Default value	54440 [-]	Force value	NO
Step	1 [-]		
Comm object	24096	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This port is used for TCP communication with the AirGate server.			
<b>Note:</b> Use port 5440 for standard ComAp AirGate service.			

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## Subgroup: Messages Settings

### Event Message

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Enabled / Disabled [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	10926	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables or disables sending of Event Messages.			

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### Wrn Message

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Enabled / Disabled [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	8482	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables or disables sending of Warning Messages.			

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## BOR Message

Setpoint group	ETH Interface 2 - Untrusted CM-4G-GPS Ethernet	Related FW	1.1.0
Range [units]	Enabled / Disabled [-]		
Default value	Enabled	Force value	YES
Step	[-]		
Comm object	8484	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables or disables sending of Breaker Open + FltRes Messages.			

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## E-mail Language

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Depends on controller's supported languages. [-]		
Default value	English	Force value	NO
Step	[-]		
Comm object	24299	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Use this setpoint to set the language of Event, Warning, etc. e-mails.			

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## Subgroup: E-mail Settings

### E-mail Address 1

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..63 characters [-]		
Default value	[-]	Force value	NO
Step	[-]		
Comm object	24298	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Enter a valid e-mail address where event and alarm messages will be sent.			

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### E-mail Address 2

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..63 characters [-]		
Default value	[-]	Force value	NO
Step	[-]		
Comm object	24297	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Enter a valid e-mail address where event and alarm messages will be sent.			

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### E-mail Address 3

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..63 characters [-]		
Default value	[-]	Force value	NO
Step	[-]		
Comm object	24145	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Enter a valid e-mail address where event and alarm messages will be sent.			

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## E-mail Address 4

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..63 characters [-]		
Default value	[-]	Force value	NO
Step	[-]		
Comm object	24144	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Enter a valid e-mail address where event and alarm messages will be sent.			

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## SMTP User Name

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..31 characters [-]		
Default value	[-]	Force value	NO
Step	[-]		
Comm object	23877	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Use this setpoint to enter the username for the SMTP server. Leave the setpoint blank if the SMTP server does not require authentication.			

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## SMTP User Password

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..15 characters [-]		
Default value	[-]	Force value	NO
Step	[-]		
Comm object	23876	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Use this setpoint to enter the password for the SMTP server. Leave the setpoint blank if the SMTP server does not require authentication.			

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## SMTP Server Address

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..31 characters [-]		
Default value	global.airgate.link:9925	Force value	NO
Step	[-]		
Comm object	24093	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used for entering the domain name (e.g. smtp.yourprovider.com) or IP address (e.g. 74.125.39.109) and port number (e.g. :9925) of the SMTP server. Ask your internet provider or IT manager for this information.			
<div><div></div><div><b>Example:</b> Enter the IP address "74.125.39.109" and port number "9925" as "74.125.39.109:9925".</div></div>			
<div><b>Note:</b> You may use also any public SMTP server which does not require connection over SSL/TLS channels.</div>			

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## SMTP Sender Address

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..31 characters [-]		
Default value	[-]	Force value	NO
Step	[-]		
Comm object	23878	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Enter an existing email address into this setpoint. This address will be used as sender address in active e-mails that will be sent from the controller.			
<i><b>Note:</b> It is not needed to enter an existing email address, nevertheless valid email format needs to be followed.</i>			
<b>IMPORTANT:</b> This item is obligatory when emails are configured.			

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## SMTP Encryption Type

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0						
Range [units]	NONE / SSL/TLS / STARTTLS [-]								
Default value	NONE	Force value	NO						
Step	[-]								
Comm object	24076	Related applications	BTB						
Config level	Standard								
Setpoint visibility	Always								
Description									
This setpoint selects encryption type for SMTP session.									
<table><tr><td>NONE</td><td>Session is without of any encryption.</td></tr><tr><td>SSL/TLS</td><td>Encrypted channel is created first and only after that session is created.</td></tr><tr><td>STARTTLS</td><td>Session is created without of encryption and after command STARTTLS it is switched to encrypted session.</td></tr></table>				NONE	Session is without of any encryption.	SSL/TLS	Encrypted channel is created first and only after that session is created.	STARTTLS	Session is created without of encryption and after command STARTTLS it is switched to encrypted session.
NONE	Session is without of any encryption.								
SSL/TLS	Encrypted channel is created first and only after that session is created.								
STARTTLS	Session is created without of encryption and after command STARTTLS it is switched to encrypted session.								

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## Subgroup: SNMP Settings

### SNMP Agent

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Disabled / SNMP v1/v2c / SNMP v3 [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	24336	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoints Enables or disables Simple Network Management Protocol (SNMP) Agent.			
<b>Note:</b> <i>SNMP v3 has upgraded encryption, remote configuration, and security (extra setpoints are available).</i>			
<b>Note:</b> <i>It is supported only User-Based security model (USM, RFC-3414). View-based Access Control Model (VACM, RFC-3415) is not supported.</i>			

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### SNMP Trap Format

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	v1 Trap / v2 Notific / v2 Inform [-]		
Default value	v2 Inform	Force value	NO
Step	[-]		
Comm object	24136	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> != Disabled		
Description			
This setpoint selects format of the SNMP trap messages.			
v1 Trap		SNMPv1 trap format is used	
v2 Notific		SNMPv2c Notification format is used	
v2 Inform		SNMPv2c Inform format is used	

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## SNMP RD Community String

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..31 characters [-]		
Default value	public	Force value	NO
Step	[-]		
Comm object	24335	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> != Disabled		
Description			
SNMP Community String only for reading.			

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## SNMP WR Community String

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0..31 characters [-]		
Default value	private	Force value	NO
Step	[-]		
Comm object	24334	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> = SNMP v1/v2c		
Description			
SNMP Community String for writing and reading.			

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## SNMP Traps IP Address 1

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 63 characters [-]		
Default value	-	Force value	NO
Step	[-]		
Comm object	24095	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> != Disabled		
Description			
IP address 1 for receiving SNMP Traps. Leave this setpoint blank if SNMP traps should not be send.			

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## SNMP Traps IP Address 2

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Valid IP address [-]		
Default value	-	Force value	NO
Step	[-]		
Comm object	24094	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> != Disabled		
Description			
IP address 2 for receiving SNMP Traps. Leave this setpoint blank if SNMP traps should not be send.			

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## SNMP Engine User Name

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 31 characters [-]		
Default value	-	Force value	NO
Step	[-]		
Comm object	23851	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> = SNMP v3		
Description			
Defines SNMP v3 Engine User Name.			

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## SNMP Privacy Protocol

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	DES / 3DES / AES128 / AES256 [-]		
Default value	AES128	Force value	NO
Step	[-]		
Comm object	23856	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> = SNMP v3		
Description			
Selects SNMP v3 Privacy Protocol.			

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## SNMP Authentication Protocol

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	MD5 / SHA / SHA256[-]		
Default value	SHA	Force value	NO
Step	[-]		
Comm object	23857	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> = SNMP v3		
Description			
Selects SNMP v3 Authentication Protocol.			

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## SNMP Security Level

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	NONE/ AUTH-NOPRIV / AUTH-PRIV [-]		
Default value	NONE	Force value	NO
Step	[-]		
Comm object	23855	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>SNMP Agent (page 343)</b> = SNMP v3		
Description			
Selects SNMP v3 security level. If NONE the agent will work in SNMP v2c mode..			

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## Subgroup: Modbus Server Settings

### Modbus Server

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Disabled / Enabled [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	24337	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Enables or disables Modbus communication via <b>Ethernet 2 (page 18)</b> .			

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## Modbus Client Inactivity Timeout

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
	ETH Interface 2 - Untrusted		
	ETH Interface 3 - Modbus		
Range [units]	0 .. 65535 [s]		
Default value	60 s	Force value	NO
Step	1 s		
Comm object	24097	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Modbus connection (TCP socket) is closed by controller, if a Modbus client does not communicate for this time.			
Note: This setpoint is shared with other Modbus Client Inactivity Timeout setpoints.			

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## Subgroup: ComAp Client Settings

### Direct Connection

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Disabled / Enabled [-]		
Default value	Enabled	Force value	NO
Step	[-]		
Comm object	24099	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Use this setpoint to enable/disable direct connection of a ComAp client (e.g. IntelliConfig) to the IP address of the controller.			
<b>Note:</b> For Direct connection the controller IP address must be reachable from the client IP address.			

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## Direct Connection Port

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 65535 [-]		
Default value	23 [-]	Force value	NO
Step	1 [-]		
Comm object	24374	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This port is used to listen for an incoming TCP connection on <b>Ethernet 2 (page 18)</b> .			

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## ComAp Client Inactivity Timeout

Setpoint group	ETH Interface 1 - TrustedETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 65535 [s]		
Default value	60 s	Force value	YES
Step	1 s		
Comm object	24098	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Connection (TCP socket) is closed by controller, if a client (e.g. InteliConfig) does not communicate for this time. This timeout applies to both direct and AirGate connection.			
<b>Note:</b> This setpoint is shared with <b>ComAp Client Inactivity Timeout (page 348)</b> .			

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## Subgroup: NTP Settings

### NTP Clock Synchronization

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	Disabled / Enabled [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	24075	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint is used to enable/disable synchronization of the controller's time with the exact time from a NTP server.			

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### NTP Server

Setpoint group	ETH Interface 2 - Untrusted	Related FW	1.1.0
Range [units]	0 .. 63 characters [-]		
Default value	pool.ntp.org	Force value	NO
Step	[-]		
Comm object	24074	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
NTP server address for time synchronization.			
<b>Note:</b> Only valid IP address or domain can be inserted.			

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## Group: ETH Interface 3 - Modbus

### Subgroup: TCP/IP Settings

#### IP Address Mode

Setpoint group	ETH Interface 3 - Modbus	Related FW	1.1.0
Range [units]	Manual / Automatic / Disabled [-]		
Default value	Automatic	Force value	NO
Step	[-]		
Comm object	24049	Related applications	BTB

<b>Config level</b>	Standard
<b>Setpoint visibility</b>	Only if relevant module is installed
<b>Description</b>	
This setpoint is used to select the method how the ethernet connection is adjusted on <b>Ethernet 3 (page 18)</b> .	
<b>Manual:</b>	The Ethernet connection is fixed by means of the setpoints <b>IP Address (page 350)</b> , <b>Subnet Mask (page 350)</b> and <b>Gateway IP (page 351)</b> . This method should be used for a classic Ethernet or internet connection. When this type of connection opens, the controller is specified by its IP address. This means that it would be inconvenient if the IP address were not fixed (static).
<b>Automatic:</b>	The Ethernet connection settings is obtained automatically from the DHCP server. The obtained settings is shown in related values. If the process of obtaining the settings from the DHCP server is not successful, the values <i>000.000.000.000</i> are shown.
<b>Disabled:</b>	The Ethernet terminal is disabled.

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## IP Address

Setpoint group	ETH Interface 3 - Modbus	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	192.168.3.254	Force value	NO
Step	[-]		
Comm object	24047	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 349) = Manual		
Description			
<p>The setpoint is used to select the method how the IP Address is adjusted on <b>Ethernet 3 (page 18)</b>.</p> <p>If <b>IP Address Mode (page 349)</b> = Manual, this setpoint is used to adjust the IP address of the <b>Ethernet 3 (page 18)</b> interface of the controller. Ask your IT specialist for help with this setting.</p> <p>If <b>IP Address Mode (page 349)</b> = Automatic this setpoint is inactive. The IP address is assigned by the DHCP server.</p>			
<b>Note:</b> Only valid IP address can be inserted.			

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## Subnet Mask

<b>Setpoint group</b>	ETH Interface 3 - Modbus	<b>Related FW</b>	1.1.0
<b>Range [units]</b>	0 .. 15 characters [-]		
<b>Default value</b>	255.255.255.0	<b>Force value</b>	NO

Step	[-]		
Comm object	24045	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 349) = Manual		
Description			
<p>The setpoint is used to select the method how the Subnet Mask is adjusted on <b>Ethernet 3 (page 18)</b>.</p> <p>If <b>IP Address Mode (page 349)</b> = Manual this setpoint is used to adjust the Subnet Mask. Ask your IT specialist for help with this setting.</p> <p>If <b>IP Address Mode (page 349)</b> = Automatic this setpoint is inactive. The Subnet Mask is assigned by the DHCP server.</p>			
<b>Note:</b> Only valid IP address can be inserted.			

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## Gateway IP

Setpoint group	ETH Interface 3 - Modbus	Related FW	1.1.0
Range [units]	0 .. 15 characters [-]		
Default value	192.168.3.1	Force value	NO
Step	[-]		
Comm object	24043	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if IP Address Mode (page 349) = Manual		
Description			
<p>This setpoint is used to select the method how the Gateway IP is adjusted.</p> <p>If <b>IP Address Mode (page 349)</b> = Manual, this setpoint is used to adjust the Gateway IP address of the <b>Ethernet 3 (page 18)</b> interface of the controller. Ask your IT specialist for help with this setting.</p> <p>If <b>IP Address Mode (page 349)</b> = Automatic this setpoint is inactive. The Gateway IP address is assigned by the DHCP server.</p> <p>A gateway is a device which connects the respective segment with the other segments and/or Internet.</p> <p><b>Note:</b> Only valid IP address can be inserted.</p>			

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## Subgroup: Modbus Settings

### Modbus Type

Setpoint group	ETH Interface 3 - Modbus	Related FW	1.1.0
Range [units]	Modbus Client / Modbus Server / Disabled [-]		
Default value	Disabled	Force value	NO
Step	[-]		
Comm object	23868	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint enables the Modbus Client or Server on the Modbus Interface.			

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### Modbus Client Inactivity Timeout

Setpoint group	ETH Interface 1 - Trusted	Related FW	1.1.0
	ETH Interface 2 - Untrusted		
	ETH Interface 3 - Modbus		
Range [units]	0 .. 65535 [s]		
Default value	60 s	Force value	NO
Step	1 s		
Comm object	24097	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
Modbus connection (TCP socket) is closed by controller, if a Modbus client does not communicate for this time.			
Note: This setpoint is shared with other Modbus Client Inactivity Timeout setpoints.			

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## Group: User Buttons

### Subgroup: User Buttons

#### User Button 1

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20826	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 1 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 1 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 1 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 1 is still 0.		

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#### User Button 2

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20827	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 2 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 2 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 2 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 2 is still 0.		

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## User Button 3

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20828	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 3 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 3 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 3 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 3 is still 0.		

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## User Button 4

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20829	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 4 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 4 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 4 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 4 is still 0.		

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## User Button 5

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20830	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 5 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 5 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 5 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 5 is still 0.		

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## User Button 6

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20831	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 6 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 6 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 6 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 6 is still 0.		

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## User Button 7

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20832	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 7 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 7 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 7 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 7 is still 0.		

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## User Button 8

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20833	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 8 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 8 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 8 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 8 is still 0.		

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## User Button 9

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20834	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 9 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 9 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 9 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 9 is still 0.		

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## User Button 10

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20835	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 10 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 10 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 10 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 10 is still 0.		

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## User Button 11

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20836	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 11 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 11 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 11 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 11 is still 0.		

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## User Button 12

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20837	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 12 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 12 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 12 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 12 is still 0.		

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## User Button 13

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20838	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 13 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 13 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 13 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 13 is still 0.		

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## User Button 14

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20839	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 14 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 14 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 14 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 14 is still 0.		

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## User Button 15

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20840	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 15 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 15 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 15 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 15 is still 0.		

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## User Button 16

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20841	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 16 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 16 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 16 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 16 is still 0.		

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## User Button 17

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20842	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 17 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 17 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 17 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 17 is still 0.		

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## User Button 18

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20843	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 18 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 18 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 18 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 18 is still 0.		

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## User Button 19

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20844	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 19 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 19 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 19 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 19 is still 0.		

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## User Button 20

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20845	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 20 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 20 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 20 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 20 is still 0.		

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## User Button 21

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20846	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 21 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 21 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 21 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 21 is still 0.		

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## User Button 22

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20847	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 22 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 22 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 22 is still 1.  <i><b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.</i>		
MAN OFF	Value of the User Button 22 is still 0.		

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## User Button 23

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20848	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 23 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 23 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 23 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 23 is still 0.		

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## User Button 24

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20849	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 24 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 24 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 24 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 24 is still 0.		

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## User Button 25

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20850	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 25 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 25 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 25 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 25 is still 0.		

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## User Button 26

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20851	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 26 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 26 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 26 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 26 is still 0.		

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## User Button 27

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20852	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 27 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 27 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 27 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 27 is still 0.		

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## User Button 28

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20853	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 28 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 28 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 28 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 28 is still 0.		

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## User Button 29

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20854	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 29 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 29 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 29 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 29 is still 0.		

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## User Button 30

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20855	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 30 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 30 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 30 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 30 is still 0.		

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## User Button 31

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20856	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 31 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 31 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 31 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 31 is still 0.		

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## User Button 32

Setpoint group	User Buttons	Related FW	1.1.0
Range [units]	COMMAND / MAN ON / MAN OFF [-]		
Default value	COMMAND	Force value	YES
Step	[-]		
Comm object	20857	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
This setpoint adjusts behavior of User Button 32 which is part of <b>User Buttons (page 171)</b> .			
COMMAND	User Button 32 is controlled by command from <b>External display (page 75)</b> .		
MAN ON	Value of the User Button 32 is still 1.  <b>Note:</b> You should always switch from MAN ON to MAN OFF before switching to COMMAND, otherwise value of the User Button 1 will be 1 until command is received.		
MAN OFF	Value of the User Button 32 is still 0.		

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## Group: Timers & Counters

### Subgroup: Pulse counters

#### Conversion Coeff. Fast Pulse 1

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	OFF / 0 .. 65000 [-]		
Default value	OFF	Force value	YES
Step	1 [-]		
Comm object	20307	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the rate of increasing of the <b>Fast Pulse Counter 1 (page 433)</b> which is physically configured to binary input 9.			
Set this setpoint to OFF to turn the function off. See the chapter <b>Pulse Counters (page 167)</b> for more information.			

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#### Conversion Coeff. Fast Pulse 2

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	OFF / 0 .. 65000 [-]		
Default value	OFF	Force value	YES
Step	1 [-]		
Comm object	20308	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the rate of increasing of the <b>Fast Pulse Counter 2 (page 434)</b> which is physically configured to binary input 10.			
Set this setpoint to OFF to turn the function off. See the chapter <b>Pulse Counters (page 167)</b> for more information.			

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## Conversion Coefficient Pulse 1

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	OFF / 0 .. 65000 [-]		
Default value	OFF	Force value	NO
Step	1 [-]		
Comm object	10994	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the rate of increasing of the "slow" <b>Pulse Counter 1 (page 434)</b> which is connected with LBI <b>PULSE COUNTER 1 (PAGE 556)</b> .			
Set this setpoint to OFF to turn the function off. See the chapter <b>Pulse Counters (page 167)</b> for more information.			

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## Conversion Coefficient Pulse 2

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	OFF / 0 .. 65000 [-]		
Default value	OFF	Force value	NO
Step	1 [-]		
Comm object	10995	Related applications	BTB
Config level	Advanced		
Setpoint visibility	Always		
Description			
This setpoint adjusts the rate of increasing of the "slow" <b>Pulse Counter 2 (page 434)</b> which is connected with LBI <b>PULSE COUNTER 2 (PAGE 556)</b> .			
Set this setpoint to OFF to turn the function off. See the chapter <b>Pulse Counters (page 167)</b> for more information.			

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## Subgroup: Timer 1


### Timer 1 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15358	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 1. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 1 Setup (page 372)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 1 (PAGE 567)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 1 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10969	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 1 Function (page 371)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 1. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 2


### Timer 2 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disabled [-]	Force value	YES
Step	[-]		
Comm object	15359	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 2. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 2 Setup (page 374)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 2 (PAGE 568)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 2 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10970	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 2 Function (page 373)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 2. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 3


### Timer 3 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15360	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 3. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 3 Setup (page 376)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 3 (PAGE 568)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 3 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10971	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 3 Function (page 375)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 3. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 4

### Timer 4 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15361	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 4. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 4 Setup (page 378)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 4 (PAGE 568)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 4 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10973	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 4 Function (page 377)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 4. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 5


### Timer 5 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15362	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 5. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 5 Setup (page 380)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 5 (PAGE 569)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 5 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10974	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 5 Function (page 379)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 5. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 6


### Timer 6 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15363	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 6. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 6 Setup (page 382)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 6 (PAGE 569)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 6 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10975	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 6 Function (page 381)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 6. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 7

### Timer 7 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15364	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 7. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 7 Setup (page 384)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 7 (PAGE 569)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 7 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10976	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 7 Function (page 383)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 7. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 8

### Timer 8 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15365	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 8. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 8 Setup (page 386)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 8 (PAGE 570)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 8 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10977	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 8 Function (page 385)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 8. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 9


### Timer 9 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15366	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 9. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 9 Setup (page 388)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 9 (PAGE 570)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 9 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10978	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 9 Function (page 387)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 9. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 10

### Timer 10 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15367	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		

#### Description

This setpoint defines and enables the function of the Timer 10. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint **Timer 10 Setup (page 390)**.

Once the Timer is activated the LBO **EXERCISE TIMER 10 (PAGE 570)** is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.

**IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.**


**IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.**

Disabled	The Timer is disabled.
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.

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## Timer 10 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10979	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 10 Function (page 389)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 10. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 11


### Timer 11 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15368	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 11. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 11 Setup (page 392)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 11 (PAGE 571)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 11 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10980	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 11 Function (page 391)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 11. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## Subgroup: Timer 12

### Timer 12 Function

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	Disabled / Manual On / No Func / Mode OFF [-]		
Default value	Disable	Force value	YES
Step	[-]		
Comm object	15369	Related applications	BTB
Config level	Standard		
Setpoint visibility	Always		
Description			
<p>This setpoint defines and enables the function of the Timer 12. The functions which are supposed to change the Controller Mode requires controller running in AUTO mode. The activation condition of the Timer is configured via setpoint <b>Timer 12 Setup (page 394)</b>.</p> <p>Once the Timer is activated the LBO <b>EXERCISE TIMER 12 (PAGE 571)</b> is closed regardless of chosen timer function. If the CU is switched off when the Timer should be activated, the Timer will be activated immediately after the CU is switched on if the Timer condition is still fulfilled.</p>			
<b>IMPORTANT: The LBO is activated always when the Timer should be activated e.g. even when controller is in different mode than AUTO.</b>			
<b>IMPORTANT: In case that Timer 1, Timer 2, etc. should be activated at the same time, the Timer with selected higher priority function is executed.</b>			
Disabled	The Timer is disabled.		
Manual On	The Timer is disabled but his binary output is activated (can be used for testing purposes).		
No Func	There is no any other function, only binary output of the Timer is activated once the condition is fulfilled.		
Mode OFF	The binary output of the Timer is internally connected to the Remote OFF binary input.		
Rem Start/Stop	The binary output of the Timer is internally connected to the binary input Remote Start/Stop.		

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## Timer 12 Setup

Setpoint group	Timers & Counters	Related FW	1.1.0
Range [units]	N/A [-]		
Default value	N/A [-]	Force value	NO
Step	N/A [-]		
Comm object	10981	Related applications	BTB
Config level	Standard		
Setpoint visibility	Only if <b>Timer 12 Function (page 393)</b> != Disabled or Manual On		
Description			
Use this setpoint to setup the exercise Timer 12. See <b>Exercise Timers (page 128)</b> for step by step manual.			

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## 8.1.4 Values

### What values are:

Values (or quantities) are analog or binary data objects, measured or computed by the controller, that are intended for reading from the controller screen, PC, MODBUS, etc. Values are organized into groups according to their meaning.

For full list of values go to the chapter **List of values (page 396)**

### Invalid flag

If valid data is not available for a particular value, the invalid flag is set to it. This situation may be due to the following:

- The value is not being evaluated in the scope of the current application and configuration.
- Sensor fail has been detected on an analog input.
- The configured ECU or extension module does not provide the particular value.
- The communication with the ECU or extension module is interrupted.

A value containing the invalid flag is displayed as "#####" in IntelliConfig and on the controller screen. If such a value is read out via MODBUS, it will contain the data 32768 in the case of signed values and 65535 in the case of unsigned values.

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Group: Bus Left .....	402
Group: Bus Right .....	412
Group: Gen-sets .....	414
Group: Power Management .....	427
Group: Load/VAR Control .....	429
Group: Controller I/O .....	430
Group: Statistics .....	432
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Group: PLC .....	482
Group: DIST-IN 1-32 .....	512
Group: DIST-IN 33-64 .....	519
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## List of values

Group: Bus Left	402	Bus Left Voltage	409	Gen-set 9 Power	416
Bus Left Import P	402	Bus Left V Unabalance Ph-		Gen-set 10 Power	416
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Bus Left Import P L2	402	Bus Left V Unbalance Ph-		Gen-set 12 Power	417
Bus Left Import P L3	402	Ph	409	Gen-set 13 Power	417
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Bus Left Import S	403	Mains Current L3	410	Gen-set 18 Power	418
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Bus Left Load Character		Bus Right Voltage L2-L3	413	Gen-set 28 Power	420
L2	405	Bus Right Voltage L3-L1	413	Gen-set 29 Power	420
Bus Left Power Factor L3	406	Bus Right Voltage	413	Gen-set 30 Power	420
Bus Left Load Character		Bus Right Voltage THD L1	413	Gen-set 31 Power	420
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Bus Left Voltage THD L1	406	Bus Right Voltage THD L3	414	Gen-set 33 Power	421
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🔍 back to Controller  
objects



## Group: Bus Left

### Bus Left Import P

<b>Value group</b>	Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	8703	<b>Related applications</b>	BTB
<b>Description</b>			
Imported active power [kW] from Bus Left.			

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### Bus Left Import P L1

<b>Value group</b>	Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	8805	<b>Related applications</b>	BTB
<b>Description</b>			
Imported active power [kW] from L1 phase of the Bus Left.			

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### Bus Left Import P L2

<b>Value group</b>	Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	8806	<b>Related applications</b>	BTB
<b>Description</b>			
Imported active power [kW] from L2 phase of the Bus Left.			

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### Bus Left Import P L3

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	8807	<b>Related applications</b>	BTB
<b>Description</b>			
Imported active power [kW] from L3 phase of the Bus Left.			

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### Bus Left Import Q

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kVAr		
<b>Comm object</b>	8704	<b>Related applications</b>	BTB
<b>Description</b>			
Imported reactive power [kVAr] from Bus Left.			

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### Bus Left Import Q L1

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	8808	<b>Related applications</b>	BTB
<b>Description</b>			
Imported reactive power [kVAr] from L1 phase of the Bus Left.			

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### Bus Left Import Q L2

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	8809	<b>Related applications</b>	BTB
<b>Description</b>			
Imported reactive power [kVAr] from L2 phase of the Bus Left.			

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### Bus Left Import Q L3

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	8810	<b>Related applications</b>	BTB
<b>Description</b>			
Imported reactive power [kVAr] from L3 phase of the Bus Left.			

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### Bus Left Import S

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kVA		
<b>Comm object</b>	8811	<b>Related applications</b>	BTB
<b>Description</b>			
Imported apparent power [kVA] from Bus Left.			

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### Bus Left Import S L1

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	kVA		
<b>Comm object</b>	8812	<b>Related applications</b>	BTB
<b>Description</b>			
Imported apparent power [kVA] from L1 phase of the Bus Left.			

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### Bus Left Import S L2

Value group	Value Group Bus Left	Related FW	1.1.0
Units	kVA		
Comm object	8813	Related applications	BTB
Description			
Imported apparent power [kVA] from L2 phase of the Bus Left.			

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### Bus Left Import S L3

Value group	Value Group Bus Left	Related FW	1.1.0
Units	kVA		
Comm object	8814	Related applications	BTB
Description			
Imported apparent power [kVA] from L3 phase of the Bus Left.			

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### Bus Left Power Factor

Value group	Value Group Bus Left	Related FW	1.1.0
Units	[-]		
Comm object	16157	Related applications	BTB
Description			
Power factor of the Bus Left.			

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### Bus Left Load Character

Value group	Value Group Bus Left	Related FW	1.1.0
Units	[-]		
Comm object	8709	Related applications	BTB
Description			
Character of Bus Left load. "L" means inductive load, "C" is capacitive and "R" is resistive load ( <b>Bus Left Power Factor (page 404) = 1</b> ).			
Load character of the Bus Left.			
L = inductive load, C = capacitive load, and R = resistive load ( <b>Bus Left Power Factor (page 404) = 1</b> ).			

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## Bus Left Power Factor L1

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	20580	<b>Related applications</b>	BTB
<b>Description</b>			
Power factor of the L1 phase of the Bus Left.			

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## Bus Left Load Character L1

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	8818	<b>Related applications</b>	BTB
<b>Description</b>			
Load character of the L1 phase of the Bus Left. L = inductive load, C = capacitive load, and R = resistive load ( <b>Bus Left Power Factor L1 (page 405) = 1</b> ).			

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## Bus Left Power Factor L2

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	20581	<b>Related applications</b>	BTB
<b>Description</b>			
Power factor of the L2 phase of the Bus Left.			

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## Bus Left Load Character L2

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	8819	<b>Related applications</b>	BTB
<b>Description</b>			
Load character of the L2 phase of the Bus Left. L = inductive load, C = capacitive load, and R = resistive load ( <b>Bus Left Power Factor L2 (page 405) = 1</b> ).			

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### Bus Left Power Factor L3

Value group	Value Group Bus Left	Related FW	1.1.0
Units	[-]		
Comm object	20582	Related applications	BTB
Description			
Power factor of the L3 phase of the Bus Left.			

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### Bus Left Load Character L3

Value group	Value Group Bus Left	Related FW	1.1.0
Units	[-]		
Comm object	8820	Related applications	BTB
Description			
Load character of the L3 phase of the Bus Left. L = inductive load, C = capacitive load, and R = resistive load (Bus Left Power Factor L3 (page 406) = 1).			

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### Bus Left Voltage THD L1

Value group	Value Group Bus Left	Related FW	1.1.0
Units	%		
Comm object	16060	Related applications	BTB
Description			
This value represents <b>Voltage Total Harmonic Distortion (page 16) Bus Left Voltage L1-N (page 408)</b> .			

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### Bus Left Voltage THD L2

Value group	Value Group Bus Left	Related FW	1.1.0
Units	%		
Comm object	16061	Related applications	BTB
Description			
This value represents <b>Voltage Total Harmonic Distortion (page 16) of Bus Left Voltage L2-N (page 408)</b> .			

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### Bus Left Voltage THD L3

Value group	Value Group Bus Left	Related FW	1.1.0
Units	%		
Comm object	16062	Related applications	BTB
Description			
This value represents <b>Voltage Total Harmonic Distortion (page 16)</b> of <b>Bus Left Voltage L3-N (page 408)</b> .			

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### Mains Current THD L1

Value group	Value Group Bus Left	Related FW	1.1.0
Units	%		
Comm object	16064	Related applications	BTB
Description			
This value represents <b>Current Total Harmonic Distortion (page 17)</b> of <b>Mains Current L1 (page 410)</b> .			

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### Mains Current THD L2

Value group	Value Group Bus Left	Related FW	1.1.0
Units	%		
Comm object	16065	Related applications	BTB
Description			
This value represents <b>Current Total Harmonic Distortion (page 17)</b> of <b>Mains Current L2 (page 410)</b> .			

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### Mains Current THD L3

Value group	Value Group Bus Left	Related FW	1.1.0
Units	%		
Comm object	16066	Related applications	BTB
Description			
This value represents <b>Current Total Harmonic Distortion (page 17)</b> of <b>Mains Current L3 (page 410)</b> .			

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### Bus Left Frequency

Value group	Value Group Bus Left	Related FW	1.1.0
Units	Hz		
Comm object	20800	Related applications	BTB
Description			
Frequency of Bus Left.			

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### Bus Left Voltage L1-N

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	8195	<b>Related applications</b>	BTB
<b>Description</b>			
Value of Bus Left voltage on phase 1.			

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### Bus Left Voltage L2-N

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	8196	<b>Related applications</b>	BTB
<b>Description</b>			
Value of Bus Left voltage on phase 2.			

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### Bus Left Voltage L3-N

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	8197	<b>Related applications</b>	BTB
<b>Description</b>			
Value of Bus Left voltage on phase 3.			

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### Bus Left Voltage L1-L2

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	9631	<b>Related applications</b>	BTB
<b>Description</b>			
Value of Bus Left phase to phase voltage between L1 and L2 phases.			

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### Bus Left Voltage L2-L3

<b>Value group</b>	Value Group Bus Left	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	9632	<b>Related applications</b>	BTB
<b>Description</b>			
Value of Bus Left phase to phase voltage between L2 and L3 phases.			

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## Bus Left Voltage L3-L1

Value group	Value Group Bus Left	Related FW	1.1.0
Units	V		
Comm object	9633	Related applications	BTB
Description			
Value of Bus Left phase to phase voltage between L3 and L1 phases.			

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## Bus Left Voltage

Value group	Value Group Bus Left	Related FW	1.1.0
Units	V		
Comm object	10666	Related applications	BTB
Description			
Average value of all Bus Left Voltage phases.			

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## Bus Left V Unbalance Ph-N

Value group	Value Group Bus Left	Related FW	1.1.0
Units	V		
Comm object	10549	Related applications	BTB
Description			
This value contains the maximum difference of values <b>Bus Left Voltage L1-N (page 408)</b> , <b>Bus Left Voltage L2-N (page 408)</b> , <b>Bus Left Voltage L3-N (page 408)</b> at a given moment.			
<b>Note:</b> Difference of the values and the evaluation of the protection is influenced by the setpoint <b>Connection type (page 244)</b> .			

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## Bus Left V Unbalance Ph-Ph

Value group	Value Group Bus Left	Related FW	1.1.0
Units	V		
Comm object	17337	Related applications	BTB
Description			
This value contains the maximum difference of values <b>Bus Left Voltage L1-L2 (page 408)</b> , <b>Bus Left Voltage L2-L3 (page 408)</b> , <b>Bus Left Voltage L3-L1 (page 409)</b> at a given moment.			
<b>Note:</b> Difference of the values and the evaluation of the protection is influenced by the setpoint <b>Connection type (page 244)</b> .			

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### +Bus Left Voltage

Value group	Value Group Bus Left	Related FW	1.1.0
Units	V		
Comm object	16615	Related applications	BTB
Description			
Value of +Bus Left voltage measured by <b>Symmetrical components (page 15)</b>			

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### +Bus Left Voltage Relative

Value group	Value Group Bus Left	Related FW	1.1.0
Units	V		
Comm object	16616	Related applications	BTB
Description			
Value of +Bus Left voltage measured by <b>Symmetrical components (page 15)</b> which is related to <b>Bus LeftAC Shore Nominal Voltage Ph-N (page 246)</b> or <b>Bus Left Nominal Voltage Ph-Ph (page 246)</b> .			

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### Mains Current L1

Value group	Value Group Bus Left	Related FW	1.1.0
Units	A		
Comm object	8801	Related applications	BTB
Description			
Current of the L1 phase of the Bus Left.			

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### Mains Current L2

Value group	Value Group Bus Left	Related FW	1.1.0
Units	A		
Comm object	8802	Related applications	BTB
Description			
Current of the L2 phase of the Bus Left.			

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### Mains Current L3

Value group	Value Group Bus Left	Related FW	1.1.0
Units	A		
Comm object	8803	Related applications	BTB
Description			
Current of the L3 phase of the Bus Left.			

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## Mains Current Unbalance

Value group	Value Group Bus Left	Related FW	1.1.0
Units	A		
Comm object	17338	Related applications	BTB
<b>Description</b>			
This value contains the maximum difference of values <b>Mains Current L1 (page 410)</b> , <b>Mains Current L2 (page 410)</b> and <b>Mains Current L3 (page 410)</b> .			
<i><b>Note:</b> Difference of the values and the evaluation of the protection is influenced by the setpoint <b>Connection type (page 244)</b>.</i>			

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## Slip Frequency

Value group	Value Group Bus Right	Related FW	1.1.0
Units	Hz		
Comm object	8224	Related applications	BTB
<b>Description</b>			
Slip frequency during synchronization.			

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## Slip Angle

Value group	Value Group Bus Right	Related FW	1.1.0
Units	°		
Comm object	8225	Related applications	BTB
<b>Description</b>			
Slip angle during synchronization.			

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## Group: Bus Right

### Bus Right Frequency

<b>Value group</b>	Value Group Bus Right	<b>Related FW</b>	1.1.0
<b>Units</b>	Hz		
<b>Comm object</b>	20799	<b>Related applications</b>	BTB
<b>Description</b>			
This is the value of Bus Right frequency.			

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### Bus Right Voltage L1-N

<b>Value group</b>	Value Group Bus Right	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	8192	<b>Related applications</b>	BTB
<b>Description</b>			
Voltage of the L1 phase of the Bus Right.			

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### Bus Right Voltage L2-N

<b>Value group</b>	Value Group Bus Right	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	8193	<b>Related applications</b>	BTB
<b>Description</b>			
Voltage of the L2 phase of the Bus Right.			

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### Bus Right Voltage L3-N

<b>Value group</b>	Value Group Bus Right	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	8194	<b>Related applications</b>	BTB
<b>Description</b>			
Voltage of the L3 phase of the Bus Right.			

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### Bus Right Voltage L1-L2

<b>Value group</b>	Value Group Bus Right	<b>Related FW</b>	1.1.0
<b>Units</b>	V		
<b>Comm object</b>	9628	<b>Related applications</b>	BTB
<b>Description</b>			
Phase to phase voltage between the L1 and L2 phases of the Bus Right.			

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### Bus Right Voltage L2-L3

Value group	Value Group Bus Right	Related FW	1.1.0
Units	V		
Comm object	9629	Related applications	BTB
Description			
Phase to phase voltage between the L2 and L3 phases of the Bus Right.			

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### Bus Right Voltage L3-L1

Value group	Value Group Bus Right	Related FW	1.1.0
Units	V		
Comm object	9630	Related applications	BTB
Description			
Phase to phase voltage between the L3 and L1 phases of the Bus Right.			

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### Bus Right Voltage

Value group	Value Group Bus Right	Related FW	1.1.0
Units	V		
Comm object	10645	Related applications	BTB
Description			
Average value of all voltage phases of the Bus Right.			

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### Bus Right Voltage THD L1

Value group	Value Group Bus Right	Related FW	1.1.0
Units	%		
Comm object	16052	Related applications	BTB
Description			
This value represents <b>Voltage Total Harmonic Distortion (page 16)</b> of <b>Bus Right Voltage L1-N (page 412)</b> .			

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### Bus Right Voltage THD L2

Value group	Value Group Bus Right	Related FW	1.1.0
Units	%		
Comm object	16053	Related applications	BTB
Description			
This value represents <b>Voltage Total Harmonic Distortion (page 16)</b> of <b>Bus Right Voltage L2-N (page 412)</b> .			

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### Bus Right Voltage THD L3

Value group	Value Group Bus Right	Related FW	1.1.0
Units	%		
Comm object	16054	Related applications	BTB
<b>Description</b>			
This value represents <b>Voltage Total Harmonic Distortion (page 16)</b> of <b>Bus Right Voltage L3-N (page 412)</b> .			

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### Bus Right V Unbalance Ph-N

Value group	Value Group Bus Right	Related FW	1.1.0
Units	V		
Comm object	10548	Related applications	BTB
<b>Description</b>			
This value contains the maximum difference of values <b>Bus Right Voltage L1-N (page 412)</b> , <b>Bus Right Voltage L2-N (page 412)</b> , <b>Bus Right Voltage L3-N (page 412)</b> at a given moment.			
<i><b>Note:</b> Difference of the values and the evaluation of the protection is influenced by the setpoint Connection type (page 244).</i>			

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### Bus Right V Unbalance Ph-Ph

Value group	Value Group Bus Right	Related FW	1.1.0
Units	V		
Comm object	17336	Related applications	BTB
<b>Description</b>			
This value contains the maximum difference of values <b>Bus Right Voltage L1-L2 (page 412)</b> , <b>Bus Right Voltage L2-L3 (page 413)</b> , <b>Bus Right Voltage L3-L1 (page 413)</b> at a given moment.			
<i><b>Note:</b> Difference of the values and the evaluation of the protection is influenced by the setpoint Connection type (page 244).</i>			

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## Group: Gen-sets

### Gen-set 1 Power

Value group	Gen-sets	Related FW	1.1.0
Units	kW		
Comm object	10935	Related applications	BTB
<b>Description</b>			
Active power of Bus 1.			

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### Gen-set 2 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10936	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 2.			

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### Gen-set 3 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10937	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 3.			

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### Gen-set 4 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10938	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 4.			

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### Gen-set 5 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10939	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 5.			

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### Gen-set 6 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10940	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 6.			

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### Gen-set 7 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10941	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 7.			

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### Gen-set 8 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10942	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 8.			

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### Gen-set 9 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10943	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 9.			

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### Gen-set 10 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10944	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 10.			

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### Gen-set 11 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10945	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 11.			

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### Gen-set 12 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10946	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 12.			

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### Gen-set 13 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10947	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 13.			

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### Gen-set 14 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10948	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 14.			

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### Gen-set 15 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10949	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 15.			

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### Gen-set 16 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10950	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 16.			

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### Gen-set 17 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10951	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 17.			

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### Gen-set 18 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10952	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 18.			

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### Gen-set 19 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10953	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 19.			

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### Gen-set 20 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10954	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 20.			

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### Gen-set 21 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10955	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 21.			

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### Gen-set 22 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10956	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 22.			

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### Gen-set 23 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10957	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 23.			

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### Gen-set 24 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10958	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 24.			

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### Gen-set 25 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10959	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 25.			

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### Gen-set 26 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10960	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 26.			

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### Gen-set 27 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10961	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 27.			

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### Gen-set 28 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10962	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 28.			

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### Gen-set 29 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10963	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 29.			

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### Gen-set 30 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10964	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 30.			

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### Gen-set 31 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10965	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 31.			

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### Gen-set 32 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10966	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 32.			

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### Gen-set 33 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20546	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 33.			

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### Gen-set 34 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20547	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 34.			

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### Gen-set 35 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20548	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 35.			

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### Gen-set 36 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20549	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 36.			

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### Gen-set 37 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20550	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 37.			

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### Gen-set 38 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20551	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 38.			

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### Gen-set 39 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20552	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 39.			

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### Gen-set 40 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20553	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 40.			

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### Gen-set 41 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20554	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 41.			

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### Gen-set 42 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20555	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 42.			

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### Gen-set 43 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20556	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 43.			

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### Gen-set 44 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20557	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 44.			

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### Gen-set 45 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20558	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 45.			

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### Gen-set 46 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20559	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 46.			

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### Gen-set 47 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20560	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 47.			

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### Gen-set 48 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20561	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 48.			

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### Gen-set 49 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20562	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 49.			

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### Gen-set 50 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20563	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 50.			

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### Gen-set 51 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20564	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 51.			

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### Gen-set 52 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20565	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 52.			

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### Gen-set 53 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20566	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 53.			

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### Gen-set 54 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20567	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 54.			

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### Gen-set 55 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20568	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 55.			

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### Gen-set 56 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20569	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 56.			

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### rGen-set 57 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20570	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 57.			

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### Gen-set 58 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20571	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 58.			

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### Gen-set 59 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20572	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 59.			

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### Gen-set 60 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20573	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 60.			

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### Gen-set 61 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20574	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 61.			

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### Gen-set 62 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20575	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 62.			

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### Gen-set 63 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20576	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 63.			

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### Gen-set 64 Power

<b>Value group</b>	Gen-sets	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	20577	<b>Related applications</b>	BTB
<b>Description</b>			
Active power of Bus 64.			

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## Group: Power Management

### Running Nominal Power Of All

<b>Value group</b>	Power Management	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10658	<b>Related applications</b>	BTB
<b>Description</b>			
Actual nominal power of all running controllers on inter-controller CAN.			

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### Running Nominal P In Load Shar

<b>Value group</b>	Power Management	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	15806	<b>Related applications</b>	BTB
<b>Description</b>			
Actual nominal power of all running Gen-sets in Load Sharing connected to the same group.			

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## Total Running Samax

<b>Value group</b>	Power Management	<b>Related FW</b>	1.1.0
<b>Units</b>	kVA		
<b>Comm object</b>	16425	<b>Related applications</b>	BTB
<b>Description</b>			
This value show maximal apparent power of running Controllers within the group that are connected to the bus/mains.  The value is limited due to date type to -32000...32000 in case the sum of all apparent power of Controllers is above this range, the value shows fixed value 32000 and the warning Total Running PQS Value Overflow is activated.			

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## Total Running P

<b>Value group</b>	Power Management	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	10657	<b>Related applications</b>	BTB
<b>Description</b>			
Actual value of active power from all controllers connected to the bus.			

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## Total Running P In Load Shar

<b>Value group</b>	Power Management	<b>Related FW</b>	1.1.0
<b>Units</b>	kW		
<b>Comm object</b>	15805	<b>Related applications</b>	BTB
<b>Description</b>			
This value shows the active power produced by all Gen-sets in the same group in Load Sharing.			

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## Total Running Q

<b>Value group</b>	Power Management	<b>Related FW</b>	1.1.0
<b>Units</b>	kVAr		
<b>Comm object</b>	10656	<b>Related applications</b>	BTB
<b>Description</b>			
Actual value of reactive power from all controllers connected to the bus.			

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## Total Running S

Value group	Power Management	Related FW	1.1.0
Units	kVA		
Comm object	16424	Related applications	BTB
Description			
Actual value of apparent power from all controllers connected to the bus.			

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## Total Running Power Factor

Value group	Power Management	Related FW	1.1.0
Units	[-]		
Comm object	14590	Related applications	BTB
Description			
This value represents the total power factor (Cos $\phi$ ) of all running Controllers.			

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## Total Running Load Character

Value group	Power Management	Related FW	1.1.0
Units	[-]		
Comm object	9028	Related applications	BTB
Description			
This value represents the total character of all running Controllers.			

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## Group: Load/VAR Control

### Loadsharing Output

Value group	Control Loops	Related FW	1.1.0
Units	%		
Comm object	10924	Related applications	BTB
Description			
Internal request of internal loadsharing regulator.			

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### Varsharing Output

Value group	Load/VAR Control	Related FW	1.1.0
Units	%		
Comm object	10925	Related applications	BTB
Description			
Internal request of internal varsharing regulator.			

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## Group: Controller I/O

### Battery Voltage

Value group	Controller I/O	Related FW	1.1.0
Units	V		
Comm object	8213	Related applications	BTB
Description			
Controller's supply voltage.			

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### CU-AIN-01

Value group	Controller I/O	Related FW	1.1.0
Units	Configurable		
Comm object	9155	Related applications	BTB
Description			
This is the value of the analog input 1 of the controller.			
<b>Note:</b> Name of this value is changed according to the controller configuration.			

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### CU-AIN-02

Value group	Controller I/O	Related FW	1.1.0
Units	Configurable		
Comm object	9156	Related applications	BTB
Description			
This is the value of the analog input 2 of the controller.			
<b>Note:</b> Name of this value is changed according to the controller configuration.			

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### CU-AIN-03

Value group	Controller I/O	Related FW	1.1.0
Units	Configurable		
Comm object	9157	Related applications	BTB
Description			
This is the value of the analog input 3 of the controller.			
<b>Note:</b> Name of this value is changed according to the controller configuration.			

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## CU-AIN-04

Value group	Controller I/O	Related FW	1.1.0
Units	Configurable		
Comm object	9158	Related applications	BTB
<b>Description</b>			
This is the value of the analog input 4 of the controller.			
<b>Note:</b> Name of this value is changed according to the controller configuration.			

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## Binary Inputs

Value group	Controller I/O	Related FW	1.1.0
Units	[-]		
Comm object	8235	Related applications	BTB
<b>Description</b>			
States of the binary inputs of the controller.			
01. CU-BIN-01			
02. CU-BIN-02			
03. CU-BIN-03			
04. CU-BIN-04			
05. CU-BIN-05			
06. CU-BIN-06			
07. CU-BIN-07			
08. CU-BIN-08			
09. CU-BIN-09			
10. CU-BIN-10			
11. CU-BIN-11			
12. CU-BIN-12			
<b>Note:</b> Names are changed based on names of representative binary inputs. See <b>Default configuration (page 114)</b> to see default binary inputs names.			

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## Binary Outputs

Value group	Controller I/O	Related FW	1.1.0
Units	[-]		
Comm object	8239	Related applications	BTB
<b>Description</b> State of the binary outputs of the controller. 01. CU-BOUT-01 02. CU-BOUT-02 03. CU-BOUT-03 04. CU-BOUT-04 05. CU-BOUT-05 06. CU-BOUT-06 07. CU-BOUT-07 08. CU-BOUT-08 09. CU-BOUT-09 10. CU-BOUT-10 11. CU-BOUT-11 12. CU-BOUT-12  <i><b>Note:</b> Names are changed based on names of representative binary outputs. See <b>Default configuration</b> (page 114) to see default binary outputs names.</i>			

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## Group: Statistics

### Bus Left kVAh

Value group	Statistics	Related FW	1.1.0
Units	kVAh		
Comm object	13665	Related applications	BTB
<b>Description</b> Total apparent energy imported/exported from/to the Bus Left through the CB.			

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### Bus Left kWh Exported

Value group	Statistics	Related FW	1.1.0
Units	kVAh		
Comm object	11025	Related applications	BTB
<b>Description</b> Counter of Bus Left Import P (page 402).  <i><b>Note:</b> This value can be also switched into one decimal see <b>Power Formats And Units</b> (page 166).</i>			

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## Bus Left kVArh Exported

Value group	Statistics	Related FW	1.1.0
Units	kVArh		
Comm object	11026	Related applications	BTB
<b>Description</b>			
Counter of <b>Bus Left Import Q</b> (page 402).			
<i><b>Note:</b> This value can be also switched into one decimal see <b>Power Formats And Units</b> (page 166).</i>			

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## Bus Left kWh Imported

Value group	Statistics	Related FW	1.1.0
Units	kWh		
Comm object	16710	Related applications	BTB
<b>Description</b>			
Active energy imported from the Bus Left to the Bus Right.			

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## Bus Left kVArh Imported

Value group	Statistics	Related FW	1.1.0
Units	kWh		
Comm object	16711	Related applications	BTB
<b>Description</b>			
Reactive energy imported from the Bus Left to the Bus Right.			

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## Fast Pulse Counter 1

Value group	Statistics	Related FW	1.1.0
Units	[-]		
Comm object	20303	Related applications	BTB
<b>Description</b>			
This is the Statistic value of the Fast Pulse Counter 1 which is physically configured to binary input 9. Change the conversion rate via setpoint <b>Conversion Coeff. Fast Pulse 1</b> (page 369). See the chapter <b>Pulse Counters</b> (page 167) for more information.			
<i><b>Note:</b> The Value can be set via IntelliConfig in the interface "Set Statistics".</i>			

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## Fast Pulse Counter 2

Value group	Statistics	Related FW	1.1.0
Units	[-]		
Comm object	20304	Related applications	BTB
<b>Description</b>			
<p>This is the Statistic value of the Fast Pulse Counter 2 which is physically configured to binary input 10. Change the conversion rate via setpoint <b>Conversion Coeff. Fast Pulse 2 (page 369)</b>. See the chapter <b>Pulse Counters (page 167)</b> for more information.</p> <p><b>Note:</b> The Value can be set via IntelliConfig in the interface "Set Statistics".</p>			

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## Pulse Counter 1

Value group	Statistics	Related FW	1.1.0
Units	[-]		
Comm object	10986	Related applications	BTB
<b>Description</b>			
<p>This is the Statistic value of the Pulse Counter 1 which is connected with LBI <b>PULSE COUNTER 1 (PAGE 556)</b>. Change the conversion rate via setpoint <b>Conversion Coefficient Pulse 1 (page 370)</b>. See the chapter <b>Pulse Counters (page 167)</b> for more information.</p> <p><b>Note:</b> The Value can be set via IntelliConfig in the interface "Set Statistics".</p>			

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## Pulse Counter 2

Value group	Statistics	Related FW	1.1.0
Units	[-]		
Comm object	10987	Related applications	BTB
<b>Description</b>			
<p>This is the Statistic value of Pulse the Counter 2 which is connected with LBI <b>PULSE COUNTER 2 (PAGE 556)</b>. Change the conversion rate via setpoint <b>Conversion Coefficient Pulse 2 (page 370)</b>. See the chapter <b>Pulse Counters (page 167)</b> for more information.</p> <p><b>Note:</b> The Value can be set via IntelliConfig in the interface "Set Statistics".</p>			

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## Time

<b>Value group</b>	Statistics	<b>Related FW</b>	1.1.0
<b>Units</b>	HH:MM:SS		
<b>Comm object</b>	24554	<b>Related applications</b>	BTB
<b>Description</b>			
Shows setup time.			

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## Date

<b>Value group</b>	Statistics	<b>Related FW</b>	1.1.0
<b>Units</b>	DD.MM.YYYY		
<b>Comm object</b>	24553	<b>Related applications</b>	BTB
<b>Description</b>			
Shows setup date.			

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## Time Mode

<b>Value group</b>	Statistics	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	20252	<b>Related applications</b>	BTB
<b>Description</b>			
Shows setup time mode. STD - Standard zone time (e.g GMT+1 for Prague) DST - Daylight Saving Time = STD+1 (e.g. GMT+2 for Prague)			

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## Group: Info

### Controller Mode

<b>Value group</b>	Info	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	9887	<b>Related applications</b>	BTB
<b>Description</b>			
Controller mode.			

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## Breaker state

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	9245	Related applications	BTB
Description			
This value contains actual breaker state message.			

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## Timer Text

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	10040	Related applications	BTB
Description			
This value contains actual timer text message.			

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## Connection Type

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	12944	Related applications	BTB
Description			
This value contains name of currently selected connection type, which is adjusted via <b>Connection type</b> (page 244).			

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## Timer Value

Value group	Info	Related FW	1.1.0
Units	[MM:SS]		
Comm object	14147	Related applications	BTB
Description			
This value contains time of active timer which is counted down, name of the timer is in value <b>Timer Text</b> (page 436).			

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## ID String

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	24501	Related applications	BTB
Description			
Name of controller which is used in IntelliConfig in command bar.			

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## FW Version

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	24339	Related applications	BTB
Description			
Major and minor firmware version number.			

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## Application

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	8480	Related applications	BTB
Description			
The value contains actual application in controller.			

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## FW Branch

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	8707	Related applications	BTB
Description			
The value contains actual branch of firmware in controller.			

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## CAN Intercontroller Comm Mode

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	23969	Related applications	BTB
Description			
This value contains actual mode of <b>CAN Intercontroller Communication (page 120)</b> .			
<b>Note:</b> In case that there is a mismatch between this value and setpoint <b>CAN Intercontroller Comm Mode (page 320)</b> , alarm <b>ALI CAN Mode Inconsistency (page 671)</b> is activated.			

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## CAN Intercontroller Comm Redundancy

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	23970	Related applications	BTB
<b>Description</b>			
This value informs if CAN Intercontroller communication Redundancy is enabled or not.			
<b>Note:</b> In case that there is a mismatch between this value and setpoint <b>CAN Intercontroller Comm Mode</b> (page 320), alarm <b>ALI CAN Mode Inconsistency</b> (page 671) is activated.			

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## SD Card Status

Value group	Info	Related FW	1.1.0																						
Units	[-]																								
Comm object	20589	Related applications	BTB																						
Description																									
This value shows the actual status of the SD Card.																									
<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>Mount In Progress</td><td>The SD Card is being booted.</td></tr><tr><td>Not Inserted</td><td>There is no SD Card in the SD card slot detected.</td></tr><tr><td>Unmount</td><td>The SD card is inserted but the setpoint <b>SD Card File System (page 321)</b> is set to Unmount option.</td></tr><tr><td>Ready To Use</td><td>SD Card is mounted and ready to be used.</td></tr><tr><td>Format Required</td><td>The wrong file system format of the SD Card is detected.</td></tr><tr><td>Formatting</td><td>The formatting process of the SD Card is active.</td></tr><tr><td>Formatting Failed</td><td>The formatting process failed.</td></tr><tr><td>Write Protected</td><td>It is not possible to write data on SD Card (Read Only mode).</td></tr><tr><td>Not Supported</td><td>Used SD Card is not supported (wrong parameters of the SD card).</td></tr><tr><td>Error</td><td>This status is used for any other errors which are not covered by the states above.</td></tr></table>				Value	Meaning	Mount In Progress	The SD Card is being booted.	Not Inserted	There is no SD Card in the SD card slot detected.	Unmount	The SD card is inserted but the setpoint <b>SD Card File System (page 321)</b> is set to Unmount option.	Ready To Use	SD Card is mounted and ready to be used.	Format Required	The wrong file system format of the SD Card is detected.	Formatting	The formatting process of the SD Card is active.	Formatting Failed	The formatting process failed.	Write Protected	It is not possible to write data on SD Card (Read Only mode).	Not Supported	Used SD Card is not supported (wrong parameters of the SD card).	Error	This status is used for any other errors which are not covered by the states above.
Value	Meaning																								
Mount In Progress	The SD Card is being booted.																								
Not Inserted	There is no SD Card in the SD card slot detected.																								
Unmount	The SD card is inserted but the setpoint <b>SD Card File System (page 321)</b> is set to Unmount option.																								
Ready To Use	SD Card is mounted and ready to be used.																								
Format Required	The wrong file system format of the SD Card is detected.																								
Formatting	The formatting process of the SD Card is active.																								
Formatting Failed	The formatting process failed.																								
Write Protected	It is not possible to write data on SD Card (Read Only mode).																								
Not Supported	Used SD Card is not supported (wrong parameters of the SD card).																								
Error	This status is used for any other errors which are not covered by the states above.																								

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## SD Card Capacity

Value group	Info	Related FW	1.1.0
Units	[GB]		
Comm object	20026	Related applications	BTB
<b>Description</b>			
This value provides information about SD Card storage capacity in GB.			

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## SD Card Free Space

<b>Value group</b>	Info	<b>Related FW</b>	1.1.0
<b>Units</b>	[%]		
<b>Comm object</b>	20027	<b>Related applications</b>	BTB
<b>Description</b>			
This value shows relative free space of SD Card storage.			

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## History Lifetime

Value group	Info	Related FW	1.1.0																										
Units	[%]																												
Comm object	20284	Related applications	BTB																										
Description																													
This value shows the lifetime usage of non-volatile memory which is used for storing of history records. Please refer to the table below for detailed information.																													
<table><tr><th>Value [%]</th><th>Meaning</th></tr><tr><td>- 1</td><td>Memory's lifetime usage can not be obtained.</td></tr><tr><td>10</td><td>Memory's lifetime usage is between 0-10%.</td></tr><tr><td>20</td><td>Memory's lifetime usage is between 11-20%..</td></tr><tr><td>30</td><td>Memory's lifetime usage is between 21-30%.</td></tr><tr><td>40</td><td>Memory's lifetime usage is between 31-40%.</td></tr><tr><td>50</td><td>Memory's lifetime usage is between 41-50%.</td></tr><tr><td>60</td><td>Memory's lifetime usage is between 51-60%.</td></tr><tr><td>70</td><td>Memory's lifetime usage is between 61-70%.</td></tr><tr><td>80</td><td>Memory's lifetime usage is between 71-80%.</td></tr><tr><td>90</td><td>Memory's lifetime usage is between 81-90%.</td></tr><tr><td>100</td><td>Memory's lifetime usage is between 91-100%.</td></tr><tr><td>110</td><td>Memory's lifetime usage is over 100 %. The memory may fail.</td></tr></table>				Value [%]	Meaning	- 1	Memory's lifetime usage can not be obtained.	10	Memory's lifetime usage is between 0-10%.	20	Memory's lifetime usage is between 11-20%..	30	Memory's lifetime usage is between 21-30%.	40	Memory's lifetime usage is between 31-40%.	50	Memory's lifetime usage is between 41-50%.	60	Memory's lifetime usage is between 51-60%.	70	Memory's lifetime usage is between 61-70%.	80	Memory's lifetime usage is between 71-80%.	90	Memory's lifetime usage is between 81-90%.	100	Memory's lifetime usage is between 91-100%.	110	Memory's lifetime usage is over 100 %. The memory may fail.
Value [%]	Meaning																												
- 1	Memory's lifetime usage can not be obtained.																												
10	Memory's lifetime usage is between 0-10%.																												
20	Memory's lifetime usage is between 11-20%..																												
30	Memory's lifetime usage is between 21-30%.																												
40	Memory's lifetime usage is between 31-40%.																												
50	Memory's lifetime usage is between 41-50%.																												
60	Memory's lifetime usage is between 51-60%.																												
70	Memory's lifetime usage is between 61-70%.																												
80	Memory's lifetime usage is between 71-80%.																												
90	Memory's lifetime usage is between 81-90%.																												
100	Memory's lifetime usage is between 91-100%.																												
110	Memory's lifetime usage is over 100 %. The memory may fail.																												

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## Forced Value Status

<b>Value group</b>	Info	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	20544	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains list of all 32 LBIs for <b>Forced Value (page 137)</b> . Logical 1 means that the respective LBI is currently activated.			

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## SW Key Feature List

<b>Value group</b>	Info	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	20591	<b>Related applications</b>	BTB
<b>Description</b>			
<p>This value contains list of premium features which are unlocked by SW key. Logical 1 means that the feature is activated and can be used without of restrictions.</p> <ol style="list-style-type: none"><li>1. Reserved</li><li>2. Modbus Master</li><li>3. Hot Swap Redundancy</li><li>4. PLC ExtendedReserved</li><li>5. Reserved</li></ol>			

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## Hot Swap Redundancy Status

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	16887	Related applications	BTB
Description			
This value contains list of status bits related to Hot Swap Redundancy. If <b>Hot Swap Redundancy (page 253)</b> = Master one of bits 01-04 is always active, bits 05-08 are never active. If <b>Hot Swap Redundancy (page 253)</b> = Backup one of bits 05-08 is always active, bits 01-04 are never active. If <b>Hot Swap Redundancy (page 253)</b> = Disabled none of bits is active.			
Master: Backup OK	<ul style="list-style-type: none"> <li>&gt; this controller is the master</li> <li>&gt; the backup is alive and ready to perform Hot Swap</li> <li>&gt; <b>the master is controlling</b></li> </ul>		
Master: Backup Control	<ul style="list-style-type: none"> <li>&gt; this controller is the master</li> <li>&gt; the master is considered to be dead by the backup controller</li> <li>&gt; the master is forced to the listening mode</li> <li>&gt; <b>the backup is controlling</b></li> </ul>		
Master: Backup Dead	<ul style="list-style-type: none"> <li>&gt; this controller is the master</li> <li>&gt; the backup is considered to be dead by the master controller</li> <li>&gt; the backup is forced to the listening mode</li> <li>&gt; <b>the master is controlling</b></li> </ul>		
Master: Backup Not Ready For HS	<ul style="list-style-type: none"> <li>&gt; this controller is the master</li> <li>&gt; <b>backup is not ready to perform Hot Swap</b></li> </ul>		
Backup: Master OK	<ul style="list-style-type: none"> <li>&gt; this controller is the backup</li> <li>&gt; the master is alive</li> <li>&gt; <b>the master is controlling</b></li> </ul>		
Backup: Master Control	<ul style="list-style-type: none"> <li>&gt; this controller is the backup</li> <li>&gt; the backup is considered to be dead by the master controller</li> <li>&gt; the backup is forced to the listening mode</li> <li>&gt; <b>the master is controlling</b></li> </ul>		
Backup: Master Dead	<ul style="list-style-type: none"> <li>&gt; this controller is the backup</li> <li>&gt; the master is considered to be dead by the backup controller</li> <li>&gt; the master is forced to the listening mode</li> <li>&gt; <b>the backup is controlling</b></li> </ul>		
Backup: Data Synchro Fail	<ul style="list-style-type: none"> <li>&gt; this controller is the backup</li> <li>&gt; <b>data needed for Hot Swap performance are not received from master</b></li> </ul>		

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## CAN16

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	8546	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <1,16>. Each bit represent controller with the same CAN address as number of the bit.			
<ul style="list-style-type: none"><li>&gt; Log. 1 - this controller receives messages from the controller with specific CAN address</li><li>&gt; Log. 0 - this controller does not receive messages from the controller with specific CAN address</li></ul>			

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## CAN32

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	8827	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <17,32>. Each bit represent controller with the same CAN address as number of the bit.			
<ul style="list-style-type: none"><li>&gt; Log. 1 - this controller receives messages from the controller with specific CAN address</li><li>&gt; Log. 0 - this controller does not receive messages from the controller with specific CAN address</li></ul>			

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## CAN48

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	16684	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <33,48>. Each bit represent controller with the same CAN address as number of the bit.			
<ul style="list-style-type: none"><li>&gt; Log. 1 - this controller receives messages from the controller with specific CAN address</li><li>&gt; Log. 0 - this controller does not receive messages from the controller with specific CAN address</li></ul>			

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## CAN64

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	16685	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <49,64>. Each bit represent controller with the same CAN address as number of the bit.			
<ul style="list-style-type: none"><li>&gt; Log. 1 - this controller receives messages from the controller with specific CAN address</li><li>&gt; Log. 0 - this controller does not receive messages from the controller with specific CAN address</li></ul>			

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## Reg16

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	11081	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <1,16>. Each bit represent controller with the same CAN address as number of the bit.			
<ul style="list-style-type: none"><li>&gt; Log. 1 - controller with this CAN address is in the same group (is connected to the same bus).</li><li>&gt; Log. 0 - controller with this CAN address is <b>NOT</b> in the same group (is <b>NOT</b> connected to the same bus).</li></ul>			

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## Reg32

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	11082	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <17,32>. Each bit represent controller with the same CAN address as number of the bit.			
<ul style="list-style-type: none"><li>&gt; Log. 1 - controller with this CAN address is in the same group (is connected to the same bus).</li><li>&gt; Log. 0 - controller with this CAN address is <b>NOT</b> in the same group (is <b>NOT</b> connected to the same bus).</li></ul>			

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## Reg48

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	16688	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <33,48>. Each bit represent controller with the same CAN address as number of the bit. <ul style="list-style-type: none"><li>➤ Log. 1 - controller with this CAN address is in the same group (is connected to the same bus).</li><li>➤ Log. 0 - controller with this CAN address is <b>NOT</b> in the same group (is <b>NOT</b> connected to the same bus).</li></ul>			

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## Reg64

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	16689	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <49,64>. Each bit represent controller with the same CAN address as number of the bit. <ul style="list-style-type: none"><li>➤ Log. 1 - controller with this CAN address is in the same group (is connected to the same bus).</li><li>➤ Log. 0 - controller with this CAN address is <b>NOT</b> in the same group (is <b>NOT</b> connected to the same bus).</li></ul>			

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## Gen Loaded 16

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	10196	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <1,16>. Each bit represent controller with the same CAN address as number of the bit. <ul style="list-style-type: none"><li>➤ Log. 1 - controller with this CAN address is currently loaded</li><li>➤ Log. 0 - controller with this CAN address is currently not loaded</li></ul>			

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## Gen Loaded 32

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	10197	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <17,32>. Each bit represent controller with the same CAN address as number of the bit. <ul style="list-style-type: none"><li>&gt; Log. 1 - controller with this CAN address is currently loaded</li><li>&gt; Log. 0 - controller with this CAN address is currently not loaded</li></ul>			

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## Gen Loaded 48

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	16686	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <33,48>. Each bit represent controller with the same CAN address as number of the bit. <ul style="list-style-type: none"><li>&gt; Log. 1 - controller with this CAN address is currently loaded</li><li>&gt; Log. 0 - controller with this CAN address is currently not loaded</li></ul>			

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## Gen Loaded 64

Value group	Info	Related FW	1.1.0
Units	[-]		
Comm object	16687	Related applications	BTB
<b>Description</b>			
This value contains binary information about controllers connected via <b>CAN2A (page 17)</b> and/or <b>CAN2B (page 17)</b> with <b>CAN Controller Address (page 316)</b> = <49,64>. Each bit represent controller with the same CAN address as number of the bit. <ul style="list-style-type: none"><li>&gt; Log. 1 - controller with this CAN address is currently loaded</li><li>&gt; Log. 0 - controller with this CAN address is currently not loaded</li></ul>			

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## Group: Log Bout

### Log Bout 1

<b>Value group</b>	Log Bout	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	9143	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs.			

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### Log Bout 2

<b>Value group</b>	Log Bout	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	9144	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs.			

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### Log Bout 3

<b>Value group</b>	Log Bout	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	9145	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs.			

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### Log Bout 4

<b>Value group</b>	Log Bout	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	9146	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs.			

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### Log Bout 5

<b>Value group</b>	Log Bout	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	9147	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs.			

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## Log Bout 6

Value group	Log Bout	Related FW	1.1.0
Units	[-]		
Comm object	9148	Related applications	BTB
Description			
State of binary outputs.			

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## Group: Ethernet

### Subgroup: Common For All Interfaces

## MAC Address

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24333	Related applications	BTB
Description			
Current MAC address of the controller's ethernet interface.			

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### Subgroup: Ethernet Port Status

## ETH Port 3 Status

Value group	Ethernet	Related FW	1.1.0										
Units	[-]												
Comm object	24064	Related applications	BTB										
Description													
This value reflects what communication mode is used on the Ethernet Port 3.													
<table><tr><td>Link Down</td><td>There is no connected cable to the Ethernet Port (socket) or the cable is broken.</td></tr><tr><td>10- HD</td><td>10 Mbit Half-Duplex</td></tr><tr><td>10- FD</td><td>10 Mbit Full-Duplex</td></tr><tr><td>100- HD</td><td>100 Mbit Half-Duplex</td></tr><tr><td>100- FD</td><td>100 Mbit Full-Duplex</td></tr></table>				Link Down	There is no connected cable to the Ethernet Port (socket) or the cable is broken.	10- HD	10 Mbit Half-Duplex	10- FD	10 Mbit Full-Duplex	100- HD	100 Mbit Half-Duplex	100- FD	100 Mbit Full-Duplex
Link Down	There is no connected cable to the Ethernet Port (socket) or the cable is broken.												
10- HD	10 Mbit Half-Duplex												
10- FD	10 Mbit Full-Duplex												
100- HD	100 Mbit Half-Duplex												
100- FD	100 Mbit Full-Duplex												
<b>Note:</b> Note: At one time the Half-Duplex can only send or receive the information whereas Full-Duplex can do both at once.													

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## ETH Port 2 Status

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24088	Related applications	BTB
Description			
This value reflects what communication mode is used on the Ethernet Port 2.			
Link Down	There is no connected cable to the Ethernet Port (socket) or the cable is broken.		
10- HD	10 Mbit Half-Duplex		
10- FD	10 Mbit Full-Duplex		
100- HD	100 Mbit Half-Duplex		
100- FD	100 Mbit Full-Duplex		
<b>Note:</b> Note: At one time the Half-Duplex can only send or receive the information whereas Full-Duplex can do both at once.			

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## ETH Port 1 Status

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24050	Related applications	BTB
Description			
This value reflects what communication mode is used on the Ethernet Port 1.			
Link Down	There is no connected cable to the Ethernet Port (socket) or the cable is broken.		
10- HD	10 Mbit Half-Duplex		
10- FD	10 Mbit Full-Duplex		
100- HD	100 Mbit Half-Duplex		
100- FD	100 Mbit Full-Duplex		
<b>Note:</b> Note: At one time the Half-Duplex can only send or receive the information whereas Full-Duplex can do both at once.			

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## Subgroup: Trusted Interface

### Current IP Address

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24060	Related applications	BTB
Description			
Current IP address of the <b>Ethernet 1 (page 17)</b> interface.			

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### Current Subnet Mask

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24058	Related applications	BTB
Description			
Current subnet mask of the <b>Ethernet 1 (page 17)</b> interface.			

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### Current Gateway

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24056	Related applications	BTB
Description			
Current gateway address the <b>Ethernet 1 (page 17)</b> communication.			

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### ETH Interface Status

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24062	Related applications	BTB
Description			
Current status.of the <b>Ethernet 1 (page 17)</b> communication.			

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## Subgroup: Untrusted Interface

### Current IP Address

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24184	Related applications	BTB
Description			
Current IP address of the <b>Ethernet 2 (page 18)</b> interface.			

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### Current Subnet Mask

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24183	Related applications	BTB
Description			
Current subnet mask of the <b>Ethernet 2 (page 18)</b> interface.			

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### Current Gateway

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24182	Related applications	BTB
Description			
Current IP gateway address of the <b>Ethernet 2 (page 18)</b> communications.			

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### Primary DNS

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24181	Related applications	BTB
Description			
Current domain name server of the <b>Ethernet 2 (page 18)</b> interface.			

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## Secondary DNS

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24100	Related applications	BTB
Description			
Backup domain name server of the <b>Ethernet 2 (page 18)</b> interface.			

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## ETH Interface Status

Value group	Ethernet	Related FW	1.1.0
Units	[-]		
Comm object	24180	Related applications	BTB
Description			
Current status of the <b>Ethernet 2 (page 18)</b> communication.			

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## AirGate Status

Value group	Ethernet	Related FW	1.1.0																		
Units	[-]																				
Comm object	24007	Related applications	BTB																		
Description																					
Diagnostic code for AirGate connection. Helps with troubleshooting.																					
<b>IMPORTANT: If the AirGate key in the Access Administration is empty the controller will not connect to the AirGate despite the function is enabled. Access Administration is available in Tools of the IntelliConfig.</b>																					
<table><tr><th>Code</th><th>Description</th></tr><tr><td>0</td><td>Not defined</td></tr><tr><td>1</td><td>Waiting to connect</td></tr><tr><td>2</td><td>Resolving</td></tr><tr><td>3</td><td>Connecting</td></tr><tr><td>4</td><td>Creating secure channel</td></tr><tr><td>5</td><td>Registrstion</td></tr><tr><td>6</td><td>Connected, inoperable</td></tr><tr><td>7</td><td>Connected, operable</td></tr></table>				Code	Description	0	Not defined	1	Waiting to connect	2	Resolving	3	Connecting	4	Creating secure channel	5	Registrstion	6	Connected, inoperable	7	Connected, operable
Code	Description																				
0	Not defined																				
1	Waiting to connect																				
2	Resolving																				
3	Connecting																				
4	Creating secure channel																				
5	Registrstion																				
6	Connected, inoperable																				
7	Connected, operable																				

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## AirGate ID

<b>Value group</b>	Ethernet	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	24345	<b>Related applications</b>	BTB
<b>Description</b>			
Identification string generated by AirGate server for the purpose of establishing communication via IntelliConfig or any other supported PC tool.			

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## AirGate Servicing Node

<b>Value group</b>	Info	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	24010	<b>Related applications</b>	BTB
<b>Description</b>			
This value displays the IP address to Servicing node to which is controller connected in order to use AirGate connection.			

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## Last E-mail Result

Value group	Ethernet	Related FW	1.1.0																																																																
Units	[-]																																																																		
Comm object	24332	Related applications	BTB																																																																
Description																																																																			
Result of last email, which was sent by controller.																																																																			
<table><tr><td>Code</td><td>Description</td></tr><tr><td>0</td><td>Email was successfully sent.</td></tr><tr><td>1</td><td>SIMCom declined connection request.</td></tr><tr><td>2</td><td>It is not possible to establish connection with SMTP server.</td></tr><tr><td>3</td><td>SMTP server is not ready for communication.</td></tr><tr><td>4</td><td>Maximum transmitted data length not defined.</td></tr><tr><td>5</td><td>No response from SMTP server.</td></tr><tr><td>6</td><td>Command to SMTP server not sent.</td></tr><tr><td>7</td><td>Did not receive data from SMTP server.</td></tr><tr><td>8</td><td>HELO command was refused.</td></tr><tr><td>9</td><td>EHLO command was refused.</td></tr><tr><td>10</td><td>SMTP server does not support 8-bit encoding.</td></tr><tr><td>11</td><td>AUTH LOGIN command was refused.</td></tr><tr><td>12</td><td>Wrong user name.</td></tr><tr><td>13</td><td>Wrong password.</td></tr><tr><td>14</td><td>MAIL FROM command was refused.</td></tr><tr><td>15</td><td>RCPT TO command was refused.</td></tr><tr><td>16</td><td>DATA command was refused.</td></tr><tr><td>17</td><td>Sending of email failed.</td></tr><tr><td>18</td><td>SMTP server rejected email data.</td></tr><tr><td>19</td><td>SMTP server rejected email data.</td></tr><tr><td>20</td><td>QUIT command was refused.</td></tr><tr><td>21</td><td>There is no valid server IP address.</td></tr><tr><td>22</td><td>Process of sending email aborted.</td></tr><tr><td>23</td><td>Closing connection error.</td></tr><tr><td>24</td><td>Failed to accept server response after connection is established.</td></tr><tr><td>25</td><td>It is impossible to create data for command DATA.</td></tr><tr><td>26</td><td>It is impossible to read data for command DATA.</td></tr><tr><td>27</td><td>Email address can't be read.</td></tr><tr><td>28</td><td>Error during encoding process.</td></tr><tr><td>29</td><td>Error during HMAC MD5 encoding process.</td></tr><tr><td>30</td><td>There is no attempt for sending email yet.</td></tr></table>				Code	Description	0	Email was successfully sent.	1	SIMCom declined connection request.	2	It is not possible to establish connection with SMTP server.	3	SMTP server is not ready for communication.	4	Maximum transmitted data length not defined.	5	No response from SMTP server.	6	Command to SMTP server not sent.	7	Did not receive data from SMTP server.	8	HELO command was refused.	9	EHLO command was refused.	10	SMTP server does not support 8-bit encoding.	11	AUTH LOGIN command was refused.	12	Wrong user name.	13	Wrong password.	14	MAIL FROM command was refused.	15	RCPT TO command was refused.	16	DATA command was refused.	17	Sending of email failed.	18	SMTP server rejected email data.	19	SMTP server rejected email data.	20	QUIT command was refused.	21	There is no valid server IP address.	22	Process of sending email aborted.	23	Closing connection error.	24	Failed to accept server response after connection is established.	25	It is impossible to create data for command DATA.	26	It is impossible to read data for command DATA.	27	Email address can't be read.	28	Error during encoding process.	29	Error during HMAC MD5 encoding process.	30	There is no attempt for sending email yet.
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30	There is no attempt for sending email yet.																																																																		

31	Cannot resolve SMTP server's IP address.
32	Error while reading CO 24327 (base64 email data)
33	Problem with authorization type (i.e. smtp.gmail.com support only STARTTLS)
34	SMTP server does not support STARTTLS command.
35	STARTTLS command was refused.
36	There is a problem during TLS handshake process.

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### Subgroup: Modbus Interface

#### Current IP Address

<b>Value group</b>	ETH Interface 3 - Modbus	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	24046	<b>Related applications</b>	BTB
<b>Description</b>			
Current IP address of the <b>Ethernet 3 (page 18)</b> interface.			

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#### Current Subnet Mask

<b>Value group</b>	ETH Interface 3 - Modbus	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	24044	<b>Related applications</b>	BTB
<b>Description</b>			
Current subnet mask of the <b>Ethernet 3 (page 18)</b> interface.			

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#### Current Gateway

<b>Value group</b>	ETH Interface 3 - Modbus	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	24042	<b>Related applications</b>	BTB
<b>Description</b>			
Current IP gateway address of the <b>Ethernet 3 (page 18)</b> communications.			

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## Primary DNS

Value group	ETH Interface 3 - Modbus	Related FW	1.1.0
Units	[-]		
Comm object	24039	Related applications	BTB
Description			
Current domain name server of the <b>Ethernet 3</b> (page 18) interface.			

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## Secondary DNS

Value group	ETH Interface 3 - Modbus	Related FW	1.1.0
Units	[-]		
Comm object	24037	Related applications	BTB
Description			
Backup domain name server of the <b>Ethernet 3</b> (page 18) interface.			

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## ETH Interface Status

Value group	ETH Interface 3 - Modbus	Related FW	1.1.0
Units	[-]		
Comm object	24048	Related applications	BTB
Description			
Current status of the <b>Ethernet 3</b> (page 18) communication.			

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## Group: Remote Control

### RemoteControl2B 1

Value group	Remote Control	Related FW	1.1.0
Units	-		
Comm object	16671	Related applications	BTB
Description			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP</b> (page 215). Data type of this value is Int16.			

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## RemoteControl2B 2

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16672	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int16.			

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## RemoteControl2B 3

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16673	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int16.			

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## RemoteControl2B 4

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16674	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int16.			

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## RemoteControl2B 5

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16675	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int16.			

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### RemoteControl2B 6

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16676	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int16.			

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### RemoteControl2B 7

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16677	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int16.			

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### RemoteControl2B 8

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16678	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int16.			

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### RemoteControl4B 1

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16679	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int32.			

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## RemoteControl4B 2

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16680	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int32.			

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## RemoteControl4B 3

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16681	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int32.			

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## RemoteControl4B 4

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16682	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Int32.			

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## RemoteControlBin

<b>Value group</b>	Remote Control	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	16683	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains user data written over <b>Modbus-RTU, Modbus/TCP (page 215)</b> . Data type of this value is Binary16.			

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## Group: User Buttons

### User Buttons

<b>Value group</b>	User Buttons	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	20743	<b>Related applications</b>	BTB
<b>Description</b>			
State of <b>User Buttons (page 171)</b> .			
1. User Button 1	11. User Button 11	21. User Button 21	31. User Button 31
2. User Button 2	12. User Button 12	22. User Button 22	32. User Button 32
3. User Button 3	13. User Button 13	23. User Button 23	
4. User Button 4	14. User Button 14	24. User Button 24	
5. User Button 5	15. User Button 15	25. User Button 25	
6. User Button 6	16. User Button 16	26. User Button 26	
7. User Button 7	17. User Button 17	27. User Button 27	
8. User Button 8	18. User Button 18	28. User Button 28	
9. User Button 9	19. User Button 19	29. User Button 29	
10. User Button 10	20. User Button 20	30. User Button 30	

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## Group: ECU

### ECU Frequency Select

<b>Value group</b>	ECU	<b>Related FW</b>	1.1.0
<b>Units</b>	-		
<b>Comm object</b>	12926	<b>Related applications</b>	BTB
<b>Description</b>			
Shows selected frequency of ECU. The value is calculated from setpoint <b>Nominal Frequency (page 250)</b>			
<b>&gt;</b> If is <b>Nominal Frequency (page 250)</b> in range from 45 Hz to 54 Hz, is considered as 50 Hz application. The value is set to 0.			
<b>&gt;</b> If is <b>Nominal Frequency (page 250)</b> in range from 55 Hz to 65 Hz, is considered as 60 Hz application. The value is set to 1.			

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## Group: PLC

### PLC-AOUT 1

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21248	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 2

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21249	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 3

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21250	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21251	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 5

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21252	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 6

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21253	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 7

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21254	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 8

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21255	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 9

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21256	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 10

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21257	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 11

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21258	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 12

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21259	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 13

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21260	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 14

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21261	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 15

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21262	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 16

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21263	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 17

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21264	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 18

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21265	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 19

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21266	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 20

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21267	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 21

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21268	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 22

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21269	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 23

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21270	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 24

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21271	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 25

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21272	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 26

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21273	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 27

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21274	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 28

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21275	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 29

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21276	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 30

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21277	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 31

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21278	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 32

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21279	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 33

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21280	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 34

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21281	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 35

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21282	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 36

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21283	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 37

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21284	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 38

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21285	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 39

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21286	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21287	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 41

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21288	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 42

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21289	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 43

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21290	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 44

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21291	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 45

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21292	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 46

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21293	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 47

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21294	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 48

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21295	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 49

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21296	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 50

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21297	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 51

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21298	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 52

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21299	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 53

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21300	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 54

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21301	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 55

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21302	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 56

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21303	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 57

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21304	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 58

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21305	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 59

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21306	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 60

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21307	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 61

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21308	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 62

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21309	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 63

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21310	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 64

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21311	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-BOUT 1

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10424	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 2

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10425	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 3

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10426	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10427	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 5

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10428	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 6

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10429	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 7

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10430	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 8

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10431	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 9

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10432	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 10

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10433	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 11

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10434	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 12

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10435	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 13

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10436	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 14

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10437	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 15

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10438	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 16

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10439	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 17

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14570	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 18

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14571	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 19

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14572	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 20

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14573	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 21

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14574	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 22

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14575	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 23

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14576	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 24

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14577	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 25

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14578	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 26

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14579	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 27

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14580	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 28

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14581	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 29

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14582	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 30

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14583	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 31

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14584	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 32

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14585	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC Resource 1

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21216	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 2

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21217	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 3

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21218	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21219	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 5

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21220	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 6

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21221	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 7

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21222	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 8

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21223	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 9

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21224	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 10

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21225	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 11

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21226	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 12

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21227	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 13

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21228	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 14

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21229	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 15

Value group	PLC	Related FW	1.1.0
Units	[-]		
Comm object	21230	Related applications	BTB
Description			
Internal value of PLC block.			

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## PLC Resource 16

Value group	PLC	Related FW	1.1.0
Units	[-]		
Comm object	21231	Related applications	BTB
Description			
Internal value of PLC block.			

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## Group: PLC

### PLC-AOUT 1

Value group	PLC	Related FW	1.1.0
Units	[-]		
Comm object	21248	Related applications	BTB
Description			
State of analog output of PLC.			

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### PLC-AOUT 2

Value group	PLC	Related FW	1.1.0
Units	[-]		
Comm object	21249	Related applications	BTB
Description			
State of analog output of PLC.			

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### PLC-AOUT 3

Value group	PLC	Related FW	1.1.0
Units	[-]		
Comm object	21250	Related applications	BTB
Description			
State of analog output of PLC.			

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#### PLC-AOUT 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21251	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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#### PLC-AOUT 5

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21252	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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#### PLC-AOUT 6

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21253	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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#### PLC-AOUT 7

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21254	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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#### PLC-AOUT 8

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21255	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 9

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21256	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 10

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21257	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 11

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21258	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 12

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21259	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 13

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21260	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 14

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21261	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 15

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21262	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 16

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21263	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 17

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21264	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 18

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21265	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 19

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21266	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 20

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21267	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 21

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21268	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 22

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21269	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 23

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21270	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 24

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21271	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 25

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21272	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 26

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21273	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 27

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21274	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 28

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21275	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 29

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21276	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 30

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21277	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 31

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21278	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 32

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21279	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 33

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21280	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 34

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21281	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 35

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21282	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 36

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21283	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 37

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21284	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 38

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21285	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 39

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21286	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21287	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 41

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21288	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 42

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21289	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 43

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21290	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 44

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21291	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 45

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21292	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 46

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21293	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 47

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21294	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 48

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21295	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 49

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21296	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 50

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21297	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 51

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21298	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 52

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21299	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 53

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21300	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 54

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21301	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 55

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21302	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 56

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21303	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 57

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21304	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 58

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21305	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 59

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21306	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 60

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21307	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 61

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21308	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 62

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21309	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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### PLC-AOUT 63

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21310	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-AOUT 64

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21311	<b>Related applications</b>	BTB
<b>Description</b>			
State of analog output of PLC.			

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## PLC-BOUT 1

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10424	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 2

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10425	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 3

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10426	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10427	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 5

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10428	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 6

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10429	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 7

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10430	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 8

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10431	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 9

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10432	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 10

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10433	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 11

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10434	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 12

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10435	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 13

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10436	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 14

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10437	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 15

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10438	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 16

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10439	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 17

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14570	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 18

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14571	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 19

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14572	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 20

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14573	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 21

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14574	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 22

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14575	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 23

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14576	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 24

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14577	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 25

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14578	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 26

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14579	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 27

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14580	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 28

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14581	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 29

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14582	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 30

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14583	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 31

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14584	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 32

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	14585	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 33

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16914	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 34

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16915	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 35

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16916	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 36

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16917	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 37

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16918	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 38

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16919	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC-BOUT 39

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16920	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 40

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16921	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 41

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16922	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 42

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16923	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 43

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16924	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 44

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16925	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 45

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16926	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 46

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16927	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 47

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16928	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 48

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16929	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 49

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16930	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 50

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16931	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 51

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16932	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 52

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16933	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 53

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16934	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 54

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16935	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 55

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16936	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 56

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16937	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 57

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16938	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 58

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16939	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 59

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16940	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 60

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16941	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 61

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16942	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 62

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16943	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 63

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16944	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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## PLC-BOUT 64

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	16945	<b>Related applications</b>	BTB
<b>Description</b>			
State of binary outputs of PLC.			

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### PLC Resource 1

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21216	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 2

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21217	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 3

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21218	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 4

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21219	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 5

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21220	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 6

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21221	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 7

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21222	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 8

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21223	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 9

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21224	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 10

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21225	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 11

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21226	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 12

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21227	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 13

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21228	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 14

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21229	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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### PLC Resource 15

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21230	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 16

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21231	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 17

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21232	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 18

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21233	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 19

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21234	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## PLC Resource 20

<b>Value group</b>	PLC	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	21235	<b>Related applications</b>	BTB
<b>Description</b>			
Internal value of PLC block.			

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## Group: DIST-IN 1-32

### Binary inputs 1 1-8

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	13301	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 1. Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> . <ol style="list-style-type: none"><li>1. DISTBIN-1 1</li><li>2. DISTBIN-1 2</li><li>3. DISTBIN-1 3</li><li>4. DISTBIN-1 4</li><li>5. DISTBIN-1 5</li><li>6. DISTBIN-1 6</li><li>7. DISTBIN-1 7</li><li>8. DISTBIN-1 8</li></ol>			

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### Binary inputs 1 9-16

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	20890	Related applications	BTB
<b>Description</b>			
This value contains second 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 1. <div><b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b></div> Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> . <ol style="list-style-type: none"><li>1. DISTBIN-1 9</li><li>2. DISTBIN-1 10</li><li>3. DISTBIN-1 11</li><li>4. DISTBIN-1 12</li><li>5. DISTBIN-1 13</li><li>6. DISTBIN-1 14</li><li>7. DISTBIN-1 15</li><li>8. DISTBIN-1 16</li></ol>			

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## Binary inputs 1 17-24

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	16741	Related applications	BTB
<b>Description</b>			
This value contains third 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 1.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> .			
<ol style="list-style-type: none"> <li>1. DISTBIN-1 17</li> <li>2. DISTBIN-1 18</li> <li>3. DISTBIN-1 19</li> <li>4. DISTBIN-1 20</li> <li>5. DISTBIN-1 21</li> <li>6. DISTBIN-1 22</li> <li>7. DISTBIN-1 23</li> <li>8. DISTBIN-1 24</li> </ol>			

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## Binary inputs 1 25-32

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	16805	Related applications	BTB
<b>Description</b>			
This value contains fourth 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 1.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> .			
<ol style="list-style-type: none"> <li>1. DISTBIN-1 25</li> <li>2. DISTBIN-1 26</li> <li>3. DISTBIN-1 27</li> <li>4. DISTBIN-1 28</li> <li>5. DISTBIN-1 29</li> <li>6. DISTBIN-1 30</li> <li>7. DISTBIN-1 31</li> <li>8. DISTBIN-1 32</li> </ol>			

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## DISTAIN-1 1

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20955	Related applications	BTB
<b>Description</b>			
This value contains data of first distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-1 2

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20956	Related applications	BTB
<b>Description</b>			
This value contains data of second distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-1 3

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20957	Related applications	BTB
<b>Description</b>			
This value contains data of third distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-1 4

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20958	Related applications	BTB
<b>Description</b>			
This value contains data of fourth distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## Binary inputs 2 1-8

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	13302	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 2. Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 2</b> .			
1. DISTBIN-2 1			
2. DISTBIN-2 2			
3. DISTBIN-2 3			
4. DISTBIN-2 4			
5. DISTBIN-2 5			
6. DISTBIN-2 6			
7. DISTBIN-2 7			
8. DISTBIN-2 8			

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## Binary inputs 2 9-16

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	20891	Related applications	BTB
<b>Description</b>			
This value contains second 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 2.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 2.</b>			
<ol style="list-style-type: none"> <li>1. DISTBIN-2 9</li> <li>2. DISTBIN-2 10</li> <li>3. DISTBIN-2 11</li> <li>4. DISTBIN-2 12</li> <li>5. DISTBIN-2 13</li> <li>6. DISTBIN-2 14</li> <li>7. DISTBIN-2 15</li> <li>8. DISTBIN-2 16</li> </ol>			

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## Binary inputs 2 17-24

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	16742	Related applications	BTB
<b>Description</b>			
This value contains third 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 2.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 2.</b>			
<ol style="list-style-type: none"> <li>1. DISTBIN-2 17</li> <li>2. DISTBIN-2 18</li> <li>3. DISTBIN-2 19</li> <li>4. DISTBIN-2 20</li> <li>5. DISTBIN-2 21</li> <li>6. DISTBIN-2 22</li> <li>7. DISTBIN-2 23</li> <li>8. DISTBIN-2 24</li> </ol>			

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## Binary inputs 2 25-32

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	[-]		
Comm object	16806	Related applications	BTB
<b>Description</b>			
This value contains fourth 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 2.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 2</b> .			
<ol style="list-style-type: none"> <li>1. DISTBIN-2 25</li> <li>2. DISTBIN-2 26</li> <li>3. DISTBIN-2 27</li> <li>4. DISTBIN-2 28</li> <li>5. DISTBIN-2 29</li> <li>6. DISTBIN-2 30</li> <li>7. DISTBIN-2 31</li> <li>8. DISTBIN-2 32</li> </ol>			

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## DISTAIN-2 1

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20959	Related applications	BTB
<b>Description</b>			
This value contains data of first distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 2</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-2 2

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20960	Related applications	BTB
<b>Description</b>			
This value contains data of second distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 2</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-2 3

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20961	Related applications	BTB
<b>Description</b>			
This value contains data of third distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 2</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-2 4

Value group	DIST-IN 1-32	Related FW	1.1.0
Units	Based on configuration		
Comm object	20962	Related applications	BTB
<b>Description</b>			
This value contains data of fourth distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 1</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			

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## Group: DIST-IN 33-64

### Binary inputs 33 1-8

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	25858	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 33. Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> . <ol style="list-style-type: none"><li>1. DISTBIN-33 1</li><li>2. DISTBIN-33 2</li><li>3. DISTBIN-33 3</li><li>4. DISTBIN-33 4</li><li>5. DISTBIN-33 5</li><li>6. DISTBIN-33 6</li><li>7. DISTBIN-33 7</li><li>8. DISTBIN-33 8</li></ol>			

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### Binary inputs 33 9-16

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	20922	Related applications	BTB
<b>Description</b>			
This value contains last 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 33. <div><b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b></div> Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> . <ol style="list-style-type: none"><li>1. DISTBIN-33 9</li><li>2. DISTBIN-33 10</li><li>3. DISTBIN-33 11</li><li>4. DISTBIN-33 12</li><li>5. DISTBIN-33 13</li><li>6. DISTBIN-33 14</li><li>7. DISTBIN-33 15</li><li>8. DISTBIN-33 16</li></ol>			

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## Binary inputs 33 17-24

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	16773	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 33.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> .			
<ol style="list-style-type: none"><li>1. DISTBIN-33 17</li><li>2. DISTBIN-33 18</li><li>3. DISTBIN-33 19</li><li>4. DISTBIN-33 20</li><li>5. DISTBIN-33 21</li><li>6. DISTBIN-33 22</li><li>7. DISTBIN-33 23</li><li>8. DISTBIN-33 24</li></ol>			

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## Binary inputs 33 25-32

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	16837	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 33.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> .			
<ol style="list-style-type: none"><li>1. DISTBIN-33 25</li><li>2. DISTBIN-33 26</li><li>3. DISTBIN-33 27</li><li>4. DISTBIN-33 28</li><li>5. DISTBIN-33 29</li><li>6. DISTBIN-33 30</li><li>7. DISTBIN-33 31</li><li>8. DISTBIN-33 32</li></ol>			

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### DISTAIN-33 1

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21083	Related applications	BTB
<b>Description</b>			
This value contains data of first distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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### DISTAIN-33 2

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21084	Related applications	BTB
<b>Description</b>			
This value contains data of second distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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### DISTAIN-33 3

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21085	Related applications	BTB
<b>Description</b>			
This value contains data of third distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-33 4

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21086	Related applications	BTB
<b>Description</b>			
This value contains data of fourth distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 33</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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## Binary inputs 34 1-8

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	20859	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 34. Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
1. DISTBIN-34 1			
2. DISTBIN-34 2			
3. DISTBIN-34 3			
4. DISTBIN-34 4			
5. DISTBIN-34 5			
6. DISTBIN-34 6			
7. DISTBIN-34 7			
8. DISTBIN-34 8			

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## Binary inputs 34 9-16

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	20923	Related applications	BTB
<b>Description</b>			
This value contains last 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 34.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
<ol style="list-style-type: none"> <li>1. DISTBIN-34 9</li> <li>2. DISTBIN-34 10</li> <li>3. DISTBIN-34 11</li> <li>4. DISTBIN-34 12</li> <li>5. DISTBIN-34 13</li> <li>6. DISTBIN-34 14</li> <li>7. DISTBIN-34 15</li> <li>8. DISTBIN-34 16</li> </ol>			

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## Binary inputs 34 17-24

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	16774	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 34.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
<ol style="list-style-type: none"> <li>1. DISTBIN-34 17</li> <li>2. DISTBIN-34 18</li> <li>3. DISTBIN-34 19</li> <li>4. DISTBIN-34 20</li> <li>5. DISTBIN-34 21</li> <li>6. DISTBIN-34 22</li> <li>7. DISTBIN-34 23</li> <li>8. DISTBIN-34 24</li> </ol>			

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## Binary inputs 34 25-32

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	[-]		
Comm object	16838	Related applications	BTB
<b>Description</b>			
This value contains first 8 Binary Inputs of distributed binary inputs from <b>DIST-IN (page 30)</b> module 34.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			
Received data are from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
<ol style="list-style-type: none"> <li>1. DISTBIN-34 25</li> <li>2. DISTBIN-34 26</li> <li>3. DISTBIN-34 27</li> <li>4. DISTBIN-34 28</li> <li>5. DISTBIN-34 29</li> <li>6. DISTBIN-34 30</li> <li>7. DISTBIN-34 31</li> <li>8. DISTBIN-34 32</li> </ol>			

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## DISTAIN-34 1

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21087	Related applications	BTB
<b>Description</b>			
This value contains data of first distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-34 2

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21088	Related applications	BTB
<b>Description</b>			
This value contains data of second distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-34 3

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21089	Related applications	BTB
<b>Description</b>			
This value contains data of third distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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## DISTAIN-34 4

Value group	DIST-IN 33-64	Related FW	1.1.0
Units	Based on configuration		
Comm object	21090	Related applications	BTB
<b>Description</b>			
This value contains data of fourth distributed analog input from <b>DIST-IN (page 30)</b> module which are received from Controller Unit with <b>CAN Controller Address (page 316) = 34</b> .			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 8C CAN FD!</b>			

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## Group: SH Modules

### SHBIN-1

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10572	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary inputs from SHBIN module 1. <ol style="list-style-type: none"><li>1. SHBIN-1 1</li><li>2. SHBIN-1 2</li><li>3. SHBIN-1 3</li><li>4. SHBIN-1 4</li><li>5. SHBIN-1 5</li><li>6. SHBIN-1 6</li><li>7. SHBIN-1 7</li><li>8. SHBIN-1 8</li></ol>			

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### SHBIN-2

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10573	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary inputs from SHBIN module 2. <ol style="list-style-type: none"><li>1. SHBIN-2 1</li><li>2. SHBIN-2 2</li><li>3. SHBIN-2 3</li><li>4. SHBIN-2 4</li><li>5. SHBIN-2 5</li><li>6. SHBIN-2 6</li><li>7. SHBIN-2 7</li><li>8. SHBIN-2 8</li></ol>			

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### SHBIN-3

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10574	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary inputs from SHBIN module 3. <ol style="list-style-type: none"><li>1. SHBIN-3 1</li><li>2. SHBIN-3 2</li><li>3. SHBIN-3 3</li><li>4. SHBIN-3 4</li><li>5. SHBIN-3 5</li><li>6. SHBIN-3 6</li><li>7. SHBIN-3 7</li><li>8. SHBIN-3 8</li></ol>			

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### SHBIN-4

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10575	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary inputs from SHBIN module 4. <ol style="list-style-type: none"><li>1. SHBIN-4 1</li><li>2. SHBIN-4 2</li><li>3. SHBIN-4 3</li><li>4. SHBIN-4 4</li><li>5. SHBIN-4 5</li><li>6. SHBIN-4 6</li><li>7. SHBIN-4 7</li><li>8. SHBIN-4 8</li></ol>			

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## SHBIN-5

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	11341	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary inputs from SHBIN module 5. <ol style="list-style-type: none"><li>1. SHBIN-5 1</li><li>2. SHBIN-5 2</li><li>3. SHBIN-5 3</li><li>4. SHBIN-5 4</li><li>5. SHBIN-5 5</li><li>6. SHBIN-5 6</li><li>7. SHBIN-5 7</li><li>8. SHBIN-5 8</li></ol>			

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## SHBIN-6

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	11342	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary inputs from SHBIN module 6. <ol style="list-style-type: none"><li>1. SHBIN-6 1</li><li>2. SHBIN-6 2</li><li>3. SHBIN-6 3</li><li>4. SHBIN-6 4</li><li>5. SHBIN-6 5</li><li>6. SHBIN-6 6</li><li>7. SHBIN-6 7</li><li>8. SHBIN-6 8</li></ol>			

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## SHBOUT-1

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10576	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary outputs from SHBOUT module 1. <ol style="list-style-type: none"><li>1. SHBOUT-1 1</li><li>2. SHBOUT-1 2</li><li>3. SHBOUT-1 3</li><li>4. SHBOUT-1 4</li><li>5. SHBOUT-1 5</li><li>6. SHBOUT-1 6</li><li>7. SHBOUT-1 7</li><li>8. SHBOUT-1 8</li></ol>			

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## SHBOUT-2

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10577	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary outputs from SHBOUT module 2. <ol style="list-style-type: none"><li>1. SHBOUT-2 1</li><li>2. SHBOUT-2 2</li><li>3. SHBOUT-2 3</li><li>4. SHBOUT-2 4</li><li>5. SHBOUT-2 5</li><li>6. SHBOUT-2 6</li><li>7. SHBOUT-2 7</li><li>8. SHBOUT-2 8</li></ol>			

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### SHBOUT-3

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10578	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary outputs from SHBOUT module 3.  1. SHBOUT-3 1 2. SHBOUT-3 2 3. SHBOUT-3 3 4. SHBOUT-3 4 5. SHBOUT-3 5 6. SHBOUT-3 6 7. SHBOUT-3 7 8. SHBOUT-3 8			

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### SHBOUT-4

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	10579	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary outputs from SHBOUT module 4.  1. SHBOUT-4 1 2. SHBOUT-4 2 3. SHBOUT-4 3 4. SHBOUT-4 4 5. SHBOUT-4 5 6. SHBOUT-4 6 7. SHBOUT-4 7 8. SHBOUT-4 8			

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## SHBOUT-5

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	11343	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary outputs from SHBOUT module 5. <ol style="list-style-type: none"><li>1. SHBOUT-5 1</li><li>2. SHBOUT-5 2</li><li>3. SHBOUT-5 3</li><li>4. SHBOUT-5 4</li><li>5. SHBOUT-5 5</li><li>6. SHBOUT-5 6</li><li>7. SHBOUT-5 7</li><li>8. SHBOUT-5 8</li></ol>			

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## SHBOUT-6

<b>Value group</b>	SH Modules	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	11344	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains Binary Inputs of shared binary outputs from SHBOUT module 6. <ol style="list-style-type: none"><li>1. SHBOUT-6 1</li><li>2. SHBOUT-6 2</li><li>3. SHBOUT-6 3</li><li>4. SHBOUT-6 4</li><li>5. SHBOUT-6 5</li><li>6. SHBOUT-6 6</li><li>7. SHBOUT-6 7</li><li>8. SHBOUT-6 8</li></ol>			

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### SHAIN-1 1

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	10584	Related applications	BTB
<b>Description</b>			
This value contains data of first shared analog input from SHAOUT module 1.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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### SHAIN-1 2

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	10585	Related applications	BTB
<b>Description</b>			
This value contains data of second shared analog input from SHAOUT module 1.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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### SHAIN-1 3

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	10586	Related applications	BTB
<b>Description</b>			
This value contains data of third shared analog input from SHAOUT module 1.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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### SHAIN-1 4

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	10587	Related applications	BTB
<b>Description</b>			
This value contains data of fourth shared analog input from SHAOUT module 1.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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### SHAIN-2 1

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	11390	Related applications	BTB
<b>Description</b>			
This value contains data of first shared analog input from SHAOUT module 2.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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### SHAIN-2 2

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	11391	Related applications	BTB
<b>Description</b>			
This value contains data of second shared analog input from SHAOUT module 2.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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### SHAIN-2 3

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	11392	Related applications	BTB
<b>Description</b>			
This value contains data of third shared analog input from SHAOUT module 2.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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### SHAIN-2 4

Value group	SH Modules	Related FW	1.1.0
Units	[-]		
Comm object	11393	Related applications	BTB
<b>Description</b>			
This value contains data of fourth shared analog input from SHAOUT module 2.			
<b>IMPORTANT: This value is received (and visible) only when it is configured with sensor type "Electronic".</b>			

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## Group: Virtual Shared OUT

### Binary outputs 1-8

<b>Value group</b>	Virtual Shared OUT	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	13333	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains first 8 Binary Outputs of distributed binary outputs from <b>DIST-OUT (page 31)</b> module.			
1. DISTBOUT 1			
2. DISTBOUT 2			
3. DISTBOUT 3			
4. DISTBOUT 4			
5. DISTBOUT 5			
6. DISTBOUT 6			
7. DISTBOUT 7			
8. DISTBOUT 8			

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### Binary outputs 9-16

<b>Value group</b>	Virtual Shared OUT	<b>Related FW</b>	1.1.0
<b>Units</b>	[-]		
<b>Comm object</b>	20954	<b>Related applications</b>	BTB
<b>Description</b>			
This value contains second 8 Binary Outputs of distributed binary outputs from <b>DIST-OUT (page 31)</b> module.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
1. DISTBOUT 9			
2. DISTBOUT 10			
3. DISTBOUT 11			
4. DISTBOUT 12			
5. DISTBOUT 13			
6. DISTBOUT 14			
7. DISTBOUT 15			
8. DISTBOUT 16			

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## Binary outputs 17-24

Value group	Virtual Shared OUT	Related FW	1.1.0
Units	[-]		
Comm object	16870	Related applications	BTB
<b>Description</b>			
This value contains third 8 Binary Outputs of distributed binary outputs from <b>DIST-OUT (page 31)</b> module.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
<ol style="list-style-type: none"> <li>1. DISTBOUT 17</li> <li>2. DISTBOUT 18</li> <li>3. DISTBOUT 19</li> <li>4. DISTBOUT 20</li> <li>5. DISTBOUT 21</li> <li>6. DISTBOUT 22</li> <li>7. DISTBOUT 23</li> <li>8. DISTBOUT 24</li> </ol>			

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## Binary outputs 25-32

Value group	Virtual Shared OUT	Related FW	1.1.0
Units	[-]		
Comm object	16871	Related applications	BTB
<b>Description</b>			
This value contains fourth 8 Binary Outputs of distributed binary outputs from <b>DIST-OUT (page 31)</b> module.			
<b>IMPORTANT: This value is supported only when CAN Intercontroller Comm Mode (page 320) = 64C CAN FD or 32C CAN FD or 8C CAN FD!</b>			
<ol style="list-style-type: none"> <li>1. DISTBOUT 25</li> <li>2. DISTBOUT 26</li> <li>3. DISTBOUT 27</li> <li>4. DISTBOUT 28</li> <li>5. DISTBOUT 29</li> <li>6. DISTBOUT 30</li> <li>7. DISTBOUT 31</li> <li>8. DISTBOUT 32</li> </ol>			

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# 8.1.5 Logical binary inputs

**What Logical binary inputs are:**

Logical binary inputs are inputs for binary values and functions.

**Alphabetical groups of Logical binary inputs**

LBI: B .....	538
LBI: E .....	541
LBI: F .....	544
LBI: G .....	552
LBI: H .....	552
LBI: N .....	553
LBI: P .....	554
LBI: R .....	556
LBI: S .....	557
LBI: T .....	557

For full list of Logical binary inputs go to the chapter **Logical binary inputs alphabetically (page 537)**.

## Logical binary inputs alphabetically

LBI: B .....	538	Emergency MAN .....	544	LBI: G .....	552
Breaker Trip .....	538	LBI: F .....	544	Group link .....	552
BTB Disable .....	538	Fault Reset Button .....	544	LBI: H .....	552
BTB Feedback .....	539	Force BTB Close .....	545	Hot Swap Ctrl Block .....	552
BTB Feedback Negative .....	540	Force Protection Disable .....	545	Hot Swap Heartbeat	
LBI: E .....	541	Forced Value Input 01 .....	545	Detect .....	553
ECU Communication Fail		Forced Value Input 02 .....	545	Hot Swap Recovery .....	553
Block .....	541	Forced Value Input 03 .....	546	Horn Reset Button .....	553
ECU Communication Fail		Forced Value Input 04 .....	546	LBI: N .....	553
Block 1 .....	541	Forced Value Input 05 .....	546	Not Used .....	553
ECU Communication Fail		Forced Value Input 06 .....	546	LBI: P .....	554
Block 2 .....	541	Forced Value Input 07 .....	546	Protection Force Disable 1 .....	554
ECU Communication Fail		Forced Value Input 08 .....	547	Protection Force Disable 2 .....	555
Block 3 .....	541	Forced Value Input 09 .....	547	Protection Force Disable 3 .....	555
ECU Communication Fail		Forced Value Input 10 .....	547	Pulse Counter 1 .....	556
Block 4 .....	541	Forced Value Input 11 .....	547	Pulse Counter 2 .....	556
ECU Communication Fail		Forced Value Input 12 .....	547	LBI: R .....	556
Block 5 .....	542	Forced Value Input 13 .....	548	Remote MAN .....	556
ECU Communication Fail		Forced Value Input 14 .....	548	Remote OFF .....	556
Block 6 .....	542	Forced Value Input 15 .....	548	LBI: S .....	557
ECU Communication Fail		Forced Value Input 16 .....	548	Synchronization Check .....	557
Block 7 .....	542	Forced Value Input 17 .....	548	Synchronization	
ECU Communication Fail		Forced Value Input 18 .....	549	Permissive .....	557
Block 8 .....	542	Forced Value Input 19 .....	549	Synchronization Run .....	557
ECU Communication Fail		Forced Value Input 20 .....	549	LBI: T .....	557
Block 9 .....	542	Forced Value Input 21 .....	549	Time Stamp Act .....	557
ECU Communication Fail		Forced Value Input 22 .....	549		
Block 10 .....	543	Forced Value Input 23 .....	550		
ECU Communication Fail		Forced Value Input 24 .....	550		
Block 11 .....	543	Forced Value Input 25 .....	550		
ECU Communication Fail		Forced Value Input 26 .....	550		
Block 12 .....	543	Forced Value Input 27 .....	550		
ECU Communication Fail		Forced Value Input 28 .....	551		
Block 13 .....	543	Forced Value Input 29 .....	551		
ECU Communication Fail		Forced Value Input 30 .....	551		
Block 14 .....	543	Forced Value Input 31 .....	551		
ECU Communication Fail		Forced Value Input 32 .....	551		
Block 15 .....	544				
ECU Communication Fail					
Block 16 .....	544				

 **back to Controller objects**



## LBI: B

### Breaker Trip

Related FW	1.1.0	Related applications	BTB
LBI ID	120		
Description			
This logical input is used to open BTB breaker. No unloading or reserve counting is done, the breaker will be immediately opened after the LBI is activated.			

🔍 back to Logical binary inputs alphabetically

### BTB Disable

Related FW	1.1.0	Related applications	BTB
LBI ID	124		
<b>Description</b>			
<p>This binary input is used to prevent BTB closing and opening.</p> <ul style="list-style-type: none"><li>➤ If the input is active during synchronizing, the controller will continue synchronizing without issuing the BTB closing command until the input is deactivated or Sync timeout is elapsed.</li><li>➤ If the input is active and the BTB Button is pressed in MAN mode to close the BTB to dead bus, the BTB will not be closed until this input is deactivated and the BTB Button is pressed again.</li><li>➤ If the input is active and the BTB is to be closed to dead bus automatically, the BTB will not be closed until this input is deactivated.</li><li>➤ If the input is active and BTB is already closed, the breaker will not open.</li></ul>			

🔍 back to Logical binary inputs alphabetically

BTB Feedback

Related FW	1.1.0	Related applications	BTB
LBI ID	65		

Description

Use this input to indicate whether the bus tie breaker is opened or closed.

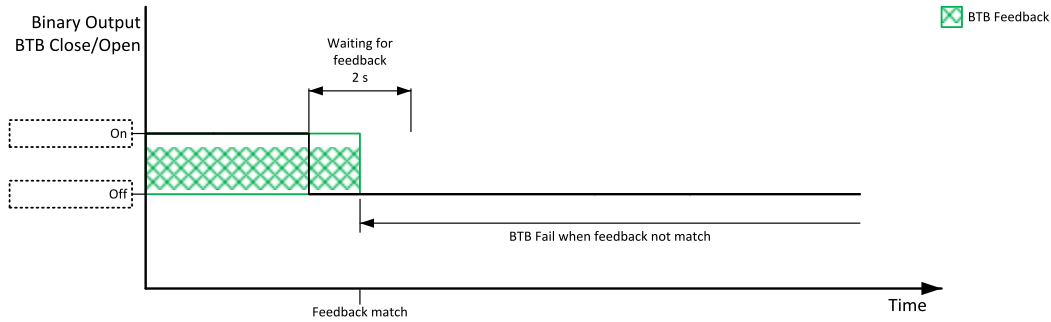


Image 7.2 BTB Feedback 1

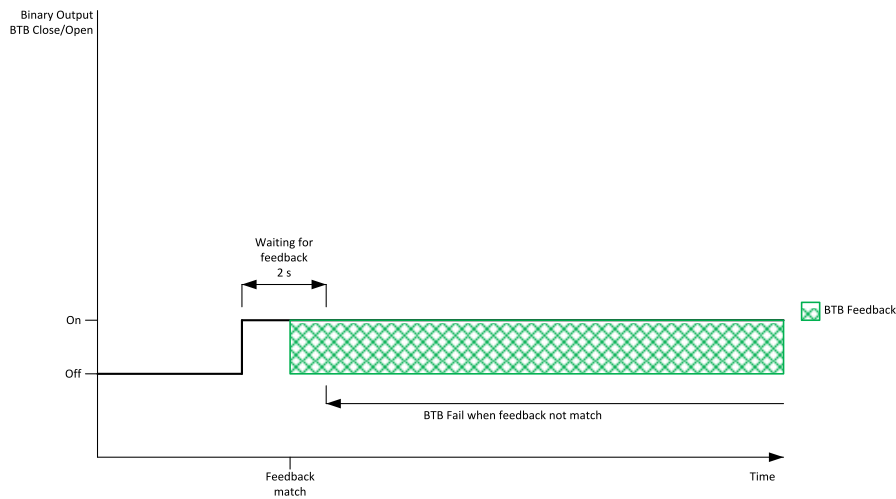


Image 7.3 BTB Feedback 2

[back to Logical binary inputs alphabetically](#)

BTB Feedback Negative

Related FW	1.1.0	Related applications	BTB
LBI ID	66		

Description

Use this input to indicate whether the bus tie breaker is opened or closed.  
This input is logically inverted against LBI **BTB FEEDBACK** (PAGE 539).

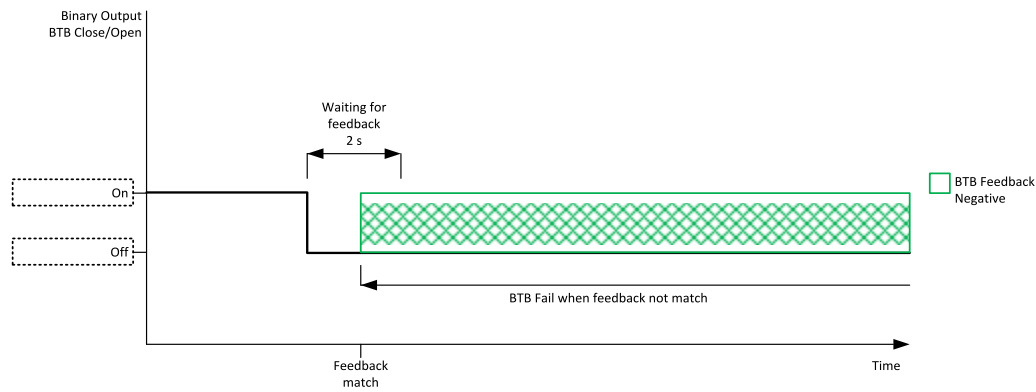


Image 7.4 BTB Feedback 1

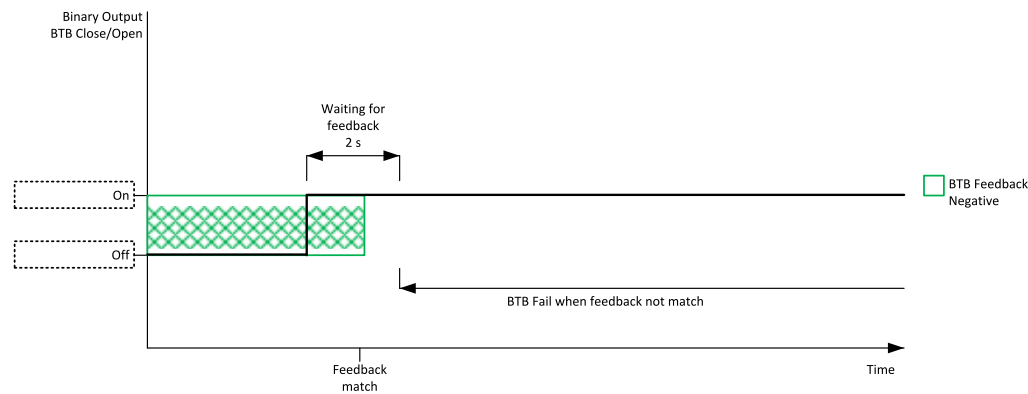


Image 7.5 BTB Feedback 2

◀ back to Logical binary inputs alphabetically

## LBID: E

### ECU Communication Fail Block

Related FW	1.1.0	Related applications	BTB
LBID ID	141		
Description			
Activation of this binary input blocks all protections (including user protections) for every single configured ECU.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 1

Related FW	1.1.0	Related applications	BTB
LBID ID	1020		
Description			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 1. Alarm <b>Wrn ECU 1 Comm Fail (page 658)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 2

Related FW	1.1.0	Related applications	BTB
LBID ID	1021		
Description			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 2. Alarm <b>Wrn ECU 2 Comm Fail (page 658)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 3

Related FW	1.1.0	Related applications	BTB
LBID ID	1022		
Description			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 3. Alarm <b>Wrn ECU 3 Comm Fail (page 658)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 4

Related FW	1.1.0	Related applications	BTB
LBID ID	1023		
Description			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 4. Alarm <b>Wrn ECU 4 Comm Fail (page 658)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 5

Related FW	1.1.0	Related applications	BTB
LBI ID	1024		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 5. Alarm <b>Wrn ECU 5 Comm Fail (page 659)</b> is deactivated while this LBI is active.			

⬆ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 6

Related FW	1.1.0	Related applications	BTB
LBI ID	1025		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 6. Alarm <b>Wrn ECU 6 Comm Fail (page 659)</b> is deactivated while this LBI is active.			

⬆ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 7

Related FW	1.1.0	Related applications	BTB
LBI ID	1026		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 7. Alarm <b>Wrn ECU 7 Comm Fail (page 659)</b> is deactivated while this LBI is active.			

⬆ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 8

Related FW	1.1.0	Related applications	BTB
LBI ID	1027		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 8. Alarm <b>Wrn ECU 8 Comm Fail (page 660)</b> is deactivated while this LBI is active.			

⬆ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 9

Related FW	1.1.0	Related applications	BTB
LBI ID	1028		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 9. Alarm <b>Wrn ECU 9 Comm Fail (page 660)</b> is deactivated while this LBI is active.			

⬆ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 10

Related FW	1.1.0	Related applications	BTB
LBI ID	1029		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 10. Alarm <b>Wrn ECU 10 Comm Fail (page 660)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 11

Related FW	1.1.0	Related applications	BTB
LBI ID	1030		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 11. Alarm <b>Wrn ECU 11 Comm Fail (page 660)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 12

Related FW	1.1.0	Related applications	BTB
LBI ID	1031		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 12. Alarm <b>Wrn ECU 12 Comm Fail (page 661)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 13

Related FW	1.1.0	Related applications	BTB
LBI ID	1032		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 13. Alarm <b>Wrn ECU 13 Comm Fail (page 661)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

### ECU Communication Fail Block 14

Related FW	1.1.0	Related applications	BTB
LBI ID	1033		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 14. Alarm <b>Wrn ECU 14 Comm Fail (page 661)</b> is deactivated while this LBI is active.			

⬅ back to Logical binary inputs alphabetically

## ECU Communication Fail Block 15

Related FW	1.1.0	Related applications	BTB
LBI ID	1034		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 15. Alarm <b>Wrn ECU 15 Comm Fail (page 662)</b> is deactivated while this LBI is active.			

⬆ back to Logical binary inputs alphabetically

## ECU Communication Fail Block 16

Related FW	1.1.0	Related applications	BTB
LBI ID	1035		
<b>Description</b>			
Activation of this binary input blocks all protections (including user protections) for ECU configured in ECU slot 16. Alarm <b>Wrn ECU 16 Comm Fail (page 662)</b> is deactivated while this LBI is active.			

⬆ back to Logical binary inputs alphabetically


## Emergency MAN

Related FW	1.1.0	Related applications	BTB
LBI ID	45		
<b>Description</b>			
This input is designed to allow the breaker to be controlled externally (not by the controller). This feature can be useful in case of some failure, which disables the breaker to be controlled by the controller. The controller behaves in the following way: <ul style="list-style-type: none"><li>➤ Stops all functions regarding the breaker control, deactivates all outputs related to it.</li><li>➤ When the input is deactivated, the controller takes control according to the situation in the moment of deactivation.</li></ul>			

⬆ back to Logical binary inputs alphabetically

LBI: F

## Fault Reset Button

Related FW	1.1.0	Related applications	BTB
LBI ID	191		
<b>Description</b>			
Binary input has the same function as Fault Reset button  on an <b>External display (page 75)</b> .			

⬆ back to Logical binary inputs alphabetically

## Force BTB Close

Related FW	1.1.0	Related applications	BTB
LBI ID	952		
Description			
This binary input force to close bus tie breaker..			

🔍 back to Logical binary inputs alphabetically

## Force Protection Disable

Related FW	1.1.0	Related applications	BTB
LBI ID	16		
Description			
Selected protections are disabled if LBI: Force Protection Disable is active..			
Activation and deactivation of this binary input will create history record:			
> Force Protection Disable active			
> Force Protection Disable inactive			
Behavior depends on configuration of LBI - normally close or normally open.			

🔍 back to Logical binary inputs alphabetically

## Forced Value Input 01

Related FW	1.1.0	Related applications	BTB
LBI ID	19		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

🔍 back to Logical binary inputs alphabetically

## Forced Value Input 02

Related FW	1.1.0	Related applications	BTB
LBI ID	20		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

🔍 back to Logical binary inputs alphabetically



### Forced Value Input 03

Related FW	1.1.0	Related applications	BTB
LBI ID	21		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 04

Related FW	1.1.0	Related applications	BTB
LBI ID	22		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 05

Related FW	1.1.0	Related applications	BTB
LBI ID	23		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 06

Related FW	1.1.0	Related applications	BTB
LBI ID	24		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 07

Related FW	1.1.0	Related applications	BTB
LBI ID	25		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 08

Related FW	1.1.0	Related applications	BTB
LBI ID	26		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 09

Related FW	1.1.0	Related applications	BTB
LBI ID	27		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 10

Related FW	1.1.0	Related applications	BTB
LBI ID	28		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 11

Related FW	1.1.0	Related applications	BTB
LBI ID	29		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 12

Related FW	1.1.0	Related applications	BTB
LBI ID	30		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 13

Related FW	1.1.0	Related applications	BTB
LBI ID	31		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 14

Related FW	1.1.0	Related applications	BTB
LBI ID	32		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 15

Related FW	1.1.0	Related applications	BTB
LBI ID	33		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 16

Related FW	1.1.0	Related applications	BTB
LBI ID	34		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 17

Related FW	1.1.0	Related applications	BTB
LBI ID	839		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 18

Related FW	1.1.0	Related applications	BTB
LBI ID	840		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 19

Related FW	1.1.0	Related applications	BTB
LBI ID	841		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 20

Related FW	1.1.0	Related applications	BTB
LBI ID	842		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 21

Related FW	1.1.0	Related applications	BTB
LBI ID	843		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 22

Related FW	1.1.0	Related applications	BTB
LBI ID	844		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 23

Related FW	1.1.0	Related applications	BTB
LBI ID	845		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 24

Related FW	1.1.0	Related applications	BTB
LBI ID	846		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 25

Related FW	1.1.0	Related applications	BTB
LBI ID	847		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 26

Related FW	1.1.0	Related applications	BTB
LBI ID	848		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 27

Related FW	1.1.0	Related applications	BTB
LBI ID	849		
Description			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<b>Note:</b> This LBI can be renamed during configuration.			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 28

Related FW	1.1.0	Related applications	BTB
LBI ID	850		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 29

Related FW	1.1.0	Related applications	BTB
LBI ID	851		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 30

Related FW	1.1.0	Related applications	BTB
LBI ID	852		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 31

Related FW	1.1.0	Related applications	BTB
LBI ID	853		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

### Forced Value Input 32

Related FW	1.1.0	Related applications	BTB
LBI ID	854		
<b>Description</b>			
This LBI is used for activation of preconfigured <b>Forced Value (page 137)</b> to setpoint.			
<i><b>Note:</b> This LBI can be renamed during configuration.</i>			

⬅ back to Logical binary inputs alphabetically

## LBI: G

### Group link

Related FW	1.1.0	Related applications	BTB
LBI ID	59		
Description			
<p>This input is used for logical connection and disconnection of two gen-set groups selected with setpoints <b>Group Link L (page 255)</b> and <b>Group Link R (page 256)</b>. If the input is active, then the two selected groups will perform <b>Power management (page 1)</b>, load sharing and Var sharing together as one large group.</p>			
<p><b>Note:</b> This function is independent on the group which the particular controller belongs to, i.e. the controller can provide linking function e.g. for groups 3,4 although it belongs to group 2.</p>			

🔍 back to Logical binary inputs alphabetically

## LBI: H

### Hot Swap Ctrl Block

Related FW	1.1.0	Related applications	BTB
LBI ID	1047		
<b>Description</b>			
<p>This LBI is used to detect if this controller is considered to be dead by the second <b>Hot Swap Redundancy (page 138)</b> controller.</p> <p>If the LBI is activated this controller is considered to be dead and it is forced to the listening mode. The controller in listening mode does not send any messages to other controllers but only reads what is being transmitted. This LBI has to be physically wired to the LBO <b>HOT SWAP SWITCH (PAGE 573)</b> of the second <b>Hot Swap Redundancy (page 138)</b> controller.</p> <p><i><b>Note:</b> If both Master and Backup controllers are alive, the Master is in control and the Backup is automatically in the listening mode. This LBI is used only to force the listening mode on controller which is considered to be dead by the second controller.</i></p>			
<b>IMPORTANT:</b> This input has to be configured to physical input of the controller.			
<b>IMPORTANT:</b> This input has to be configured on both Master and Backup controllers.			

🔍 back to Logical binary inputs alphabetically

## Hot Swap Heartbeat Detect

Related FW	1.1.0	Related applications	BTB
LBI ID	1037		
Description			
<p>This LBI is used for detection that the second <b>Hot Swap Redundancy (page 138)</b> is alive.</p> <p>This LBI has to be physically wired to the LBO <b>HOT SWAP HEARTBEAT (PAGE 572)</b> of the second <b>Hot Swap Redundancy (page 138)</b> controller. If the Heartbeat signal is not received, this controller activates LBO <b>Hot Swap Switch (page 573)</b>.</p> <p><b>IMPORTANT: This input has to be configured to physical input of the controller.</b></p> <p><b>IMPORTANT: This input has to be configured on both Master and Backup controllers.</b></p>			


⬆ back to Logical binary inputs alphabetically

## Hot Swap Recovery

Related FW	1.1.0	Related applications	BTB
LBI ID	1048		
Description			
<p>This binary input is used to recover the <b>Hot Swap Redundancy (page 138)</b> system in case of Wrn Master Controller Failed or Wrn Backup Controller Failed alarm is present in the Alarm list.The necessary condition to recovery the system to the default state is that both controllers are in the OFF mode.</p> <p><b>Note:</b> <i>If warnings remains after the recovery, the wiring and configuration should be checked.</i></p>			

⬆ back to Logical binary inputs alphabetically

## Horn Reset Button

Related FW	1.1.0	Related applications	BTB
LBI ID	192		
Description			
Binary input has the same function as Horn reset  button on an <b>External display (page 75)</b> .			

⬆ back to Logical binary inputs alphabetically

LBI: N

## Not Used

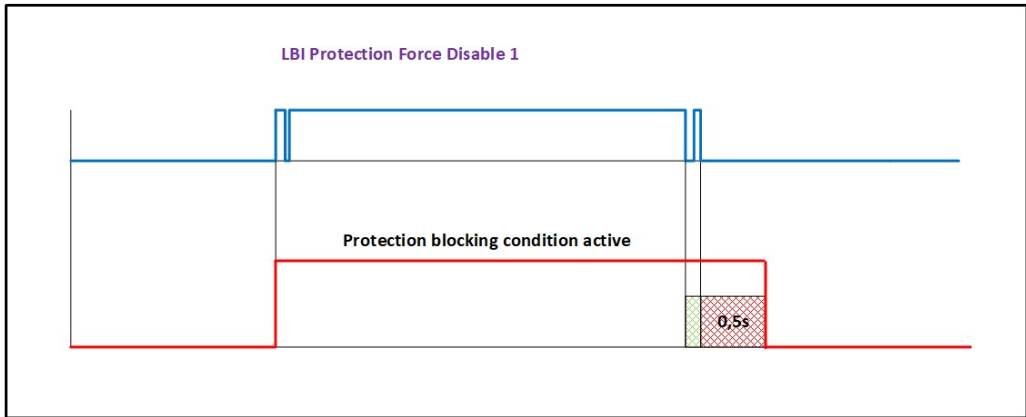
Related FW	1.1.0	Related applications	BTB
LBI ID	184		
Description			
Binary input has no function. Use this configuration when binary input is not used.			

⬆ back to Logical binary inputs alphabetically



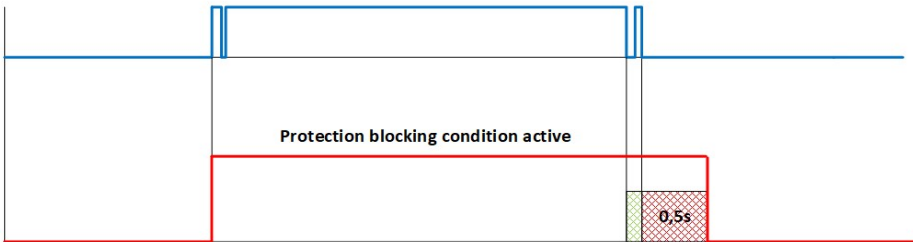
LBI: P

Protection Force Disable 1

Related FW	1.1.0	Related applications	BTB
LBI ID	16		
Description			
Activation of this LBI disables selected protections.			
Proper history record is written to the history log.			
<div>&gt; Protection Force Disable 1 active</div> <div>&gt; Protection Force Disable 1 inactive</div>			
<div><div><div>LBI Protection Force Disable 1</div></div></div>			

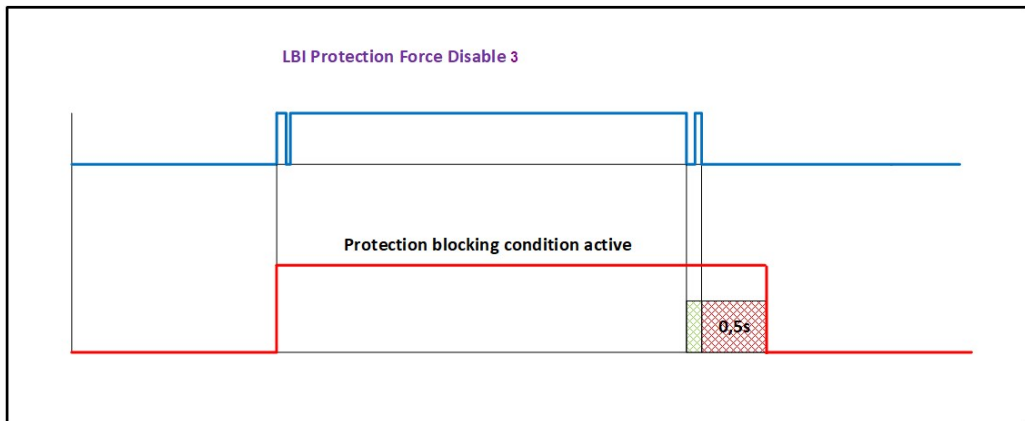
[⬆ back to Logical binary inputs alphabetically](#)

## Protection Force Disable 2

Related FW	1.1.0	Related applications	BTB
LBI ID	17		
<b>Description</b>			
Activation of this LBI disables selected protections.			
Proper history record is written to the history log.			
<div>&gt; Protection Force Disable 2 active</div> <div>&gt; Protection Force Disable 2 inactive</div>			
<div><div><div>LBI Protection Force Disable 2</div></div></div>			

⬅ back to Logical binary inputs alphabetically

## Protection Force Disable 3

Related FW	1.1.0	Related applications	BTB
LBI ID	18		
Description			
Activation of this LBI disables selected protections.			
Proper history record is written to the history log.			
<div>&gt; Protection Force Disable 3 active</div> <div>&gt; Protection Force Disable 3 inactive</div>			
<div><div>LBI Protection Force Disable 3</div></div>			

⬅ back to Logical binary inputs alphabetically

## Pulse Counter 1

Related FW	1.1.0	Related applications	BTB
LBI ID	87		
<b>Description</b>			
This is the input of the "slow" <b>Pulse Counters (page 167)</b> function which is connected with LBI <b>PULSE COUNTER 1 (PAGE 556)</b> .			

⬆️ back to Logical binary inputs alphabetically

## Pulse Counter 2

Related FW	1.1.0	Related applications	BTB
LBI ID	88		
<b>Description</b>			
This is the input of the "slow" <b>Pulse Counters (page 167)</b> function which is connected with LBI <b>PULSE COUNTER 2 (PAGE 556)</b> .			

⬆️ back to Logical binary inputs alphabetically

LBI: R

## Remote MAN

Related FW	1.1.0	Related applications	BTB
LBI ID	618		
<b>Description</b>			
The controller is switched to the MAN mode when this binary input is closed. When opens controller is switched back to previous mode.			
Remote control priority:			
➤ Remote OFF (Highest priority)			
➤ Remote MAN			
➤ Remote AUTO (Lowest Priority)			

⬆️ back to Logical binary inputs alphabetically

## Remote OFF

Related FW	1.1.0	Related applications	BTB
LBI ID	617		
<b>Description</b>			
The controller is switched to the OFF mode when this binary input is closed. When opens controller is switched back to previous mode.			
Remote control priority:			
➤ Remote OFF (Highest priority)			
➤ Remote MAN			
➤ Remote AUTO (Lowest Priority)			

⬆️ back to Logical binary inputs alphabetically

## LBI: S

### Synchronization Check

Related FW	1.1.0	Related applications	BTB
LBI ID	1166		
Description			
This logical input activates synchronization without breaker closing. Breaker will not be closed after synchronization windows is reached.			

⬅ back to Logical binary inputs alphabetically

### Synchronization Permissive

Related FW	1.1.0	Related applications	BTB
LBI ID	1167		
Description			
This logical input is used to activate passive synchronization. It only allows to automatically close the breaker when synchronization windows is reached.			
<i><b>Note:</b> Passive synchronization can be used together with rated change.</i>			

⬅ back to Logical binary inputs alphabetically

### Synchronization Run

Related FW	1.1.0	Related applications	BTB
LBI ID	1168		
Description			
This logical input activates synchronization with automatic breaker closing when synchronization windows is reached.			

⬅ back to Logical binary inputs alphabetically

## LBI: T

### Time Stamp Act

Related FW	1.1.0	Related applications	BTB
LBI ID	125		
Description			
This binary input is used as activation condition for periodic history records if setpoint <b>Time Stamp Act (page 257)</b> is set to Condition.			

⬅ back to Logical binary inputs alphabetically

# 8.1.6 Logical binary outputs

**What Logical binary outputs are:**

Logical binary outputs are outputs for binary values and functions.

**Alphabetical groups of Logical binary outputs**

LBO: A .....	560
LBO: B .....	562
LBO: C .....	562
LBO: E .....	564
LBO: F .....	571
LBO: H .....	572
LBO: I .....	574
LBO: M .....	574
LBO: N .....	578
LBO: P .....	578
LBO: S .....	578

For full list of Logical binary outputs go to the chapter **Logical binary outputs alphabetically (page 559)**.

## Logical binary outputs alphabetically

LBO: A .....	560	ECU 7 Comm Fail .....	565	LBO: M .....	574
Access Locked .....	560	ECU 8 Comm Fail .....	566	BTB Close/Open .....	574
Alarm .....	560	ECU 9 Comm Fail .....	566	BTB OFF Coil .....	575
Alarm Flashing .....	560	ECU 10 Comm Fail .....	566	BTB ON Coil .....	576
Alarm Bus Right		ECU 11 Comm Fail .....	566	BTB Status .....	576
Frequency .....	560	ECU 12 Comm Fail .....	566	BTB UV Coil .....	577
Alarm Overcurrent .....	560	ECU 13 Comm Fail .....	566	Mode RUN .....	577
Alarm Bus Right Voltage .....	561	ECU 14 Comm Fail .....	567	Mode PRG .....	577
Alarm Bus Right .....	561	ECU 15 Comm Fail .....	567	LBO: N .....	578
Alarm Bus Right		ECU 16 Comm Fail .....	567	Not Used .....	578
Frequency .....	561	ECU Comm OK .....	567	LBO: P .....	578
Alarm Bus Right Voltage .....	561	Exercise Timer 1 .....	567	Peripheral Module Comm	
LBO: B .....	562	Exercise Timer 2 .....	568	Fail .....	578
Bus Left Deadbus .....	562	Exercise Timer 3 .....	568	LBO: S .....	578
Bus Left Healthy .....	562	Exercise Timer 4 .....	568	Still Log 0 .....	578
Bus Right Deadbus .....	562	Exercise Timer 5 .....	569	Still Log 1 .....	578
Bus Right Healthy .....	562	Exercise Timer 6 .....	569	Synchronization .....	578
LBO: C .....	562	Exercise Timer 7 .....	569		
Common Alarm Active		Exercise Timer 8 .....	570		
Level 1 .....	562	Exercise Timer 9 .....	570		
Common Alarm Active		Exercise Timer 10 .....	570		
Level 2 .....	563	Exercise Timer 11 .....	571		
Common Alarm Level 1 .....	563	Exercise Timer 12 .....	571		
Common Alarm Level 2 .....	563	LBO: F .....	571		
Common Alarm Only .....	563	FltRes Button Echo .....	571		
Common History Record .....	563	LBO: H .....	572		
Common Breaker Open .....	564	Heartbeat .....	572		
Common Breaker Open +		Horn .....	572		
FltRes .....	564	Horn Flashing .....	572		
Common Warning .....	564	Hot Swap Heartbeat .....	572		
LBO: E .....	564	Hot Swap Switch .....	573		
ECU Comm Fail .....	564	HornRes Button Echo .....	573		
ECU 1 Comm Fail .....	564	HW AC Voltage			
ECU 2 Comm Fail .....	565	Measurement Error .....	573		
ECU 3 Comm Fail .....	565	LBO: I .....	574		
ECU 4 Comm Fail .....	565	In Synchronism .....	574		
ECU 5 Comm Fail .....	565	Initialized .....	574		
ECU 6 Comm Fail .....	565				

🔍 back to Controller objects

## LBO: A

### Access Locked

Related FW	1.1.0	Related applications	BTB
LBO ID	2480		
Description			
This output is closed when the function <b>Access lock (page 117)</b> is activated and it can be used to block any LBOs which are required to be locked.			

🔍 back to Logical binary outputs alphabetically

### Alarm

Related FW	1.1.0	Related applications	BTB
LBO ID	2		
Description			
The output is designed to be used as external alarm indication such as a red bulb in the control room etc. The output is active when at least one unconfirmed alarm is present in the alarmlist and remains active until confirmation of alarm.			

🔍 back to Logical binary outputs alphabetically

### Alarm Flashing

Related FW	1.1.0	Related applications	BTB
LBO ID	28		
Description			
This is the flashing alternative of the output <b>ALARM (PAGE 560)</b> , i.e. the output flashes with 1 Hz period while the output Alarm is closed.			

🔍 back to Logical binary outputs alphabetically

### Alarm Bus Right Frequency

Related FW	1.1.0	Related applications	BTB
LBO ID	1266		
Description			
This output is active when at least 1 protection caused by <b>Bus Right &gt;f Protection (page 313)</b> or <b>Bus Right &lt;f Protection (page 314)</b> is active.			

🔍 back to Logical binary outputs alphabetically

### Alarm Overcurrent

Related FW	1.1.0	Related applications	BTB
LBO ID	109		
Description			
This output is active while at least one of the following overcurrent protection is active <b>Short Circuit Protection (page 298)</b> or <b>IDMT Bus Left &gt;A Protection (page 298)</b> .			

🔍 back to Logical binary outputs alphabetically

## Alarm Bus Right Voltage

Related FW	1.1.0	Related applications	BTB
LBO ID	1263		
Description			
This output is active when at least 1 alarm caused by <b>Bus Right &gt;V Protection (page 306)</b> or <b>Bus Right &lt;V Protection (page 307)</b> is present in the alarmlist.			

🔍 back to Logical binary outputs alphabetically

## Alarm Bus Right

Related FW	1.1.0	Related applications	BTB
LBO ID	197		
Description			
This output is active when at least 1 protection caused by <b>Bus Left &gt;&gt;V Protection (page 302)</b> , <b>Bus Left &gt;V Protection (page 300)</b> or <b>Bus Left &lt;V Protection (page 303)</b> , <b>Bus Left &lt;&lt;V Protection (page 304)</b> , <b>Bus Left &gt;&gt;f Protection (page 310)</b> , <b>Bus Left &gt;f Protection (page 309)</b> , <b>Bus Left &lt;f Protection (page 311)</b> , <b>Bus Left &lt;&lt;f Protection (page 312)</b> is active.			

🔍 back to Logical binary outputs alphabetically

## Alarm Bus Right Frequency

Related FW	1.1.0	Related applications	BTB
LBO ID	1271		
Description			
This output is closed when at least 1 protection caused by <b>Bus Left &gt;&gt;f Protection (page 310)</b> , <b>Bus Left &gt;f Protection (page 309)</b> , <b>Bus Left &lt;f Protection (page 311)</b> or <b>Bus Left &lt;&lt;f Protection (page 312)</b> is active.			

🔍 back to Logical binary outputs alphabetically

## Alarm Bus Right Voltage

Related FW	1.1.0	Related applications	BTB
LBO ID	1270		
Description			
This output is closed when at least 1 protection caused by <b>Bus Left &gt;&gt;V Protection (page 302)</b> , <b>Bus Left &gt;V Protection (page 300)</b> , <b>Bus Left &lt;V Protection (page 303)</b> or <b>Bus Left &lt;&lt;V Protection (page 304)</b> is active.			

🔍 back to Logical binary outputs alphabetically



## LBO: B

### Bus Left Deadbus

Related FW	1.1.0	Related applications	BTB
LBO ID	2676		
Description			
This output is active when the Bus Left is considered to be dead (Bus Left voltage is below relative value set by the setpoint <b>Bus Left Dead Level (page 249)</b> ).			

⬅ back to Logical binary outputs alphabetically

### Bus Left Healthy

Related FW	1.1.0	Related applications	BTB
LBO ID	78		
Description			
This output is closed while Bus Left parameters (voltage & frequency) are considered as healthy, i. e. within limits.			

⬅ back to Logical binary outputs alphabetically

### Bus Right Deadbus

Related FW	1.1.0	Related applications	BTB
LBO ID	2675		
Description			
This output is active when the Bus Right is considered to be dead (Bus Right voltage is below relative value set by the setpoint <b>Bus Right Dead Level (page 248)</b> ).			

⬅ back to Logical binary outputs alphabetically

### Bus Right Healthy

Related FW	1.1.0	Related applications	BTB
LBO ID	77		
Description			
This output is closed while Bus Right parameters (voltage & frequency) are considered as healthy, i.e. within limits.			

⬅ back to Logical binary outputs alphabetically

## LBO: C

### Common Alarm Active Level 1

Related FW	1.1.0	Related applications	BTB
LBO ID	13		
Description			
This output is closed when there is at least one <b>Alarms level 1 (page 635)</b> in the alarmlist.			

⬅ back to Logical binary outputs alphabetically

### Common Alarm Active Level 2

Related FW	1.1.0	Related applications	BTB
LBO ID	15		
Description			
This output is closed when there is at least one <b>Alarms level 2 (page 692)</b> in the alarmlist.			

⬅ back to Logical binary outputs alphabetically

### Common Alarm Level 1

Related FW	1.1.0	Related applications	BTB
LBO ID	14		
Description			
This output is closed when there is at least one <b>unconfirmed Alarms level 1 (page 635)</b> in the alarmlist.			

⬅ back to Logical binary outputs alphabetically

### Common Alarm Level 2

Related FW	1.1.0	Related applications	BTB
LBO ID	16		
Description			
This output is closed when there is at least one <b>unconfirmed Alarms level 2 (page 692)</b> in the alarmlist.			

⬅ back to Logical binary outputs alphabetically

### Common Alarm Only

Related FW	1.1.0	Related applications	BTB
LBO ID	11		
Description			
This output is closed when there is at least one alarm of type <b>Alarm Only (page 669)</b> present in the alarmlist.			

⬅ back to Logical binary outputs alphabetically

### Common History Record

Related FW	1.1.0	Related applications	BTB
LBO ID	12		
Description			
This output is closed for 1 second every time alarm of type <b>History Record Only (page 675)</b> occurs.			
<b>Note:</b> When any History Record alarm is activated the history record is logged into history.			

⬅ back to Logical binary outputs alphabetically

## Common Breaker Open

Related FW	1.1.0	Related applications	BTB
LBO ID	10		
Description			
This output is closed when there is at least one active alarm of type <b>Breaker Open*</b> (page 197).			
<b>Note:</b> When any Breaker Open alarm is activated the BTB opens immediately.			

⬅ back to Logical binary outputs alphabetically

## Common Breaker Open + FltRes

Related FW	1.1.0	Related applications	BTB
LBO ID	4		
Description			
This output is closed when there is at least one active alarm of type <b>Breaker Open + FltRes</b> (page 197) present in the alarmlist.			
<b>Note:</b> When any Breaker Open + FltRes alarm is activated the BTB opens immediately.			

⬅ back to Logical binary outputs alphabetically

## Common Warning

Related FW	1.1.0	Related applications	BTB
LBO ID	3		
Description			
This output is closed when there is at least one alarm of type <b>Warning</b> (page 638) present in the alarmlist.			

⬅ back to Logical binary outputs alphabetically

## LBO: E

### ECU Comm Fail

Related FW	1.1.0	Related applications	BTB
LBO ID	114		
Description			
This output is closed when there is no communication with at least one configured ECU.			

⬅ back to Logical binary outputs alphabetically

### ECU 1 Comm Fail

Related FW	1.1.0	Related applications	BTB
LBO ID	1998		
Description			
This output is closed when there is no communication with ECU configured in ECU slot 1.			

⬅ back to Logical binary outputs alphabetically

### ECU 2 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	1999		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 2.			

[back to Logical binary outputs alphabetically](#)

### ECU 3 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2000		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 3.			

[back to Logical binary outputs alphabetically](#)

### ECU 4 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2001		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 4.			

[back to Logical binary outputs alphabetically](#)

### ECU 5 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2002		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 5.			

[back to Logical binary outputs alphabetically](#)

### ECU 6 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2003		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 6.			

[back to Logical binary outputs alphabetically](#)

### ECU 7 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2004		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 7.			

[back to Logical binary outputs alphabetically](#)

### ECU 8 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2005		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 8.			

⬆ back to Logical binary outputs alphabetically

### ECU 9 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2006		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 9.			

⬆ back to Logical binary outputs alphabetically

### ECU 10 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2007		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 10.			

⬆ back to Logical binary outputs alphabetically

### ECU 11 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2008		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 11.			

⬆ back to Logical binary outputs alphabetically

### ECU 12 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2009		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 12.			

⬆ back to Logical binary outputs alphabetically

### ECU 13 Comm Fail

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	2010		
<b>Description</b>			
This output is closed when there is no communication with ECU configured in ECU slot 13.			

⬆ back to Logical binary outputs alphabetically

### ECU 14 Comm Fail

Related FW	1.1.0	Related applications	BTB
LBO ID	2011		
Description			
This output is closed when there is no communication with ECU configured in ECU slot 14.			

⬅ back to Logical binary outputs alphabetically

### ECU 15 Comm Fail

Related FW	1.1.0	Related applications	BTB
LBO ID	2012		
Description			
This output is closed when there is no communication with ECU configured in ECU slot 15.			

⬅ back to Logical binary outputs alphabetically

### ECU 16 Comm Fail

Related FW	1.1.0	Related applications	BTB
LBO ID	2013		
Description			
This output is closed when there is no communication with ECU configured in ECU slot 16.			

⬅ back to Logical binary outputs alphabetically

### ECU Comm OK

Related FW	1.1.0	Related applications	BTB
LBO ID	347		
Description			
This output is closed when all configured ECUs are communicating without any issue.			

⬅ back to Logical binary outputs alphabetically

### Exercise Timer 1

Related FW	1.1.0	Related applications	BTB
LBO ID	1250		
Description			
This output is closed when the Exercise timer 1 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 1 (page 371)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

⬅ back to Logical binary outputs alphabetically

## Exercise Timer 2

Related FW	1.1.0	Related applications	BTB
LBO ID	1251		
<b>Description</b>			
This output is closed when the Exercise timer 2 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 2 (page 373)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

⬅ back to Logical binary outputs alphabetically

## Exercise Timer 3

Related FW	1.1.0	Related applications	BTB
LBO ID	1946		
<b>Description</b>			
This output is closed when the Exercise timer 3 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 3 (page 375)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

⬅ back to Logical binary outputs alphabetically

## Exercise Timer 4

Related FW	1.1.0	Related applications	BTB
LBO ID	1947		
<b>Description</b>			
This output is closed when the Exercise timer 4 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 4 (page 377)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

⬅ back to Logical binary outputs alphabetically

## Exercise Timer 5

Related FW	1.1.0	Related applications	BTB
LBO ID	1948		
<b>Description</b>			
This output is closed when the Exercise timer 5 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 5 (page 379)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

⬅ back to Logical binary outputs alphabetically

## Exercise Timer 6

Related FW	1.1.0	Related applications	BTB
LBO ID	1949		
<b>Description</b>			
This output is closed when the Exercise timer 6 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 6 (page 381)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

⬅ back to Logical binary outputs alphabetically

## Exercise Timer 7

Related FW	1.1.0	Related applications	BTB
LBO ID	1950		
<b>Description</b>			
This output is closed when the Exercise timer 7 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 7 (page 383)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

⬅ back to Logical binary outputs alphabetically



## Exercise Timer 8

Related FW	1.1.0	Related applications	BTB
LBO ID	1951		
<b>Description</b>			
This output is closed when the Exercise timer 8 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 8 (page 385)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

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## Exercise Timer 9

Related FW	1.1.0	Related applications	BTB
LBO ID	2630		
<b>Description</b>			
This output is closed when the Exercise timer 9 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 9 (page 387)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

 [back to Logical binary outputs alphabetically](#)

## Exercise Timer 10

Related FW	1.1.0	Related applications	BTB
LBO ID	2631		
<b>Description</b>			
This output is closed when the Exercise timer 10 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 10 (page 389)</b> subgroup.			
<i><b>Note:</b> If more than one timer is active at the same time, timer with selected higher priority function is applied.</i>			

 [back to Logical binary outputs alphabetically](#)

## Exercise Timer 11

Related FW	1.1.0	Related applications	BTB
LBO ID	2632		
Description			
<p>This output is closed when the Exercise timer 11 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 11 (page 391)</b> subgroup.</p>			
<p><b>Note:</b> <i>If more than one timer is active at the same time, timer with selected higher priority function is applied.</i></p>			

◀ back to Logical binary outputs alphabetically


## Exercise Timer 12

Related FW	1.1.0	Related applications	BTB
LBO ID	2633		
Description			
<p>This output is closed when the Exercise timer 12 is activated. The output can be used to make periodic tests of breaker, any external logic etc. and its activation depends on the setpoints in the <b>Subgroup: Timer 12 (page 393)</b> subgroup.</p>			
<p><b>Note:</b> <i>If more than one timer is active at the same time, timer with selected higher priority function is applied.</i></p>			

◀ back to Logical binary outputs alphabetically

LBO: F

## FltRes Button Echo

Related FW	1.1.0	Related applications	BTB
LBO ID	30		
Description			
This output provides 1 s pulse when:			
<div><div>&gt;</div><div>Fault Reset button  is pressed on an <b>External display (page 75)</b>.</div></div>			
<div><div>&gt;</div><div>Fault Reset command is received via communication line</div></div>			
<div><div>&gt;</div><div>LBI FAULT RESET BUTTON (PAGE 544) is activated.</div></div>			

◀ back to Logical binary outputs alphabetically



## LBO: H

### Heartbeat

Related FW	1.1.0	Related applications	BTB
LBO ID	81		
Description			
This output toggles on/off in a period of 500 ms whenever the controller is switched on and functional.			

🔍 back to Logical binary outputs alphabetically

### Horn

Related FW	1.1.0	Related applications	BTB
LBO ID	1		
Description			
<p>This output is closed when any <b>Alarms (page 635)</b> is activated and stays closed until:</p> <ul style="list-style-type: none"><li>&gt; Fault reset  is pressed</li><li>&gt; Horn reset  is pressed</li><li>&gt; <b>Horn Timeout (page 251)</b> elapses</li></ul>			

🔍 back to Logical binary outputs alphabetically

### Horn Flashing

Related FW	1.1.0	Related applications	BTB
LBO ID	29		
Description			
This is the flashing alternative of the output <b>HORN (PAGE 572)</b> , i.e. the output flashes with 1 Hz period while the output Horn is closed.			

🔍 back to Logical binary outputs alphabetically

### Hot Swap Heartbeat

Related FW	1.1.0	Related applications	BTB
LBO ID	2447		
Description			
<p>This output is used to inform the second <b>Hot Swap Redundancy (page 138)</b> controller about the fact that this controller is alive.</p> <p>This LBO has to be physically wired to the LBI <b>HOT SWAP HEARTBEAT DETECT (PAGE 553)</b> of the second <b>Hot Swap Redundancy (page 138)</b> controller. If the signal is not sent, the second controller activates LBO <b>HOT SWAP SWITCH (PAGE 573)</b>.</p> <p><b>IMPORTANT: This output has to be configured to physical output of the controller.</b></p> <p><b>IMPORTANT: This output has to be configured on both Master and Backup controllers.</b></p>			

🔍 back to Logical binary outputs alphabetically

## Hot Swap Switch

Related FW	1.1.0	Related applications	BTB
LBO ID	2469		
Description			
<p>This output is activated when the LBI <b>HOT SWAP HEARTBEAT DETECT (PAGE 553)</b> of this controller do not receive the LBO <b>HOT SWAP HEARTBEAT (PAGE 572)</b> signal from the second <b>Hot Swap Redundancy (page 138)</b> controller.</p> <p>This output is used as control signal for switches / switch disconnectors that are used to disconnect specific terminals of the second <b>Hot Swap Redundancy (page 138)</b> controller. It is also used as physical input for LBI <b>HOT SWAP CTRL BLOCK (PAGE 552)</b> of the second controller.</p> <p><b>IMPORTANT: This output has to be configured to physical output of the controller.</b></p> <p><b>IMPORTANT: This output has to be configured on both Master and Backup controllers.</b></p>			

🔍 back to Logical binary outputs alphabetically

## HornRes Button Echo

Related FW	1.1.0	Related applications	BTB
LBO ID	31		
Description			
This output is closed for 1 s every time Horn Reset Button is pressed.			

🔍 back to Logical binary outputs alphabetically

## HW AC Voltage Measurement Error

Related FW	1.1.0	Related applications	BTB
LBO ID	2560		
Description			
<p>This logical binary output is activated once the wrong 3V3 reference voltage is detected.</p> <p>It is recommended to use it to activate user protection which will open BTB and turn off the System to prevent any damage to the System, load or mains.</p> <p><b>IMPORTANT: This LBO only works on HW revision D and higher.</b></p>			

🔍 back to Logical binary outputs alphabetically

## LBO: I

### In Synchronism

Related FW	1.1.0	Related applications	BTB
LBO ID	80		
<b>Description</b>			
This output is closed during synchronization when Slip Angle, Slip Frequency and Voltages are inside required windows.			
Required windows are:			
<ul style="list-style-type: none"><li>&gt; <b>Slip Angle (page 411)</b> between Bus Left and Bus Right Voltage is within range given by <b>Phase Window (page 265)</b> for time longer than <b>Dwell Time (page 265)</b>. Required if <b>Synchronization Type (page 262)</b> = PhaseMatch.</li><li>&gt; <b>Slip Frequency (page 411)</b> between between Bus Left and Bus Right Frequency is withing range given by <b>Slip Frequency Window (page 266)</b> for time longer than <b>Dwell Time (page 265)</b>. Required if <b>Synchronization Type (page 262)</b> = SlipSynchr.</li><li>&gt; Voltage difference between Bus Left and Bus Right voltage in all phases must be lower or equal to <b>Voltage Window (page 264)</b> for time longer than <b>Dwell Time (page 265)</b>. Required always.</li></ul>			

⬅ back to Logical binary outputs alphabetically

### Initialized

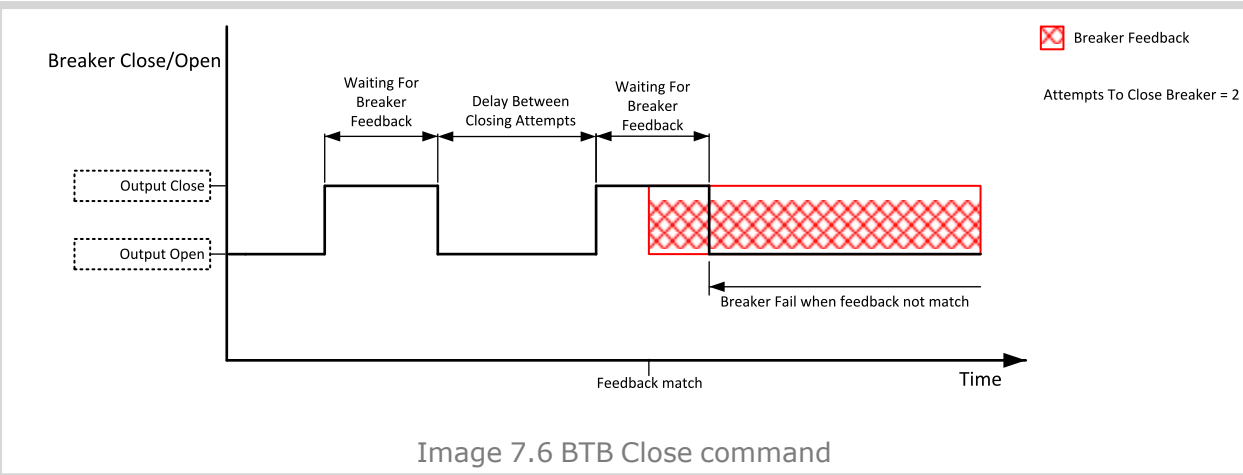
Related FW	1.1.0	Related applications	BTB
LBO ID	1222		
<b>Description</b>			
This output is activated after the controller is initialized. It can be used to block some PLC logic blocks while controller initialization is being proceeded.			

⬅ back to Logical binary outputs alphabetically

## LBO: M

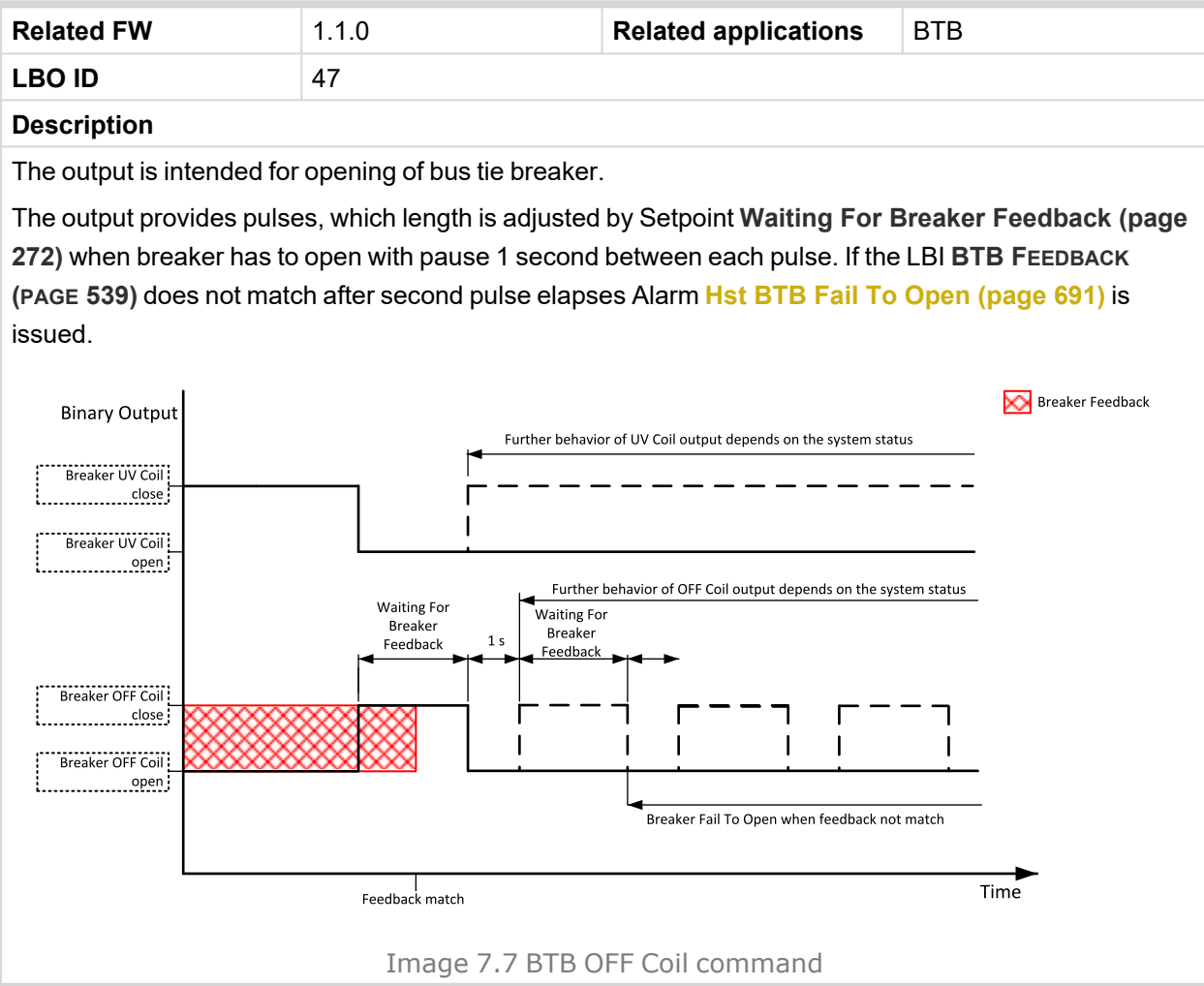
### BTB Close/Open

Related FW	1.1.0	Related applications	BTB
LBO ID	45		
<b>Description</b>			
The output controls the bus tie breaker. Its state represents the breaker position requested by the controller.			
If the feedback does not respond to a change within time adjusted in Setpoint <b>Waiting For Breaker Feedback (page 272)</b> and it was already the last attempt the specific alarm based on the current breaker position is issued.			



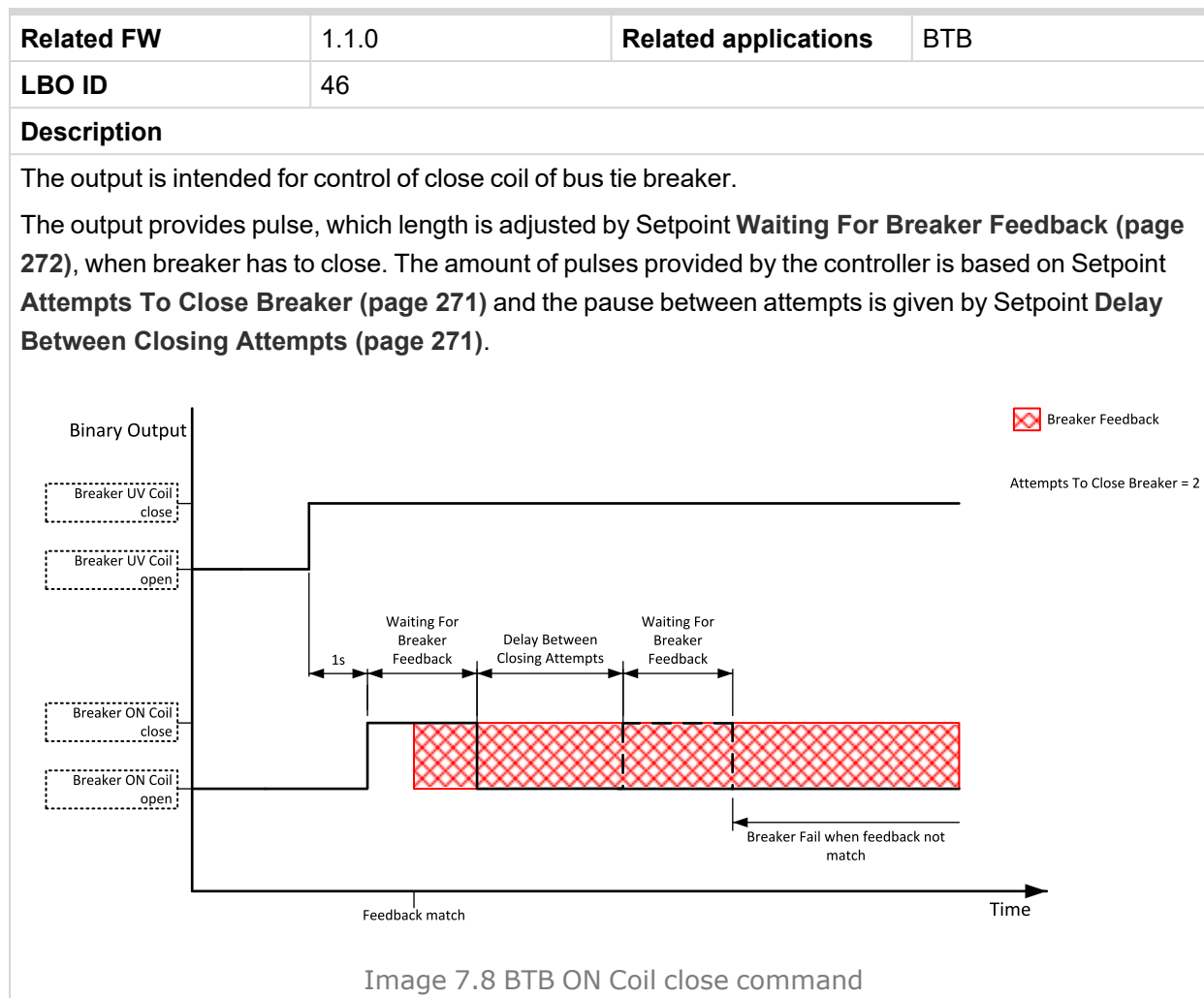
back to Logical binary outputs alphabetically

### BTB OFF Coil



back to Logical binary outputs alphabetically

## BTB ON Coil



◀ back to Logical binary outputs alphabetically

## BTB Status

Related FW	1.1.0	Related applications	BTB
LBO ID	85		
Description			
<p>This output indicates the BTB position as it is internally considered by the controller. The position is based on <b>BTB FEEDBACK (PAGE 539)</b> and <b>BTB FEEDBACK NEGATIVE (PAGE 540)</b>.</p> <ul style="list-style-type: none"><li>➤ In case that only <b>BTB FEEDBACK (PAGE 539)</b> is used, this output mirrors the input.</li><li>➤ In case that both <b>BTB FEEDBACK (PAGE 539)</b> and <b>BTB FEEDBACK NEGATIVE (PAGE 540)</b> are used and<ul style="list-style-type: none"><li>➤➤ Feedback match - output indicates BTB position according to feedbacks.</li><li>➤➤ Feedback do not match - output indicates last position when feedbacks matched.</li></ul></li></ul>			

◀ back to Logical binary outputs alphabetically

## BTB UV Coil

Image 7.9 BTB UV Coil close command

**⬆ back to Logical binary outputs alphabetically**

## Mode RUN

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	18		
<b>Description</b>			
This output is active whenever <b>Controller Mode (page 435)</b> = MAN.			

⬆ back to Logical binary outputs alphabetically

## Mode PRG

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>LBO ID</b>	17		
<b>Description</b>			
This output is active whenever <b>Controller Mode (page 435)</b> = OFF.			

**⬆ back to Logical binary outputs alphabetically**



## LBO: N

### Not Used

Related FW	1.1.0	Related applications	BTB
LBO ID	286		
Description			
Output has no function.			

⬅ back to Logical binary outputs alphabetically

## LBO: P

### Peripheral Module Comm Fail

Related FW	1.1.0	Related applications	BTB
LBO ID	115		
Description			
This output is closed when there is no communication with at least one configured peripheral module.			

⬅ back to Logical binary outputs alphabetically

## LBO: S

### Still Log 0

Related FW	1.1.0	Related applications	BTB
LBO ID	26		
Description			
Logical binary output which is still in logical 0.			

⬅ back to Logical binary outputs alphabetically

### Still Log 1

Related FW	1.1.0	Related applications	BTB
LBO ID	27		
Description			
Logical binary output which is still in logical 1.			

⬅ back to Logical binary outputs alphabetically

### Synchronization

Related FW	1.1.0	Related applications	BTB
LBO ID	69		
Description			
The output is closed when synchronization is active (synchronization via BTB breaker) and opens when LBO BTB STATUS (PAGE 576) closes.			

⬅ back to Logical binary outputs alphabetically

# 8.1.7 Logical analog inputs

**What Logical analog inputs are:**

Logical analog inputs are inputs for analog values.

**Alphabetical groups of Logical analog inputs**

LAI: B .....	581
LAI: C .....	582
LAI: N .....	585

For full list of Logical analog inputs go to the chapter **Logical analog inputs alphabetically (page 580)**.

Logical analog inputs alphabetically

LAI: B .....581

    Bus Measurement P ..... 581

    Bus Measurement Q .....581

LAI: C .....582

    Cold Temp 1 ..... 582

    Cold Temp 2 ..... 582

    Cold Temp 3 ..... 582

    Cold Temp 4 ..... 583

    Cold Temp 5 ..... 583

    Cold Temp 6 ..... 583

    Cold Temp 7 ..... 584

    Cold Temp 8 ..... 584

    Cold Temp 9 ..... 584

    Cold Temp 10 ..... 585

LAI: N .....585

    Not Used ..... 585

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## LAI: B

### Bus Measurement P

Related FW	1.1.0	Related applications	BTB
LAI ID	5		
Description			
This LAI is designed for <b>Bus Import Measurement (page 185)</b> , when <b>Bus Measurement P (page 275)</b> = Analog Input.			

⬅ back to Logical analog inputs alphabetically

### Bus Measurement Q

Related FW	1.1.0	Related applications	BTB
LAI ID	6		
Description			
This LAI is designed for <b>Bus Import Measurement (page 185)</b> , when <b>Bus Measurement Q (page 276)</b> = Analog Input.			

⬅ back to Logical analog inputs alphabetically

## LAI: C

### Cold Temp 1

Related FW	1.1.0	Related applications	BTB
LAI ID	56		
Description			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensate the CAN module configured with address (index) 1.			
<b>Note:</b> The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).			

⬅ back to Logical analog inputs alphabetically

### Cold Temp 2

Related FW	1.1.0	Related applications	BTB
LAI ID	57		
Description			
<p>This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensate the CAN module configured with address (index) 2.</p> <p><b>Note:</b> <i>The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).</i></p>			

⬅ back to Logical analog inputs alphabetically

### Cold Temp 3

Related FW	1.1.0	Related applications	BTB
LAI ID	58		
Description			
<p>This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensate the CAN module configured with address (index) 3.</p> <p><b>Note:</b> <i>The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).</i></p>			

⬅ back to Logical analog inputs alphabetically

### Cold Temp 4

Related FW	1.1.0	Related applications	BTB
LAI ID	59		
<b>Description</b>			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensates the CAN module configured with address (index) 4.			
<b>Note:</b> The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).			

◀ back to Logical analog inputs alphabetically

### Cold Temp 5

Related FW	1.1.0	Related applications	BTB
LAI ID	341		
<b>Description</b>			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensates the CAN module configured with address (index) 5.			
<b>Note:</b> The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).			

◀ back to Logical analog inputs alphabetically

### Cold Temp 6

Related FW	1.1.0	Related applications	BTB
LAI ID	342		
<b>Description</b>			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensates the CAN module configured with address (index) 6.			
<b>Note:</b> The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).			

◀ back to Logical analog inputs alphabetically

### Cold Temp 7

Related FW	1.1.0	Related applications	BTB
LAI ID	343		
<b>Description</b>			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensates the CAN module configured with address (index) 7.			
<b>Note:</b> The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).			

◀ back to Logical analog inputs alphabetically

### Cold Temp 8

Related FW	1.1.0	Related applications	BTB
LAI ID	344		
<b>Description</b>			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensates the CAN module configured with address (index) 8.			
<b>Note:</b> The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).			

◀ back to Logical analog inputs alphabetically

### Cold Temp 9

Related FW	1.1.0	Related applications	BTB
LAI ID	418		
<b>Description</b>			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel® AIN8TC). This input compensates the CAN module configured with address (index) 9.			
<b>Note:</b> The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).			

◀ back to Logical analog inputs alphabetically

## Cold Temp 10

Related FW	1.1.0	Related applications	BTB
LAI ID	419		
Description			
This LAI is used for compensation of thermocouple temperature measurement. It is used when there is a significant temperature difference between on-board terminal and a module terminal (such as Intel AIN8TC). This input compensate the CAN module configured with address (index) 10.			
<b>Note:</b> <i>The compensation is only for thermocouples without internal compensation "Thermo (nc) ..." (not cold junction compensation).</i>			

[▲ back to Logical analog inputs alphabetically](#)

LAI: N

## Not Used

Related FW	1.1.0	Related applications	BTB
LAI ID	230		
Description			
Input has no function.			

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# 8.1.8 Fixed Protection States

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## Fixed Protections States 1

Related FW	1.1.0	Related applications	BTB
Comm object	20744		
Description			
<p>This is a group of fixed protection states.</p> <p>List of protection states by bits:</p> <ol style="list-style-type: none"><li>1. <b>Wrn Brute Force Protection Active (page 639)</b></li><li>2. <b>Wrn Redundant CAN inconsistency (page 665)</b></li><li>3. <b>Wrn CAN2 Empty (page 640)</b></li><li>4. <b>Wrn SHBIN Collision (page 668)</b></li><li>5. <b>Wrn SHAIN Collision (page 666)</b></li><li>6. Not Used</li><li>7. Not Used</li><li>8. Not Used</li><li>9. <b>ALI SD Card Formatting/Mounting (page 673)</b></li><li>10. <b>Wrn SD Card File System Failed (page 665)</b></li><li>11. <b>AHI Battery Undervoltage (page 675)</b></li><li>12. <b>AHI Battery Overvoltage (page 674)</b></li><li>13. <b>Wrn SD Card Failed (page 665)</b></li><li>14. <b>Wrn Long Term History Fail (page 664)</b></li><li>15. Reserved</li><li>16. Reserved</li><li>17. Reserved</li><li>18. Reserved</li><li>19. Reserved</li><li>20. Reserved</li><li>21. Reserved</li><li>22. Reserved</li><li>23. Reserved</li><li>24. Reserved</li><li>25. Reserved</li><li>26. Reserved</li><li>27. Reserved</li><li>28. Reserved</li><li>29. Reserved</li><li>30. Reserved</li></ol>			

 [back to Fixed Protection States](#)

## Fixed Protections States 2

Related FW	1.1.0	Related applications	BTB
Comm object	20745		
Description			
<p>This is a group of fixed protection states.</p> <p>List of protection states by bits:</p> <ol style="list-style-type: none"><li>1. <b>Hst Bus Left &gt;V L1-N (page 676)</b></li><li>2. <b>Hst Bus Left &gt;V L2-N (page 676)</b></li><li>3. <b>Hst Bus Left &gt;V L3-N (page 676)</b></li><li>4. <b>Hst Bus Left &gt;V L1-L2 (page 676)</b></li><li>5. <b>Hst Bus Left &gt;V L2-L3 (page 677)</b></li><li>6. <b>Hst Bus Left &gt;V L3-L1 (page 677)</b></li><li>7. <b>Hst Bus Left &gt;&gt;V L1-N (page 677)</b></li><li>8. <b>Hst Bus Left &gt;&gt;V L2-N (page 678)</b></li><li>9. <b>Hst Bus Left &gt;&gt;V L3-N (page 678)</b></li><li>10. <b>Hst Bus Left &gt;&gt;V L1-L2 (page 678)</b></li><li>11. <b>Hst Bus Left &gt;&gt;V L2-L3 (page 679)</b></li><li>12. <b>Hst Bus Left &gt;&gt;V L3-L1 (page 679)</b></li><li>13. Reserved</li><li>14. Reserved</li><li>15. Reserved</li><li>16. Reserved</li><li>17. Reserved</li><li>18. Reserved</li><li>19. <b>Hst Bus Left &lt;V L1-N (page 679)</b></li><li>20. <b>Hst Bus Left &lt;V L2-N (page 680)</b></li><li>21. <b>Hst Bus Left &lt;V L3-N (page 680)</b></li><li>22. <b>Hst Bus Left &lt;V L1-L2 (page 680)</b></li><li>23. <b>Hst Bus Left &lt;V L2-L3 (page 680)</b></li><li>24. <b>Hst Bus Left &lt;V L3-L1 (page 681)</b></li><li>25. <b>Hst Bus Left &lt;&lt;V L1-N (page 681)</b></li><li>26. <b>Hst Bus Left &lt;&lt;V L2-N (page 681)</b></li><li>27. <b>Hst Bus Left &lt;&lt;V L3-N (page 682)</b></li><li>28. <b>Hst Bus Left &lt;&lt;V L1-L2 (page 682)</b></li><li>29. <b>Hst Bus Left &lt;&lt;V L2-L3 (page 682)</b></li><li>30. <b>Hst Bus Left &lt;&lt;V L3-L1 (page 683)</b></li><li>31. <b>Hst Bus Left V Unbalance Ph-N (page 684)</b></li><li>32. <b>Hst Bus Left V Unbalance Ph-Ph (page 685)</b></li></ol>			

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## Fixed Protections States 3

Related FW	1.1.0	Related applications	BTB
Comm object	20746		
Description			
<p>This is a group of fixed protection states.</p> <p>List of protection states by bits:</p> <ol style="list-style-type: none"><li>1. <b>Hst Bus Left &gt;f</b> (page 683)</li><li>2. <b>Hst Bus Left &gt;&gt;f</b> (page 683)</li><li>3. <b>Hst Bus Left &lt;f</b> (page 684)</li><li>4. <b>Hst Bus Left &lt;&lt;f</b> (page 684)</li><li>5. <b>IDMT Overload</b> (page 694)</li><li>6. <b>BOR Short Circuit</b> (page 694)</li><li>7. <b>BOR IDMT Bus Left &gt;A</b> (page 694)</li><li>8. <b>BOR Current Unbalance</b> (page 694)</li><li>9. <b>ALI Bus Left Ph Rotation Opposite</b> (page 671)</li><li>10. <b>Hst BTB Fail</b> (page 689)</li><li>11. Reserved</li><li>12. <b>Hst Synchronization Fail</b> (page 692)</li><li>13. <b>Hst Bus Right &gt;V L1-N</b> (page 685)</li><li>14. <b>Hst Bus Right &gt;V L2-N</b> (page 685)</li><li>15. <b>Hst Bus Right &gt;V L3-N</b> (page 685)</li><li>16. <b>Hst Bus Right &gt;V L1-L2</b> (page 686)</li><li>17. <b>Hst Bus Right &gt;V L2-L3</b> (page 686)</li><li>18. <b>Hst Bus Right &gt;V L3-L1</b> (page 686)</li><li>19. <b>Hst Bus Right &lt;V L1-N</b> (page 686)</li><li>20. <b>Hst Bus Right &lt;V L2-N</b> (page 687)</li><li>21. <b>Hst Bus Right &lt;V L3-N</b> (page 687)</li><li>22. <b>Hst Bus Right &lt;V L1-L2</b> (page 687)</li><li>23. <b>Hst Bus Right &lt;V L2-L3</b> (page 687)</li><li>24. <b>Hst Bus Right &lt;V L3-L1</b> (page 688)</li><li>25. <b>Hst Bus Right V Unbalance Ph-N</b> (page 688)</li><li>26. <b>Hst Bus Right V Unbalance Ph-Ph</b> (page 689)</li><li>27. <b>Hst Bus Right &gt;f</b> (page 688)</li><li>28. <b>Hst Bus Right &lt;f</b> (page 688)</li><li>29. <b>Bus Meas Error</b> (page 689)</li><li>30. Reserved</li><li>31. Reserved</li><li>32. Reserved</li></ol>			

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## Fixed Protections States 4

Related FW	1.1.0	Related applications	BTB
Comm object	20747		
Description			
<p>This is a group of fixed protection states.</p> <p>List of protection states by bits:</p> <ol style="list-style-type: none"><li>1. <b>Wrn Alarm e-mail 1 Fail (page 638)</b></li><li>2. <b>Wrn Alarm e-mail 2 Fail (page 638)</b></li><li>3. <b>Wrn Alarm e-mail 3 Fail (page 638)</b></li><li>4. <b>Wrn Alarm e-mail 4 Fail (page 638)</b></li><li>5. <b>Wrn SNMP TRAP 1 Fail (page 668)</b></li><li>6. <b>Wrn SNMP TRAP 2 Fail (page 669)</b></li><li>7. Not Used</li><li>8. Not Used</li><li>9. Not Used</li><li>10. Not Used</li><li>11. Not Used</li><li>12. Not Used</li><li>13. Not Used</li><li>14. Not Used</li><li>15. Reserved</li><li>16. <b>Hst BTB Fail To Open (page 691)</b></li><li>17. <b>Hst BTB Fail To Close (page 690)</b></li><li>18. Reserved</li><li>19. Reserved</li><li>20. Reserved</li><li>21. Reserved</li><li>22. <b>ALI SD Card Not Compatible (page 672)</b></li><li>23. <b>ALI SD Card In Slot (page 672)</b></li><li>24. <b>ALI SD Card Full (page 673)</b></li></ol>			

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# 8.1.9 User Protection States

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## User Protections States 1

Related FW	1.1.0	Related applications	BTB
Comm object	20759		
Description			
This is a group of user protection states.			

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## User Protections States 2

Related FW	1.1.0	Related applications	BTB
Comm object	20760		
Description			
This is a group of user protection states.			

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## User Protections States 3

Related FW	1.1.0	5Related applications	BTB
Comm object	20761		
Description			
This is a group of user protection states.			

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## User Protections States 4

Related FW	1.1.0	Related applications	BTB
Comm object	20762		
Description			
This is a group of user protection states.			

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## User Protections States 5

Related FW	1.1.0	Related applications	BTB
Comm object	20763		
Description			
This is a group of user protection states.			

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## User Protections States 6

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>Comm object</b>	20764		
<b>Description</b>			
This is a group of user protection states.			

[◀ back to User Protection States](#)

## User Protections States 7

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>Comm object</b>	20765		
<b>Description</b>			
This is a group of user protection states.			

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## User Protections States 8

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>Comm object</b>	20766		
<b>Description</b>			
This is a group of user protection states.			

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## User Protections States 9

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>Comm object</b>	20767		
<b>Description</b>			
This is a group of user protection states.			

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## User Protections States 10

<b>Related FW</b>	1.1.0	<b>Related applications</b>	BTB
<b>Comm object</b>	20768		
<b>Description</b>			
This is a group of user protection states.			

[◀ back to User Protection States](#)



## 8.1.10 PLC

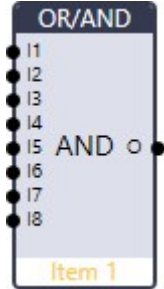
### List of PLC blocks

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## Group: Logical functions

### OR/AND

PLC group	Basic logical functions	
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	1	

#### Inputs

Input	Type	Negation	Range	Function
Input 1	Binary	Yes	0/1	Input 1
Input 2	Binary	Yes	0/1	Input 2
Input 3	Binary	Yes	0/1	Input 3 (optional)
Input 4	Binary	Yes	0/1	Input 4 (optional)
Input 5	Binary	Yes	0/1	Input 5 (optional)
Input 6	Binary	Yes	0/1	Input 6 (optional)
Input 7	Binary	Yes	0/1	Input 7 (optional)
Input 8	Binary	Yes	0/1	Input 8 (optional)

#### Outputs

Output	Type	Negation	Range	Function
Output	Binary	Yes	0/1	Result of the logical operation

#### Description

The block performs logical operation OR / AND of 2 - 8 binary operands. The inputs as well as the output can be inverted.

#### Function OR

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	1

#### Function AND

Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

There have to be at least 2 inputs every time. There may be up to 8 inputs configured.

PLC Editor: Function block

+

No.	Input		Inv.
1		...	<input type="checkbox"/>
2		...	<input type="checkbox"/>
3		...	<input type="checkbox"/>
4		...	<input type="checkbox"/>
5		...	<input type="checkbox"/>
6		...	<input type="checkbox"/>
7		...	<input type="checkbox"/>
8		...	<input type="checkbox"/>

• Output: PLC-BOUT 1.8

☐ Inverted output

Function type:

AND

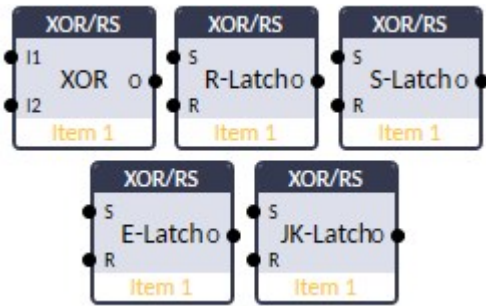
OK

Cancel

Image 7.10 Configuration of OR/AND block

⬆️ back to List of PLC blocks

## XOR/RS

PLC group	Basic logical functions				
Related FW	1.1.0				
Related applications	BTB				
PLC Block ID	39				
Inputs					
Input	Type	Negation	Range	Function	
Input 1..2	Binary	Yes	0/1	Inputs 1..2	
Outputs					
Output	Type	Negation	Range	Function	
Output	Binary	Yes	0/1	Result of the logical operation	
Description					
The block performs logical (boolean) XOR operation of two binary operands or several variants of the RS flipflop function. Both Inputs and Output can be inverted.					
Function type XOR					
Input 1	Input 2	Output			
0	0	0			
0	1	1			
1	0	1			
1	1	0			
The result of XOR operation between two binary inputs (Input 1 and Input 2) is defined by table below.					
Function type RS					
Input 2 (R)	Input 1 (S)	R-latch	S-latch	E-latch	JK-latch
Q					
0	0	Q <sup>-1</sup>	Q <sup>-1</sup>	Q <sup>-1</sup>	Q <sup>-1</sup>
0	1	1	1	1	1
1	0	0	0	0	0
1	1	0	1	Q <sup>-1</sup>	NOT(Q <sup>-1</sup> )
The Q <sup>-1</sup> denotes the state of the RS block output in the last evaluation cycle.					
The block Output value is given by the selected RS flip-flop variant evaluation:					
➤ R-latch: When both inputs (R, S) are set the Reset input is dominant.					
➤ S-latch: When both inputs (R, S) are set the Set input is dominant.					
➤ E-latch: When both inputs (R, S) are set the previous output is preserved.					
➤ JK-latch: When both inputs (R, S) are set the block output is negated.					
The block has the setting for the variant functions of the RS flip-flop circuit. This setting is					

available in the block configuration dialog (i.e. it is done in the configuration and cannot be changed dynamically while the PLC is running).

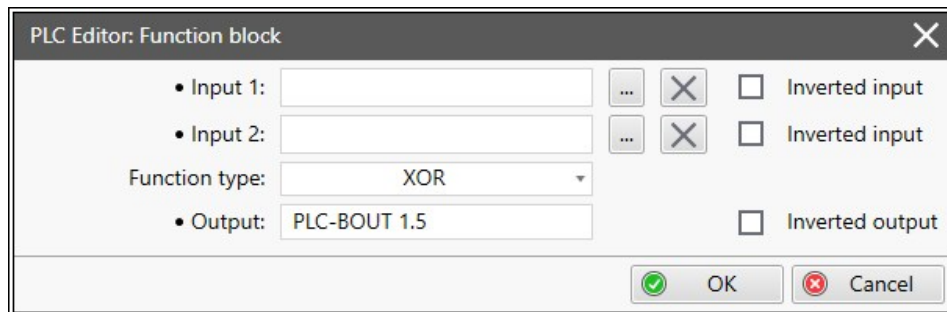


Image 7.11 Configuration of XOR/RS block

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## Group: Comparators

### Comp Delay


PLC group	Comparison of analog inputs			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	46			
Inputs				
Input	Type	Negation	Range	Function
Input 1	Analog	No	$-2^{32} .. 2^{32}$	Compared value
Input 2	Analog	No	$-2^{32} .. 2^{32}$	Comparison level
Delay	Analog	No	0.0 .. 3000.0 [s]	Comparative delay
Outputs				
Output	Type	Negation	Range	Function
Output	Binary	Yes	0/1	Comparator output
Description				
<p>This PLC block compares the Input value with the Reference comparison level using the selected Relation. The Output will switch on if the Input is equal/higher/smaller/etc. than the Reference comparison level for a time longer than the Delay. All Relation operations between the Input and the Reference are described in the table below.</p>				
Shortcut	Name		Relation	
LT	less than		Input "<" Reference	
LE	less than equal		Input "<=" Reference	
EQ	equal		Input "==" Reference	
GT	greater than		Input ">" Reference (default)	
GE	greater than equal		Input ">=" Reference	



Image 7.12 Configuration of Comp Delay block

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## Comp Hyst

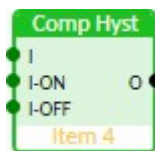
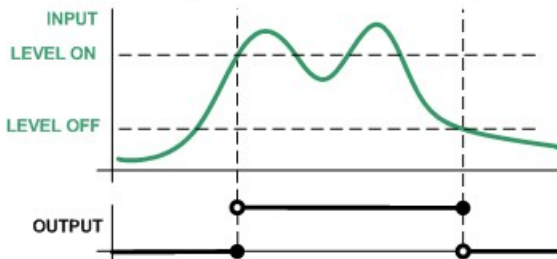
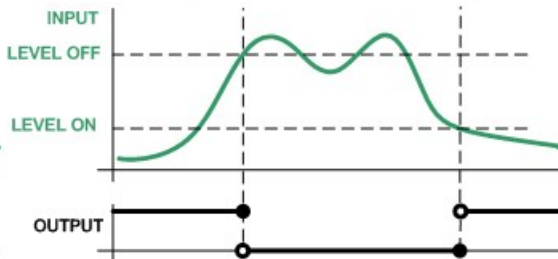
PLC group	Comparison of analog inputs			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	3			
Inputs				
Input	Type	Negation	Range	Function
Input	Analog	No	$-2^{32} .. 2^{32}$	Compared value
Input ON	Analog	No	$-2^{32} .. 2^{32}$	Comparative level for switching on
Input OFF	Analog	No	$-2^{32} .. 2^{32}$	Comparative level for switching off
Outputs				
Output	Type	Negation	Range	Function
Output	Binary	No	0/1	Comparator output
Description				
TThe block compares the Input value with two comparison levels I-ON and I-OFF. The evaluation of the block depends on whether the I-ON level is higher than the I-OFF level or vice versa.				
<div><div><p>LEVEL ON &gt; LEVEL OFF</p></div><div><p>LEVEL ON &lt; LEVEL OFF</p></div></div>				

Image 7.13 Different On and Off levels

Image 7.13 Different On and Off levels

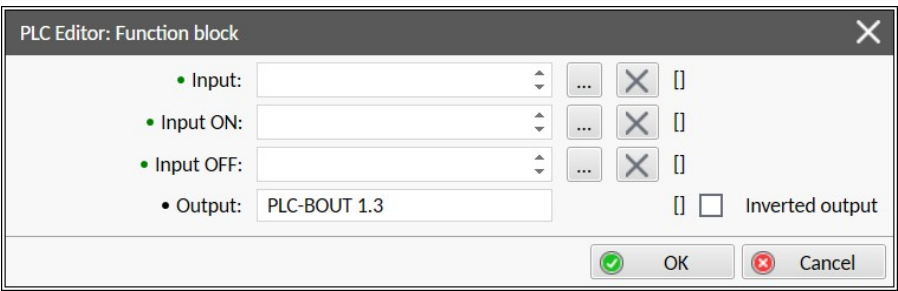



Image 7.14 Configuration of Comp Hyst block

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### Comp Win

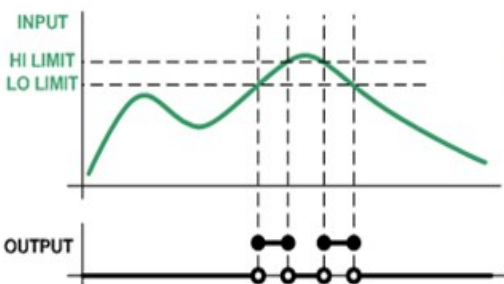
PLC group	Comparison of analog inputs	
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	18	

Inputs				
Input	Type	Negation	Range	Function
Input	Analog	No	$-2^{32} \dots 2^{32}$	Compared value
Input HIGH	Analog	No	$-2^{32} \dots 2^{32}$	Upper window limit
Input LOW	Analog	No	$-2^{32} \dots 2^{32}$	Lower window limit

Outputs				
Output	Type	Negation	Range	Function
Output	Binary	No	0/1	Comparator output

Description				
The block output is switched on whenever the input value is in the range defined by Lo and Hi levels.				

HI LIMIT > LO LIMIT



LO LIMIT > HI LIMIT

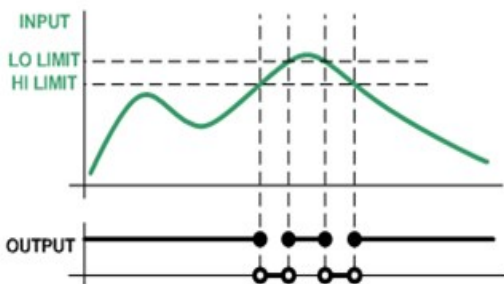


Image 7.15 Principle of delay

Image 7.15 Principle of delay

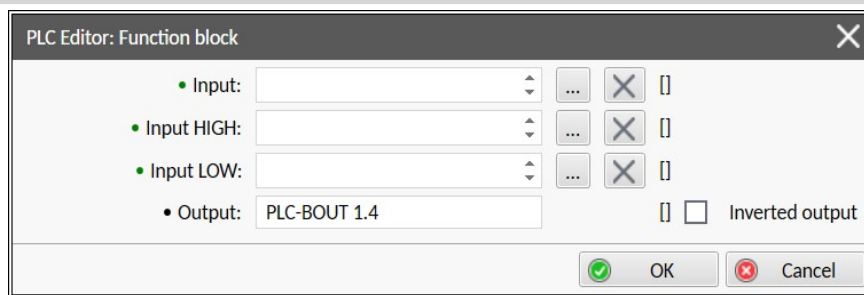


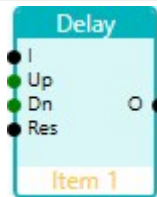
Image 7.16 Configuration of Comp Time block

**Note:** All inputs and can be constants or values from controller.

## back to List of PLC blocks

### Group: Time functions

#### Delay

PLC group	Time functions			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	33			
Inputs				
Input	Type	Negation	Range	Function
Input	Binary	No	0/1	Input signal to be delayed
Input time up	Analog	No	0 .. 214 748 364,7 [s, m, h]	Delay of the rising edge resp. pulse length generated by rising edge of the input
Input time down	Analog	No	0 .. 214 748 364,7 [s, m, h]	Delay of the falling edge resp. pulse length generated by falling edge of the input
Input reset	Binary	No	0/1	Resets the output to logical 0. The output remains in logical 0 until new rising edge appears on Input (when Input reset is deactivated already)
Outputs				
Output	Type	Negation	Range	Function
Output	Binary	No	0/1	Output signal
Description				
<p>This block can operate in two operating modes (Delay mode, Pulse mode) = the block mode is defined by the Pulse on edge checkbox option - if checked, the Pulse mode is active.</p> <p>➤ <b>Delay mode</b> - the rising edge at the Output is generated with a delay of the Input time up lenght when arising edge is detected on the Input. A falling edge at the Output is generated with a delay of the Input time down length when a falling edge is detected on the Input. If the delayed falling</p>				



edge at the Output arrived before the delayed rising edge, then no pulse would be generated at the Output.

- **Pulse mode** - a pulse of Input time up length is generated at the Output when a rising edge is detected, a pulse of Input time down length is generated at the Output when a falling edge is detected.

**Note:** Because of 100 ms tact, the analog inputs are limited to resolution 0,1 s.

**Note:** If Input time up or Input time down value is <0, this input is internally set to zero.

**Note:** Use Pulse on edge option to choose between delay and pulse mode.

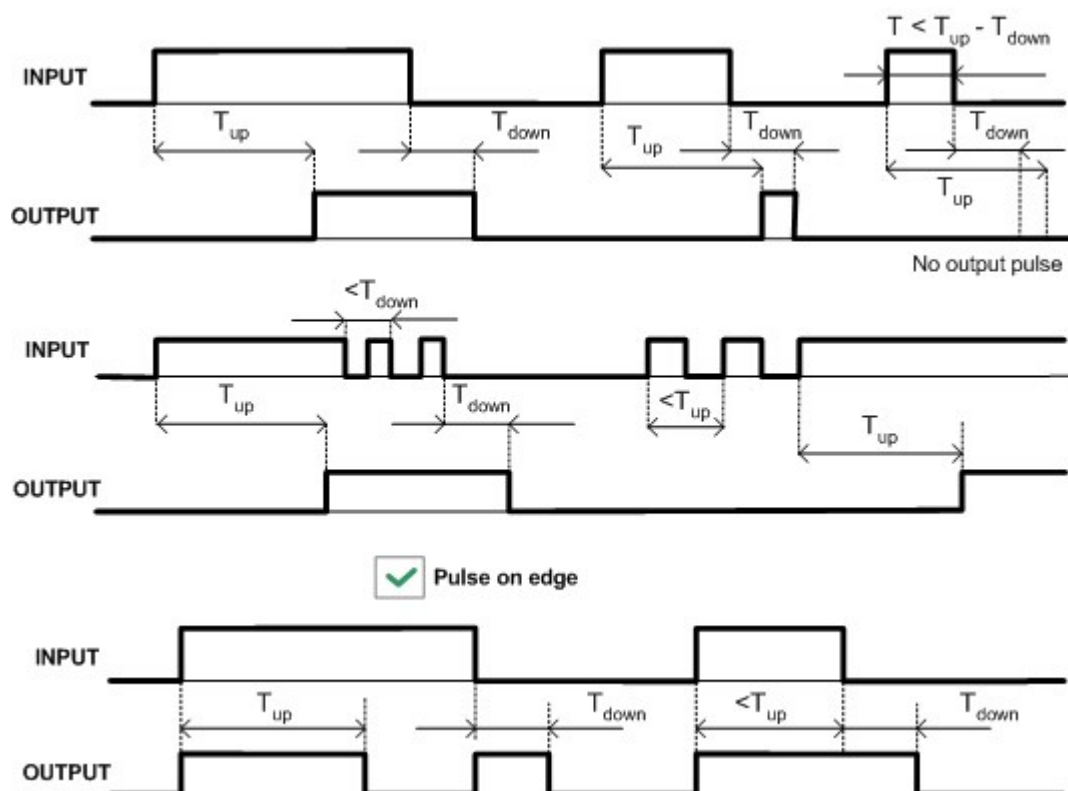


Image 7.17 Delay modes principles

PLC Editor: Function block

• Input:  ... X

• Input time up:  [s] ... X

• Input time down:  [s] ... X

• Input reset:  ... X

• Output: PLC-BOUT 1.5

☐ Pulse on edge

Time unit: s

☐ Inverted input

☐ Inverted input

☐ Inverted output

OK Cancel

Image 7.18 Configuration of Delay block

## Timer

PLC group	Time functions	
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	38	

### Inputs

Input	Type	Negation	Range	Function
Run	Binary	No	0/1	The timer runs only if this input is active or not connected
Reload	Binary	No	0/1	This input reloads the timer to the initial value
Reload value	Analog	No	0,0 .. 214 748 364,7 [s]	Initial value of the timer

### Outputs

Output	Type	Negation	Range	Function
Output	Binary	No	0/1	Timer output
Actual Timer Value	Analog	No	N/A	Analog value that shows Actual Timer Value Lowest available value from: <PLC Resource 1 (page 508) to PLC Resource 16 (page 511)>

### Description

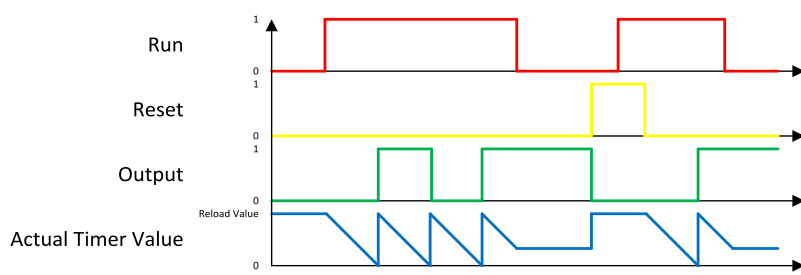
The block performs countdown Timer according to the selected Timer mode and actual inputs values.

The Timer mode could be selected as:

- ComAp timer mode = if the Timer block is to generate a periodic signal at its Output
- Timer mode TP = if the Timer block is to generate a pulse signal of defined width at its Output
- Timer mode TON = if the Timer block is to delay the rising edge of the Input by a defined time.
- Timer mode TOFF = if the Timer block is to delay the falling edge of the Input by a defined time.

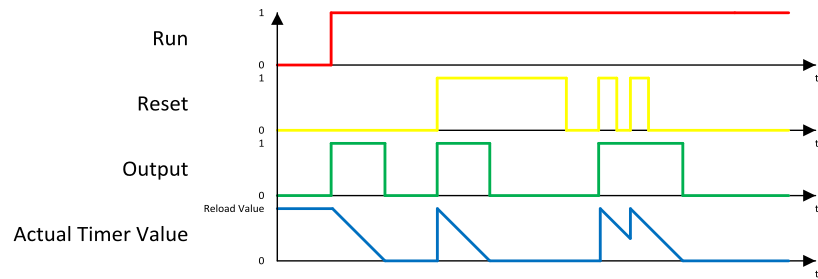
#### Timer mode ComAp

The Timer is counting down only when the Run is on and Reset is off. It is also reset to the Reload value if it reaches 0 or Reset is enabled. The state of the binary Output is negated whenever the Timer value is zero.



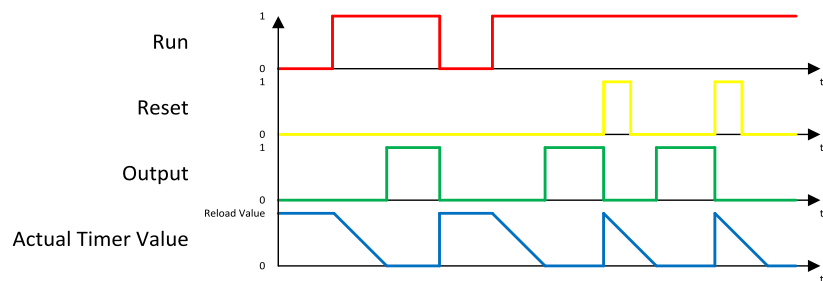
#### Timer mode TP

The Timer counts down when Run is on. The Reset accepts only the rising edge and is required to load the Reload value to the actual Timer value. The Output is set as long as the Actual Timer Value is not equal to 0 (the countdown is in progress).



### Timer mode TON

The Timer starts counting down with the rising edge of Run. The falling edge of Run, like the rising edge of Reset, reloads the Reload value to actual Timer value. The Output is set when the Actual Timer Value is 0 (the countdown is finished).



### Timer mode TOF

The Timer starts counting down with the falling edge of the Run. The rising edge of Run, like the rising edge of Reset, reloads the Reload value to actual Timer value. The Output is set if the Actual Timer Value is not equal to 0 (the countdown is in progress).

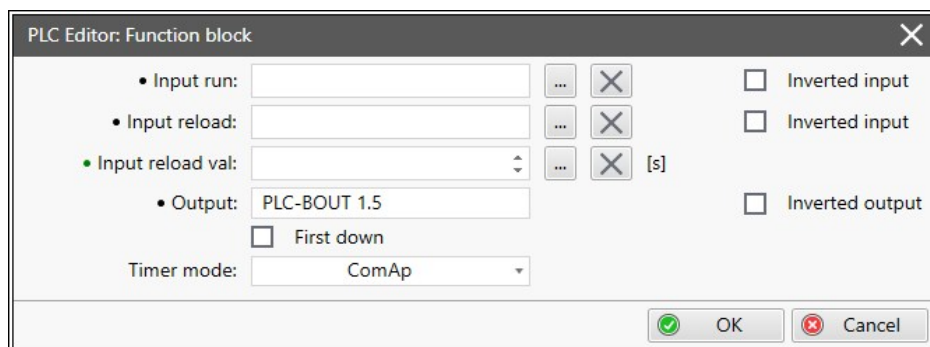
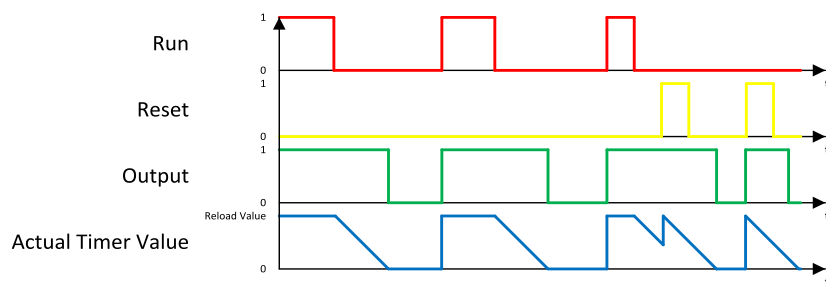


Image 7.19 Configuration of Timer block

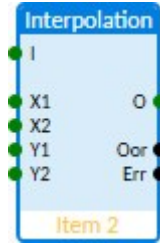
**Note:** For ComAp Timer mode: if you want the Output to start at logic 0, check the First down option. Otherwise, the Output will start at logical 1.

**IMPORTANT:** For ComAp Timer mode: if no inputs are connected and the First down option is not checked, the Output is active.

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## Group: Math operations

### Interpolation

PLC group		
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	34	

Inputs			
Input	Type	Range	Function
Input	Analog	$-2^{32} .. 2^{32}$	Input value
X1	Analog	$-2^{32} .. 2^{32}$	Low X limit of definition
X2	Analog	$-2^{32} .. 2^{32}$	High X limit of definition
Y1	Analog	$-2^{32} .. 2^{32}$	Low Y limit of definition
Y2	Analog	$-2^{32} .. 2^{32}$	High Y limit of definition

Outputs			
Output	Type	Range	Function
Output	Analog	Y1 .. Y2	Transformed value
Out of Range	Binary	0/1	Closed when input is out of range <X1, X2>
Data Invalid	Binary	0/1	Closed when value on analog output is invalid

Description
<p>This block performs a linear transformation of the input. The transformation function is defined by two pairs of points [X1, Y1] and [X2, Y2]. If the <b>Input</b> lies inside of the interval &lt;X1, X2&gt; the <b>Output</b> is given by the conversion. If the <b>Input</b> is lying outside of this interval, <b>Output</b> is saturated either on high or low limit given by Y1 or Y2 and Out of Range is closed. If any of the inputs gets invalid, Data Invalid is closed and <b>Output</b> is set to invalid value. The <b>Output</b>, Y1, Y2 has resolution and dimension based on settings of the block. The resolution and dimensions of the X1 and X2 is same as resolution of the <b>Input</b>.</p>

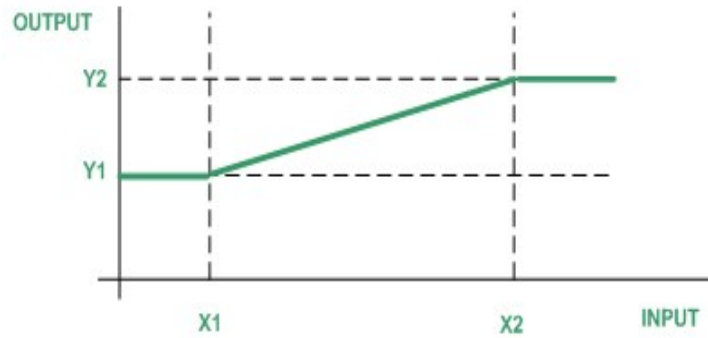


Image 7.20 Principle of Interpolation

PLC Editor: Function block

• Input: [ ] ... [X] [ ]

• X 1: [ ] ... [X] [ ]

• X 2: [ ] ... [X] [ ]

• Y 1: [ ] ... [X] [-]

• Y 2: [ ] ... [X] [-]

• Output: PLC-AOUT 3 [-]

Dimension: -

Resolution: 1

• Out of Range: PLC-BOUT 1.6

• Data Invalid: PLC-BOUT 1.5

☐ Inverted output

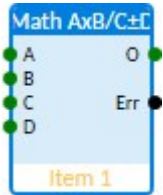
☐ Inverted output

OK Cancel

Image 7.21 Configuration of Interpolation block

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### AxB/C±D

PLC group				
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	51			
Inputs				
Input	Abbr.	Type	Range	Function
Input A	A	Analog	$-2^{32}-1 \dots +2^{32}-1$	First multiplicand
Input B	B	Analog	$-2^{32}-1 \dots +2^{32}-1$	Second multiplicand
Input C	C	Analog	$-2^{32}-1 \dots +2^{32}-1$	Divider
Input D	D	Analog	$-2^{32}-1 \dots +2^{32}-1$	Additive term (optional)
Outputs				

Output	Abbr.	Type	Range	Function
Output	O	Binary	$-2^{32}-1 \dots +2^{32}-1$	Result of the $O = \frac{A \cdot B}{C} \pm D$ operation
Data invalid	Err	Binary	0/1	Set when <b>Output</b> is out of range or when dividing by zero occurs

### Description

The block realizes the mathematical operation  $A \cdot B / C \pm D$ . The operation  $\pm$  is selected by **Function typeselector**. In case of any invalid data on any of the inputs, the **Output** is set to invalid value and **Data Invalid** is closed. The **Output** has resolution and dimension based on setting of the block.

Image 7.22 Configuration of Math  $A \cdot B / C \pm D$  block

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### Math Fc.

PLC group		
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	17	
Inputs		

Input	Type	Negation	Range	Function
Input 1	Analog	No	$-2^{32} \dots 2^{32}$	Input 1
Input 2	Analog	No	$-2^{32} \dots 2^{32}$	Input 2
Input 3	Analog	No	$-2^{32} \dots 2^{32}$	Input 3
Input 4	Analog	No	$-2^{32} \dots 2^{32}$	Input 4
Input 5	Analog	No	$-2^{32} \dots 2^{32}$	Input 5
Input 6	Analog	No	$-2^{32} \dots 2^{32}$	Input 6
Input 7	Analog	No	$-2^{32} \dots 2^{32}$	Input 7
Input 8	Analog	No	$-2^{32} \dots 2^{32}$	Input 8

Outputs				
Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} \dots 2^{32}$	Result of the mathematical operation

Description
<p>This block performs basic mathematical operations of 2 to 8 operands based on selected function. All invalid inputs are ignored. If any configured input contains an invalid value and at least one configured input is valid, the output has value counted from only valid configured inputs based on the selected function. If all configured inputs are invalid output has an invalid value.</p> <p>The Output has a Resolution and Dimension according to the block settings.</p>

Function	Output
<b>ADD</b> - Addition	Input 1 + Input 2 + ... + Input N
<b>SUB</b> - Substraction	Input 1 - Input 2 - ... - Input N
<b> SUB </b> - Absolute value of subtraction	ABS(Input 1 - Input 2 - ... - Input N)
<b>AVG</b> - Average	(Input 1 + Input 2 + ... + Input N) / N
<b>MIN</b> - Minimal value	MIN(Input 1, Input 2, ... ,Input N)
<b>MAX</b> - Maximal value	MAX(Input 1, Input 2, ... ,Input N)

<b>Note:</b> In case of AVG operation type the N is number of inputs with valid value.
--

PLC Editor: Function block

+

No.	Input	Unit
1		[-]
2		[-]
3		[-]
4		[-]
5		[-]
6		[-]
7		[-]
8		[-]

Output:

PLC-AOUT 6

[-]

Dimension:

-

Resolution:

1

Function type:

ADD

ADD

SUB

[SUB]

AVG

MAX

MIN

OK

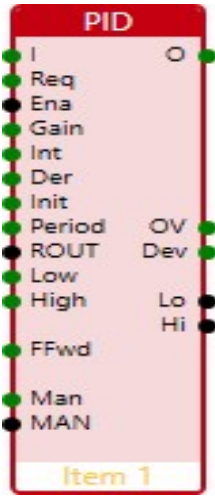
Cancel

Image 7.23 Configuration of Math Fc. block

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## Group: Regulators

### PID

PLC group		
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	41	
Inputs		



Input	Type	Negation	Range	Function
Input Value	Analog	No	$-2^{32} \dots 2^{32}$	Actual (controlled) value "process value".
Requested Value	Analog	No	$-2^{32} \dots 2^{32}$	Required value "setpoint value".
PID Enable	Binary	Yes	0/1	When PID Enable is not true or there is an invalid value on the Input Value of the controller the output of the PID block has a Init Value. If this input is not connected the controller is enabled.
Gain	Analog	No	0,00 .. 100,00	Gain of the controller K. The value 0 turns the controller off. Negative values are not allowed, use the Reverse Output parameter for such a purpose.
Int	Analog	No	0,00 .. 120,00 s	Integration time constant of the controller Ti. The value 0 disables the integrating part.
Der	Analog	No	0,00 .. 4,00 s	Derivation time constant of the controller Td. The value 0 disables the derivating part.
Init Value	Analog	No	-10 000 .. 10 000	The output value is in the Init Value mode when PID Enable is not active or there is an invalid value on the Input Value of the controller. The Init Value is not limited by the Low Limit and High Limit. Output value in the Init mode is given in a whole range of regulator output (from -10 000 to 10 000).
Period	Analog	No	0,1 - 3250,0 s	Evaluation period (decimation factor of default PLC period = 100ms). The period should be adjusted according to the response speed of the system, e.g. longer period for slower systems, a shorter period for faster systems.
Reverse	Binary	Yes	0/1	Reverse Output:

Output				off - higher controller output → higher process value (default) on - higher controller output → lower process value
Low Limit	Analog	No	-10 000 .. 10 000	This value defines the low limit (minimum) of the controller output.
High Limit	Analog	No	-10 000 .. 10 000	This value defines the high limit (maximum) of the controller output.
FeedForward Value	Analog	No	$-2^{32} .. 2^{32}$	Feedforward control value.
FeedForward Weight	Analog	No	$-3,4^{\pm 38} .. 3,4^{\pm 38}$	Feedforward control value weight Wff (default 0 %) [Float data type]
Manual Value	Analog	No	-10 000 .. 10 000	Controller output value in MANual mode. There is a difference to the Init Value (inactive PID block) = manual value is available only while the PID Enable is true and is limited by the High Limit and Low Limit.
MANual Mode	Binary	Yes	0/1	Manual Mode: off - AUTomatic mode (default) on - MANual mode
<b>Outputs</b>				
<b>Output</b>	<b>Type</b>	<b>Negation</b>	<b>Range</b>	<b>Function</b>
Output	Analog	No	-10 000 .. 10 000	Process value (controller output) "control value".
Output Velocity	Analog	No	-10 000 .. 10 000	Derivation of controller output "speed of control value".
Control Deviation	Analog	No	-10 000 .. 10 000	Control deviation (= "requested value" - "actual value").
Out Low Limit	Binary	Yes	0/1	Controller output reaches the Low Limit.
Out High Limit	Binary	Yes	0/1	Controller output reaches the High Limit.
<b>Description</b>				
The PID block is a PID controller, created by combining a proportional, an integration and a derivative controller together (all forming the feed-back controller) with an optional forward control path (intended for the feedforward control).				

The main purpose of using a PID controller is to eliminate the entry control deviation by changing the output control value (also called the manipulated value). The Control Deviation is evaluated as the difference between the Requested Value (setpoint value) and the Input Value (process value). If the controller is operating in automatic mode (MANual mode input is inactive), the action value is calculated according to the control law equation. In the case of manual control (MAN mode input is active), the value of the Manual Value is used instead. In both cases, the Output value is limited by the Low Limit and High Limit values.

The PID block features::

- Standard controller parameters (ISA Form).
- Limitation of the control (process) value (block output).
- Adjustable evaluation period.
- Feed-forward input (with feed-forward gain parameter).
- AUT/MAN switch with manual setpoint value.
- RACT switch (reversing of control value polarity).

The function of the PID controller can be disabled by the PID Enable. While the regulator is disabled, the output is set to a Init Value.

**Note:** Negative values of Gain are not allowed, use the Reverse Output input for such a purpose.

**Note:** There is a difference between Init Value (inactive PID block) and Manual Value - Manual Value is available only while the PID Enable is true, MAN mode is enabled and is limited by the High Limit and low Limit.

PLC Editor: Function block

Input Value:

...

X

[-]

Requested Value:

...

X

[-]

PID Enable:

...

X

Inverted input

Gain:

...

X

[-]

Int:

...

X

[s]

Der:

...

X

[s]

Init Value:

...

X

[-]

Period:

...

X

[s]

Reverse Output:

...

X

Inverted input

Low Limit:

...

X

[-]

High Limit:

...

X

[-]

FeedForward Value:

...

X

[]

FeedForward Weight

0,000000000

Manual Value:

...

X

[-]

MANual mode:

...

X

Inverted input

Output:

PLC-AOUT 1

[-]

Dimension:

-

Resolution:

1

Output Velocity:

PLC-AOUT 2

[-]

Dimension:

-

Resolution:

1

Control Deviation:

PLC-AOUT 3

[-]

Out Low Limit:

PLC-BOUT 1.1

Inverted output

Out High Limit:

PLC-BOUT 1.2

Inverted output


OK

Cancel

Image 7.24 Configuration of PID block

⬅ back to List of PLC blocks

## Up/Down Ctrl Block

PLC group		
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	42	

### Inputs

Input	Type	Negation	Range	Function
Input Value	Analog	No	-10 000 .. 10 000	Control value (Input) = obviously velocity output of antecedent PID control block.
Control deviation	Analog	No	-10 000 .. 10 000	Control deviation (= "requested value" - "actual value") of antecedent block (usually PID controller). Works with Deadband parameter.
U/D Enable	Binary	Yes	0/1	When U/D Enable is not true or there is an invalid value on the Input Value of the block, both the outputs (Output Up or Output Down) has a value off. If this input is not connected the controller is enabled.
Period	Analog	No	0,1 .. 3250,0 s	Period of evaluation (decimation factor of default PLC period 100ms). The time interval between the start time of one pulse to start time of the next pulse. The period should be adjusted according to the Actuator Time and shouldn't be shorter than the antecedent PID controller evaluation period.
Actuator Time	Analog	No	0,1 .. 3250,0 s	It is time that the actuator (servo, etc.) needs for changing its position from fully closed to fully open.
Min On Time	Analog	No	0,1 .. 3250,0 s	The minimum amount of time a relay is allowed to be closed (Output Up or Output Down is on).
Min Off Time	Analog	No	0,1 .. 3250,0 s	The minimum amount of time a relay is opened (Output Up or Output Down is off) during the constant switching control range. This time could be zero.
Deadband	Analog	No	-10 000 ..	Deadband range (of input Control deviation,

			10 000	presumed symmetrical interval) → both outputs (Output Up or Output Down) are inactive (off).
Low Limit	Binary	Yes	0/1	Antecedent controller output reaches the Low Limit.
High Limit	Binary	Yes	0/1	Antecedent controller output reaches the High Limit.
Manual Up	Binary	Yes	0/1	In MANual mode force the SCU to activate (Manual Down must be inactive) Output Up.
Manual Down	Binary	Yes	0/1	In MANual mode force the SCU to activate (Manual Up must be inactive) Output Down.
MANual Mode	Binary	Yes	0/1	Manual Mode: off - AUTomatic mode (default) on - MANual mode
<b>Outputs</b>				
<b>Output</b>	<b>Type</b>	<b>Negation</b>	<b>Range</b>	<b>Function</b>
Output Up	Binary	Yes	0/1	Actuator control - Raise
Output Down	Binary	Yes	0/1	Actuator control - Lower
<b>Description</b>				
<p>The PLC block performs the function of Up/Down Control Unit (Relay Control block) with binary outputs Up/Down and adjustable regulation period. The function of the block can be disabled by the binary input U/D Enable. The Input signal corresponds to the speed (velocity = the change of the action variable) output of the primary controller (Output Velocity of the PID block). The input signal value is expected in range &lt;-10000; +10000&gt;.</p> <p>If the Deadband parameter is non-zero, the switching of the outputs (Output Up or Output Down) is suppressed for input signal Control Deviation smaller than the value of Deadband. The remaining switching pulse length is still maintained for future evaluation.</p> <p>If inputs Low Limit or High Limit (primary controller output reaches its limits - due to this the Input signal is zero), the remaining pulse time is maintained accordingly to perform appropriate output (Output Up or Output Down) switching.</p> <p>By activating the binary input MAN, the inputs Manual Up or Manual Down are respected on the outputs (Output Up or Output Down) - when both the Manual Up or Manual Down is active, both the outputs Output Up and Output Down are inactive.</p>				
<b>Use case:</b>				
<ul style="list-style-type: none"> <li>➤ The U/D Ctrl block (Up/Down relay Control block) is intended for use as an output stage of the primary controller, converting its analog control action to up/down outputs (PWM controlled).</li> <li>➤ Block parameters are therefore set according to the characteristics of the actuator connected onward.</li> <li>➤ The PID block and U/D Ctrl block connected together thus forms PID controller with relay controlled Up / Down outputs.</li> <li>➤ The U/D Ctrl block itself could also act as converting block from analog value to PWM modulated signals.</li> </ul>				

- If the U/D Ctrl block is operating in MANual mode, the manual setting of respective outputs (Output Up / Output Down) is possible.

PLC Editor: Function block

- Input Value: [ ] ... X [ ]
- Control Deviation: [ ] ... X [ ]
- U/D Enable: [ ] ... X ☐ Inverted input
- Period: [ ] ... X [s]
- Actuator Time: [ ] ... X [s]
- Min On Time: [ ] ... X [s]
- Min Off Time: [ ] ... X [s]
- Deadband: [ ] ... X [ ]
- Low Limit: [ ] ... X ☐ Inverted input
- High Limit: [ ] ... X ☐ Inverted input
- Manual Up: [ ] ... X ☐ Inverted input
- Manual Down: [ ] ... X ☐ Inverted input
- MANual Mode: [ ] ... X ☐ Inverted input
- Output Up: PLC-BOUT 1.3 ☐ Inverted output
- Output Down: PLC-BOUT 1.2 ☐ Inverted output

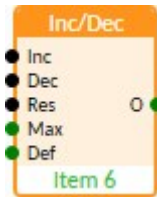
OK Cancel

Image 7.25 Configuration of Up/Down Ctrl Block

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## Group: Ramp functions

### Inc/Dec

PLC group				
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	22			
Inputs				
Input	Type	Negation	Range	Function
Increment	Binary	No	0/1	Rising edge increase value of <b>Output</b> by 1
Decrement	Binary	No	0/1	Rising edge decrease value of <b>Output</b> by 1

Reset	Binary	No	0/1	Rising edge resets <b>Output</b> to <b>Default</b>
Maximum	Analog	No	$-2^{32} .. 2^{32}$	Maximum value of <b>Output</b>
Default	Analog	No	$-2^{32} .. 2^{32}$	Initial value of <b>Output</b>

**Outputs**

Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} .. \text{Maximum}$	Output value

**Description**

The block increments/decrements **Output** based on rising edge on **Increment/Decrement**.  
 If the Increment and Decrement edges arrive simultaneously, the Output value does not change.

- If the counter value is at Maximum and incrementation is coming, the counter will be 0 again.
- If the counter value is at 0 and decrementing is coming, the counter will have be at Maximum.

The Output can be reset by rising edge on Reset.

The Output has a Resolution and Dimension according to the block settings.


**Note:** If both the inputs Increment and Decrement are active, the Output value is not changed.

**IMPORTANT:** When the controller is powered off the Output value is not preserved.

Image 7.26 Configuration of Inc/Dec block

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### Mov Avg

PLC group		
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	7	
Inputs		



Input	Type	Negation	Range	Function
Input	Analog	No	$-2^{32} .. 2^{32}$	Input Value
Filter Length	Analog	No	1 .. 16	Filter length = length of sample train
Sampling Period	Analog	No	0,1 .. 3600,0 [s]	Time interval between samples
Reset	Binary	No	0/1	Reset (clearing) of filter internal memory
Enable	Binary	No	0/1	Filter processing enable (If this input is not connected the block is enabled.)

Outputs				
Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} .. 2^{32}$	Filtered Input

**Description**

The block calculates the arithmetic mean of the N most recent samples of the input value with a selectable sampling interval. The filter uses sample train (sequence of successive samples) for computation of the filtered value as arithmetic average of N last samples of the input value. The simple average computation is used: Typical usage of this function is filtering of a value whose instantaneous value fluctuates rapidly around its mean, which is changing slower. The **Output** has resolution and dimension based on setting of the block.

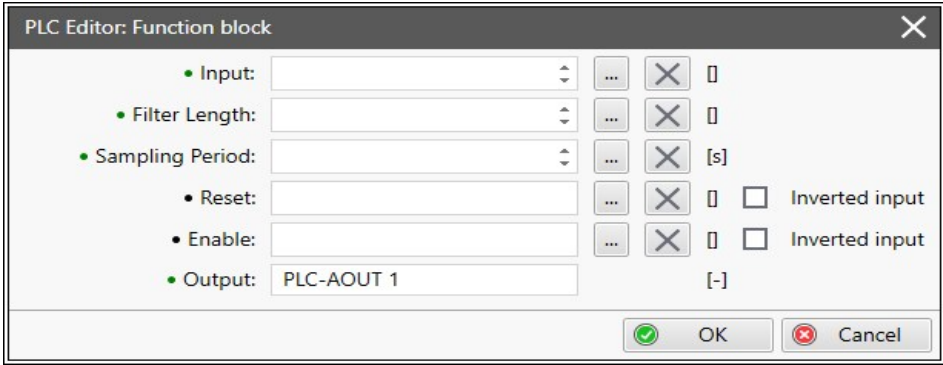
  


Image 7.27 Configuration of Moving Average block

⬅ back to List of PLC blocks

## Ramp

PLC group		
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	19	
Inputs		

Input	Type	Negation	Range	Function
Input	Analog	No	$-2^{32} \dots 2^{32}$	Value to be ramped
Up	Analog	No	$-2^{32} \dots 2^{32}$	Maximal rising rate of the <b>Output</b> per second
Down	Analog	No	$-2^{32} \dots 2^{32}$	Maximal lowering rate of the <b>Output</b> per second

**Outputs**

Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} \dots 2^{32}$	Ramped value

**Description**

This block limits maximal rate of change of **Output**. The maximal rates **Up** and **Down** are adjustable separately and ramping is based on enabled ramps. The **Output** has resolution and dimension based on setting of the block.

Function	Description
Enabled Up	<b>Output</b> can be ramped only up.
Enabled Down	<b>Output</b> can be ramped only down.
Enabled Up/Down	<b>Output</b> can be ramped up and down.

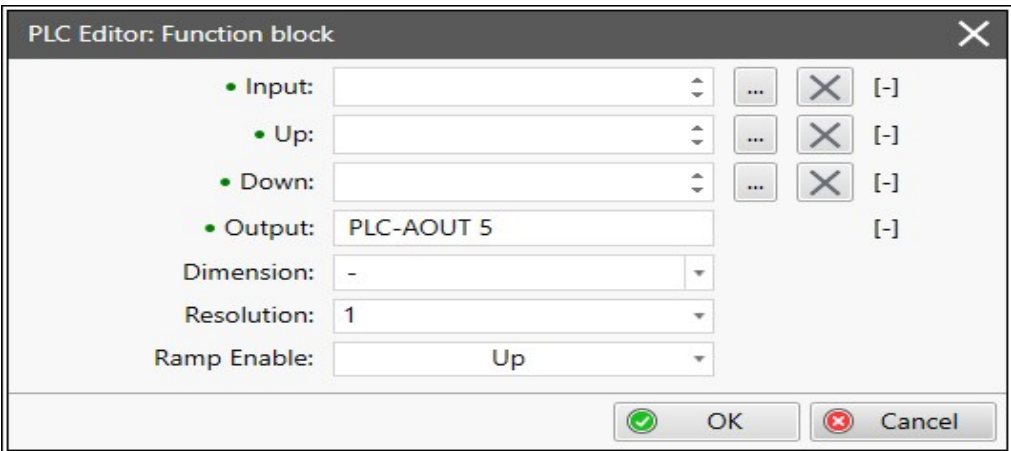



Image 7.28 Configuration of Ramp block

⬅ back to List of PLC blocks

## Up/Down

PLC group		
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	20	
Inputs		

Input	Type	Negation	Range	Function
Limit 1	Analog	No	$-2^{32} \dots 2^{32}$	First limit of <b>Output</b>
Limit 2	Analog	No	$-2^{32} \dots 2^{32}$	Second limit of <b>Output</b>
Reset	Binary	No	0/1	Resets <b>Output</b> to <b>Default Output Value</b> when active
Speed Up	Analog	No	$-2^{32} \dots 2^{32}$	Rising rate of <b>Output</b> per second
Speed Down	Analog	No	$-2^{32} \dots 2^{32}$	Lowering rate of <b>Output</b> per second
Up	Binary	No	0/1	Activates rising of <b>Output</b>
Down	Binary	No	0/1	Activates lowering of <b>Output</b>
Default Output Value	Analog	No	$-2^{32} \dots 2^{32}$	Initial value of <b>Output</b>

Outputs				
Output	Type	Negation	Range	Function
Output	Analog	No	Limit 1 .. Limit 2	Output value

Description
<p>This block works as an analog ramp controlled by binary inputs <b>Up</b> and <b>Down</b> with a defined rate of increase/decrease.</p> <p>The ramp speed is adjusted by <b>Speed Up</b> and <b>Speed Down</b>.</p> <p>The <b>Output</b> limitation is set by <b>Limit 1</b> and <b>Limit 2</b>. The default value of <b>Output</b> is set by <b>Default Output Value</b>.</p> <p>Activate <b>Reset</b> to reset <b>Output</b> to <b>Default Output Value</b>. The <b>Output</b> has resolution and dimension based on setting of the block.</p>

**IMPORTANT:** If both the inputs **Up** and **Down** are active, the **Output** is set to **Default Output Value**.

PLC Editor: Function block

Limit 1:

...

X

[-]

Limit 2:

...

X

[-]

Reset:

...

X

Speed Up:

...

X

[-]

Speed Down:

...

X

[-]

Up:

...

X

Down:

...

X

Default Output Value:

...

X

[-]

Output:

PLC-AOUT 5

[-]

Dimension:

-

Resolution:

1

☐

Inverted input

☐

Inverted input

☐

Inverted input

OK


Cancel

Image 7.29 Configuration of Up/Down block

⬅ back to List of PLC blocks

Group: Other functions

## Analog Switch

PLC group	Other functions			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	5			
Inputs				
Input	Type	Negation	Range	Function
Input 1	Analog	No	$-2^{32} .. 2^{32}$	Input value 1
Input 2	Analog	No	$-2^{32} .. 2^{32}$	Input value 2
Input SW	Binary	No	0/1	Switching between Input value 1 and 2
Outputs				
Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} .. 2^{32}$	Switch output
Description				
The block is switching <b>Input 1</b> and <b>Input 2</b> based on value of <b>Input SW</b> . The <b>Output</b> has resolution and dimension based on setting of the block.				

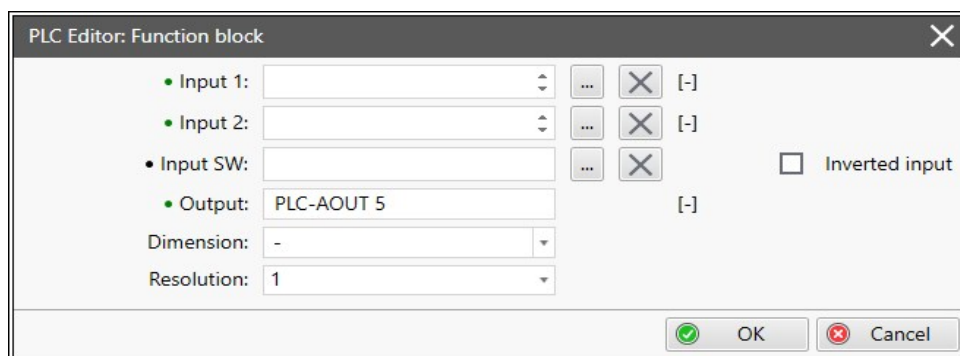
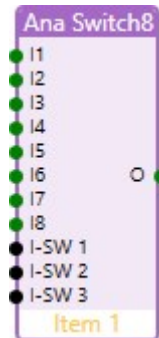


Image 7.30 Configuration of Analog Switch block

⬅ back to List of PLC blocks

## Analog Switch 8

PLC group	Other functions			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	45			
Inputs				
Input	Type	Negation	Range	Function
Input 1	Analog	No	$-2^{32} \dots 2^{32}$	Input value 1
Input 2	Analog	No	$-2^{32} \dots 2^{32}$	Input value 2
Input 3	Analog	No	$-2^{32} \dots 2^{32}$	Input value 3 (optional)
Input 4	Analog	No	$-2^{32} \dots 2^{32}$	Input value 4 (optional)
Input 5	Analog	No	$-2^{32} \dots 2^{32}$	Input value 5 (optional)
Input 6	Analog	No	$-2^{32} \dots 2^{32}$	Input value 6 (optional)
Input 7	Analog	No	$-2^{32} \dots 2^{32}$	Input value 7 (optional)
Input 8	Analog	No	$-2^{32} \dots 2^{32}$	Input value 8 (optional)
Input SW 1	Binary	No	0/1	Switch input 1
Input SW 2	Binary	No	0/1	Switch input 2
Input SW 3	Binary	No	0/1	Switch input 3
Outputs				

Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} \dots 2^{32}$	Switch output according to the SW 1, SW 2 and SW 3

### Description

The block works as an analog multiplexer. The output value could be selected from up to 8 inputs according to the 'Input SW 3', 'Input SW 2' and 'Input SW 1' state is appropriate input value copied to the output, see the table below.

Input SW 3	Input SW 2	Input SW 1	Output
0	0	0	Input 1
0	0	1	Input 2
0	1	0	Input 3
0	1	1	Input 4
1	0	0	Input 5
1	0	1	Input 6
1	1	0	Input 7
1	1	1	Input 8

PLC Editor: Function block

No.	Input	Unit
1		[-]
2		[-]
3		[-]
4		[-]
5		[-]
6		[-]
7		[-]
8		[-]

• Input SW 1:    ☐ Inverted input  
 • Input SW 2:    ☐ Inverted input  
 • Input SW 3:    ☐ Inverted input

• Output:  [-]  
 Dimension:   
 Resolution:

OK Cancel

Image 7.31 Configuration of Analog Switch 8 block

[back to List of PLC blocks](#)

## Circuit Breaker

PLC group	Other functions	 <p>The diagram shows a 'Circuit Breaker' PLC block with the following connections:</p> <ul style="list-style-type: none"> <li>Inputs (left): C/O, Close, Open, FB, NFB, Dis, Chrg.</li> <li>Outputs (right): ON, OFF, UV, C/O, Status, FtC, FtO, Fail.</li> <li>Label at the bottom: Item 1.</li> </ul>
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	58	

### Inputs

Input	Abbr.	Type	Range	Function
Close/Open	C/O	Binary	0/1	According to the Close/Open value the circuit breaker closes/opens (level control)
Close	Close	Binary	0/1	The rising edge of the Close signal forces the breaker to close (edge control)
Open	Open	Binary	0/1	The rising edge of the Open signal forces the breaker to open (edge control)
Feedback	FB	Binary	0/1	Feedback from breaker (aux.) contactor
Negative Feedback	NFB	Binary	0/1	Inverted Feedback
Disabled	Dis	Binary	0/1	Control (closing) disabled
Charged	Chrg	Binary	0/1	Breaker (spring) charged (has tension)

### Outputs

Output	Abbr.	Type	Range	Function
ON Coil	ON	Binary	0/1	On (switching) coil
OFF Coil	OFF	Binary	0/1	Off (tripping) coil
UV Coil	UV	Binary	0/1	Under voltage coil
Output Close/Open	C/O	Binary	0/1	Close / Open signal
Status Close/Open	Status	Binary	0/1	State of circuit breaker control
Fail to Close	FtC	Binary	0/1	Failed to close

### Description

This block performs general **Circuit Breaker (CB)** control based on the state machine principle.

#### Inputs

- **Close/Open:** Input for level control of breaker close/open control. Since the block contains a state machine and the possibility of impulse (edge) control is required, an edge response is also introduced for level control as well, i.e., the rising edge is interpreted as a **CB** Close request and a falling edge as a **CB** Open request.
- **Close:** The request to switch on (Close **CB**) - minimum pulse length is 200 ms - manual issue, edge responsive.

- > **Open:** The request to switch off (Open **CB**) - minimum pulse length is 200 ms - manual issue, edge responsive.
- > **Feedback:** Feedback from auxiliary breaker contacts, not required to configure. (If not configured, the mismatch between requested and breaker state is not evaluated; it is assumed that the breaker is currently in the desired state).
- > **Feedback Negative:** It is not required to be configured together with the **CBFeedback** input. However, if **Feedback Negative** is configured, the **Feedback** input must be configured too. Then, not only the mismatch between the desired state and the feedback is always evaluated, but also the mismatch between the two feedbacks.
- > **Disable:** If the **CB** is disconnected (opened), the **Disable** input will blocks its switching (closing). If the **CB** has already been switched on, this input does not open it. It is not necessary to configure this input = if the input is not configured, it is evaluated as inactive.
- > **Charged:** This input has the same function (but in inverse logic) as **CBDisabled**, it is used only in conjunction with information about the breaker spring tension. Configuration of the input is not required; if the input is not configured, it is evaluated as active.

### Outputs

- > **ON Coil:** Switching signal for ON (closing) **CB** coil - pulse length of 5 sec (the feedback confirmation is expected within this 5 sec).
- > **OFF Coil:** Tripping signal for OFF (opening) **CB** coil - pulse length of 5 sec (the feedback confirmation is expected within this 5 sec).
- > **UV Coil:** Level signal for UV (under voltage) **CB** coil = remains on till the **CB** should be opened.
- > **Output Close/Open:** Request signal for closing/opening the circuit breaker (level control).
- > **Status Close/Open:** Information about the breaker status based on the evaluation of the Feedback and/or Feedback Negative signals.
- > **Failed To Close:** In case of a failed attempt to close the **CB** (second attempt), a 5s pulse is generated at the output. A user protection may be configured on it.
- > **Failed To Open:** In case of a failed attempt to open the **CB**, a 5s pulse is generated at the output. A user protection may be configured on it.
- > **Other Fail:** Information about other non-correlated **CB** events (states). A 5s pulse is generated at the breaker output in the event of a mismatch between **Feedback** and **Feedback Negative** and/or where **Feedback** is lost or, conversely, **Feedback** is set in a situation where a change in **CB** state is unexpected.



PLC Editor: Function block

• Close/Open:  ... ☒ ☐ Inverted input

• Close:  ... ☒ ☐ Inverted input

• Open:  ... ☒ ☐ Inverted input

• Feedback:  ... ☒ ☐ Inverted input

• Negative Feedback:  ... ☒ ☐ Inverted input

• Disabled:  ... ☒ ☐ Inverted input

• Charged:  ... ☒ ☐ Inverted input

• ON Coil: PLC-BOUT 1.1 ☐ ☐ Inverted output

• OFF Coil: PLC-BOUT 1.2 ☐ ☐ Inverted output

• UV Coil: PLC-BOUT 1.3 ☐ ☐ Inverted output

• Output Close/Open: PLC-BOUT 1.4 ☐ ☐ Inverted output

• Status Close/Open: PLC-BOUT 1.5 ☐ ☐ Inverted output

• Fail to Close: PLC-BOUT 1.6 ☐ ☐ Inverted output

• Fail to Open: PLC-BOUT 1.7 ☐ ☐ Inverted output

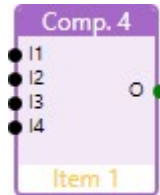
• Other Fail: PLC-BOUT 1.8 ☐ ☐ Inverted output

☒ OK ☐ Cancel

Image 7.32 Configuration of Circuit Breaker block

⬅ back to List of PLC blocks

#### Comp. 4

PLC group	Other functions			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	49			
Inputs				
Input	Type	Negation	Range	Function
Input 1	Binary	Yes	0/1	Bit 0,4,8,12,16,20,24,28 - according to selected group of bits.
Input 2	Binary	Yes	0/1	Bit 1,5,9,13,17,21,25,29 - according to selected group of bits.
Input 3	Binary	Yes	0/1	Bit 2,6,10,14,18,22,26,30 - according to selected group of bits.
Input 4	Binary	Yes	0/1	Bit 3,7,11,15,19,23,27,31 - according to selected group of bits.

Outputs				
Output	Type	Negation	Range	Function
Output	Analog	No	-2 147 483 647 .. 2 147 483 647	Value to be "composed" to bits

**Description**

The block converts selected input bits to analog form and provides the output analog value. The resulting quad of bits is placed in the Output value within the selected bit range (Bits).

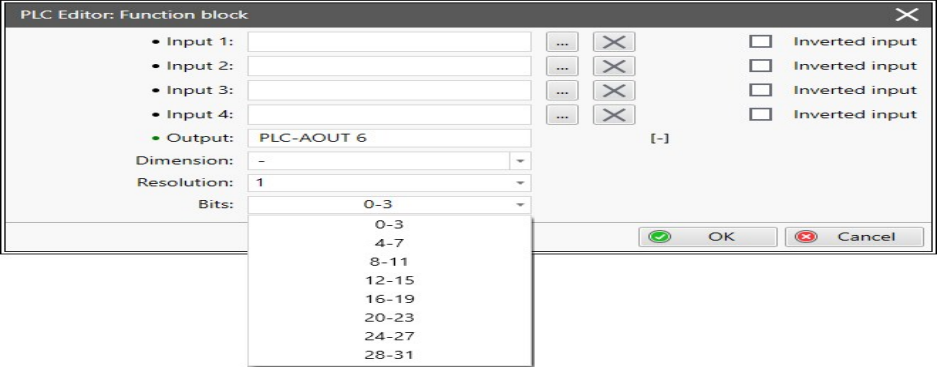
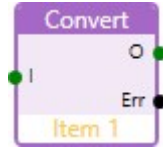


Image 7.33 Configuration of Comp. 4 block

⬅ back to List of PLC blocks

## Convert

<b>PLC group</b>	Other functions	
<b>Related FW</b>	1.1.0	
<b>Related applications</b>	BTB	
<b>PLC Block ID</b>	52	

Inputs				
Input	Type	Negation	Range	Function
Input	Analog	No	$-2^{32} .. 2^{32}$	Input value

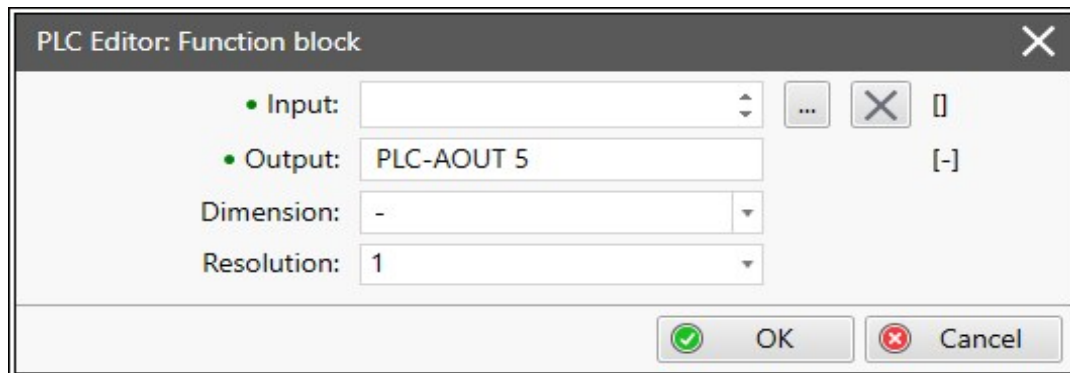
Outputs				
Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} .. 2^{32}$	Converted Input value
Output	Binary	Yes	0/1	The attribute of invalid data on output

**Description**

The block converts the Input based on selected resolution and dimension, and reflects it to the Output. Dimension is converted based on user configuration without any extra recalculation. Resolution is converted and recalculation is used.

**Example:** If the input is 100,5 W and the convert block is used to convert dimensions to kW with resolution 1, the output shows 101 kW.

**Note:** Conversion is done to Integer32, if the input value is out of Integer32 range, output value is set to invalid status.



The screenshot shows a dialog box titled "PLC Editor: Function block" with a close button (X) in the top right corner. Inside the dialog, there are four configuration fields:

- Input:** A text input field that is currently empty, followed by a small vertical double-headed arrow icon, a button with three dots, a button with an 'X', and a button with a square icon.
- Output:** A text input field containing the text "PLC-AOUT 5", followed by a button with a square icon and a button with a minus sign in brackets "[-]".
- Dimension:** A dropdown menu showing a hyphen "-" as the selected value.
- Resolution:** A dropdown menu showing the value "1".

At the bottom right of the dialog, there are two buttons: "OK" with a green checkmark icon and "Cancel" with a red 'X' icon.

Image 7.34 Configuration of Convert block

[◀ back to List of PLC blocks](#)

## Counter

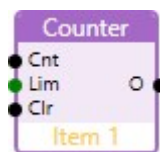
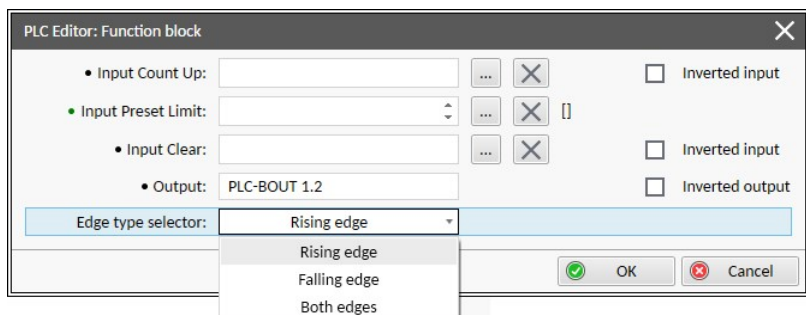

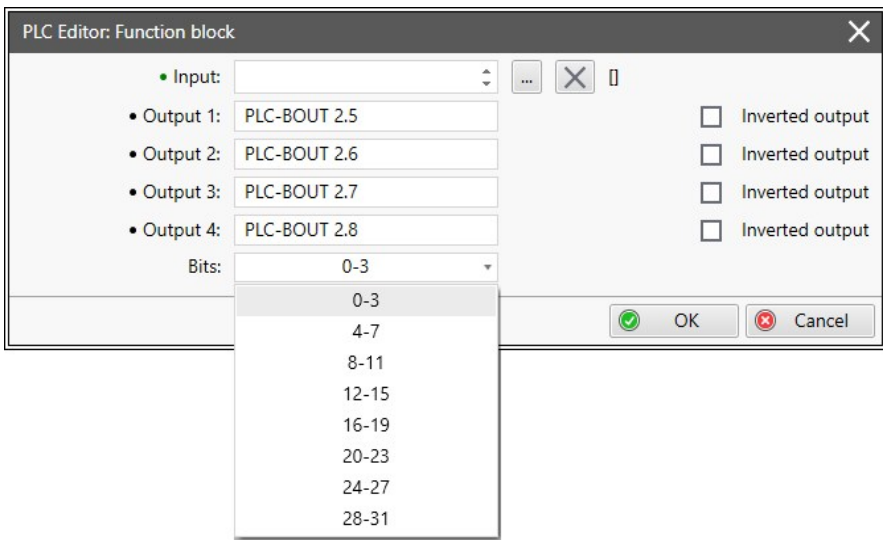
PLC group	Other functions				
Related FW	1.1.0				
Related applications	BTB				
PLC Block ID	13				
Inputs					
Input	Type	Negation	Range	Function	
Input Count Up	Binary	No	0/1	Input at which the edges are counted	
Input Preset Limit	Analog	No	0 .. 2 <sup>32</sup>	Counter value limit for activation of the output	
Input Clear	Binary	No	0/1	Reset input	
Outputs					
Output	Type	Negation	Range	Function	
Output	Binary	No	0/1	Output is activated when the counter value exceeds the limit	
Actual Counter Value	Analog	No	N/A	Analog value that shows Actual Counter Value Lowest available value from: <PLC Resource 1 (page 508) to PLC Resource 16 (page 511)>	
Description					
<p>The block works as a counter of edges (selectable rising, falling or both) with reset input and adjustable counting limit. The maximal counter value is 2 147 483 647. The counter value is lost when the controller is switched off. The output is activated when the counter value is equal to or higher than Input Preset Limit and stays active until the block reset is done using Input Clear. Activating of the Input Clear resets the counter value to 0 and deactivates the output. Holding the Input Clear active blocks the counting.</p>					
<div>IMPORTANT: The counter value is lost when the controller is switched off.</div>					
					

Image 7.35 Configuration of the Counter block

Image 7.35 Configuration of the Counter block

◀ back to List of PLC blocks

## Decomp. 4

PLC group	Other functions			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	24			
<b>Inputs</b>				
<b>Input</b>	<b>Type</b>	<b>Negation</b>	<b>Range</b>	<b>Function</b>
Input	Analog	No	-2 <sup>32</sup> .. 2 <sup>32</sup>	Value to be "decomposed" to bits
<b>Outputs</b>				
<b>Output</b>	<b>Type</b>	<b>Negation</b>	<b>Range</b>	<b>Function</b>
Output 1	Binary	Yes	0/1	Bit 0,4,8,12,16,20,24,28 - according to selected group of bits.
Output 2	Binary	Yes	0/1	Bit 1,5,9,13,17,21,25,29 - according to selected group of bits.
Output 3	Binary	Yes	0/1	Bit 2,6,10,14,18,22,26,30 - according to selected group of bits.
Output 4	Binary	Yes	0/1	Bit 3,7,11,15,19,23,27,31 - according to selected group of bits.
<b>Description</b>				
The block converts the input analog value to binary form and provides selected bits as binary outputs. The input four bits are selected by bit range selection (Bits).				
				
Image 7.36 Configuration of Decomp. 4 block				

◀ back to List of PLC blocks

## Differ

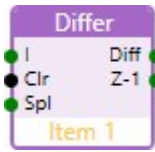
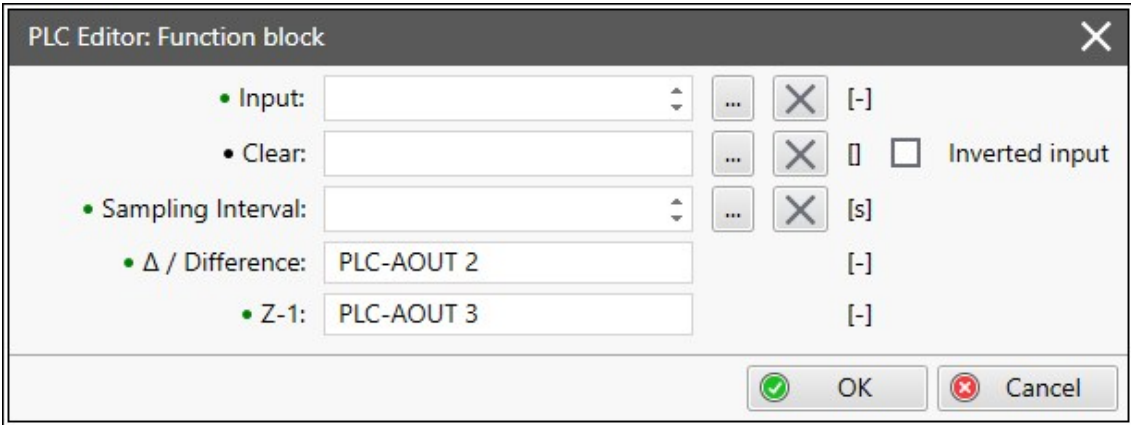

PLC group	Other functions			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	55			
Inputs				
Input	Type	Negation	Range	Function
Input	Analog	No	$-2^{32}-1 \dots +2^{32}-1$	Input value
Clear	Binary	Yes	0/1	Clear (reset) internal values
Sampling Interval	Analog	No	0,1 - 3600,0 s	Sampling period (interval between samples)
Outputs				
Output	Type	Negation	Range	Function
$\Delta$ / Difference	Analog	No	$-2^{32}-1 \dots +2^{32}-1$	Difference-by-Time of <b>Input</b> values evaluated over four samples
Z-1	Analog	No	$-2^{32}-1 \dots +2^{32}-1$	The Input value sample delayed one step (given by the sampling interval parameter)
Description				
<p>The block performs difference-by-time evaluation of analog input. Internally the block have memory for 4 consecutive values (sample train), a one-step delayed sample is available at output <b>Z-1</b>. The time interval between the samples is a block parameter and is selected by the user during the block configuration. The sampling interval can be multiple of 0,1 sec only.</p> <p>Output <math>\Delta</math> is calculated from four successive internal values based on this equation :</p> $\Delta k = \frac{e_k + 3e_{k-1} - 3e_{k-2} - e_{k-3}}{6 \quad T}$				
				

Image 7.37 Configuration of the Differ block

Image 7.37 Configuration of the Differ block

◀ back to List of PLC blocks

Hold

PLC group	Other functions	
Related FW	1.1.0	
Related applications	BTB	
PLC Block ID	37	

**Inputs**

Input	Type	Negation	Range	Function
Input	Analog	No	$-2^{32} .. 2^{32}$	Input value
Hold	Binary	No	0/1	Input triggering the function

**Outputs**

Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32} .. 2^{32}$	Hold output

**Description**

The block is holding **Input** value based on value of **Hold** and selected mode. The Output has resolution and dimension based on setting of the block.

Mode	Description
Edge	The block behaves like analog memory. Input <b>Hold</b> behaves like the reload trigger and reacts on rising edge. The initial value of the <b>Output</b> after restart of the controller is 0.
Level	The block is like a mirror of the <b>Input</b> while the <b>Hold</b> is inactive. The value of <b>Output</b> is latched at the last value while <b>Hold</b> is active.

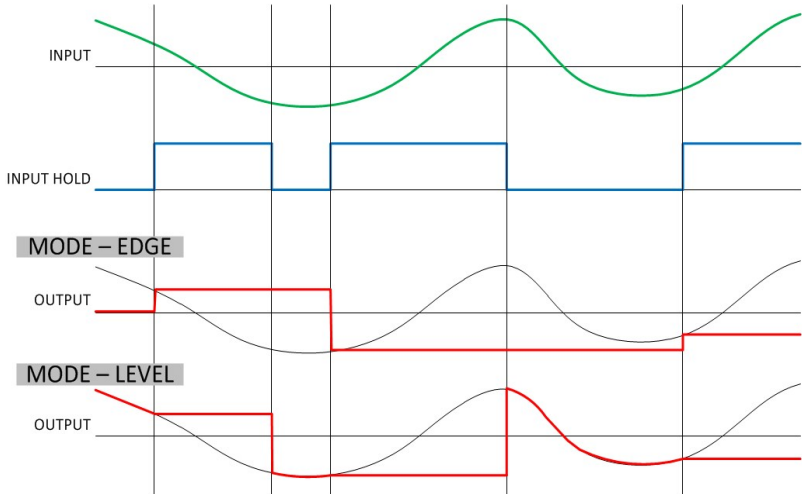


Image 7.38 Principle of the Hold modes

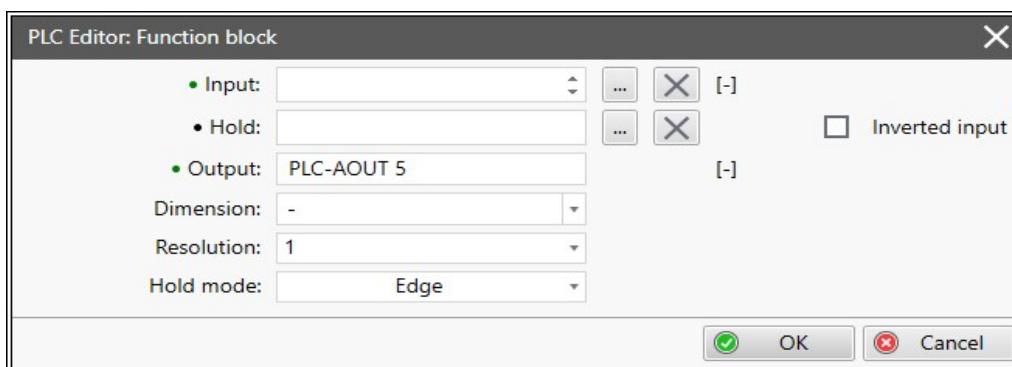
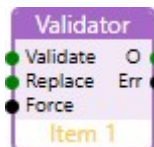


Image 7.39 Configuration of the Hold block

⬆ back to List of PLC blocks

## Validator

PLC group	Other functions			
Related FW	1.1.0			
Related applications	BTB			
PLC Block ID	54			
Inputs				
Input	Type	Negation	Range	Function
Validate	Analog	No	$-2^{32}-1 \dots +2^{32}-1$	Input value
Replace	Analog	No	$-2^{32}-1 \dots +2^{32}-1$	Replacement value
Force	Binary	Yes	0/1	Forcing of replacement
Outputs				
Output	Type	Negation	Range	Function
Output	Analog	No	$-2^{32}-1 \dots +2^{32}-1$	Output set to Validate or Replace based on the value of Validate and/or Force inputs
Invalid	Binary	Yes	0/1	Validate input has an invalid value
Description				
Block checks (validate) if the input value has a valid value (i.e. is not marked with Invalid Flag). The <b>Output</b> value is determined according to the following rules:				
<b>Function Validate</b>				
Input Validate	Input Force	Output O	Output Err	
Valid value	0	Validate	0	
Invalid value	0	Replace	1	
Valid value	1	Replace	0	
Invalid value	1	Replace	1	



PLC Editor: Function block

• Validate:

...

✕

[~]

• Replace:

...

✕

[~]

• Force:

...

✕

☐

☐ Inverted input

• Output:

PLC-AOUT 1

[~]

• Data Invalid:

PLC-BOUT 1.1

☐

☐ Inverted output

✓ OK

✕ Cancel

Image 7.40 Configuration of Validator block

⬅ back to List of PLC blocks

# 8.2 Alarms

**What alarms are:**

The controller evaluates two levels of alarms. For more information **see Alarm Management on page 117.**

## 8.2.1 Alarm levels in the controller

8.2.2 Alarms level 1 .....	635
8.2.3 Alarms level 2 .....	692

## 8.2.2 Alarms level 1

**What alarms level 1 are:**

The level 1 alarm indicates that a value or parameter is out of normal limits, but has still not reached critical level.

## List of alarms level 1

Warning .....	638	Wrn DISTIN 26 .....	647	Wrn DISTIN 63 .....	656
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## Warning

### Wrn Alarm e-mail 1 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Alarm e-mail 1 Fail
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	815
Description	<p>The alarm indicates that there was a request to send an alarm email to email address which is adjusted by setpoint <b>E-mail Address 1 (page 339)</b> and email wasn't send.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 4 (PAGE 590)</b>.</p>

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### Wrn Alarm e-mail 2 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Alarm e-mail 2 Fail
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	816
Description	<p>The alarm indicates that there was a request to send an alarm email to email address which is adjusted by setpoint <b>E-mail Address 2 (page 339)</b> and email wasn't send.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 4 (PAGE 590)</b>.</p>

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### Wrn Alarm e-mail 3 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Alarm e-mail 3 Fail
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	817
Description	<p>The alarm indicates that there was a request to send an alarm email to email address which is adjusted by setpoint <b>E-mail Address 3 (page 339)</b> and email wasn't send.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 4 (PAGE 590)</b>.</p>

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### Wrn Alarm e-mail 4 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Alarm e-mail 4 Fail
Alarm evaluated	All the time

<b>Related applications</b>	BTB
<b>Alarm ID</b>	818
<b>Description</b>	<p>The alarm indicates that there was a request to send an alarm email to email address which is adjusted by setpoint <b>E-mail Address 4 (page 340)</b> and email wasn't send.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 4 (PAGE 590)</b>.</p>

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### Wrn Backup Controller Failed

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn Backup Controller Failed
<b>Alarm evaluated</b>	Only if <b>Hot Swap Redundancy (page 253) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1289
<b>Description</b>	<p>This alarm is activated on <b>Hot Swap Redundancy (page 138)</b> master controller when master controller does not detect the <b>HOT SWAP HEARTBEAT (PAGE 572)</b> signal from backup.</p>

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### Wrn Backup Not Ready

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn Backup Not Ready
<b>Alarm evaluated</b>	Only if <b>Hot Swap Redundancy (page 253) = Master</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1146
<b>Description</b>	<p>This alarm is related to the <b>Hot Swap Redundancy (page 138)</b>. It is activated when the BACKUP controller has announced any 2nd level alarm while the MASTER controller does not indicate such alarm.</p> <p>In this case, the BACKUP is unable to take over the control if Master controller fails. This is a marginal issue and may be caused due to wrong configuration.</p>



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### Wrn Brute Force Protection Active

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn Brute Force Protection Active
<b>Alarm evaluated</b>	All the time
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1237
<b>Description</b>	<p>This alarm is activated when account break protection detects possible attack and at least one account is blocked according to <b>Account break protection (page 178)</b> rules.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 1 (PAGE 587)</b>.</p>

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### Wrn CAN2 Empty

Alarm Type	Warning (page 196)
Alarmlist message	Wrn CAN Intercontroller Empty
Alarm evaluated	Only if <b>CAN Intercontroller Empty Check (page 321)</b> = Enabled
Related applications	BTB
Alarm ID	46
Description	<p>This alarm is activated when controller is alone on Intercontroller CAN ( <b>CAN2A (page 41)</b> and/or  <b>CAN2B (page 41)</b> ) and setpoint <b>CAN Intercontroller Empty Check (page 321)</b> = Enabled.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 1 (PAGE 587)</b>.</p>

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### Wrn Default Password

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Default Credentials
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	1071
Description	<p>This alarm is active until the default password for administrator account is changed.</p>

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### Wrn DISTIN 01

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 01
Alarm evaluated	Only if DIST-IN 01 is configured
Related applications	BTB
Alarm ID	1156
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 1.</b>

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### Wrn DISTIN 02

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 02
Alarm evaluated	Only if DIST-IN 02 is configured
Related applications	BTB
Alarm ID	1157
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 2.</b>

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### Wrn DISTIN 03

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 03
Alarm evaluated	Only if DIST-IN 03 is configured
Related applications	BTB
Alarm ID	1158
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 3.</b>

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### Wrn DISTIN 04

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 04
Alarm evaluated	Only if DIST-IN 04 is configured
Related applications	BTB
Alarm ID	1159
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 4.</b>

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### Wrn DISTIN 05

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 05
Alarm evaluated	Only if DIST-IN 05 is configured
Related applications	BTB
Alarm ID	1160
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 5.</b>

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### Wrn DISTIN 06

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 06
Alarm evaluated	Only if DIST-IN 06 is configured
Related applications	BTB
Alarm ID	1161
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 6.</b>

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### Wrn DISTIN 07

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 07
Alarm evaluated	Only if DIST-IN 07 is configured
Related applications	BTB
Alarm ID	1162
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 7.</b>

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### Wrn DISTIN 08

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 08
Alarm evaluated	Only if DIST-IN 08 is configured
Related applications	BTB
Alarm ID	1163
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 8.</b>

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### Wrn DISTIN 09

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 09
Alarm evaluated	Only if DIST-IN 09 is configured
Related applications	BTB
Alarm ID	1164
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 9.</b>

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### Wrn DISTIN 10

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 10
Alarm evaluated	Only if DIST-IN 10 is configured
Related applications	BTB
Alarm ID	1165
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 10.</b>

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### Wrn DISTIN 11

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 11
Alarm evaluated	Only if DIST-IN 11 is configured
Related applications	BTB
Alarm ID	1166
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 11.</b>

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### Wrn DISTIN 12

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 12
Alarm evaluated	Only if DIST-IN 12 is configured
Related applications	BTB
Alarm ID	1167
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 12.</b>

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### Wrn DISTIN 13

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 13
Alarm evaluated	Only if DIST-IN 13 is configured
Related applications	BTB
Alarm ID	1168
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 13.</b>

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### Wrn DISTIN 14

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 14
Alarm evaluated	Only if DIST-IN 14 is configured
Related applications	BTB
Alarm ID	1169
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 14.</b>

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### Wrn DISTIN 15

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 15
Alarm evaluated	Only if DIST-IN 15 is configured
Related applications	BTB
Alarm ID	1170
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 15.</b>

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### Wrn DISTIN 16

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 16
Alarm evaluated	Only if DIST-IN 16 is configured
Related applications	BTB
Alarm ID	1171
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 16.</b>

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### Wrn DISTIN 17

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 17
Alarm evaluated	Only if DIST-IN 17 is configured
Related applications	BTB
Alarm ID	1172
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 17.</b>

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### Wrn DISTIN 18

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 18
Alarm evaluated	Only if DIST-IN 18 is configured
Related applications	BTB
Alarm ID	1173
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 18.</b>

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### Wrn DISTIN 19

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 19
Alarm evaluated	Only if DIST-IN 19 is configured
Related applications	BTB
Alarm ID	1174
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 19.</b>

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### Wrn DISTIN 20

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 20
Alarm evaluated	Only if DIST-IN 20 is configured
Related applications	BTB
Alarm ID	1175
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 20.</b>

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### Wrn DISTIN 21

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 21
Alarm evaluated	Only if DIST-IN 21 is configured
Related applications	BTB
Alarm ID	1176
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 21.</b>

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### Wrn DISTIN 22

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 22
Alarm evaluated	Only if DIST-IN 22 is configured
Related applications	BTB
Alarm ID	1177
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 22.</b>

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### Wrn DISTIN 23

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 23
Alarm evaluated	Only if DIST-IN 23 is configured
Related applications	BTB
Alarm ID	1178
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 23.</b>

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### Wrn DISTIN 24

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 24
Alarm evaluated	Only if DIST-IN 24 is configured
Related applications	BTB
Alarm ID	1179
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 24.</b>

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### Wrn DISTIN 25

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 25
Alarm evaluated	Only if DIST-IN 25 is configured
Related applications	BTB
Alarm ID	1180
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 25.</b>

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### Wrn DISTIN 26

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 26
Alarm evaluated	Only if DIST-IN 26 is configured
Related applications	BTB
Alarm ID	1181
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 26.</b>

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### Wrn DISTIN 27

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 27
Alarm evaluated	Only if DIST-IN 27 is configured
Related applications	BTB
Alarm ID	1182
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 27.</b>

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### Wrn DISTIN 28

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 28
Alarm evaluated	Only if DIST-IN 28 is configured
Related applications	BTB
Alarm ID	1183
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 28.</b>

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### Wrn DISTIN 29

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 29
Alarm evaluated	Only if DIST-IN 29 is configured
Related applications	BTB
Alarm ID	1184
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 29.</b>

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### Wrn DISTIN 30

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 30
Alarm evaluated	Only if DIST-IN 30 is configured
Related applications	BTB
Alarm ID	1185
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 30.</b>

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### Wrn DISTIN 31

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 31
Alarm evaluated	Only if DIST-IN 31 is configured
Related applications	BTB
Alarm ID	1186
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 31.</b>

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### Wrn DISTIN 32

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 32
Alarm evaluated	Only if DIST-IN 32 is configured
Related applications	BTB
Alarm ID	1187
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 32.</b>

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### Wrn DISTIN 33

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 33
Alarm evaluated	Only if DIST-IN 33 is configured
Related applications	BTB
Alarm ID	1344
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 33.</b>

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### Wrn DISTIN 34

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 34
Alarm evaluated	Only if DIST-IN 34 is configured
Related applications	BTB
Alarm ID	1345
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 34.</b>

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### Wrn DISTIN 35

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 35
Alarm evaluated	Only if DIST-IN 35 is configured
Related applications	BTB
Alarm ID	1346
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 35.</b>

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### Wrn DISTIN 36

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 36
Alarm evaluated	Only if DIST-IN 36 is configured
Related applications	BTB
Alarm ID	1347
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 36.</b>

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### Wrn DISTIN 37

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 37
Alarm evaluated	Only if DIST-IN 37 is configured
Related applications	BTB
Alarm ID	1348
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 37.</b>

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### Wrn DISTIN 38

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 38
Alarm evaluated	Only if DIST-IN 38 is configured
Related applications	BTB
Alarm ID	1349
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 38.</b>

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### Wrn DISTIN 39

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 39
Alarm evaluated	Only if DIST-IN 39 is configured
Related applications	BTB
Alarm ID	1350
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 39.</b>

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### Wrn DISTIN 40

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 40
Alarm evaluated	Only if DIST-IN 40 is configured
Related applications	BTB
Alarm ID	1351
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 40.</b>

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### Wrn DISTIN 41

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 41
Alarm evaluated	Only if DIST-IN 41 is configured
Related applications	BTB
Alarm ID	1352
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 41.</b>

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### Wrn DISTIN 42

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 42
Alarm evaluated	Only if DIST-IN 42 is configured
Related applications	BTB
Alarm ID	1353
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 42.</b>

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### Wrn DISTIN 43

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 43
Alarm evaluated	Only if DIST-IN 43 is configured
Related applications	BTB
Alarm ID	1354
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 43.</b>

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### Wrn DISTIN 44

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 44
Alarm evaluated	Only if DIST-IN 44 is configured
Related applications	BTB
Alarm ID	1355
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 44.</b>

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### Wrn DISTIN 45

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 45
Alarm evaluated	Only if DIST-IN 45 is configured
Related applications	BTB
Alarm ID	1356
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 45.</b>

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### Wrn DISTIN 46

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 46
Alarm evaluated	Only if DIST-IN 46 is configured
Related applications	BTB
Alarm ID	1357
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 46.</b>

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### Wrn DISTIN 47

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 47
Alarm evaluated	Only if DIST-IN 47 is configured
Related applications	BTB
Alarm ID	1358
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 47.</b>

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### Wrn DISTIN 48

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 48
Alarm evaluated	Only if DIST-IN 48 is configured
Related applications	BTB
Alarm ID	1359
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 48.</b>

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### Wrn DISTIN 49

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 49
Alarm evaluated	Only if DIST-IN 49 is configured
Related applications	BTB
Alarm ID	1360
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 49.</b>

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### Wrn DISTIN 50

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 50
Alarm evaluated	Only if DIST-IN 50 is configured
Related applications	BTB
Alarm ID	1361
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 50.</b>

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### Wrn DISTIN 51

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 51
Alarm evaluated	Only if DIST-IN 51 is configured
Related applications	BTB
Alarm ID	1362
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 51.</b>

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### Wrn DISTIN 52

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 52
Alarm evaluated	Only if DIST-IN 52 is configured
Related applications	BTB
Alarm ID	1363
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 52.</b>

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### Wrn DISTIN 53

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 53
Alarm evaluated	Only if DIST-IN 53 is configured
Related applications	BTB
Alarm ID	1364
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 53.</b>

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### Wrn DISTIN 54

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 54
Alarm evaluated	Only if DIST-IN 54 is configured
Related applications	BTB
Alarm ID	1365
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 54.</b>

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### Wrn DISTIN 55

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 55
Alarm evaluated	Only if DIST-IN 55 is configured
Related applications	BTB
Alarm ID	1366
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 55.</b>

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### Wrn DISTIN 56

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 56
Alarm evaluated	Only if DIST-IN 56 is configured
Related applications	BTB
Alarm ID	1367
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 56.</b>

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### Wrn DISTIN 57

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 57
Alarm evaluated	Only if DIST-IN 57 is configured
Related applications	BTB
Alarm ID	1368
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 57.</b>

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### Wrn DISTIN 58

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 58
Alarm evaluated	Only if DIST-IN 58 is configured
Related applications	BTB
Alarm ID	1369
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 58.</b>

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### Wrn DISTIN 59

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 59
Alarm evaluated	Only if DIST-IN 59 is configured
Related applications	BTB
Alarm ID	1370
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 59.</b>

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### Wrn DISTIN 60

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 60
Alarm evaluated	Only if DIST-IN 60 is configured
Related applications	BTB
Alarm ID	1371
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 60.</b>

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### Wrn DISTIN 61

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 61
Alarm evaluated	Only if DIST-IN 61 is configured
Related applications	BTB
Alarm ID	1372
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 61.</b>

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### Wrn DISTIN 62

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 62
Alarm evaluated	Only if DIST-IN 62 is configured
Related applications	BTB
Alarm ID	1373
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 62.</b>

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### Wrn DISTIN 63

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 63
Alarm evaluated	Only if DIST-IN 63 is configured
Related applications	BTB
Alarm ID	1374
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 63.</b>

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### Wrn DISTIN 64

Alarm Type	Warning (page 196)
Alarmlist message	Wrn DISTIN 64
Alarm evaluated	Only if DIST-IN 64 is configured
Related applications	BTB
Alarm ID	1375
Description	This alarm is activated when DIST-IN data are not received from controller with <b>CAN Controller Address (page 316) = 64.</b>

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## Wrn DISTOUT

<b>Alarm Type</b>	Warning (page 196)
<b>Alarmlist message</b>	Wrn DISTOUT
<b>Alarm evaluated</b>	Only if DIST-OUT is configured
<b>Related applications</b>	BTB
<b>Description</b>	This alarm is activated when failure of virtual module DIST-OUT is detected.

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### Wrn ECU 1 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 1
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 1</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 1 (PAGE 541) not activated</li></ol>
Related applications	BTB
Alarm ID	945
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 1.

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### Wrn ECU 2 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 2
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 2</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 2 (PAGE 541) not activated</li></ol>
Related applications	BTB
Alarm ID	946
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 2.

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### Wrn ECU 3 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 3
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 3</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 3 (PAGE 541) not activated</li></ol>
Related applications	BTB
Alarm ID	947
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 3.

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### Wrn ECU 4 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 4
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 4</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 4 (PAGE 541) not activated</li></ol>

<b>Related applications</b>	BTB
<b>Alarm ID</b>	948
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 4.

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### Wrn ECU 5 Comm Fail

<b>Alarm Type</b>	Warning (page 196)
<b>Alarmlist message</b>	Name of ECU in ECU slot 5
<b>Alarm evaluated</b>	<ol style="list-style-type: none"> <li>1. ECU with protection configured in ECU slot 5</li> <li>2. LBI <b>ECU COMMUNICATION FAIL BLOCK (PAGE 541)</b> and <b>ECU COMMUNICATION FAIL BLOCK 5 (PAGE 542)</b> not activated</li> </ol>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	949
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 5.

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### Wrn ECU 6 Comm Fail

<b>Alarm Type</b>	Warning (page 196)
<b>Alarmlist message</b>	Name of ECU in ECU slot 6
<b>Alarm evaluated</b>	<ol style="list-style-type: none"> <li>1. ECU with protection configured in ECU slot 6</li> <li>2. LBI <b>ECU COMMUNICATION FAIL BLOCK (PAGE 541)</b> and <b>ECU COMMUNICATION FAIL BLOCK 6 (PAGE 542)</b> not activated</li> </ol>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	950
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 6.

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### Wrn ECU 7 Comm Fail

<b>Alarm Type</b>	Warning (page 196)
<b>Alarmlist message</b>	Name of ECU in ECU slot 7
<b>Alarm evaluated</b>	<ol style="list-style-type: none"> <li>1. ECU with protection configured in ECU slot 7</li> <li>2. LBI <b>ECU COMMUNICATION FAIL BLOCK (PAGE 541)</b> and <b>ECU COMMUNICATION FAIL BLOCK 7 (PAGE 542)</b> not activated</li> </ol>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	951
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 7.

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### Wrn ECU 8 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 8
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 8</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 8 (PAGE 542) not activated</li></ol>
Related applications	BTB
Alarm ID	952
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 8.

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### Wrn ECU 9 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 9
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 9</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 9 (PAGE 542) not activated</li></ol>
Related applications	BTB
Alarm ID	953
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 9.

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### Wrn ECU 10 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 10
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 10</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 10 (PAGE 543) not activated</li></ol>
Related applications	BTB
Alarm ID	954
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 10.

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### Wrn ECU 11 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 11
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 11</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 11 (PAGE 543) not activated</li></ol>

<b>Related applications</b>	BTB
<b>Alarm ID</b>	955
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 11.

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### Wrn ECU 12 Comm Fail

<b>Alarm Type</b>	Warning (page 196)
<b>Alarmlist message</b>	Name of ECU in ECU slot 12
<b>Alarm evaluated</b>	<ol style="list-style-type: none"> <li>1. ECU with protection configured in ECU slot 12</li> <li>2. LBI <b>ECU COMMUNICATION FAIL BLOCK (PAGE 541)</b> and <b>ECU COMMUNICATION FAIL BLOCK 12 (PAGE 543)</b> not activated</li> </ol>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	956
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 12.

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### Wrn ECU 13 Comm Fail

<b>Alarm Type</b>	Warning (page 196)
<b>Alarmlist message</b>	Name of ECU in ECU slot 13
<b>Alarm evaluated</b>	<ol style="list-style-type: none"> <li>1. ECU with protection configured in ECU slot 13</li> <li>2. LBI <b>ECU COMMUNICATION FAIL BLOCK (PAGE 541)</b> and <b>ECU COMMUNICATION FAIL BLOCK 13 (PAGE 543)</b> not activated</li> </ol>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	957
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 13.

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### Wrn ECU 14 Comm Fail

<b>Alarm Type</b>	Warning (page 196)
<b>Alarmlist message</b>	Name of ECU in ECU slot 14
<b>Alarm evaluated</b>	<ol style="list-style-type: none"> <li>1. ECU with protection configured in ECU slot 14</li> <li>2. LBI <b>ECU COMMUNICATION FAIL BLOCK (PAGE 541)</b> and <b>ECU COMMUNICATION FAIL BLOCK 14 (PAGE 543)</b> not activated</li> </ol>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	958
<b>Description</b>	This alarm is activated when there is no communication received from ECU configured in ECU slot 14.

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### Wrn ECU 15 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 15
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 15</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 15 (PAGE 544) not activated</li></ol>
Related applications	BTB
Alarm ID	959
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 15.

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### Wrn ECU 16 Comm Fail

Alarm Type	Warning (page 196)
Alarmlist message	Name of ECU in ECU slot 16
Alarm evaluated	<ol style="list-style-type: none"><li>1. ECU with protection configured in ECU slot 16</li><li>2. LBI ECU COMMUNICATION FAIL BLOCK (PAGE 541) and ECU COMMUNICATION FAIL BLOCK 16 (PAGE 544) not activated</li></ol>
Related applications	BTB
Alarm ID	960
Description	This alarm is activated when there is no communication received from ECU configured in ECU slot 16.

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### Wrn Event e-mail 1 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Event e-mail 1 Fail
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	734
Description	The alarm indicates that there was a request to send an event email to email address which is adjusted by setpoint <b>E-mail Address 1 (page 339)</b> and email wasn't send.

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### Wrn Event e-mail 2 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Event e-mail 2 Fail
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	735
Description	The alarm indicates that there was a request to send an event email to email

	address which is adjusted by setpoint <b>E-mail Address 2 (page 339)</b> and email wasn't send.
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### Wrn Event e-mail 3 Fail

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn Event e-mail 3 Fail
<b>Alarm evaluated</b>	All the time
<b>Related applications</b>	BTB
<b>Alarm ID</b>	736
<b>Description</b>	The alarm indicates that there was a request to send an event email to email address which is adjusted by setpoint <b>E-mail Address 3 (page 339)</b> and email wasn't send.

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### Wrn Event e-mail 4 Fail

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn Event e-mail 4 Fail
<b>Alarm evaluated</b>	All the time
<b>Related applications</b>	BTB
<b>Alarm ID</b>	737
<b>Description</b>	The alarm indicates that there was a request to send an event email to email address which is adjusted by setpoint <b>E-mail Address 4 (page 340)</b> and email wasn't send.

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### Wrn Hot Swap Configuration Incorrect

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn Hot Swap Configuration Incorrect
<b>Alarm evaluated</b>	Only if <b>Hot Swap Redundancy (page 253)</b> != Disabled and <b>ALI SW Key Hot Swap Error (page 673)</b> is not present in the alarmlist
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1426
<b>Description</b>	<p>This alarm is activated when <b>Hot Swap Redundancy (page 138)</b> is missing the correct configuration of mandatory LBI and LBO.</p> <p>List of mandatory objects:</p> <ul style="list-style-type: none"> <li>➤ <b>LBI HOT SWAP CTRL BLOCK (PAGE 552)</b></li> <li>➤ <b>LBI HOT SWAP HEARTBEAT DETECT (PAGE 553)</b></li> <li>➤ <b>LBO HOT SWAP SWITCH (PAGE 573)</b></li> <li>➤ <b>LBO HOT SWAP HEARTBEAT (PAGE 572)</b></li> </ul> <p><b>IMPORTANT: All mandatory objects have to be configured to physical input/output of the controller.</b></p>

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### Wrn Hot Swap Data Synchro Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Hot Swap Data Synchro Fail
Alarm evaluated	Only if <b>Hot Swap Redundancy (page 253)</b> != Disabled
Related applications	BTB
Alarm ID	1426
Description	This alarm is activated when communication between <b>Hot Swap Redundancy (page 138)</b> master and backup controllers failed. This can be caused because of wrong configuration or wiring. While this alarm is active the backup controller doesn't have the data which needs for the smooth transition.

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### Wrn Long Term History Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Long Term History Fail
Alarm evaluated	Only when <b>Long Term History (page 322)</b> = Enabled
Related applications	BTB
Alarm ID	1281
Description	This alarm is activated when <b>Long Term History (page 322)</b> = Enabled but for any reason it is not possible to write the history onto the SD card. This alarm has FPS - FIXED PROTECTIONS STATES 1 (PAGE 587)

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### Wrn Master Controller Failed

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Master Controller Failed
Alarm evaluated	Only if <b>Hot Swap Redundancy (page 253)</b> != Disabled
Related applications	BTB
Alarm ID	1288
Description	This alarm is activated on <b>Hot Swap Redundancy (page 138)</b> backup controller when backup controller does not detect the <b>HOT SWAP HEARTBEAT (PAGE 572)</b> signal from master.

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### Wrn Password reset e-mail addr is not set

Alarm Type	Warning (page 196)
Alarmlist message	Wrn Password reset e-mail addr is not set
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	1292

<b>Description</b>	This alarm is active when password reset e-mail address is not filled. Fill out the password reset e-mail via IntelliConfig to remove this alarm.
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### Wrn Redundant CAN inconsistency

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn Redundant CAN inconsistency
<b>Alarm evaluated</b>	Only when <b>CAN Intercontroller Comm Redundancy (page 319)</b> = Enabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1079
<b>Description</b>	This alarm is issued when there is inconsistency between <b>CAN2A (page 17)</b> and <b>CAN2B (page 17)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 1 (PAGE 587).

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### Wrn RTC Battery Flat

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn RTC Battery Flat
<b>Alarm evaluated</b>	Only during power-on of the controller
<b>Related applications</b>	BTB
<b>Alarm ID</b>	42
<b>Description</b>	This alarm indicates that the controller detected a flat RTC Battery during power-on. The RTC battery is considered to be flat if its voltage drops below 2.8 V. To remove this alarm follow the <b>Backup battery replacement (page 77)</b> .

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### Wrn SD Card Failed

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SD Card Fail
<b>Alarm evaluated</b>	Only when <b>Long Term History (page 322)</b> = Mount or Format
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1280
<b>Description</b>	This alarm is activated when it is not possible to read or write to the SD card. The alarm is also displayed in case that the setpoint <b>SD Card File System (page 321)</b> is set to Mount or Format but the SD card is not inserted. This alarm will not be activated if the card is not compatible ( <b>ALI SD Card Not Compatible (page 672)</b> is active). This alarm has FPS - FIXED PROTECTIONS STATES 1 (PAGE 587)

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### Wrn SD Card File System Failed

<b>Alarm Type</b>	<b>Warning (page 196)</b>
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<b>Alarmlist message</b>	Wrn SD Card File System Failed
<b>Alarm evaluated</b>	Only when <b>Long Term History (page 322)</b> = Mount
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1639
<b>Description</b>	This alarm is activated when there is a wrong file system on the SD Card. The alarm is not activated if the SDcard is not compatible. This alarm has FPS - <b>FIXED PROTECTIONS STATES 1 (PAGE 587)</b> .

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### Wrn SHAIN 1

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SHAIN 1
<b>Alarm evaluated</b>	Only if SHAIN 1 is configured
<b>Related applications</b>	BTB
<b>Alarm ID</b>	36
<b>Description</b>	This alarm is activated when shared analog inputs are not received from SHAIN module 1.

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### Wrn SHAIN 2

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SHAIN 2
<b>Alarm evaluated</b>	Only if SHAIN 2 is configured
<b>Related applications</b>	BTB
<b>Alarm ID</b>	233
<b>Description</b>	This alarm is activated when shared analog inputs are not received from SHAIN module 2.

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### Wrn SHAIN Collision

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SHAIN Collision
<b>Alarm evaluated</b>	Only if SHIN 1 or SHAIN 2 module is configured
<b>Related applications</b>	BTB
<b>Alarm ID</b>	38
<b>Description</b>	This alarm is activated when controller receives shared analog inputs of any SHAIN module from more than just one controller. This alarm has FPS - <b>FIXED PROTECTIONS STATES 1 (PAGE 587)</b>

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### Wrn SHBIN 1

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SHBIN 1
<b>Alarm evaluated</b>	Only if SHBIN 1 is configured
<b>Related applications</b>	BTB
<b>Alarm ID</b>	32
<b>Description</b>	This alarm is activated when shared binary inputs are not received from SHBIN module 1.

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### Wrn SHBIN 2

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SHBIN 2
<b>Alarm evaluated</b>	Only if SHBIN 2 is configured
<b>Related applications</b>	BTB
<b>Alarm ID</b>	33
<b>Description</b>	This alarm is activated when shared binary inputs are not received from SHBIN module 2.

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### Wrn SHBIN 3

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SHBIN 3
<b>Alarm evaluated</b>	Only if SHBIN 3 is configured
<b>Related applications</b>	BTB
<b>Alarm ID</b>	34
<b>Description</b>	This alarm is activated when shared binary inputs are not received from SHBIN module 3.

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### Wrn SHBIN 4

<b>Alarm Type</b>	<b>Warning (page 196)</b>
<b>Alarmlist message</b>	Wrn SHBIN 4
<b>Alarm evaluated</b>	Only if SHBIN 4 is configured
<b>Related applications</b>	BTB
<b>Alarm ID</b>	35
<b>Description</b>	This alarm is activated when shared binary inputs are not received from SHBIN module 4.

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### Wrn SHBIN 5

Alarm Type	Warning (page 196)
Alarmlist message	Wrn SHBIN 5
Alarm evaluated	Only if SHBIN 5 is configured
Related applications	BTB
Alarm ID	216
Description	This alarm is activated when shared binary inputs are not received from SHBIN module 5.

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### Wrn SHBIN 6

Alarm Type	Warning (page 196)
Alarmlist message	Wrn SHBIN 6
Alarm evaluated	Only if SHBIN 6 is configured
Related applications	BTB
Alarm ID	217
Description	This alarm is activated when shared binary inputs are not received from SHBIN module 6.

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### Wrn SHBIN Collision

Alarm Type	Warning (page 196)
Alarmlist message	Wrn SHBIN Collision
Alarm evaluated	Only if at least one of SHBIN 1 to SHBIN 6 modules is configured
Related applications	BTB
Alarm ID	37
Description	This alarm is activated when controller receives shared binary inputs of any SHBIN module from more than just one controller. This alarm has FPS - FIXED PROTECTIONS STATES 1 (PAGE 587)

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### Wrn SNMP TRAP 1 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn SNMP TRAP 1 Fail
Alarm evaluated	Only when <b>SNMP Agent (page 343)</b> = Enabled and <b>SNMP Traps IP Address 1 (page 344)</b> is set.
Related applications	BTB
Alarm ID	823
Description	This alarm is activated if sending of SNMP trap to IP address set by <b>SNMP Traps IP Address 1 (page 344)</b> failed. This alarm has FPS - FIXED PROTECTIONS STATES 4 (PAGE 590).

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### Wrn SNMP TRAP 2 Fail

Alarm Type	Warning (page 196)
Alarmlist message	Wrn SNMP TRAP 2 Fail
Alarm evaluated	Only when <b>SNMP Agent (page 343)</b> = Enabled and <b>SNMP Traps IP Address 2 (page 345)</b> is set.
Related applications	BTB
Alarm ID	824
Description	This alarm is activated if sending of SNMP trap to IP address set by <b>SNMP Traps IP Address 2 (page 345)</b> failed. This alarm has FPS - FIXED PROTECTIONS STATES 4 (PAGE 590).

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### Wrong PLC Configuration

Alarm Type	Warning (page 196)
Alarmlist message	Wrong PLC Configuration
Alarm evaluated	Always
Related applications	BTB
Alarm ID	41
Description	This alarm is activated when the <b>PLC - Programmable Logic Controller (page 154)</b> configuration is invalid. Once the alarm is active the whole PLC does not work. This alarm will be active until the PLC configuration is not fixed and the archive is written to the controller.

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### Alarm Only

### Alarm List Indication

### ALI Bus Right Ph L1 Inverted

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Right Ph L1 Inverted
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	928
Description	This alarm is activated when Bus Right Phase L1 is inverted.

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### ALI Bus Right Ph L2 Inverted

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Right Ph L2 Inverted
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	929
Description	This alarm is activated when Bus Right Phase L2 is inverted.

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### ALI Bus Right Ph L3 Inverted

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Right Ph L3 Inverted
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	930
Description	This alarm is activated when Bus Right Phase L3 is inverted.

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### ALI Bus Right Ph Rotation Opposite

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Right Ph Rotation Opposite
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	847
Description	This alarm is activated when controller detects wrong phase rotation, e.g. <b>Phase Rotation (page 249)</b> is set to Clockwise and actual rotation is Counterclockwise, on the Bus Right side.

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### ALI Bus Left Ph L1 Inverted

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Left Ph L1 Inverted
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	925
Description	This alarm is activated when Bus Left Phase L1 is inverted.

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### ALI Bus Left Ph L2 Inverted

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Left Ph L2 Inverted
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	926
Description	This alarm is activated when Bus Left Phase L2 is inverted.

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### ALI Bus Left Ph L3 Inverted

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Left Ph L3 Inverted
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	927
Description	This alarm is activated when Bus Left Phase L3 is inverted.

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### ALI Bus Left Ph Rotation Opposite

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Bus Left Ph Rotation Opposite
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	158
Description	<p>This alarm is activated when controller detects wrong phase rotation, e.g. <b>Phase Rotation (page 249)</b> is set to Clockwise and actual rotation is Counterclockwise, on the Bus Left side.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).</p>

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### ALI CAN Mode Inconsistency

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI CAN Mode Inconsistency
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	1291
Description	<p>This alarm is active when there is mismatch between setpoint <b>CAN Intercontroller Comm Mode (page 320)</b> and value <b>CAN Intercontroller Comm Mode (page 437)</b>.</p>

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## ALI Redundant CAN Error

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI Redundant CAN Error
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	1290
Description	This alarm is active when there is a mismatch between setpoint <b>CAN Intercontroller Comm Redundancy (page 319)</b> and actual state of ⑦ <b>CAN2B (page 41)</b> .

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## ALI SD Card Not Compatible

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI SD Card Not Compatible
Alarm evaluated	Only when <b>Long Term History (page 322)</b> = Mount or Format
Related applications	BTB
Alarm ID	1610
Description	<p>This alarm is activated when the value <b>SD Card Status (page 438)</b> shows Status: Not Supported.</p> <p>Alarm is active all the time until the card is unmounted, or a compatible card is inserted.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 4 (PAGE 590).</p>

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## ALI SD Card In Slot

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI SD Card In Slot
Alarm evaluated	Only when <b>Long Term History (page 322)</b> = Unmount
Related applications	BTB
Alarm ID	1611
Description	<p>This alarm is activated when <b>SD Card File System (page 321)</b> is set to Unmount but SD Card is detected in the slot.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 4 (PAGE 590).</p>

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## ALI SD Card Full

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI SD Card Full
Alarm evaluated	Only when <b>Long Term History (page 322)</b> = Mount
Related applications	BTB
Alarm ID	1621
Description	This alarm is activated if value <b>SD Card Free Space (page 439)</b> drops below 10 %. This alarm has FPS - FIXED PROTECTIONS STATES 4 (PAGE 590).

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## ALI SD Card Formatting/Mounting

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI SD Card Formating/Mounting
Alarm evaluated	Only when <b>Long Term History (page 322)</b> = Mount or Format
Related applications	BTB
Alarm ID	1638
Description	This alarm is activated when the process of mounting or formatting is active. This alarm has FPS - FIXED PROTECTIONS STATES 1 (PAGE 587).

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## ALI Synchronization Blocked

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	Synchronization Blocked
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	1649
Description	This alarm is activated when multiple synchronization commands are active or when any Synchronization command and <b>BREAKER TRIP (PAGE 538)</b> are active.

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## ALI SW Key Hot Swap Error

Alarm Type	Alarm List Indication (page 196)
Alarmlist message	ALI SW Key Hot Swap Error
Alarm evaluated	Only if <b>Hot Swap Redundancy (page 253)</b> != Disabled
Related applications	BTB



<b>Alarm ID</b>	1461
<b>Description</b>	This alarm is activated when there is an attempt to enable premium feature <b>Hot Swap Redundancy (page 138)</b> without valid <b>SW Key (page 252)</b> .

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### ALI SW Key Modbus Master Error

<b>Alarm Type</b>	<b>Alarm List Indication (page 196)</b>
<b>Alarmlist message</b>	ALI SW Key Modbus Master Error
<b>Alarm evaluated</b>	Always
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1286
<b>Description</b>	This alarm is activated when more than 2 datapoints for <b>Modbus Client (Master) (page 149)</b> are configured without the valid SW Key inserted into the Setpoint <b>SW Key (page 252)</b> .

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### ALI Wrong Power Format

<b>Alarm Type</b>	<b>Alarm List Indication (page 196)</b>
<b>Alarmlist message</b>	ALI Wrong Power Format
<b>Alarm evaluated</b>	All the time
<b>Related applications</b>	BTB
<b>Alarm ID</b>	149
<b>Description</b>	This alarm is activated when there is inconsistency of <b>Power Formats And Units (page 166)</b> on any controller which is connected via <b>CAN2A (page 17)</b> or <b>CAN2B (page 17)</b> .

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## Alarm List + History Indication

### AHI Battery Overvoltage

<b>Alarm Type</b>	<b>Alarm List + History Record Indication (page 196)</b>
<b>Alarmlist message</b>	AHI Battery Overvoltage
<b>Alarm evaluated</b>	All the time
<b>Related applications</b>	BTB
<b>Alarm ID</b>	941
<b>Description</b>	<p>This alarm is activated when <b>Battery Voltage (page 430)</b> is over <b>Battery Overvoltage (page 254)</b> for period longer than <b>Battery Under And Overvoltage Delay (page 255)</b>.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 1 (PAGE 587)</p>

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## AHI Battery Undervoltage

Alarm Type	Alarm List + History Record Indication (page 196)
Alarmlist message	AHI Battery Undervoltage
Alarm evaluated	All the time
Related applications	BTB
Alarm ID	940
Description	<p>This alarm is activated when <b>Battery Voltage (page 430)</b> is bellow <b>Battery Undervoltage (page 254)</b> for period longer than <b>Battery Under And Overvoltage Delay (page 255)</b>.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 1 (PAGE 587)</p>

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### History Record Only

### Hst Bus Left >V L1-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left >V L1-N
Alarm evaluated	Only if Bus Left >V Protection (page 300) != Disabled
Related applications	BTB
Alarm ID	125
Description	<p>This alarm is activated by Bus Left &gt;V Protection (page 300).</p> <p>This alarm is activated when Bus Left Voltage L1-N (page 408) rises over preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left >V L2-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left >V L2-N
Alarm evaluated	Only if Bus Left >V Protection (page 300) != Disabled
Related applications	BTB
Alarm ID	126
Description	<p>This alarm is activated by Bus Left &gt;V Protection (page 300).</p> <p>This alarm is activated when Bus Left Voltage L2-N (page 408) rises above preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left >V L3-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left >V L3-N
Alarm evaluated	Only if Bus Left >V Protection (page 300) != Disabled
Related applications	BTB
Alarm ID	127
Description	<p>This alarm is activated by Bus Left &gt;V Protection (page 300).</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left >V L1-L2

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left >V L1-L2

<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;V Protection (page 300)</b> != Disabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	131
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;V Protection (page 300)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L1-L2 (page 408)</b> rises over preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left >V L2-L3

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left >V L2-L3
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;V Protection (page 300)</b> != Disabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	132
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;V Protection (page 300)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L2-L3 (page 408)</b> rises over preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left >V L3-L1

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left >V L3-L1
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;V Protection (page 300)</b> != Disabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	133
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;V Protection (page 300)</b>.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left >>V L1-N

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left >>V L1-N
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;&gt;V Protection (page 302)</b> != Disabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1080
<b>Description</b>	This alarm is activated by <b>Bus Left &gt;&gt;V Protection (page 302)</b> .

	<p>This alarm is activated when <b>Bus Left Voltage L1-N (page 408)</b> rises over preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>
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### Hst Bus Left >>V L2-N

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left >>V L2-N
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;&gt;V Protection (page 302) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1082
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;&gt;V Protection (page 302)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L2-N (page 408)</b> rises over preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

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### Hst Bus Left >>V L3-N

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;&gt;V Protection (page 302) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1084
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;&gt;V Protection (page 302)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L3-N (page 408)</b> rises over preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

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### Hst Bus Left >>V L1-L2

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left >>V L1-L2
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;&gt;V Protection (page 302) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1086
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;&gt;V Protection (page 302)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L1-L2 (page 408)</b> rises over preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

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### Hst Bus Left >>V L2-L3

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left >>V L2-L3
Alarm evaluated	Only if <b>Bus Left &gt;&gt;V Protection (page 302)</b> != Disabled
Related applications	BTB
Alarm ID	1088
Description	<p>This alarm is activated by <b>Bus Left &gt;&gt;V Protection (page 302)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L2-L3 (page 408)</b> rises over preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left >>V L3-L1

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left >>V L3-L1
Alarm evaluated	Only if <b>Bus Left &gt;&gt;V Protection (page 302)</b> != Disabled
Related applications	BTB
Alarm ID	1090
Description	<p>This alarm is activated by <b>Bus Left &gt;&gt;V Protection (page 302)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L3-L1 (page 409)</b> rises over preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left <V L1-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left <V L1-N
Alarm evaluated	Only if <b>Bus Left &gt;V Protection (page 300)</b> != Disabled
Related applications	BTB
Alarm ID	122
Description	<p>This alarm is activated by <b>Bus Left &lt;V Protection (page 303)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L1-N (page 408)</b> drops below preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left <V L2-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left <V L2-N
Alarm evaluated	Only if Bus Left >V Protection (page 300) != Disabled
Related applications	BTB
Alarm ID	123
Description	<p>This alarm is activated by Bus Left &lt;V Protection (page 303).</p> <p>This alarm is activated when Bus Left Voltage L2-N (page 408) drops below preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left <V L3-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left <V L3-N
Alarm evaluated	Only if Bus Left >V Protection (page 300) != Disabled
Related applications	BTB
Alarm ID	124
Description	<p>This alarm is activated by Bus Left &lt;V Protection (page 303).</p> <p>This alarm is activated when Bus Left Voltage L3-N (page 408) drops below preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left <V L1-L2

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left <V L1-L2
Alarm evaluated	Only if Bus Left >V Protection (page 300) != Disabled
Related applications	BTB
Alarm ID	128
Description	<p>This alarm is activated by Bus Left &lt;V Protection (page 303).</p> <p>This alarm is activated when Bus Left Voltage L1-L2 (page 408) drops below preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

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### Hst Bus Left <V L2-L3

Alarm Type	History Record Only (page 196)
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<b>Alarmlist message</b>	Hst Bus Left <V L2-L3
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;V Protection (page 300)</b> != Disabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	129
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;V Protection (page 303)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L2-L3 (page 408)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

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### Hst Bus Left <V L3-L1

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left <V L3-L1
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;V Protection (page 300)</b> != Disabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	130
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;V Protection (page 303)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L3-L1 (page 409)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

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### Hst Bus Left <<V L1-N

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left <<V L1-N
<b>Alarm evaluated</b>	Only if <b>Bus Left &lt;&lt;V Protection (page 304)</b> != Disabled
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1081
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;&lt;V Protection (page 304)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L1-N (page 408)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

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### Hst Bus Left <<V L2-N

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left <<V L2-N
<b>Alarm evaluated</b>	Only if <b>Bus Left &lt;&lt;V Protection (page 304)</b> != Disabled



<b>Related applications</b>	BTB
<b>Alarm ID</b>	1083
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;&lt;V Protection (page 304)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L2-N (page 408)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

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### Hst Bus Left <<V L3-N

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left <<V L3-N
<b>Alarm evaluated</b>	Only if <b>Bus Left &lt;&lt;V Protection (page 304) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1085
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;&lt;V Protection (page 304)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L3-N (page 408)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

🔍 back to List of alarms level 1

### Hst Bus Left <<V L1-L2

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left <<V L1-L2
<b>Alarm evaluated</b>	Only if <b>Bus Left &lt;&lt;V Protection (page 304) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1087
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;&lt;V Protection (page 304)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L1-L2 (page 408)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

🔍 back to List of alarms level 1

### Hst Bus Left <<V L2-L3

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left <<V L2-L3
<b>Alarm evaluated</b>	Only if <b>Bus Left &lt;&lt;V Protection (page 304) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1089

<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;&lt;V Protection (page 304)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L2-L3 (page 408)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>
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⬅ back to List of alarms level 1

### Hst Bus Left <<V L3-L1

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left <<V L3-L1
<b>Alarm evaluated</b>	Only if <b>Bus Left &lt;&lt;V Protection (page 304) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1091
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &lt;&lt;V Protection (page 304)</b>.</p> <p>This alarm is activated when <b>Bus Left Voltage L3-L1 (page 409)</b> drops below preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

⬅ back to List of alarms level 1

### Hst Bus Left >f

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left >f
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;f Protection (page 309) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	135
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;f Protection (page 309)</b>.</p> <p>This alarm is activated when <b>Bus Left Frequency (page 407)</b>, rises over preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 3 (PAGE 589)</b>.</p>

⬅ back to List of alarms level 1

### Hst Bus Left >>f

<b>Alarm Type</b>	<b>History Record Only (page 196)</b>
<b>Alarmlist message</b>	Hst Bus Left >>f
<b>Alarm evaluated</b>	Only if <b>Bus Left &gt;&gt;f Protection (page 310) != Disabled</b>
<b>Related applications</b>	BTB
<b>Alarm ID</b>	1092
<b>Description</b>	<p>This alarm is activated by <b>Bus Left &gt;&gt;f Protection (page 310)</b>.</p> <p>This alarm is activated when <b>Bus Left Frequency (page 407)</b>, rises over preset value.</p>

	This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).
--	---

⬅ back to List of alarms level 1

### Hst Bus Left <f

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left <f
Alarm evaluated	Only if Bus Left <f Protection (page 311) != Disabled
Related applications	BTB
Alarm ID	134
Description	<p>This alarm is activated by Bus Left &gt;f Protection (page 309).</p> <p>This alarm is activated when Bus Left Frequency (page 407), drops below preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).</p>

⬅ back to List of alarms level 1

### Hst Bus Left <<f

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left <<f
Alarm evaluated	Only if Bus Left <<f Protection (page 312) != Disabled
Related applications	BTB
Alarm ID	1093
Description	<p>This alarm is activated by Bus Left &lt;&lt;f Protection (page 312).</p> <p>This alarm is activated when Bus Left Frequency (page 407), drops below preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).</p>

⬅ back to List of alarms level 1

### Hst Bus Left V Unbalance Ph-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Left V Unbalance Ph-N
Alarm evaluated	Only if Bus Left V Unbalance Protection (page 305) != Disabled
Related applications	BTB
Alarm ID	593
Description	<p>This alarm is activated by Bus Left V Unbalance Protection (page 305)</p> <p>This alarm is activated when relative difference between Bus Left Voltage L1-N (page 408), Bus Left Voltage L2-N (page 408) or Bus Left Voltage L3-N (page 408) rises over preset value.</p> <p>This alarm has FPS - FIXED PROTECTIONS STATES 2 (PAGE 588).</p>

⬅ back to List of alarms level 1

## Hst Bus Left V Unbalance Ph-Ph

Alarm Type	History Record Only (page 196)
Alarmlist message	HstBus Left V Unbalance Ph-Ph
Alarm evaluated	Only if <b>Bus Left V Unbalance Protection (page 305)</b> != Disabled
Related applications	BTB
Alarm ID	592
Description	<p>This alarm is activated by <b>Bus Left V Unbalance Protection (page 305)</b></p> <p>This alarm is activated when relative difference between <b>Bus Left Voltage L1-L2 (page 408)</b>, <b>Bus Left Voltage L2-L3 (page 408)</b> or <b>Bus Left Voltage L3-L1 (page 409)</b> rises over preset value.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 2 (PAGE 588)</b>.</p>

◀ back to List of alarms level 1

## Hst Bus Right >V L1-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right >V L1-N
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	98
Description	<p>This alarm is activated by <b>Bus Right &gt;V Protection (page 306)</b>.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 3 (PAGE 589)</b>.</p>

◀ back to List of alarms level 1

## Hst Bus Right >V L2-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right >V L2-N
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	99
Description	<p>This alarm is activated by <b>Bus Right &gt;V Protection (page 306)</b>.</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 3 (PAGE 589)</b>.</p>

◀ back to List of alarms level 1

## Hst Bus Right >V L3-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right >V L3-N
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	100
Description	<p>This alarm is activated by <b>Bus Right &gt;V Protection (page 306)</b>.</p>

	This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).
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⬅ back to List of alarms level 1

### Hst Bus Right >V L1-L2

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right >V L1-L2
Alarm evaluated	Only if Bus Right >V Protection (page 306) != Disabled
Related applications	BTB
Alarm ID	107
Description	This alarm is activated by Bus Right >V Protection (page 306). This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right >V L2-L3

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right >V L2-L3
Alarm evaluated	Only if Bus Right >V Protection (page 306) != Disabled
Related applications	BTB
Alarm ID	108
Description	This alarm is activated by Bus Right >V Protection (page 306). This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right >V L3-L1

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right >V L3-L1
Alarm evaluated	Only if Bus Right >V Protection (page 306) != Disabled
Related applications	BTB
Alarm ID	109
Description	This alarm is activated by Bus Right >V Protection (page 306). This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right <V L1-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right <V L1-N
Alarm evaluated	Only if Bus Right >V Protection (page 306) != Disabled
Related applications	BTB
Alarm ID	95
Description	This alarm is activated by Bus Right >V Protection (page 306). This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right <V L2-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right <V L2-N
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	96
Description	This alarm is activated by <b>Bus Right &gt;V Protection (page 306)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right <V L3-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right <V L3-N
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	97
Description	This alarm is activated by <b>Bus Right &lt;V Protection (page 307)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right <V L1-L2

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right <V L1-L2
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	104
Description	This alarm is activated by <b>Bus Right &lt;V Protection (page 307)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right <V L2-L3

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right <V L2-L3
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	105
Description	This alarm is activated by <b>Bus Right &lt;V Protection (page 307)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

### Hst Bus Right <V L3-L1

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right <V L3-L1
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	106
Description	This alarm is activated by <b>Bus Right &lt;V Protection (page 307)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬆ back to List of alarms level 1

### Hst Bus Right >f

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right >f
Alarm evaluated	Only if <b>Bus Right &gt;f Protection (page 313)</b> != Disabled
Related applications	BTB
Alarm ID	121
Description	This alarm is activated by <b>Bus Right &gt;f Protection (page 313)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬆ back to List of alarms level 1

### Hst Bus Right <f

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right <f
Alarm evaluated	Only if <b>Bus Right &gt;f Protection (page 313)</b> != Disabled
Related applications	BTB
Alarm ID	120
Description	This alarm is activated by <b>Bus Right &lt;f Protection (page 314)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬆ back to List of alarms level 1

### Hst Bus Right V Unbalance Ph-N

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right V Unbalance Ph-N
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	589
Description	This alarm is activated by <b>Bus Right V Unbalance Protection (page 307)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬆ back to List of alarms level 1

## Hst Bus Right V Unbalance Ph-Ph

Alarm Type	History Record Only (page 196)
Alarmlist message	Hst Bus Right V Unbalance Ph-Ph
Alarm evaluated	Only if <b>Bus Right &gt;V Protection (page 306)</b> != Disabled
Related applications	BTB
Alarm ID	588
Description	This alarm is activated by <b>Bus Right V Unbalance Protection (page 307)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

⬅ back to List of alarms level 1

## Bus Meas Error

Alarm Type	Protection types (page 196)
Alarmlist message	Bus Meas Error
Alarm evaluated	<b>Bus Meas Error (page 315)</b> != Disabled
Related applications	BTB
Alarm ID	143
Description	<p>This protection is activated in case that voltage mismatch on Bus side is detected for longer than 20 seconds. The mismatch is detected according to the conditions below:</p> <ul style="list-style-type: none"> <li>➤ Own BTB was closed and LBO <b>Bus Left Healthy (page 562)</b> is active → mismatch detected on Bus Left</li> <li>➤ Own BTB was closed and LBO <b>Bus Right Healthy (page 562)</b> is active → mismatch detected on Bus Right</li> <li>➤ Any other controller in Group Link L closed BTB → mismatch detected on Bus Left</li> <li>➤ Any other controller in Group Link R closed BTB → mismatch detected on Bus Right</li> <li>➤ BTB connected another Control Group with BTB Feedback or controller with closed BTB</li> </ul> <p>This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).</p>

⬅ back to List of alarms level 1

## Hst BTB Fail

Alarm Type	Warning (page 196)
Alarmlist message	Hst BTB Fail
Alarm evaluated	Only if <b>BTB Control Mode (page 270)</b> = Internal
Related applications	BTB
Alarm ID	90
Description	This alarm is activated when there is a problem with position of the circuit breaker.



- > LBI BTB FEEDBACK (PAGE 539) does not match expected position given by LBO BTB CLOSE/OPEN (PAGE 574).
- > There is a mismatch between LBI BTB FEEDBACK (PAGE 539) and BTB FEEDBACK NEGATIVE (PAGE 540).

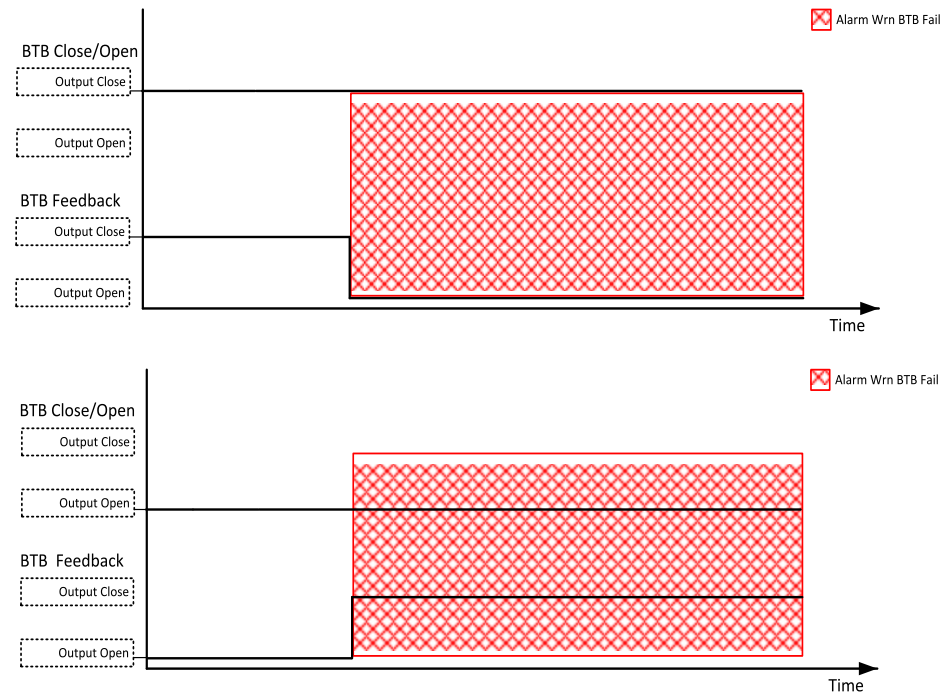


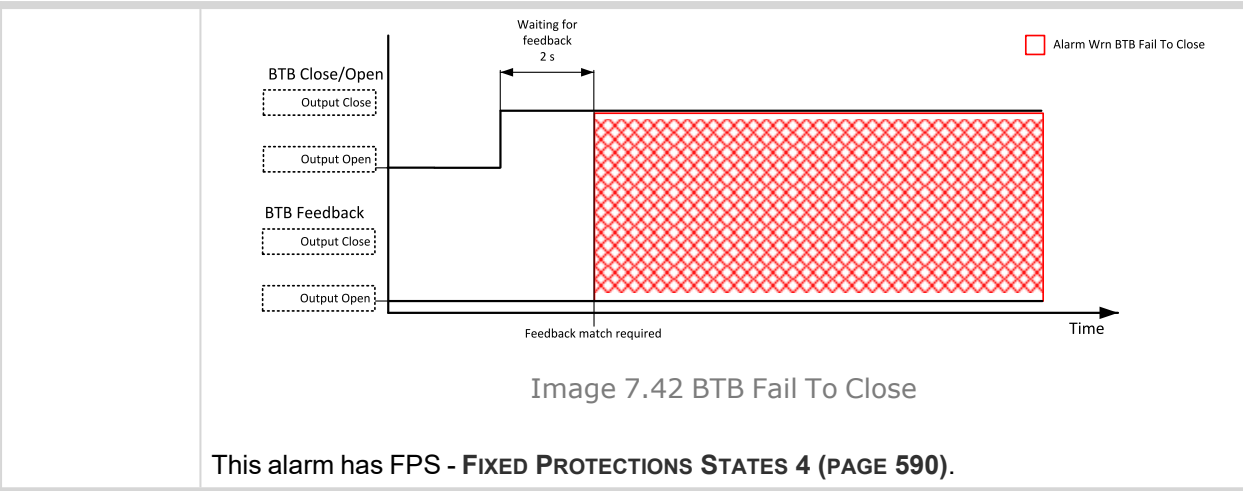
Image 7.41 BTB Fail

This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

🔍 back to List of alarms level 1

### Hst BTB Fail To Close

Alarm Type	Warning (page 196)
Alarmlist message	Hst BTB Fail To Close
Alarm evaluated	Only if BTB Control Mode (page 270) = Internal
Related applications	BTB
Alarm ID	1553
Description	<p>This alarm is activated when there is a problem with circuit breaker position while closing.</p> <ul style="list-style-type: none"> <li>&gt; LBO BTB CLOSE/OPEN (PAGE 574) closed but LBI BTB FEEDBACK (PAGE 539) did not closed in 2 seconds.</li> </ul>



🔍 back to List of alarms level 1

### Hst BTB Fail To Open

Alarm Type	Warning (page 196)
Alarmlist message	Hst BTB Fail To Open
Alarm evaluated	Only if <b>BTB Control Mode (page 270) = Internal</b>
Related applications	BTB
Alarm ID	1552
Description	<p>This alarm is activated when there is a problem with circuit breaker position while opening.</p> <p>➤ <b>LBO BTB CLOSE/OPEN (PAGE 574)</b> opened but <b>LBI BTB FEEDBACK (PAGE 539)</b> did not opened in 2 seconds.</p> <p>Image 7.43 BTB Fail To Open</p> <p>This alarm has FPS - <b>FIXED PROTECTIONS STATES 4 (PAGE 590).</b></p>

🔍 back to List of alarms level 1

### Hst Synchronization Fail

Alarm Type	Warning (page 196)
Alarmlist message	Hst Reverse Synchro Fail
Alarm evaluated	Only if <b>LBO SYNCHRONIZATION (PAGE 578)</b> is closed

<b>Related applications</b>	BTB
<b>Alarm ID</b>	93
<b>Description</b>	This alarm is activated when Reverse Synchronization fails. Reverse Synchronization is activated when synchronization is done over BTB breaker. This alarm has FPS - <b>FIXED PROTECTIONS STATES 3 (PAGE 589)</b> .

⬆ back to List of alarms level 1

### Hst Synchronization Fail

<b>Alarm Type</b>	History Record Only (page 196)
<b>Alarmlist message</b>	Hst Synchronization Fail
<b>Alarm evaluated</b>	During synchronization
<b>Related applications</b>	BTB
<b>Alarm ID</b>	94
<b>Description</b>	This alarm is activated if the synchronization fails, e.g. <b>Synchronization Timeout (page 264)</b> elapses. This alarm has FPS - <b>FIXED PROTECTIONS STATES 3 (PAGE 589)</b> .

⬆ back to List of alarms level 2

## 8.2.3 Alarms level 2

### What alarms level 2 are:

The level 2 level alarm indicates that a critical level of the respective value or parameter has been reached.

# List of alarms level 2

- Bus Protection + FltRes .....694
  - BOR Current Unbalance ..694
  - IDMT Overload .....694
  - BOR IDMT Bus Left >A ...694
  - BOR Short Circuit .....694

 **back to Alarms**

## Bus Protection + FltRes

### BOR Current Unbalance

Alarm Type	Protection types (page 196)
Alarmlist message	BOR Current Unbalance
Alarm evaluated	Only if <b>Current Unbalance Protection (page 300)</b> != Disabled
Related applications	BTB
Alarm ID	1064
Description	This alarm is activated by <b>Current Unbalance Protection (page 300)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

◀ back to List of alarms level 2

### IDMT Overload

Alarm Type	Protection types (page 196)
Alarmlist message	IDMT Overload
Alarm evaluated	Only if <b>IDMT Overload Protection (page 296)</b> != Disabled
Related applications	BTB
Alarm ID	147
Description	This alarm is activated by <b>IDMT Overload Protection (page 296)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

◀ back to List of alarms level 2

### BOR IDMT Bus Left >A

Alarm Type	Protection types (page 196)
Alarmlist message	BOR IDMT Bus Left >A
Alarm evaluated	Only if <b>IDMT Bus Left &gt;A Protection (page 298)</b> != Disabled
Related applications	BTB
Alarm ID	1063
Description	This alarm is activated by <b>IDMT Bus Left &gt;A Protection (page 298)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

◀ back to List of alarms level 2

### BOR Short Circuit

Alarm Type	Protection types (page 196)
Alarmlist message	BOR Short Circuit
Alarm evaluated	Only if <b>Short Circuit Protection (page 298)</b> != Disabled
Related applications	BTB
Alarm ID	1066
Description	This alarm is activated by <b>Short Circuit Protection (page 298)</b> . This alarm has FPS - FIXED PROTECTIONS STATES 3 (PAGE 589).

◀ back to List of alarms level 2

## 8.3 Electronic Control Unit (ECU)

The electronic control unit is used to monitoring and regulating of the controlled system such as engines.

There are generally four types of data communicated between the controller and ECU.

- Values read from the ECU (e.g. Engine coolant temperature, Lube oil pressure)
- Values/parameters written to ECU (e.g. Speed control, Frequency select)
- Commands written to ECU (e.g. Start/Stop, Fault reset)
- Fault codes

In order to use the ECU you need to firstly import ESL (ECU specification list) file which contains list of all supported ECUs for the controller. The ESL file also defines communication/diagnostic protocol used in the ECU. The ECU list package can be downloaded from ComAp website ([www.comap-control.com](http://www.comap-control.com)) and imported into a PC configuration tool in the same way as a standard controller firmware package. It can also be a part of an installation package, in this case it is not necessary to import it separately.

To configure the ECU

- Open IntelliConfig (PC configuration tool)
- Connect and login the controller
- Open the controller configuration window (Control > Controller Configuration)
- Select Modules and Click on + Add New Module in ECU section
- Choose the ECU list (IntelliConfig or MODBUS) and ECU module
- Click on Add Module on the right side
- Confirm by OK and Restart

There are several possibilities to connect CAN bus interface between ECU and ComAp controller. Refer to ComAp [Electronic Engines Support manual](#).

## 8.4 Modules

### 8.4.1 CAN modules

Supported combinations of modules .....	695
Module's protections .....	696
Theory of binary inputs and outputs .....	697
Extension modules .....	701

### Supported combinations of modules

The maximal number of CAN modules is limited by the number of the controller's generic modules. Once the physical module is configured, it allocates necessary generic modules. So, it is possible to configure as many CAN modules as many generic modules are available. The maximum number of CAN modules is also limited by the number of addresses (indexes) that can be configured for each type of the generic module. CAN modules and generic modules share indexes.

**Example:** If you configure Inteli IO8/8 module which is using 1x BI, BO, and AO generic module with index (address) 1, any other module using same generic modules will not be able to be configured with index (address) 1 (IGS-PTM, Inteli AIO9/1).

Each generic module has 8 "terminals" (inputs/outputs) and the InteliMains 1010 BTB SC has the following amount of the generic modules:

- > AI generic: 10
- > AO generic: 8
- > BI generic: 16
- > BO generic: 12
- > AI32 generic: 2

In the table below, you can see how many generic modules are necessary for each CAN module and how many indexes are available for each type of CAN module in the IntelliMains 1010 BTB SC.

CAN Module	Max number of indexes	AI generic	AO generic	BI generic	BO generic
Inteli AIN8	10	1	0	0	0
Inteli IO 8/8	12	0	1	1	1
Inteli IO 16/0	8	0	1	2	0
IGL-RA15	4	0	0	0	2
IGS-PTM	4	1	1	1	1
Inteli AIO9/1	5	2	1	0	0
Inteli AIN8TC	10	1	0	0	0
I-AOUT8	4	0	1	0	0
IS-AIN8	10	1	0	0	0
IS-AIN8TC	10	1	0	0	0
IS-BIN16/8	7	0	0	2	1

**Note:** When configuring modules do not forget to let first 4 indexes free for modules which can't use high addresses such as IGL-RA15, IGS-PTM, AIO9/1, I-AOUT8.

**Note:** Module Inteli IO8/8 has available AOUT only if it is configured with index number below 9 and Inteli AIO9/1 has available AOUT only if it is configured with index number below 5.

**Note:** Module Inteli IO8/8 with older FW than 1.3.1.2 has available AOUT only if it is configured with index number below 5.

## Module's protections

Each configured CAN module can has it's own protection and protection state. For setup: connect the controller via IntelliConfig → Control → Controller Configuration → Modules → Module Settings.

### > Protection Upon Module Failure

- >> None - No alarm will be activated if module fails. It is not possible to use the User Protection State.
- >> Warning - Wrn alarm is activated if module fails.

**Note:** The name and color of the alarm is automatically generated according to the options **Protection Upon Module Failure**, **Module Name**, and **Module Index**. The module name is automatically generated or renamed by the user.

- > **Protection State** - If you check the check box the new User Protection State will be displayed in the User Protection States group in the Values after the configuration is imported to the CU.

**Note:** The name of the User Protection State is automatically generated according to the options **Protection Upon Module Failure**, **Module Name**, and **Module Index**. The module name is automatically generated or renamed by the user.

**Example:** Wrn Intel AIN8 10 = Warning upon module failure of the Intel AIN8 module with index 10.

## Theory of binary inputs and outputs

Binary inputs .....	697
Binary outputs .....	699

Type of the binary inputs/outputs of some configured modules using BINs or BOUTs can be changed via Intel Config. For setup: connect the controller via IntelConfig → Control → Controller Configuration → Modules → Module Settings → **Binary Inputs Type / Binary Outputs Type**.

See the following chapters for more details.

### Binary inputs

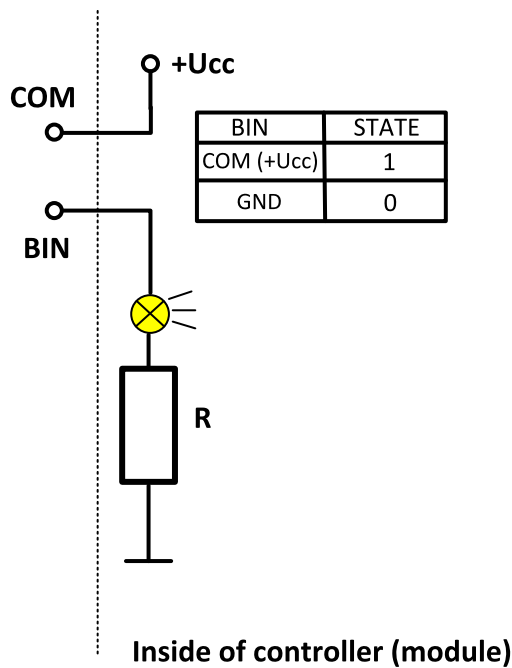
#### Pull Down

The pull-down logic is used when it is required to ensure that the logical value of inputs settles at the expected logical level whenever external devices are turned off, or they are at a high impedance state. It ensures that input is at a defined low logic level when the connection with external devices is lost. In the controller (module), the pull-down resistor is used to connect the input to the -BAT (0 V), so the log 0 (open state) is represented by 0 V. This connection is used as prevention against fluctuations and an undefined state at the input.

- The principle of internal connection is shown in the picture below.
- The bulb represents internal state of binary input.
- In case the "COM" (+Ucc) is not connected to the input terminal "BIN" then the internal state is logical 0.
- In case the "COM" (+Ucc) is connected to the input terminal "BIN" then the internal state is logical 1.



### Binary input : Pull Down



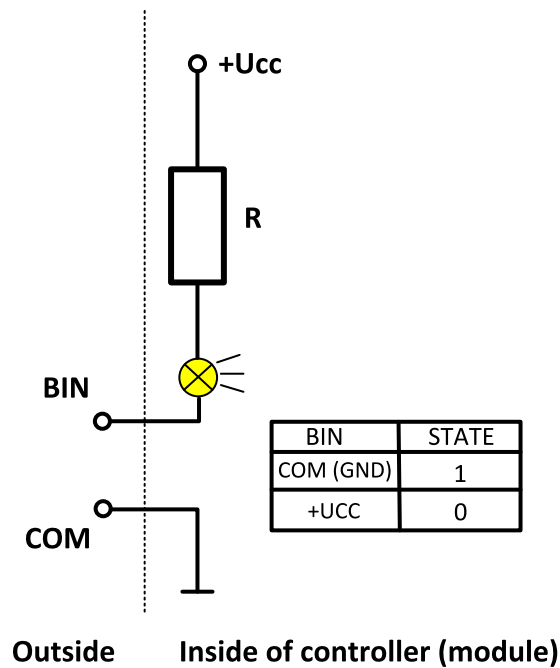
**Note:** There is not any COM terminal on the controller, the wire is directly connected to the input terminal "BIN", so if input signal is log 1 the +Ucc is directly connected to the "BIN".

### Pull Up

The pull-up logic is used when it is required to establish an additional loop over the critical components while making sure that the voltage is well-defined even when the switch is open. It ensures that input and wiring is at a defined high logical level in the absence of an input signal. In the controller (module), the pull-up resistor is used to connect the input to the +BAT (+Ucc), so the log 0 (open state) is represented by +Ucc. This connection is used as prevention against fluctuations and an undefined state at the input.

- The principle of internal connection is shown in the picture below.
- The bulb represents internal state of binary input.
- In case the input terminal "BIN" (+Ucc) is not connected to the "COM" (GND) then the internal state is logical 0.
- In case the input terminal "BIN" (+Ucc) is connected to the "COM" (GND) then the internal state is logical 1.

### Binary input : Pull Up



**Note:** There is not any COM terminal on the controller, the wire is directly connected to the input terminal "BIN", so if input signal is log 1 the GND is directly connected to the "BIN".

🔍 back to Theory of binary inputs and outputs

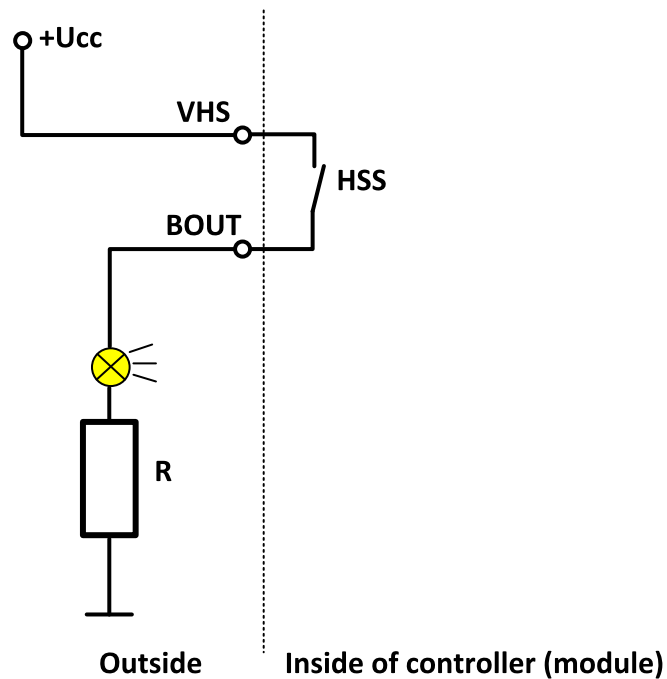
### Binary outputs

#### High side switch - HSS

The high side logic is used when load is permanently connected to the ground (GND) and when it is required to ensure that the logical value of outputs settles at the expected logical level whenever the controller (module) is turned off, or at a high impedance state. It ensures that external devices will not be randomly activated when the connection is lost.

- The principle of internal connection is shown in the picture below.
- The bulb represents internal state of binary output.
- By activating of binary output terminal (BOUT), the switch is closed, which causes connection of the load to the VHS (Voltage High side) and +Ucc, so the external state of the load is logical 1.

### Binary output: High side switch HSS



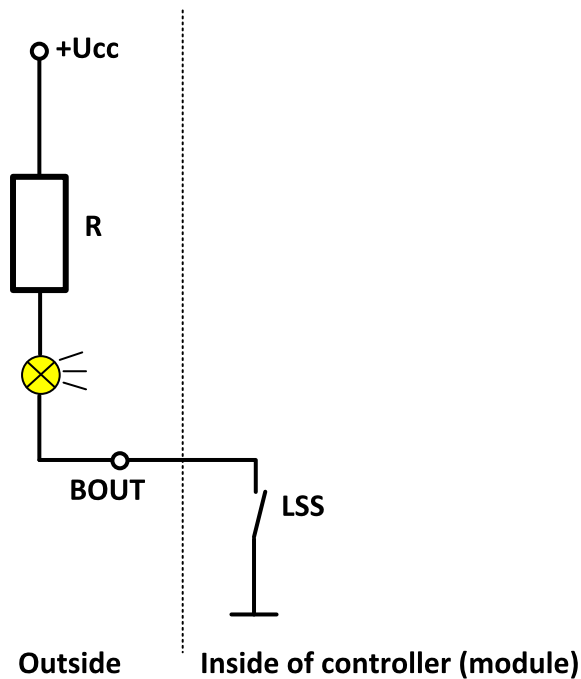
### Low side switch - LSS

The low side logic is used when load is permanently connected to the voltage (+Ucc). In case module will be turned off or the connection will be lost the external devices will be activated. It can be used as inverse logic for the detection of the lost connection.

- The principle of internal connection is shown in the picture below.
- The bulb represents internal state of binary output.
- By activating of binary output terminal (BOUT), the switch is closed, which causes connection of the load to the ground (GND), so the external state of the load is logical 1.

**Note:** Because of safety reasons, the Low side switch is not supported in the IntelliMains 1010 BTB SC controller. In case you need BOUT to BIN logical communication between controllers using Pull Up BIN logic, you must use an external module with LSS BOUT logic or any converter which converts the HSS controller's BOUT to LSS. The solution above is not recommended! Try to reconsider your options and use the Pull Down BIN logic.

### Binary output: Low side switch LSS



🔍 back to Theory of binary inputs and outputs

## Extension modules

Inteli AIN8 .....	701
Inteli IO8/8 .....	707
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IGS-PTM .....	719
Inteli AIO9/1 .....	724
Inteli AIN8TC .....	729
I-AOUT8 .....	733
IS-AIN8 .....	737
IS-AIN8TC .....	746
IS-BIN16/8 .....	751

### Inteli AIN8

Inteli AIN8 module is extension module equipped with analog inputs and Impulse/RPM input. The module is connected to controller by **CAN1A (page 17)** bus. It is possible to connect up to 10 Inteli AIN8 external units to one controller.

The detection of communication speed is indicated by fast flashing of status LED. Once the speed is detected the module remains set for the speed even when the communication is lost. Renewal of communication speed detection is done by reset of the module.



Image 7.44 Intel AIN8

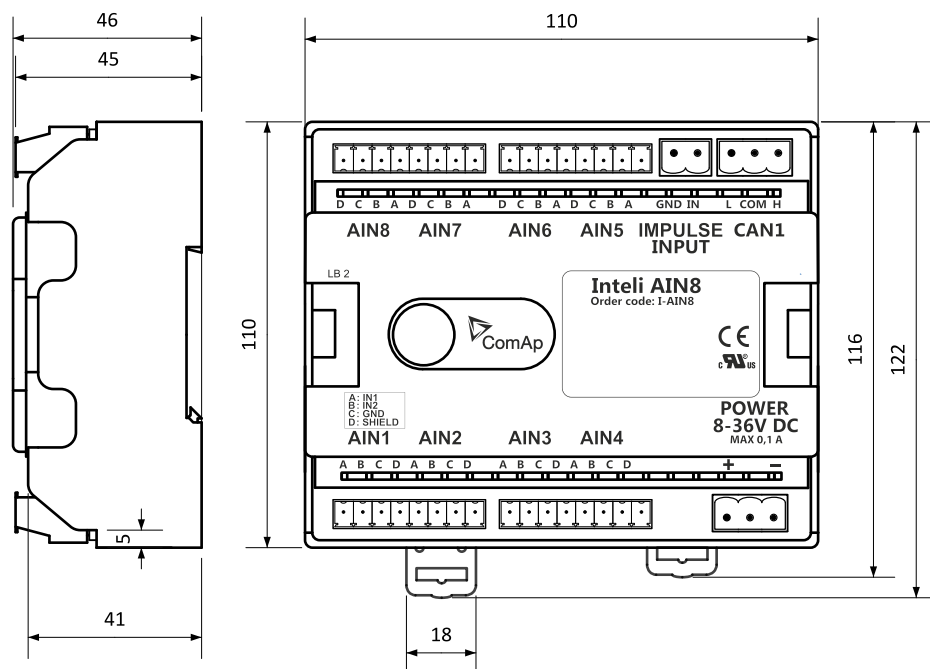
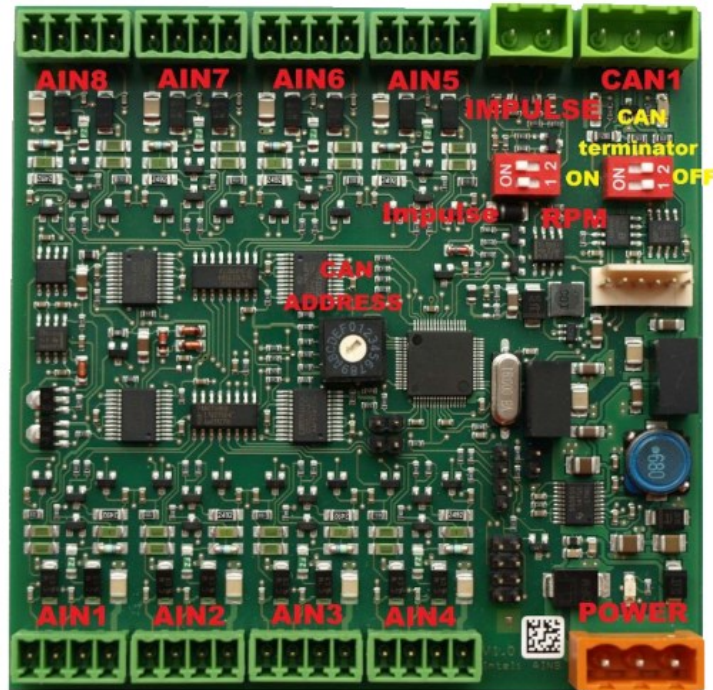


Image 7.45 Intel AIN8 dimensions

**Note:** All dimensions are in mm.

## Terminals



Analog input	8 analog Inputs
CAN1	<b>CAN1A</b> (page 17) line
Power	Power supply
CAN LED Tx, Rx	Indication transmitted or received data
Status LED	LED indication of correct function
CAN terminator	Terminating CAN resistor (active in position "ON" - switch both switches)

**IMPORTANT: Impulse input is not supported by the controller.**

## Analog inputs

- > 8 channels
- > can be configured as:
  - >> resistor three wire input
  - >> current input
  - >> voltage input

All inputs can be configured to any logical function or protection.

## Supported sensors

Sensors				
PT100 [°C] (fix)	PT100 [°F] (fix)	+ -1V	4-20mA passive	0-250 ohm
PT1000 [°C] (fix)	PT1000 [°F] (fix)	0-2.4V	4-20mA active	0-2400 ohm
NI100 [°C] (fix)	NI100 [°F] (fix)	0-5V	0-20mA passive	0-10k ohm
NI1000 [°C] (fix)	NI1000 [°F] (fix)	0-10V	+ -20mA active	

**Note:** It is also possible to use User Curves as sensor.

## CAN address

DIP switch determinates CAN address for analog inputs.

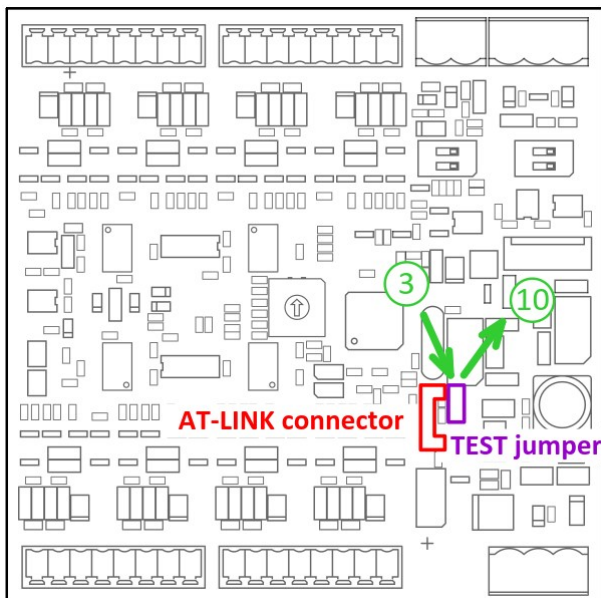


**Note:** In case of setting the CAN address to zero, the appropriate group of signals is deactivated.

## Programming firmware

Firmware upgrade process:

1. Disconnect all terminals from the unit.
2. Separate the top cover of module
3. Put the TEST jumper on a pins
4. Connect the unit with PC via RS232-null modem cable and AT-Link conv



5. Connect power supply of the module (status LED lights continuously)
6. Launch FlashPgr.exe PC software (version 4.2 or higher)
7. In FlashPrg program choose card Intel AIN8 and load FW for the module
8. Set the proper COM port (connected with the unit) and press Start button
9. Wait till process is done (If the process doesn't start – after 60 second the "Timeout" will be evaluated. In this case please check:
  - > You have proper connection with the unit
  - > COM port selection is correct

➤ Module has power supply, (no CAN bus connection, status LED lights continuously)

10. After successful programming disconnect AT-Link conv , remove TEST jumper and disconnect power supply
11. Connect power supply again (status LED should blinking)
12. Module FW is upgraded

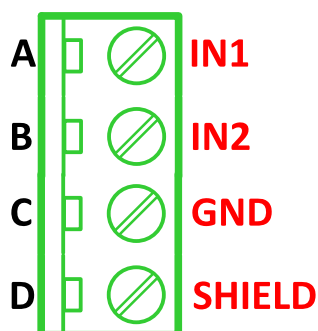
### LED indication

LED status	Description
Dark	Fw in module does not work correctly.
Flashing	Module does not communicate with controller (in case non-zero CAN address).
Lights	Power supply is in the range and the communication between Inteli AIN8 and controller works properly. Or power supply is in range and zero CAN address is set. (in case zero CAN address module doesn't communicate with the controller).

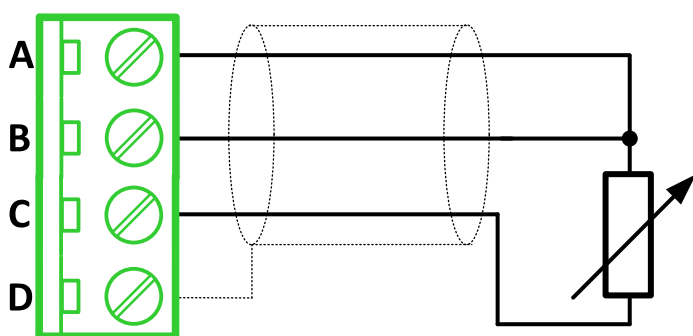
### Wiring

The following diagrams show the correct connection of sensors.

#### Terminator



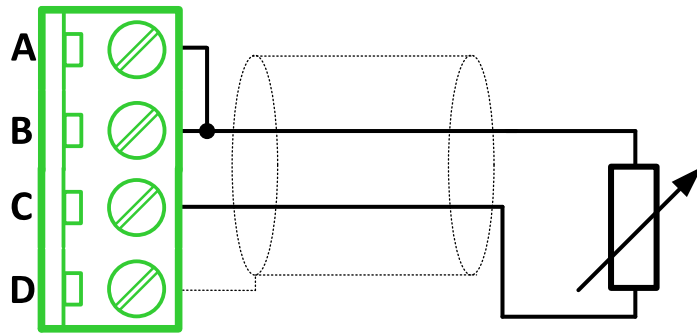
#### Resistance sensor - 3 wires



**Note:** Ranges: Pt100, Pt1000, Ni100, Ni1000, 0 – 2400  $\Omega$ , 0 – 10 k $\Omega$

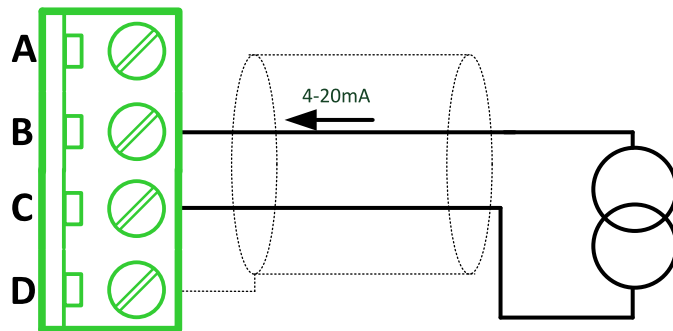


### Resistance sensor - 2 wires



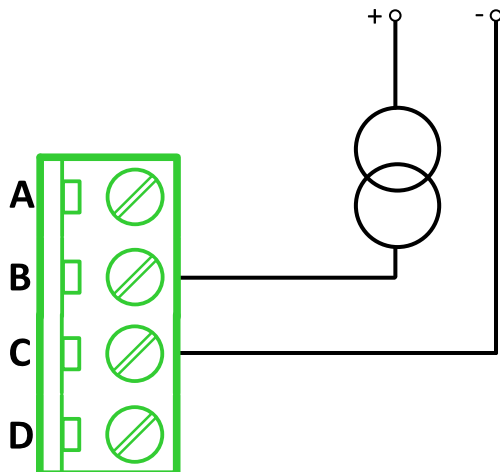
**Note:** Ranges: Pt100, Pt1000, Ni100, Ni1000, 0 – 2400  $\Omega$ , 0 – 10 k $\Omega$

### Current sensor - active



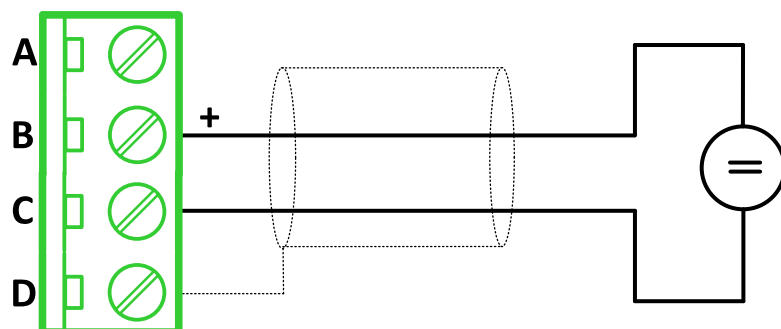
**Note:** Ranges:  $\pm 20$  mA, 4 – 20 mA

### Current sensor - passive



**Note:** Ranges: 0 – 20 mA, 4 – 20 mA

## Voltage sensor



**Note:** Ranges:  $\pm 1\text{ V}$ ,  $0 - 2,5\text{ V}$ ,  $0 - 5\text{ V}$ ,  $0 - 10\text{ V}$

## Technical data

### General data

Power supply	8 to 36 V DC
Current consumption	35 mA at 24 V ÷ 100 mA at 8 V
Interface to controller	<b>CAN1A (page 17)</b>
Protection	IP20
Storage temperature	- 40 °C to + 80 °C
Operating temperature	- 30 °C to + 70 °C
Dimensions (WxHxD)	110x110x46 mm (4,3"x4,3"x1,8")
Weight	221,5 grams

### Analog inputs

Number of channels	8
Voltage	Range 0-10 V Accuracy: $\pm 0,25\%$ of actual value + $\pm 25\text{ mV}$
Current	Range: $\pm 20\text{ mA}$ Accuracy: $\pm 0,25\%$ of actual value + $\pm 50\text{ }\mu\text{A}$
Resistive	Range: 0- 10 k $\Omega$ Accuracy: $\pm 0,5\%$ of actual value + $\pm 2\text{ }\Omega$

🔍 back to Extension modules

## Intel® IO8/8

Intel® IO8/8 module is an extension module equipped with binary inputs, binary outputs and analog outputs. The module is connected to controller by **CAN1A (page 17)** bus.

Intel® IO8/8 is the name of the module, but it is possible to configure the module (by internal switch) to two configurations:

- Intel® IO8/8 - 8 binary inputs, 8 binary outputs and 2 analog outputs
- Intel® IO16/0 - 16 binary inputs, 0 binary outputs and 2 analog outputs

It is possible to connect up to 12 Intel® IO8/8 or 8 Intel® IO 16/0 external units to one controller.

The detection of communication speed is indicated by fast flashing of status LED. Once the speed is detected the module remains set for the speed even when the communication is lost. Renewal of communication speed detection is done by reset of the module.



Image 7.46 IntelI IO8/8

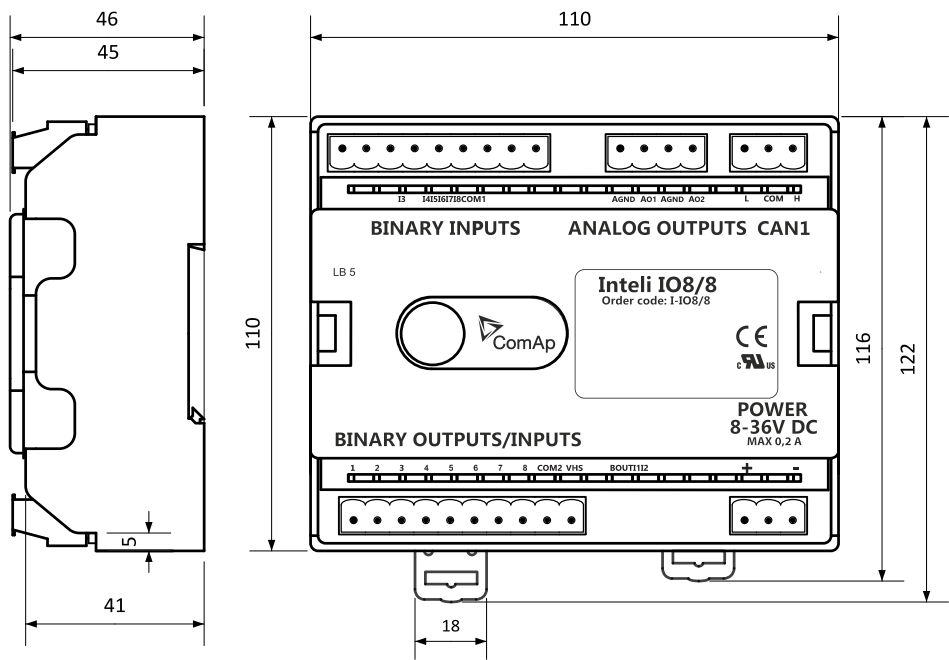
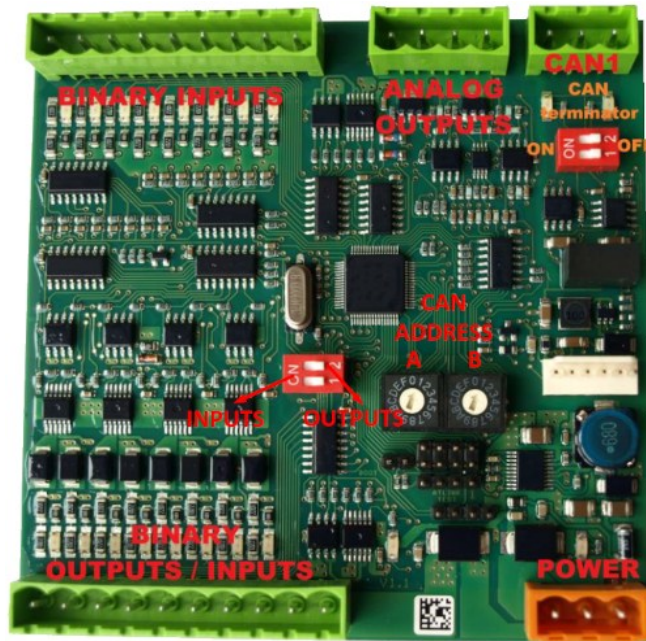


Image 7.47 IntelI IO8/8 dimensions

**Note:** All dimensions are in mm.

## Terminals



Binary inputs	8 binary inputs
Binary outputs	8 binary outputs (8 binary inputs)
Analog outputs	2 analog outputs
CAN1	<b>CAN1A (page 17)</b> line
Power	Power supply
Binary inputs LEDs	8 LEDs for binary input indication
Binary outputs LEDs	8 LEDs for binary output indication
CAN LED	Indication transmitted or received data
Status	LED indication of correct function
CAN terminator	Terminating CAN resistor (active in position "ON" - switch both switches)

## Inputs and outputs

### Binary inputs

- 8 channels
- can be configured as:
  - pull up
  - pull down

All 8 inputs are configured to one type together.

All inputs can be configured to any logical function or protection.

### Binary outputs

- 8 channels
- can be configured as:
  - High side switch
  - Low side switch

Always all 8 inputs are configured to one type (HSS/LSS) together. All 8 outputs can be modified to inputs by switch on the PCB ( Intel IO8/8 to Intel IO16/0).

### Analog outputs

- 2 channels
- can be configured as:
  - voltage 0-10V
  - current 0-20mA
  - PWM (level 5V, with adjustable frequency from 200Hz to 2400Hz, with step 1Hz)

All inputs/outputs can be configured to any logical function or protection.

### Output state check

Output state check function evaluates in real time the state of binary outputs and adjusted (required) state. In case of failure (different state of required state and real state) history record and alarm are issued (type of the alarm is set by "Protection upon module failure" - (No protection / Warning)).

This function is designed for short-circuit or other failure, which causes change of set state of binary output.

### CAN address

In Intel IO8/8 mode CAN address for binary inputs is determined by DIP switch A, CAN address for binary output and analog outputs is determined by DIP switch B.

In Intel IO16/0 mode CAN address for binary inputs is determined by DIP switch A, first group of 8 input has address A, second group of 8 inputs has address A+1. CAN address of analog outputs is set by DIP switch B.



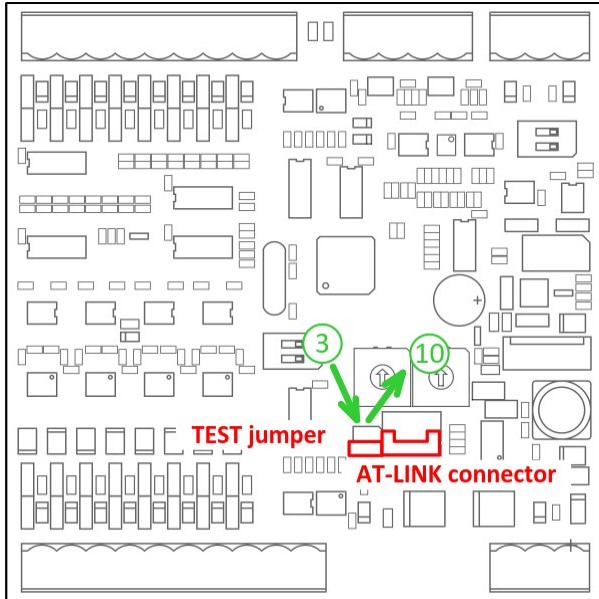
**Note:** In case of setting the CAN address to zero, the appropriate group of signals is deactivated.

### Programming firmware

Firmware upgrade process:

1. Disconnect all terminals from the unit.
2. Separate the top cover of module
3. Put the TEST jumper on a pins

4. Connect the unit with PC via RS232-null modem cable and AT-Link conv



5. Connect power supply of the module (status LED lights continuously)
6. Launch FlashPgr.exe PC software (version 4.2 or higher)
7. In FlashPrg program choose card Inteli IO8/8 and load FW for the module
8. Set the proper COM port (connected with the unit) and press Start button
9. Wait till process is done (If the process doesn't start – after 60 second the "Timeout" will be evaluated. In this case please check:
  - You have proper connection with the unit
  - COM port selection is correct
  - Module has power supply, (no CAN bus connection, status LED lights continuously)
10. After successful programming disconnect AT-Link conv , remove TEST jumper and disconnect power supply
11. Connect power supply again (status LED should blinking)
12. Module FW is upgraded

### LED indication

#### Binary input

Each binary input has LED which indicates input signal. LED is shining when input signal is set, and LED is dark while input signal has other state.

#### Binary output

Each binary output has LED which indicates output signal. Binary output LED is shining when binary output is set. When this LED is shining, then module is configured as 8 binary inputs and 8 binary outputs. When this LED is dark, then the module is configured as 16 binary inputs.

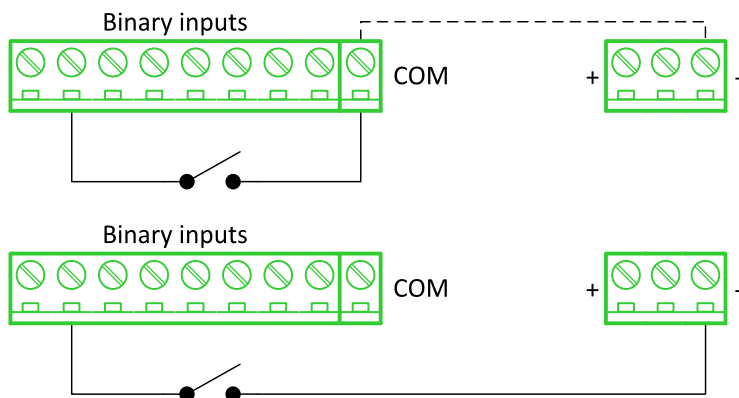
#### LED at power connector - status LED

LED status	Description
Dark	Fw in module does not work correctly.
Flashing	Module does not communicate with controller (in case non-zero CAN address).
Lights	Power supply is in the range and the communication between Inteli IO8/8 and controller works properly. Or power supply is in range and zero CAN address is set. (in case zero CAN address module doesn't communicate with the controller).

## Wiring

The following diagrams show the correct connection of inputs and outputs.

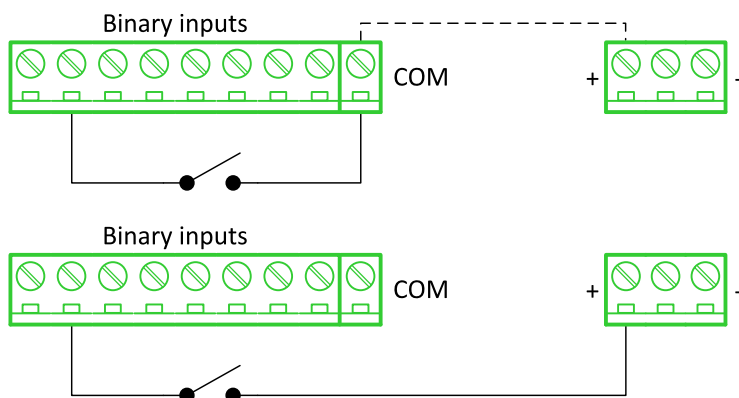
### Binary inputs - pull up



There are two options of wiring. On upper picture you can see case when binary input is connected between BIN2 and COM (COM is connected internally to the GND (-) - dashed line).

On lower picture is case of wiring between BIN2 and GND (-). Both ways are correct.

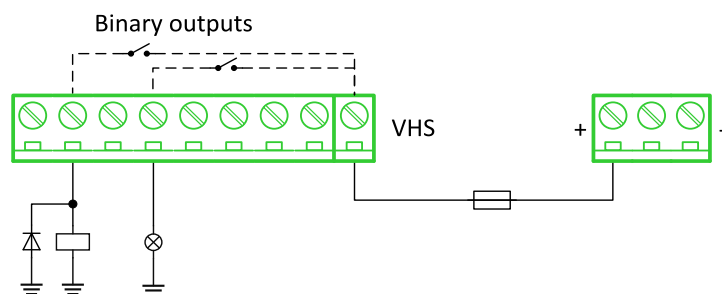
### Binary inputs - pull down



There are two options of wiring. On upper picture you can see case when binary input is connected between BIN2 and COM (COM is connected internally to the Ucc (+) - dashed line).

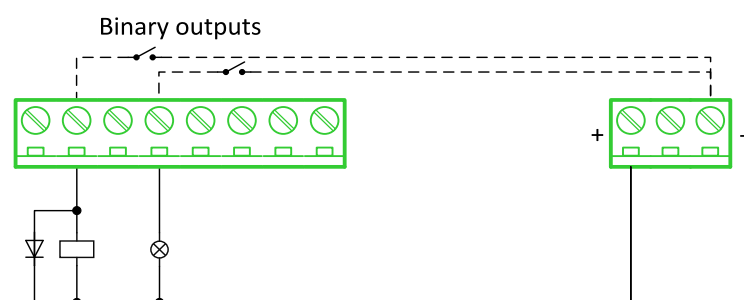
On lower picture is case of wiring between BIN2 and Ucc (+). Both ways are correct.

## Binary outputs - high side



When high side setting of outputs is chosen - binary output must be connected to the minus potential directly. Terminal VHS (voltage High side) has to be connected to positive potential directly. Maximal current of each binary output is 500 mA. Size of fuse depends on load.

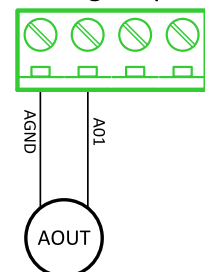
## Binary outputs - low side



When low side setting of outputs is chosen - binary output must be connected to the plus potential of power supply directly. Minus potential is connected internally - dashed line.

## Analog outputs

Analog outputs



**Note:** Limit of analog ground (AGND) is 100mA.

**IMPORTANT:** Terminator for analog output has special analog ground (AGND), which must not be connected to the GND.

## Technical data

### General data

Power supply	8 to 36 V DC
Current consumption	35 mA at 24 V ÷ 100 mA at 8 V
Interface to controller	<b>CAN1A</b> (page 17)
Protection	IP20
Storage temperature	- 40 °C to + 80 °C



<b>Operating temperature</b>	- 30 °C to + 70 °C
<b>Dimensions (WxHxD)</b>	110x110x46 mm (4,3"x4,3"x1,8")
<b>Weight</b>	240 grams

### Analog outputs

<b>Number of channels</b>	2
<b>Voltage</b>	Range 0-10 V Accuracy: $\pm 20$ mV + $\pm 0,5$ % of actual value I <sub>max</sub> 5 mA
<b>Current</b>	Range: 0-20 mA Accuracy: $\pm 100$ $\mu$ A + $\pm 0,5$ % of actual value R <sub>max</sub> 500 $\Omega$
<b>PWM</b>	Level 5 V Frequency - adjustable 200÷2400 Hz I <sub>max</sub> 20 mA

### Binary inputs

<b>Number of channels</b>	8 for Intel® IO8/8, 16 for Intel® IO16/0
<b>Input resistance</b>	4400 $\Omega$
<b>Input range</b>	0 to 36 V DC
<b>Switching voltage level for open contact indication</b>	0 to 2 V DC
<b>Max voltage level for close contact indication</b>	6 to 36 V DC

### Binary outputs

<b>Number of channels</b>	8 for Intel® IO8/8, 0 for Intel® IO16/0
<b>Max current</b>	500 mA
<b>Max switching voltage</b>	36 V DC

 [back to Extension modules](#)

## IGL-RA15

Remote annunciator (IGL-RA15) is designed as an extension signaling unit. The module is connected to controller by **CAN1A (page 17)** bus. It is possible to connect up to 4 IGL-RA15 external units to one controller.

The unit is equipped with a fully configurable tri-color (red, orange, green) LED for intuitive operation together with high functionality.



Image 7.48 IGL-RA15

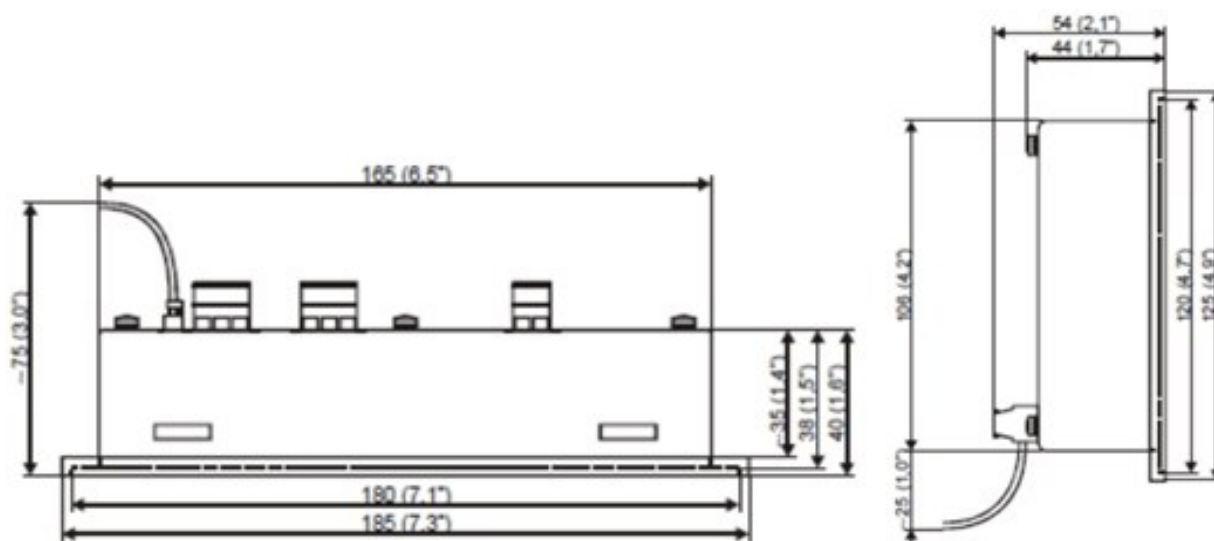


Image 7.49 IGL-RA15 dimensions

## Terminals

Horn	Horn
CAN	<b>CAN1A (page 17)</b> line
Power	Power supply

## CAN address

Address	Jumper A	Jumper B
1	OPEN	OPEN
5+6	CLOSED	OPEN
Customer defined	CLOSED	CLOSED

SW changing of **CAN1A (page 17)** address is enabled only when both jumpers are closed. Any one of these addresses (1+2 or 3+4 or 5+6 or 7+8) can be set by following steps:

- Switch to programming mode (Hold the Horn reset and Lamp test when unit is powering on). Status led is yellow

- Press Lamp test sixteen times
- Set the address up by pressing Horn reset.
  - The number of red luminous LEDs means the **CAN1A (page 17)** addresses (two for addresses 1+2, four for addresses 3+4, six for addresses 5+6 and eight for addresses 7+8)
- Press Lamp test

## LED indication

Each LED color is adjusted independently of controller output settings. If controller output 1 is set as "Common Shutdown" it doesn't mean red LED1 color for iGL-RA15. The LEDs color can be adjusted by following steps:

- Switch to programming mode (Hold the Horn reset and Lamp test when unit is powering on). Status led is yellow
- Press Horn reset to change the LED1 color (green, yellow, red)
- Press Lamp test to switch to the next LED color adjusting
- Continue to adjust all LEDs color
- After LED15 color adjusting press three times Lamp test

**Note:** If there is no operator action during address setting, color adjusting or timeout setting, the unit returns to normal operation without changes saving.

## Status LED

The signals LEDs are handled like binary outputs. It means all what can be configured to binary outputs can be also configured to the LEDs of IGL-RA15.

LED status	Description
Lights	Configured logical output is active on the controller
Dark green LED	Configured logical output is not active on the controller
Dark yellow or red LED	Configured logical output is not active on the controller and horn reset was pressed.
Yellow or red LED blinks	Configured logical output is not active on the controller and horn reset was still not pressed.

## Power LED

LED status	Description
Blinking green	The unit is OK and the communication to the master controller is OK.
Blinking red	The unit is OK, but the communication to the master controller is not running.
Blinking yellow	EEPROM check not passed OK after power on
Yellow	Horn timeout or controller address adjustment

## Horn setting

The horn output is activated if any of red or yellow LED is on. Output is on until pressing Horn reset or horn timeout counts down. The timeout can be set by following steps:

- Switch to programming mode (Hold the Horn reset and Lamp test when unit is powering on). Status led is yellow
- Press Lamp test fifteen times

- Set the horn timeout by pressing Horn reset.
  - The number of green luminous LEDs means timeout in 10 s (none for disabling horn output, 1 for 10s timeout, 2 for 10s timeout, 15 for disabling horn timeout).
  - Press Lamp test two times

**Note:** If there is no operator action during address setting, color adjusting or timeout setting, the unit returns to normal operation without changes saving.

#### The horn is activated if:

- Some of red or yellow LED lights up or
- At the end of the extended lamp test. See chapter **Lamp and horn test (page 717)**

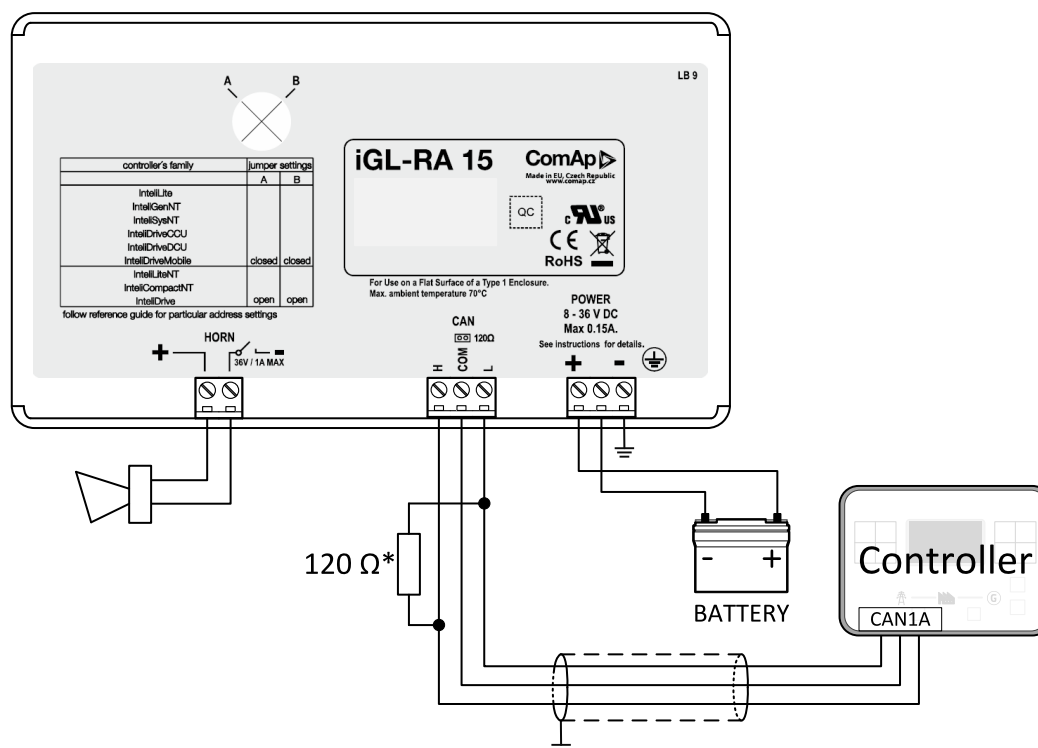
#### The horn can be silenced:

- By pressing horn reset button or
- It silences automatically after adjusted time

### Lamp and horn test

Pressing and holding lamp test button for less than 2 s execute the basic lamp test. All LEDs light up with the configured colour. If the button is hold longer than 2 s, an extended test is started. Every LED is tested step-by-step in green colour and then in red colour. The horn is activated at the end of the test. After that the unit returns to normal operation. The horn can be silenced with horn reset.

### Wiring



\* use terminator resistor only when IGL-RA 15 is the last unit on the CAN1A bus.

**Note:** The shielding of the CAN bus cable has to be grounded at one point only!

**Note:** See the section **Technical data (page 718)** for recommended CAN bus cable type

## Technical data

### General data

Power supply	8 to 36 V DC
Current consumption	0.35-0.1A (+1A max horn output) depends on supply voltage
Protection	IP65
Interface to controller	<b>CAN1A (page 17)</b>
Humidity	85%
Storage temperature	- 30 °C to + 80 °C
Operating temperature	- 20 °C to + 70 °C
Dimensions (WxHxD)	180x120x55 mm
Weight	950 g

### Horn output

Maximum current	1.0 A
Maximum switching voltage	36 V DC

### CAN bus interface

Galvanic separated	
Maximal CAN bus length	200 m
Speed	250 kbps
Nominal impedance	120 Ω
Cable type	twisted pair (shielded)
Following dynamic cable parameters are important especially for maximal 200 meters CAN bus length	
Nominal Velocity of Propagation	min. 75 % (max. 4,4 ns/m)
Wire crosscut	min. 0,25 mm <sup>2</sup>
Maximal attenuation (at 1 MHz)	2 dB/100m
<b>Recommended Industrial Automation &amp; Process Control Cables</b>	
<b>BELDEN</b> ( <a href="http://www.belden.com">www.belden.com</a> )	<ul style="list-style-type: none"> <li>➤ 3082A DeviceBus for Allen-Bradley DeviceNet</li> <li>➤ 3083A DeviceBus for Allen-Bradley DeviceNet</li> <li>➤ 3086A DeviceBus for Honeywell SDS</li> <li>➤ 3087A DeviceBus for Honeywell SDS</li> <li>➤ 3084A DeviceBus for Allen-Bradley DeviceNet</li> <li>➤ 3085A DeviceBus for Allen-Bradley DeviceNet</li> <li>➤ 3105A Paired EIA Industrial RS485 cable</li> </ul>
<b>LAPP CABLE</b> ( <a href="http://www.lappcable.com">www.lappcable.com</a> )	<ul style="list-style-type: none"> <li>➤ Unitronic BUS DeviceNet Trunk Cable</li> <li>➤ Unitronic BUS DeviceNet Drop Cable</li> <li>➤ Unitronic BUS CAN</li> <li>➤ Unitronic-FD BUS P CAN UL/CSA</li> </ul>

**IMPORTANT:** This module is not compatible with different than 250 kbps communication speed. If the ECU module with 125 kbps communication speed is connected the whole system will automatically switch to the 125 kbps, and IGL-RA15 module will stop communicating.

🔍 back to Extension modules

## IGS-PTM

IGS-PTM module is extension module equipped with binary inputs, binary outputs, analog inputs and analog output. The module is connected to controller by **CAN1A** (page 17) bus. It is possible to connect up to 4 IGS-PTM external units to one controller.



Image 7.50 IGS-PTM

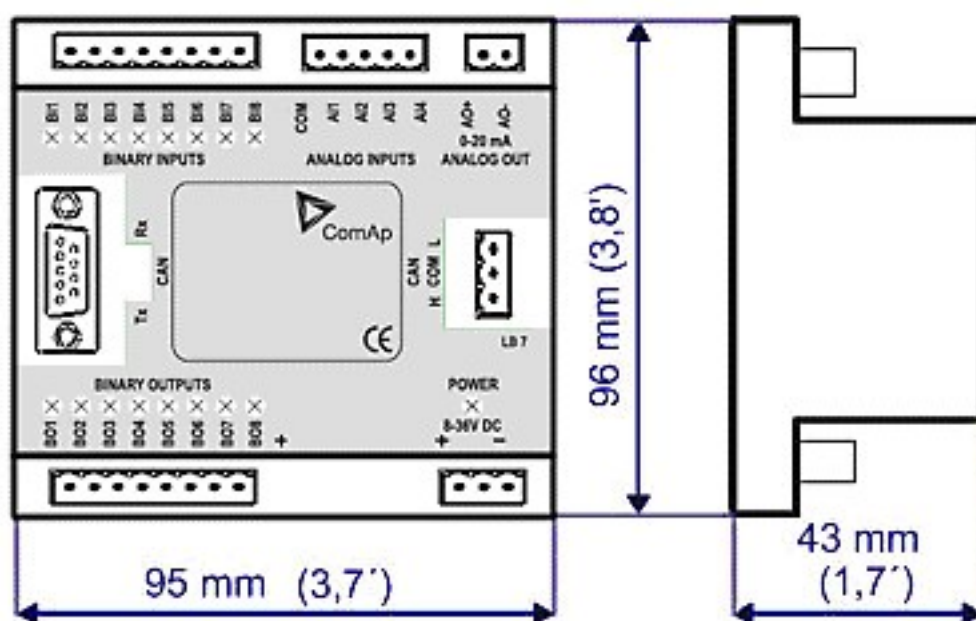
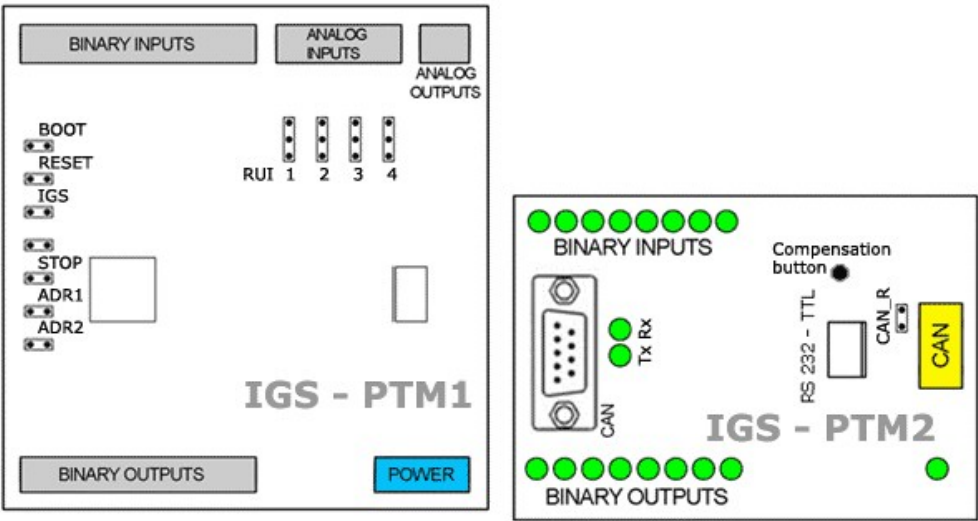


Image 7.51 IGS-PTM dimensions

Terminals



Binary inputs	8 binary inputs
Analog inputs	4 analog inputs
Analog outputs	1 analog output
Binary outputs	8 binary outputs
CAN	<b>CAN1A (page 17)</b> line
RS232-TTL	Interface for programming
Power	Power supply

Analog inputs

Analog inputs can be configured for:

- Resistance measurement
- Current measurement
- Voltage measurement

The type of analog inputs is configured via jumpers RUI located on lower PCB.

RUI	Analog input configuration
1 - 2	Resistance measuring
2 - 3	Current measuring
no jumper	Voltage measuring

Supported sensors

Sensors	
PT100 [°C] (fix)	User curves
NI100 [°C] (fix)	0-100 mV
PT100 [°F] (fix)	0-2400 ohm
NI100 [°F] (fix)	±20 mA

## CAN address

### Controller type selection

The type of controller to be used with IGS-PTM must be selected via jumper labeled IGS accessible at the lower PCB.

IGS jumper	Controller type
OPEN	IL-NT, IC-NT
CLOSE	IG-NT, IS-NT, IntelliLite

### Address configuration

If IntelliLite controller type is selected (by IGS jumper), address of IGS-PTM could be modified via jumpers labeled ADR1 and ADR2.

ADR1	ADR2	ADR offset	BIN module	BOUT module	AIN module
Open	Open	0 (default)	1	1	1
Close	Open	1	2	2	2
Open	Close	2	3	3	3
Close	Close	3	4	4	4

## Programing firmware

Firmware upgrade is via AT-link (TTL). For programming is necessary to close jumper BOOT. RESET jumper is used to reset the device. Close jumper to reset the device. For programming is used FlashProg PC tool.

## LED indication

### Binary input

Each binary input has LED which indicates input signal. LED is shining when input signal is set, and LED is dark while input signal has other state.

### Binary output

Each binary output has LED which indicates output signal. Binary output LED is shining when binary output is set.

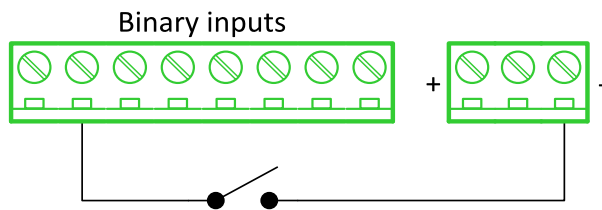
### LED at power connector - status LED

LED status	Description
Dark	No required power connected.
Quick flashing	Program check failure.
One flash and pause	Compensation fail.
Three flashes and pause	Compensation successful.
Flashes	There is no communication between IGS-PTM and the controller.
Lights	Power supply is in the range and communication between IGS-PTM and controller properly works.

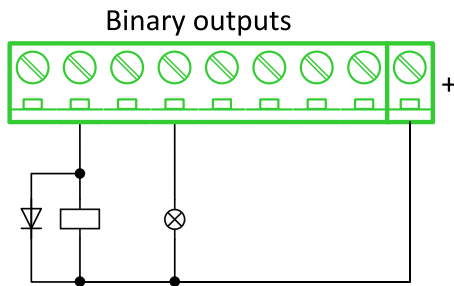


## Wiring

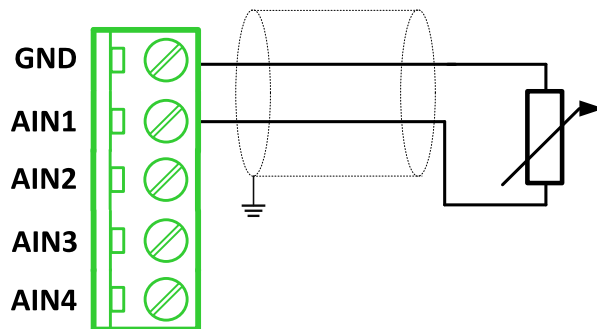
### Binary inputs



### Binary outputs



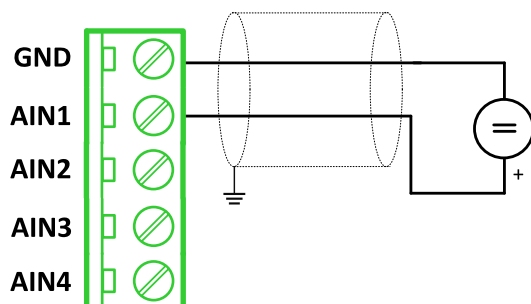
### Resistance sensor



**Note:** Range: 0- 2400  $\Omega$

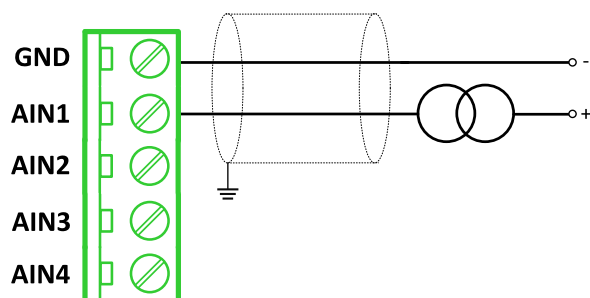
**IMPORTANT:** Physical analog input range is 0-250  $\Omega$ . In sensor configuration in PC tool it is necessary to chose 0-2400  $\Omega$  sensor HW type to ensure proper function of analog input.

### Voltage sensor



**Note:** Range 0-100 mV

### Current sensor - passive

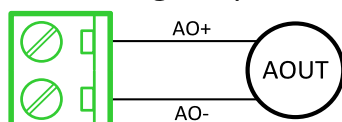


**Note:** Range:  $\pm 0-20 \text{ mA}$

**IMPORTANT:** Physical analog input range is 0-20mA. In sensor configuration in PC tool it is necessary to chose +- 20mA active sensor HW type to ensure proper function of analog input.

### Analog outputs

#### Analog output



**Note:** Range: 0 to 20 mA  $\pm 0,33 \text{ mA}$

### Technical data

#### General data

Power supply	8 to 36 V DC
Current consumption	100 mA at 24V $\div$ 500 mA
Interface to controller	<b>CAN1A (page 17)</b>
Protection	IP20
Storage temperature	- 40 °C to + 80 °C
Operating temperature	- 30 °C to + 70 °C
Dimensions (WxHxD)	95×96×43 mm (3.7'×3.8'×1.7')

#### Analog inputs

Number of channels	8
Voltage	Range 0-100 mV Accuracy: 1,5 % $\pm$ 1 mV out of measured value
Current	Range: 0-20 mA Accuracy: 2.5 % $\pm$ 0,5 ohm out of measured value
Resistive	Range: 0- 250 $\Omega$ Accuracy: 1 % $\pm$ 2 ohm out of measured value

## Analog outputs

Number of channels	1
Current	Range: 0 to 20 mA $\pm$ 0,33 mA Resolution 10 bit

## Binary inputs

Number of channels	8
Input resistance	4700 $\Omega$
Input range	0 to 36 V DC
Switching voltage level for open contact indication	0 to 2 V DC
Max voltage level for close contact indication	8 to 36 V DC

## Binary outputs

Number of channels	8
Max current	500 mA
Max switching voltage	36 V DC
Number of channels	8
Voltage	Range 0-100 mV Accuracy: 1,5 % $\pm$ 1 mV out of measured value
Current	Range: 0-20 mA Accuracy: 2.5 % $\pm$ 0,5 ohm out of measured value
Resistive	Range: 0- 250 $\Omega$ Accuracy: 1 % $\pm$ 2 ohm out of measured value

 [back to Extension modules](#)

### Inteli AIO9/1

Inteli AIO9/1 module is an extension module equipped with analog inputs and outputs – designed for DC measurement. The module is connected to controller by **CAN1A (page 17)** bus. It is possible to connect up to 5 Inteli AIO9/1 external units to one controller.

The detection of communication speed is indicated by rapid flashing of status LED. Once the speed is detected the module remains set for this speed even when the communication is lost. Renewal of communication speed detection is done by resetting of the module.



Image 7.52 Intel AIO9/1

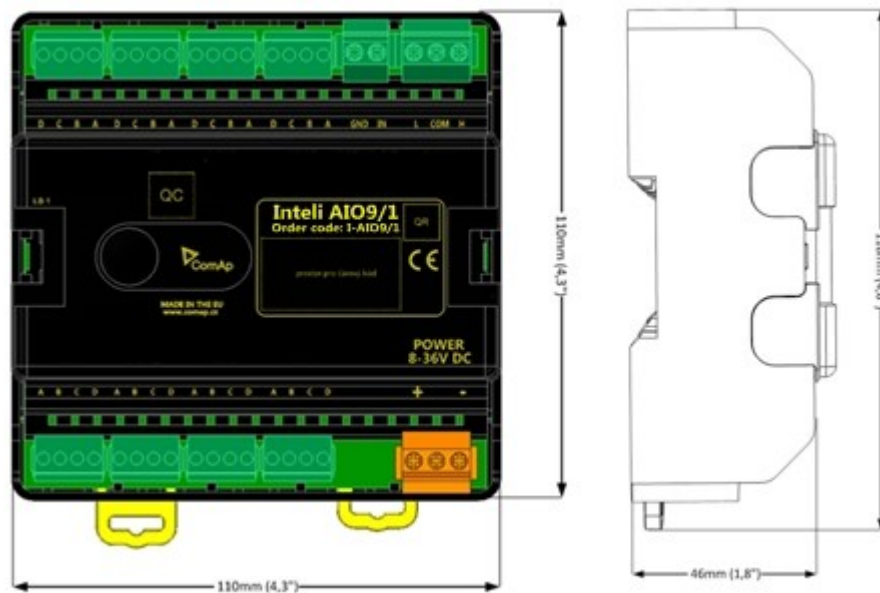
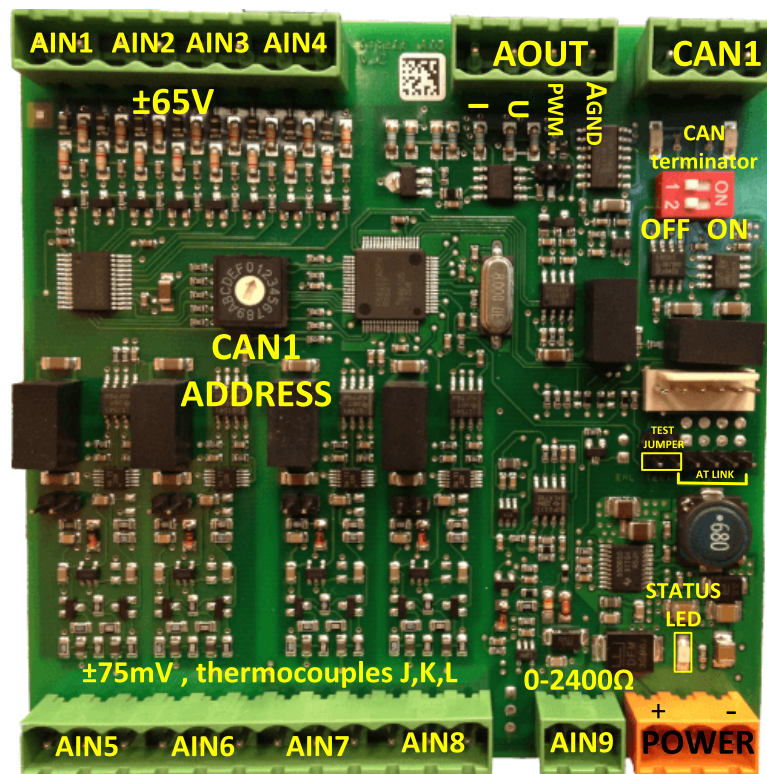


Image 7.53 Intel AIO9/1 dimensions

## Terminals



<b>ANALOG INPUT</b>	9 channels
<b>ANALOG OUTPUTS</b>	1 channel
<b>CAN</b>	CAN1 line
<b>POWER</b>	Power supply
<b>CAN LED Tx, Rx</b>	Indication transmitted or received data
<b>Status LED</b>	LED indication of correct function
<b>CAN terminator</b>	Terminating CAN resistor (active in position "ON")
<b>TEST jumper</b>	Upgrade of SW
<b>AT-LINK</b>	Connector for AT-LINK (Upgrade of SW)

## Analog inputs

- 4 channels AIN1 – AIN4 can be configured as:
  - Sensor  $\pm 65V$  (determined for measurement of battery voltage)
- 4 channels AIN5 – AIN8 can be configured as:
  - Thermocouples – type J,K or L (in  $^{\circ}C$  or  $^{\circ}F$ )
  - Sensor  $\pm 75mV$  DC – (for connecting current shunts)
- 1 channel AIN9 can be configured as:
  - RTD (Pt1000, Ni1000)
  - Common resistance 0-2400 $\Omega$

## Analog outputs

- 1 channel AOUT1. Type of output:
  - 0-10V DC
  - 0-20mA
  - PWM (5 V, freq 2.4 Hz ±2.4 kHz)
- Analog output has 4-pins connector – GND and one pin for each type of output.

All analog inputs can be configured to any logical function or protection.

## Supported sensors

Sensors		
User curves	±65 V DC (fix linear)	Thermocpl (nc) K [°C] (fix)
PT1000 [°C] (fix)	±75 mV (fix linear)	Thermocpl (nc) L [°C] (fix)
NI1000 [°C] (fix)	Thermocpl J [°C] (fix)	Thermocpl (nc) J [°F] (fix)
PT1000 [°F] (fix)	Thermocpl K [°C] (fix)	Thermocpl (nc) K [°F] (fix)
NI1000 [°F] (fix)	Thermocpl L [°C] (fix)	Thermocpl (nc) L [°F] (fix)
0-2400 Ω (fix linear)	Thermocpl (nc) J [°C] (fix)	

## Address and DIP switch setting

### Address configuration

DIP switch determinates CAN address for analog inputs and outputs.

### Programming Firmware

Firmware upgrade is available via AT-link (TTL). For programming it is necessary to close jumper TEST and switch OFF and ON the power supply.

For programming use FlashProg PC tool version 4.4 or higher.

## LED indication

LED status	Description
Dark	Fw in module does not work correctly.
Flashing	Module does not communicate with controller (in case non-zero CAN address)
Fast flashing	Detection of CAN communication speed
Lights	Power supply is in the range and the communication between Inteli AIN8TC and controller works properly. Or power supply is in range and zero CAN address is set. (in case zero CAN address module doesn't communicate with the controller)

The following diagrams show the correct connection of sensors.



Analog input 9 is determined for measuring resistance only.

## General data

### Analog inputs (not electric separated)

IntelIMains 1010 BTB SC 1.1.0 Global Guide

<b>AIN5-AIN8 – Voltage inputs</b>	<b>measurement</b>	
	<b>Range</b>	± 75 mV (nominal) (measurement up to ±80 mV)
	<b>Accuracy of measurement</b>	± 0.1 % of actual value + ± 75 µV Galvanic separated from power supply
<b>AIN9 resistance input</b>	<b>Range</b>	0- 2400 Ω
	<b>Accuracy of measurement</b>	± 0.5 % of actual value + ± 4 Ω Pt1000, Ni1000 ± 2,5 °C It is not galvanic separated from power supply.

## Analog output

I 0-20mA /500Rmax. ± 1 % of actual value + ± 200 uA  
U 0-10V ± 0.5 % of actual value + ± 50 mV  
PWM – 5 V, 200 Hz-2.4kHz 15 mA max.  
Galvanic separated from power supply

<b>Galvanic separation</b>	CAN bus is galvanic separated from the measurement and power supply
----------------------------	---

<b>Power supply</b>	8 to 36 V DC
<b>Protection</b>	IP20
<b>Current consumption</b>	150 mA at 24 V ÷ 400 mA at 8 V
<b>Storage temperature</b>	- 40 °C to + 80 °C
<b>Operating temperature</b>	- 30 °C to + 80 °C

*The product is fully supported in firmware IGS-NT 3.1.1 or higher.*

*For information about support of this module in IGS-NT fw branches and ID-DCU – please read New Feature Lists.*

 **back to Extension modules**

## Inteli AIN8TC

Inteli AIN8TC module is extension module equipped with 8 analog inputs dedicated for thermocouple sensors only. The module is connected to controller by **CAN1A (page 17)** bus. It is possible to connect up to 10 Inteli AIO9/1 external units to one controller.

The detection of communication speed is indicated by fast flashing of status LED. Once the speed is detected the module remains set for the speed even when the communication is lost. Renewal of communication speed detection is done by reset of the module.





Image 7.54 Intel AIN8TC

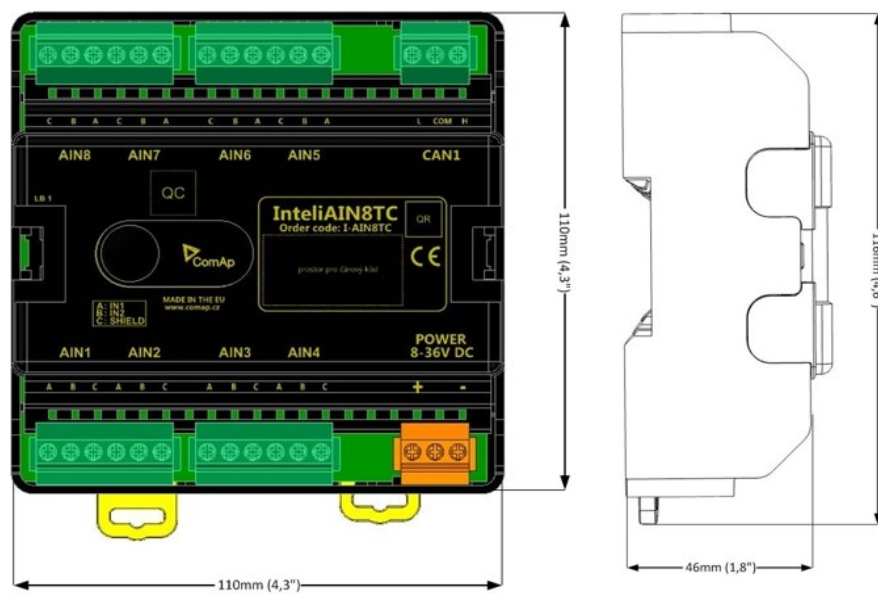
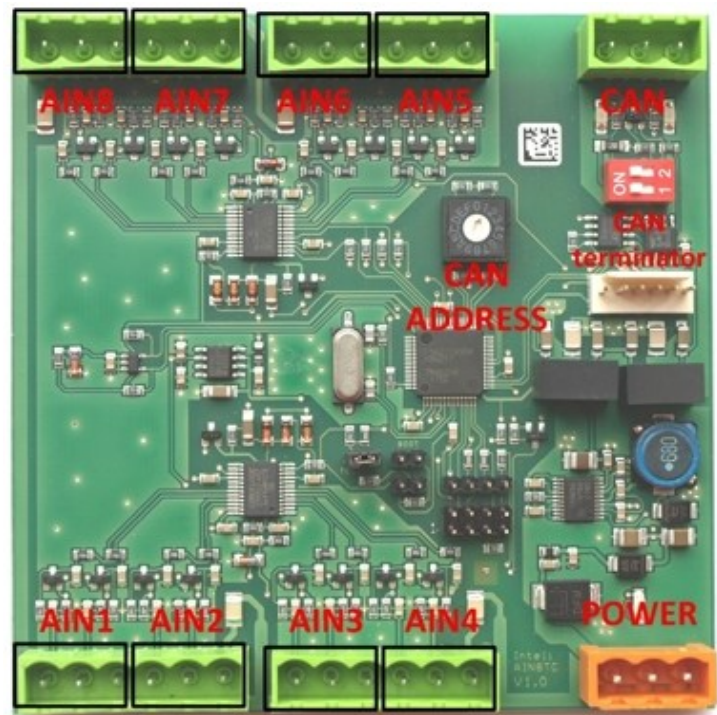


Image 7.55 Intel AIN8TC dimensions

## Terminals



Analog input	8 analog Inputs
CAN	<b>CAN1A (page 17)</b> line
Power	Power supply
CAN LED Tx, Rx	Indication transmitted or received data
Status LED	LED indication of correct function
CAN terminator	Terminating CAN resistor (active in position "ON" - switch both switches)

## Analog inputs

- 8 channels
- Can be configured as thermocouple sensors only

All inputs can be configured to any logical function or protection

## Supported sensors

Sensors	
Thermocpl J [°C] (fix)	Thermocpl (nc) J [°C] (fix)
Thermocpl K [°C] (fix)	Thermocpl (nc) K [°C] (fix)
Thermocpl L [°C] (fix)	Thermocpl (nc) L [°C] (fix)
Thermocpl J [°F] (fix)	Thermocpl (nc) J [°F] (fix)
Thermocpl K [°F] (fix)	Thermocpl (nc) K [°F] (fix)
Thermocpl L [°F] (fix)	Thermocpl (nc) L [°F] (fix)

**Note:** "nc" means "not cold junction compensation (by external sensor)". In this case is used internal temperature sensor on the PCB

### CAN address

DIP switch determinates CAN address for analog inputs.



**Note:** In case of setting the CAN address to zero, the appropriate group of signals is deactivated.

### Programming firmware

Firmware is upgraded via AT-link (TTL). For programming it is necessary to close jumper TEST.

For programming FlashProg PC tool version 4.2 or higher must be used.

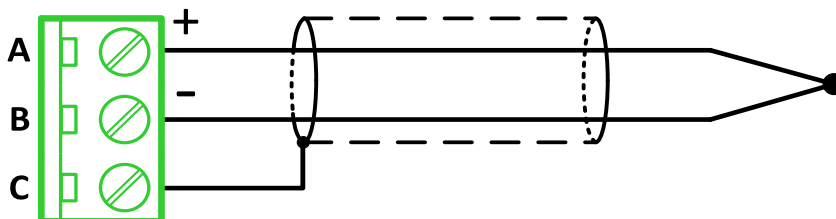
### LED indication

LED status	Description
Dark	Fw in module does not work correctly.
Flashing	Module does not communicate with controller (in case non-zero CAN address)
Fast flashing	Detection of CAN communication speed
Lights	Power supply is in the range and the communication between Intel AIN8TC and controller works properly. Or power supply is in range and zero CAN address is set. (in case zero CAN address module doesn't communicate with the controller)

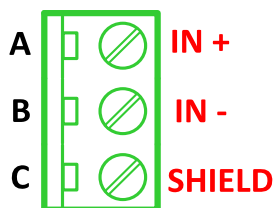
### Wiring

The following diagrams show the correct connection of sensors.

#### Thermocouple



## Terminator



## Technical data

### General data

Power supply	8 to 36 V DC
Current consumption	35 mA at 24 V ÷ 100 mA at 8 V
Interface to controller	<b>CAN1A (page 17)</b>
Protection	IP20
Storage temperature	- 40 °C to + 80 °C
Operating temperature	- 30 °C to + 70 °C
Dimensions (WxHxD)	110 × 110 × 46 mm (4.3" × 4.3" × 1.8")
Weight	237.5 grams

### Analog inputs

Number of channels	8, no galvanic separated
Voltage	Range: ± 100 mV Accuracy: ± 0.1 % of actual value + ± 100 µV (± 3 °C)

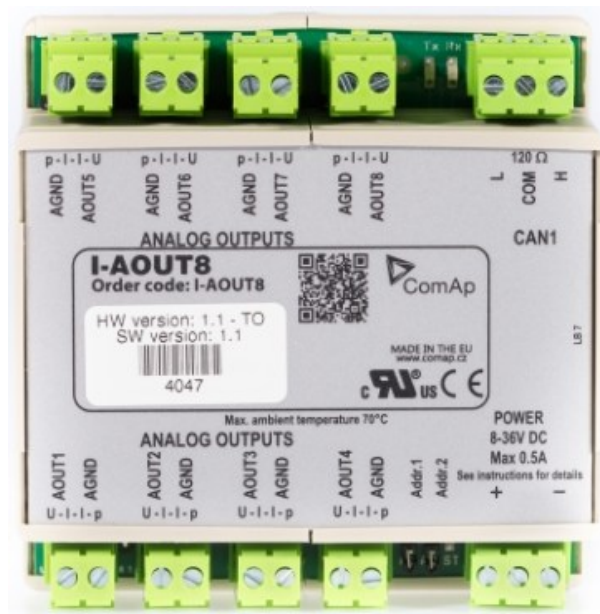
🔍 back to Extension modules

## I-AOUT8

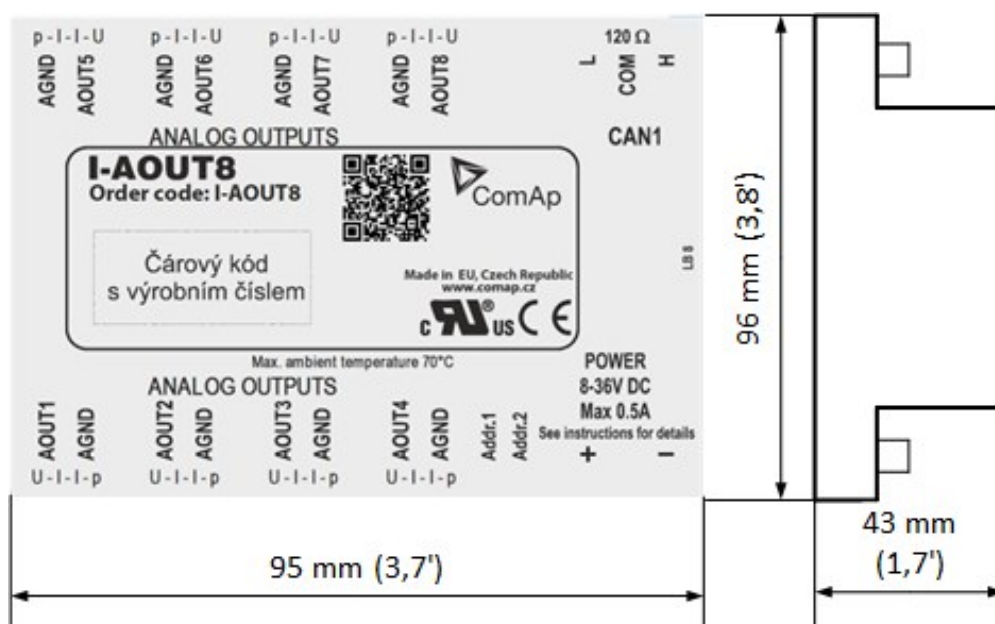
I-AOUT8 is an extension unit with 8 analog outputs. Each analog output can be switched to

- 0 to 20 mA DC
- 0 to 10 V DC
- PWM (Pulse With Modulation on 1,2 kHz)

The module is connected to controller by **CAN1A (page 17)** bus. It is possible to connect up to 4 I-AOUT8 external units to one controller. The corresponding module Address 1 to 4 (default 1) must be set on module (by Adr.1 and Adr.2 jumpers) and in controller configuration. CAN1 terminating 120 ohm resistor jumper is connected as default. AGND terminals are on the same potential.

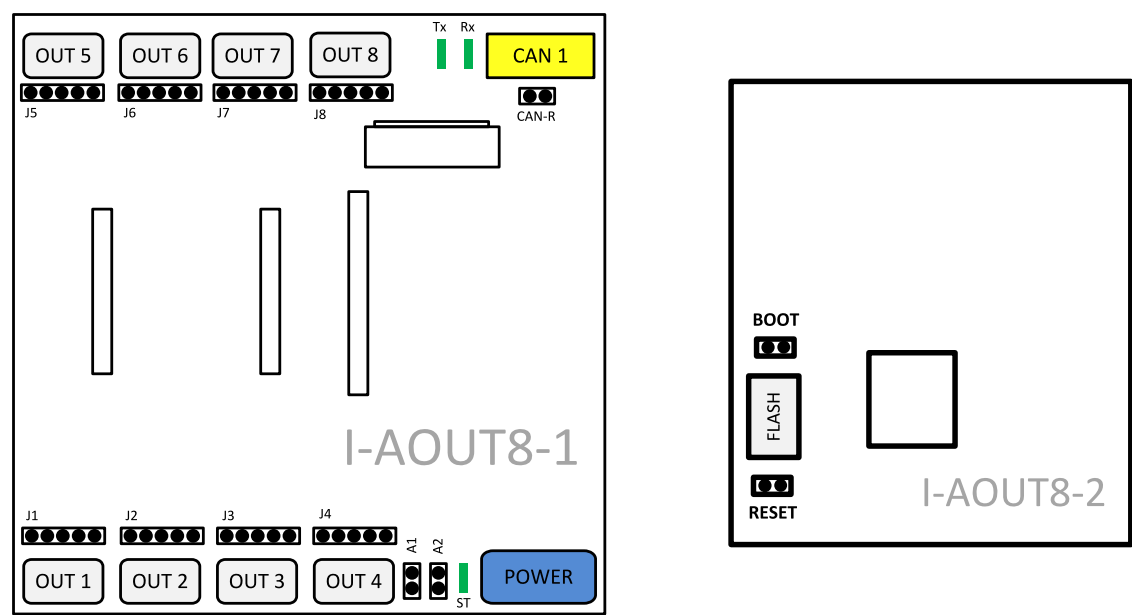


## Dimensions



Unit is 35 mm DIN rail mounted.

Connectors



POWER	Power supply
CAN 1	CAN1 line
OUT1 - OUT8	Analog output
FLASH	AT-link
J1 – J8	Output mode
A1, A2	CAN 1 address
CAN-R	Terminating resistor
BOOT	Programming
RESET	Programming / reset
Tx, Rx	CAN 1 data
ST	Power/module state

Address and jumpers setting

CAN Address

The module CAN address is set by jumpers A1 and A2. Set module CAN address correspondingly to configuration according table below.

CAN Address	A1	A2
1	Open	Open
2	Close	Open
3	Open	Close
4	Close	Close

Table 7.2 Setting CAN address

Output mode

Follow the p – I – U symbols on the module sticker. There are two equivalent positions for current output.

AOUT	Symbol	Function
	p	PWM Pulse-Width-Modulation
	I	0 to 20 mA DC
	U	0 to 10 V DC

Table 7.3 Setting output mode

Programming firmware

Firmware upgrade is via AT-link (TTL). For programming it is necessary to close jumper BOOT. RESET jumper is used to reset the device. Close jumper to reset the device. For programming is used FlashProg PC tool.

CAN1 termination

I-AOUT8 has own CAN terminating resistor (120 ohm). Close jumper CAN-R to connect terminating resistor to CAN bus, open jumper CAN-R disconnecting terminating resistor.

Wiring

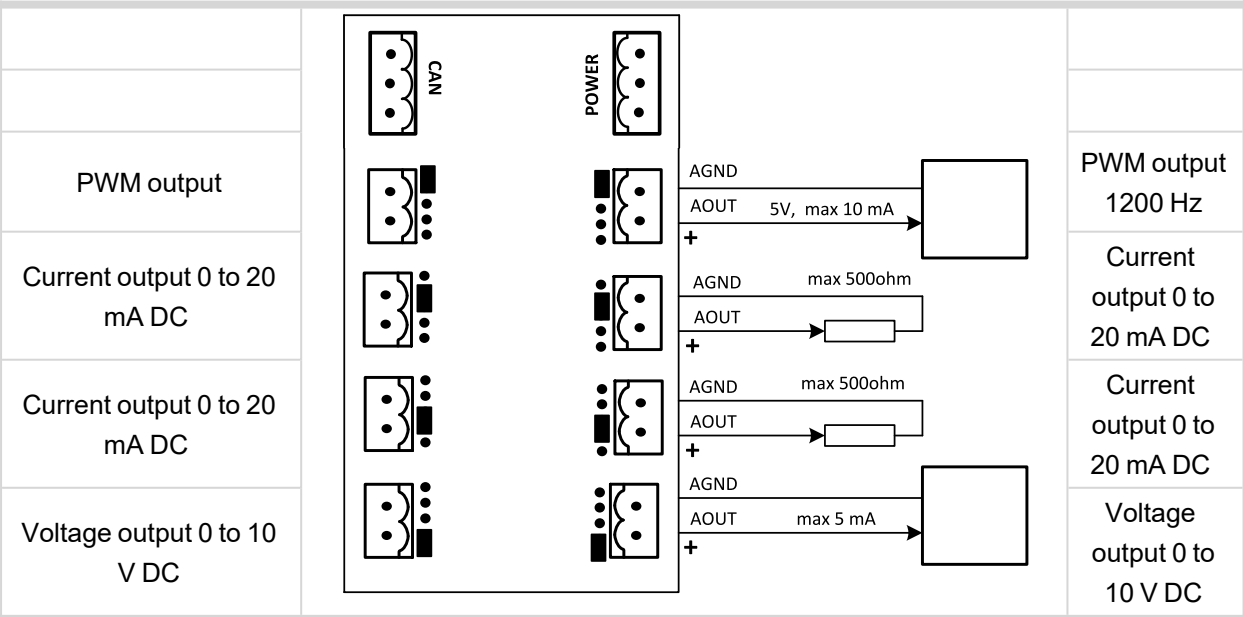


Image 7.56 Possible output modes

## Technical data

<b>Dimension (W × H × D)</b>	95 × 96 × 43 mm (3.7' × 3.8' × 1.7')
<b>Interface to controller</b>	CAN
<b>Output</b>	8 analog, no galvanic separation

<b>Type of analog output</b>
0 to 10V DC ± 1 % , max 5 mA DC
0 to 20 mA DC ± 1 % , max 500 Ω
PWM 1200 Hz, 5V DC level, max 10 mA DC

<b>Power supply</b>	8 to 36 V DC
<b>Analog output refreshment</b>	320 ms
<b>Current consumption</b>	max 300 mA (100 mA at 24 V)
<b>RS232 interface</b>	TTL, firmware upgrade via AT-link.
<b>Storage temperature</b>	-40 °C to +80 °C
<b>Operating temperature</b>	- 30 °C to + 70 °C
<b>Heat radiation</b>	2.5 W

🔍 back to Extension modules

### IS-AIN8

IS-AIN8 is input extension module equipped with 8 analog inputs which can be configured to:

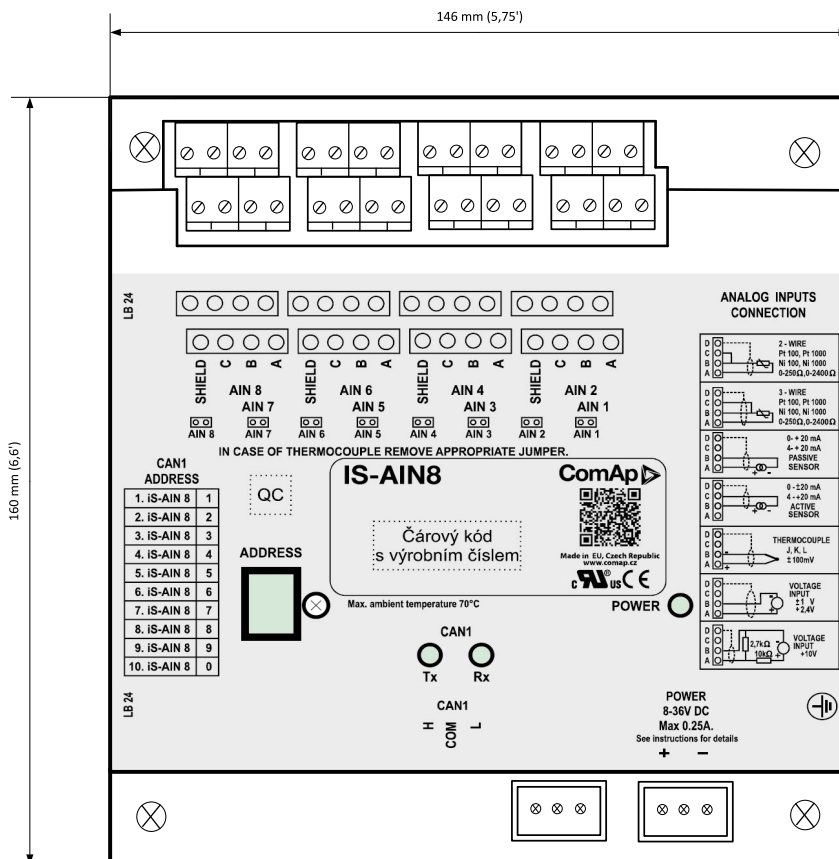
- Resistor two wire input
- Resistor three wire input
- Current input
- Thermocouple input
- Voltage input

All inputs can be configured to any logical function or protection. It is possible to connect up to 10 IS-AIN external units to one controller. IS-AIN8 is connected to controller **CAN1A (page 17)** bus.

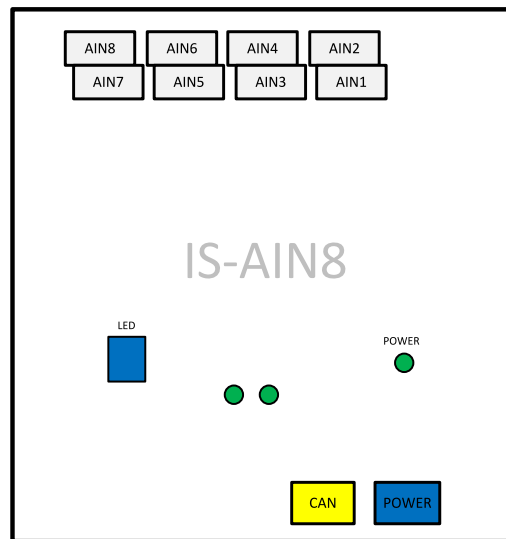
This module is compatible with MTU ECU-7 at communication speed 125 kbps when uploaded with firmware 1.2.0 and higher.

The detection of communication speed is indicated by fast flashing of status LED. Once the speed is detected the module remains set for the speed even when the communication is lost. Renewal of communication speed detection is done by reset of the module.





## Terminals



AIN1 – AIN8	8 analog inputs
CAN	CAN1 line
POWER	Power supply
POWER	State indication
Rx, Tx	Data transmitted and received on CAN1 line
LDD	CAN1 adress

## Supported sensors

Sensors				
PT100 [°C] (fix)	PT100 [°F] (fix)	+ -1V	4-20mA passive	0-250 ohm
PT1000 [°C] (fix)	PT1000 [°F] (fix)	0-2.4V	4-20mA active	0-2400 ohm
NI100 [°C] (fix)	NI100 [°F] (fix)	0-5V	0-20mA passive	0-10k ohm
NI1000 [°C] (fix)	NI1000 [°F] (fix)	0-10V	+ -20mA active	

**Note:** It is also possible to use User Curves as sensor.

TC Sensors	
Thermocpl J [°C] (fix)	Thermocpl (nc) J [°C] (fix)
Thermocpl K [°C] (fix)	Thermocpl (nc) K [°C] (fix)
Thermocpl L [°C] (fix)	Thermocpl (nc) L [°C] (fix)
Thermocpl J [°F] (fix)	Thermocpl (nc) J [°F] (fix)
Thermocpl K [°F] (fix)	Thermocpl (nc) K [°F] (fix)
Thermocpl L [°F] (fix)	Thermocpl (nc) L [°F] (fix)

**Note:** "nc" means" not cold junction compensation (by external sensor). In this case is used internal temperature sensor on the PCB

## CAN Address

CAN 1 address is set by following procedure:

1. Press Address button during IS-AIN8 power supply on to switch to addressing mode.
2. Then repeatedly press or keep pressed address button to adjust required address according to controller configuration.
3. After setting requested address, release the buttons and wait until the digits blink – it indicates writing of the change address to EEPROM memory.

	CAN 1 Address
1. IS-AIN8	1
2. IS-AIN8	2
3. IS-AIN8	3
4. IS-AIN8	4
5. IS-AIN8	5
6. IS-AIN8	6
7. IS-AIN8	7
8. IS-AIN8	8
9. IS-AIN8	9
10. IS-AIN8	0

Table 7.4 Table of recommended CAN1 address setting

## SW version check

Let suppose IS-AIN8 of SW version 1.4. Shortly press address button. Following sequence appears on the display: number "1", one second pause, number "4", two second pause, number "1", one second pause, number "4", two second pause and finally IS-AIN8 actual address. Error message (e.g. SD BOUT2) appears on Controller screen when Binary input or output Address x is configured but corresponding unit is not recognized (no message is received from CAN bus). Check IS configuration and corresponding external IS-AIN8, IS-BIN8/16 unit address setting.

## LED indication

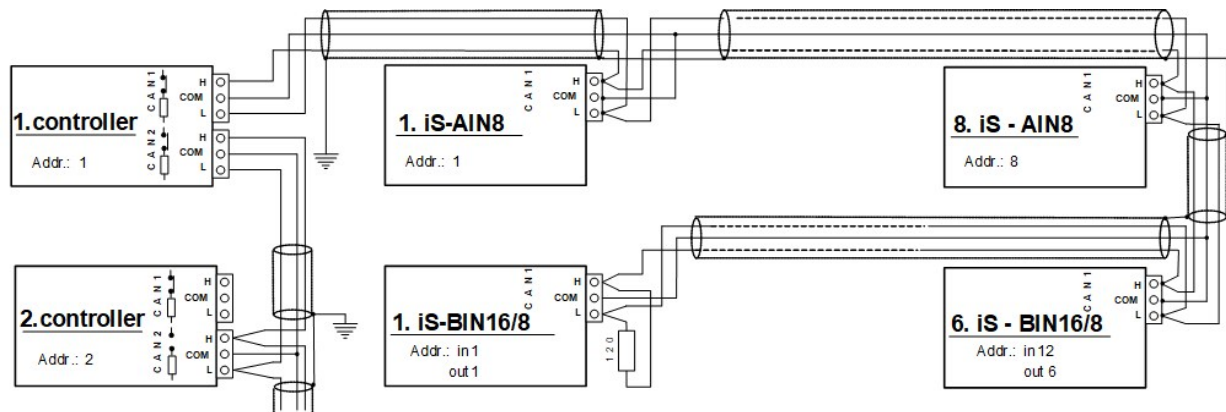
Power LED		Address LDD	
Lighting	Blink	Lighting	Blink
Power supply and CAN address are with no problems	CAN1 address is adjusted different in IS-AIN8 and in controller	Displaying current CAN1 address	Displaying current SW version

Table 7.5 LED / LDD status

Tx		Rx	
Lighting	Blink	Lighting	Blink
Any data are transmitted on the CAN1 line	Data are transmitted on the CAN1 line	Any data are received on the CAN1 line	Data are received on the CAN1 line

Table 7.6 Tx/Rx LED status

## Wiring



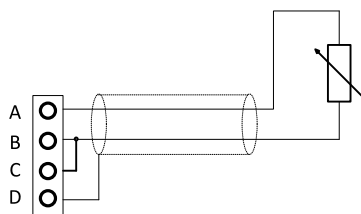
**Note:** CAN bus line has to be terminated by 120  $\Omega$  resistors on the both ends.

For longer distances is recommended to connect CAN COM terminals between all controllers and cable shielding to the **ground in one point!** External units can be connected on the CAN bus line in any order, but line arrangement (no tails no star) is necessary.

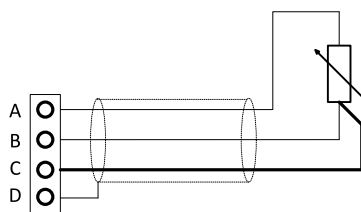
Recommended CAN bus data cables see in Chapter Technical data.

IG-MU and IG-IB units are connected to CONTROLLER CAN2 bus.

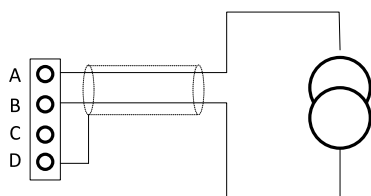
Select sensor characteristic from the list or define user sensor characteristic in PC configuration tool.



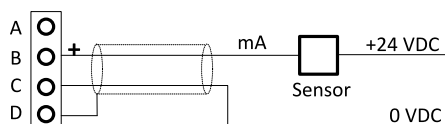
- > Resistor sensor input – two wire connection.
- > Range 0 to 2400  $\Omega$ .
- > Pt100, Pt1000, Ni100, Ni1000
- > D terminal is shielding



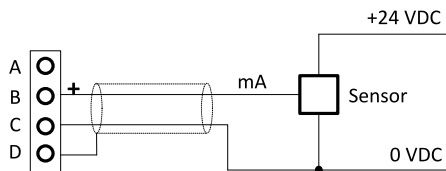
- > Resistor sensor input – three wire connection.
- > Range 0 to 2400  $\Omega$ .
- > Pt100, Pt1000, Ni100, Ni1000 – recommended.
- > D terminal is shielding



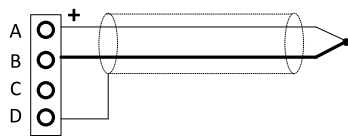
- > Passive current sensor (current source is in IS-AIN8)
- > Range 0 to +20 mA or 4 to +0 mA
- > D terminal is shielding



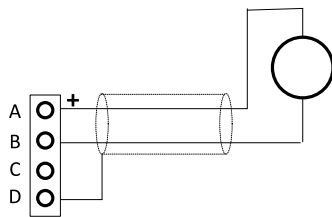
- > Active current sensor (current source is in sensor)
- > Range -20mA to +20 mA or 4 to +20 mA



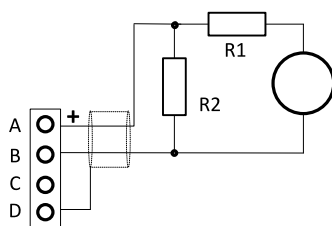
- > D terminal is shielding



- > Thermocouple J, K, L D terminal is shielding
- > From IS-AIN8 hardware version 5.1 can be B terminal grounded to frame



- > Voltage input
- > Range 0 to + 2500 mV.
- > Voltage range is 0 to  $\pm 1000$  mV.
- > D terminal is shielding



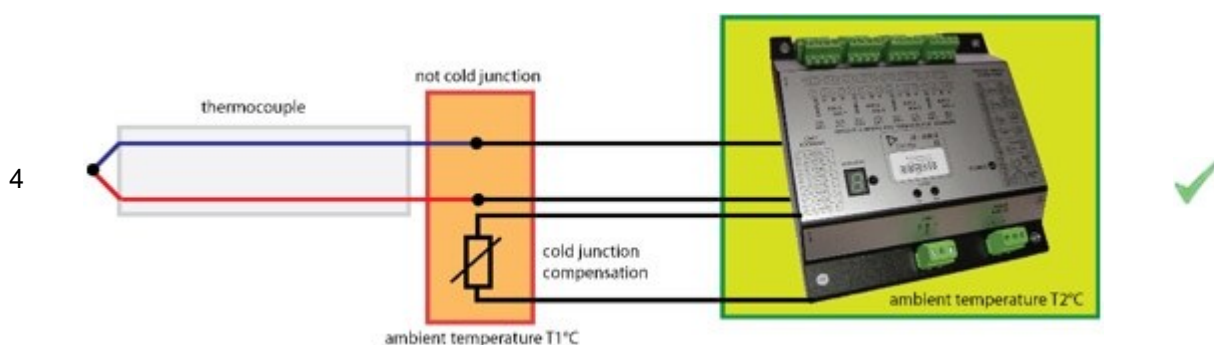
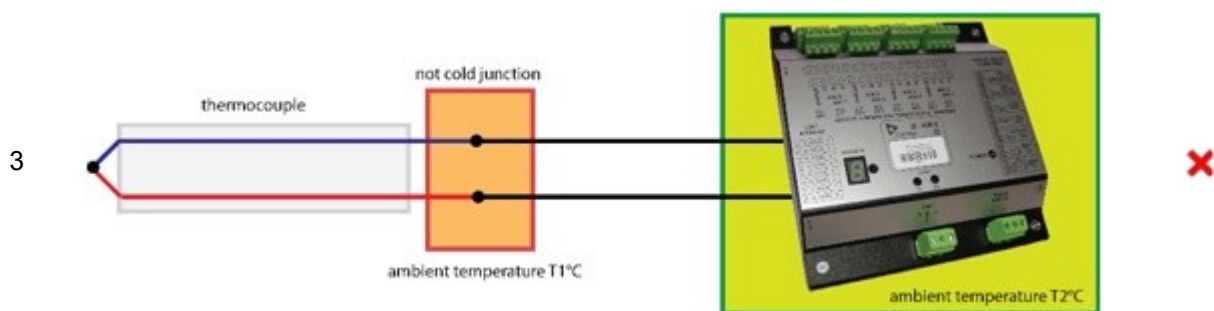
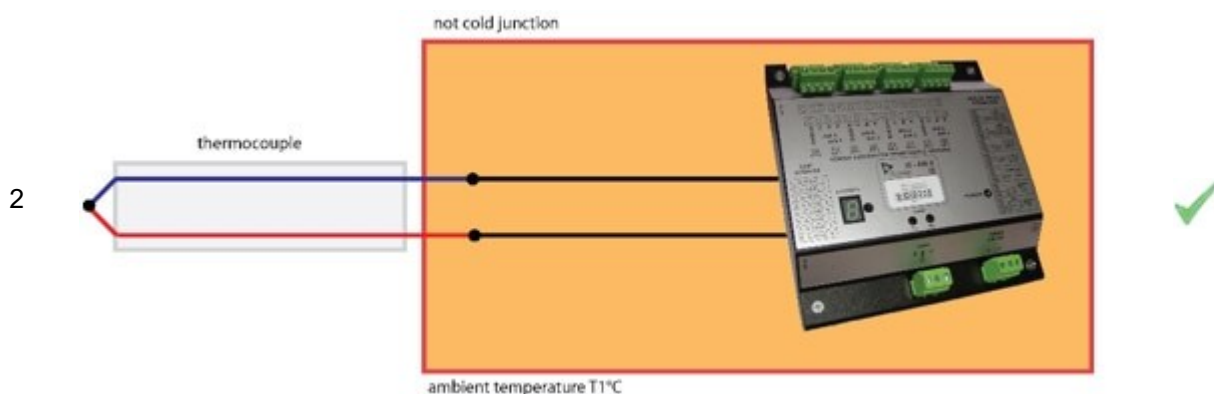
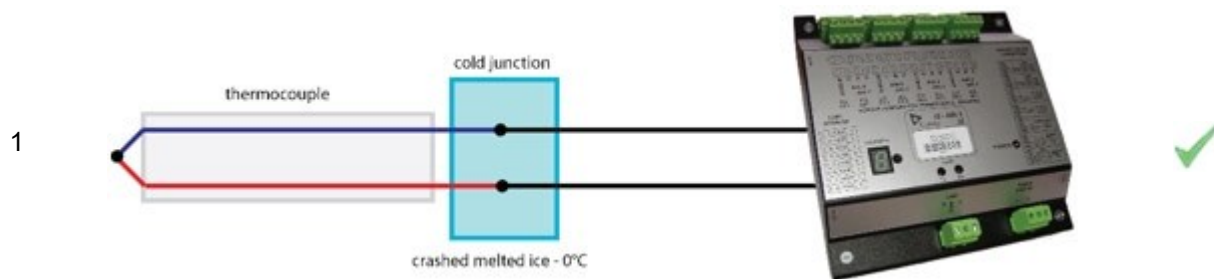
- > For 10 V input voltage range connects external resistors R1, R2 and select sensor characteristic 10 V
- > R1=10 k $\Omega$ , R2=2.7 k $\Omega$ .
- > D terminal is shielding

**Note:** If the thermocouples are connected to IS-AIN8, appropriate jumpers must be removed (see rear sticker). (jumpers are placed under the cover)



### Cold Junction Compensation (CJC)

Cold junction compensation is also called reference junction compensation. When measuring temperature using thermocouples, the reference terminal may not be held at 0°C, but at the surrounding temperature of T1°C instead. Without any compensation, the thermocouple output will be changed (reduced) by T1°C. This is compensated by adding potential difference to the IS-AIN8 corresponding to T1°C.



- **Example 1** shows the correct temperature measurement. The 3rd metal (the cable between IS-AIN8 and thermocouple) is connected in cold bath which temperature is 0°C. This is very difficult to provide in real application.
- **Example 2** shows the correct temperature measurement. The 3rd metal (the cable between IS-AIN8 and thermocouple) is connected in ambient environment which temperature is not 0°C, but T1°C. Resultant temperature is correct, because is compensated by internal IS-AIN8 temperature sensor. The temperature of IS-AIN8 and junction is the same  $T - T1 + T1$  (reduced and compensated by T1).

- **Example 3** shows the incorrect temperature measurement. The 3rd metal (the cable between IS-AIN8 and thermocouple) is connected in ambient environment which temperature is not 0°C, but T1°C. Resultant temperature is T-T1 (reduced by T1). Internal IS-AIN8 compensation should not be used because measures T2 temperature, not T1!
- **Example 4** shows the correct temperature measurement. The 3rd metal (the cable between IS-AIN8 and thermocouple) is connected in ambient environment which temperature is not 0°C, but T1°C. Resultant temperature is correct, because is compensated by external temperature sensor, T+T1 (reduced and compensated by T1).

### Cold Junction Compensation (CJC) settings

- **Example 1** is not a practical in regard of ice bath. In this case should any of not compensated (nc) sensors for analog input be selected base on used thermocouple.

Name	Not Used	Sensor	Thermo(nc) J/°C
Dimension	°C	Resolution	Thermocpl K/°F
Bargraph 0%	-32 768	Offset	Thermocpl L/°F
Bargraph 100%		Bargraph 100%	Thermo(nc) J/°C
Functions	Click + to add item	History Abbreviation	Thermo(nc) K/°C
		Protections	Thermo(nc) L/°C
			Thermo(nc) J/°F
			Thermo(nc) K/°F
			Thermo(nc) L/°F



- **Example 2** is a standard wiring between thermocouple sensor and IS-AIN8. IS-AIN8 is placed in the same ambient temperature as thermocouple terminal; it means IS-AIN8's internal temperature sensor measures the same temperature as is on thermocouple terminal. In this case, cold junction compensation is done by IS-AIN8 itself. Any of standard (compensated) sensors should be selected.

Name	Not Used	Sensor	NI1000/°C
Dimension	°C	Resolution	Thermocpl J/°C
Bargraph 0%	-3 276,8	Offset	Thermocpl K/°C
Functions	Click + to add item	Bargraph 100%	Thermocpl L/°C
		History Abbreviation	PT100/°F
		Protections	PT1000/°F
			NI100/°F
			NI1000/°F
			Thermocpl J/°F

- **Example 3** is a standard wiring between thermocouple sensor and IS-AIN8. Regardless selected type of sensor the resultant temperature will be incorrect
  - Not compensated sensor – temperature T1 is not calculated
  - Compensated sensor – IS-AIN8 measures different T2 temperature, not T1
- **Example 4** External temperature T1 sensor is included. Resultant temperature is correct if
  - Any of **not compensated sensors** (nc) is selected
  - External sensor **has a function Cold Temp 1**

HW Name	Name	Device	Functions	Protections	Sensor	Dimension	Input HW Type	Resolution	Sensor Range	Offset	Bargraph 0%	Bargr
AIN1	Not Used	IS-AIN8 1	-		PT1000/°C	°C		0,1	0,1	0,0	-3 276,8	3

Name	Not Used
Dimension	°C
Bargraph 0%	-3 276,8
Functions	Click + to add item

Item	Name	Used as (Source)
..... LAI57	Cold Temp 2	
..... LAI58	Cold Temp 3	
..... LAI59	Cold Temp 4	
..... LAI341	Cold Temp 5	

**Note:** LAI (logical analog input) Cold Temp 1 compensates every of 8 thermocouples inputs of IS-AIN8 on address 1/IS-AIN8 on address 2 – 10 is not compensated by this LAI Cold Temp 1.

- Any of non thermocouple configured input is not compensated anyway
- Any of non thermocouple input with sensor adjusted as compensated is not compensated by external compensation (IS-AIN8 compensates it itself)
- IS-AIN8 on address 2 – 10 is not compensated by this LAI Cold Temp 1.

LAI Cold Temp 2 compensates every of 8 thermocouples inputs of IS-AIN8 on address 2, etc.

Up to 32 (Cold Temp 1-4 times 8 analog input of IS-AIN8) may be compensated by external sensor.

Even only one external sensor may be configured for more than one LAI Cold Temp.

## Technical data

Dimension (W × H × D)	146 × 160 × 46 mm (5.79' × 6.6' × 1.83')
Interface to Controller	CAN1
Analog inputs	8, galvanic separated from power supply, 16 bit *



<b>Power supply</b>	8 to 36 V DC
<b>Current consumption</b>	250 mA at 24 V
<b>Protection front panel</b>	IP20
<b>Humidity</b>	95% without condensation
<b>Storage temperature</b>	-40 °C to +80 °C
<b>Operating temperature</b>	- 30 °C to + 70 °C
<b>Heat radiation</b>	2 W

\* each analog input can be software configured to:

		Measuring range		Accuracy
		From	To	
Resistance		0 Ω	2400 Ω	± 0.5 %
		0 Ω	250 Ω	± 1.0 %
Current	Passive	0/4 mA	20 mA	± 0.5 %
	Active	4 mA	20 mA	± 0.5 %
	Active	0 mA	± 20 mA	± 0.5 %
Voltage	Thermocouples J, K, L type			± 0.2 %
		0 mV	100 mV	± 0.2 %
		- 1000 mV	+ 1000 mV	± 0.5 %
		0 mA	2500 mV	± 0.5 %

<b>Standard conformity</b>	
<b>Low Voltage Directive</b>	EN 61010-1:95 +A1:97
<b>Electromagnetic Compatibility</b>	EN 50081-1:94, EN 50081-2:96 EN 50082-1:99, EN 50082-2:97

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## IS-AIN8TC

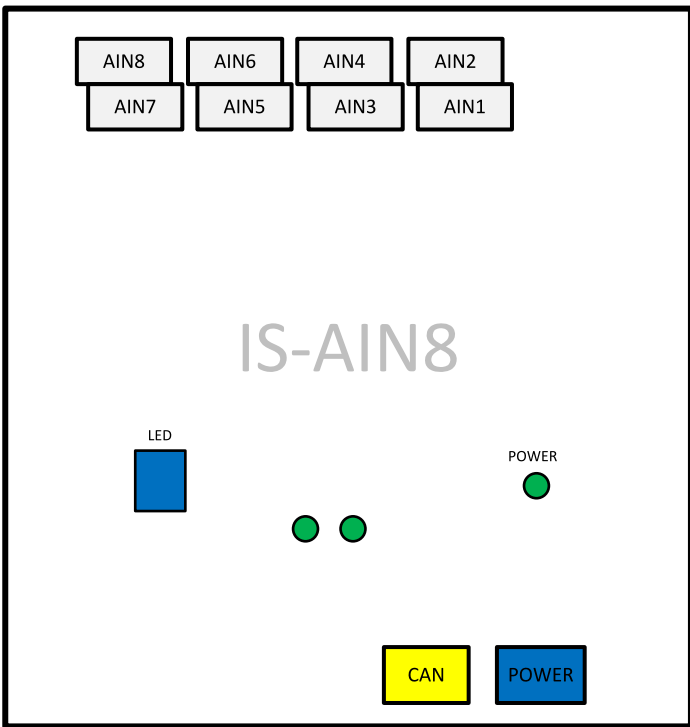
IS-AIN8 is input extension module equipped with 8 analog inputs dedicated for thermocouple sensors only.

All inputs can be configured to any logical function or protection. It is possible to connect up to 10 IS-AIN8TC external units to one controller. IS-AIN8TC is connected to controller **CAN1A (page 17)** bus.

The detection of communication speed is indicated by fast flashing of status LED. Once the speed is detected the module remains set for the speed even when the communication is lost. Renewal of communication speed detection is done by reset of the module.



## Terminals



AIN1 – AIN8	8 analog inputs
CAN	CAN1 line
POWER	Power supply
POWER	State indication
Rx, Tx	Data transmitted and received on CAN1 line
LDD	CAN1 address

## Supported sensors

Sensors	
Thermocpl J [°C] (fix)	Thermocpl (nc) J [°C] (fix)
Thermocpl K [°C] (fix)	Thermocpl (nc) K [°C] (fix)
Thermocpl L [°C] (fix)	Thermocpl (nc) L [°C] (fix)
Thermocpl J [°F] (fix)	Thermocpl (nc) J [°F] (fix)
Thermocpl K [°F] (fix)	Thermocpl (nc) K [°F] (fix)
Thermocpl L [°F] (fix)	Thermocpl (nc) L [°F] (fix)

**Note:** "nc" means "not cold junction compensation (by external sensor)". In this case is used internal temperature sensor on the PCB

## CAN Address

CAN1 address is set by following procedure:

1. Press Address button during IS-AIN8TC power supply on to switch to addressing mode.
2. Then repeatedly press or keep pressed address button to adjust required address according to controller configuration.
3. After setting requested address, release the buttons and wait until the digits blink – it indicates writing of the change address to EEPROM memory.

	CAN11 Address
1. IS-AIN8TC	1
2. IS-AIN8TC	2
3. IS-AIN8TC	3
4. IS-AIN8TC	4
5. IS-AIN8TC	5
6. IS-AIN8TC	6
7. IS-AIN8TC	7
8. IS-AIN8TC	8
9. IS-AIN8TC	9
10. IS-AIN8TC	0

Table 7.7 Table of recommended CAN1 address setting

### SW version check

Shortly press address button. Following sequence appears on the display: number "1", one second pause, number "4", two second pause, number "1", one second pause, number "4", two second pause and finally IS-AIN8TC actual address.

Error message (e.g. SD BOUT2) appears on Controller screen when Binary input or output Address x is configured but corresponding unit is not recognized (no message is received from CAN bus). Check IS configuration and corresponding external IS-AIN8TC, IS-BIN8/16 unit address setting.

### LED indication

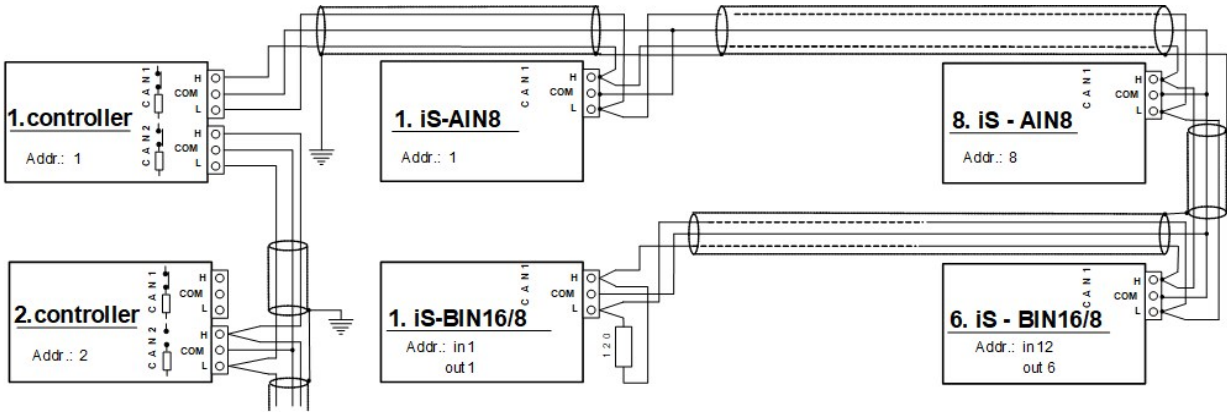
Power LED		Address LDD	
Lighting	Blink	Lighting	Blink
Power supply and CAN address are with no problems	CAN1 address is adjusted different in IS-AIN8TC and in controller	Displaying current CAN1 address	Displaying current SW version

Table 7.8 LED/LDD status

Tx		Rx	
Dark	Blink	Dark	Blink
Any data are transmitted on the CAN1 line	Data are transmitted on the CAN1 line	Any data are received on the CAN1 line	Data are received on the CAN1 line

Table 7.9 Tx/Rx LED status

# Wiring



**Note:** CAN bus line has to be terminated by 120 ohm resistors on the both ends.  
For longer distances is recommended to connect CAN COM terminals between all controllers and cable shielding to the **ground in one point!**  
External units can be connected on the CAN bus line in any order, but line arrangement (no tails no star) is necessary.  
Recommended CAN bus data cables see in Chapter Technical data.  
IG-MU and IG-IB units are connected to CONTROLLER CAN2 bus.

Select sensor characteristic from the list or define user sensor characteristic in PC configuration tool.

Thermocouple J, K, L, D terminal is shielding

# Cold Junction Compensation (CJC) settings

Please have a look at **Cold Junction Compensation (CJC) (page 742)** iS-AIN8 chapter.

# Technical data

Dimension (W × H × D)	110 × 110 × 46 mm (4.3" × 4.3" × 1.8")
Weight	237.5 grams
Interface to controller	CAN1

Analog inputs (not electric separated)	8, no galvanic separated
Measuring	±100 mV
Accuracy	± 0.1 % of actual value + ± 100 µV (± 3 °C)

<b>Internal sensor for measuring cold junction - Accuracy</b>	±1 °C in temperature range -20 °C ÷ +70 °C
<b>Galvanic separation</b>	CANbus is galvanic separated from the measurement and power supply. All analog inputs are galvanic separated from power supply. Analog inputs are not galvanic separated between channels

<b>Power supply</b>	8 to 36 V DC
<b>Protection</b>	IP20
<b>Current consumption</b>	35 mA at 24 V ÷ 100 mA at 8 V
<b>Storage temperature</b>	-40 °C to +80 °C
<b>Operating temperature</b>	- 30 °C to + 70 °C
<b>Heat radiation</b>	2 W

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## IS-BIN16/8

IS-BIN16/8 is an extension module with 16 binary inputs (galvanic separated) and 8 binary output (galvanic separated), 2 pulse inputs (frequency measurement or pulse counting). All I/O can be configured to any logical function or protection. It is possible to connect up to 7 IS-BIN16/8 external units to one controller. External modules IS-BIN16/8 is connected to controller **CAN1A (page 17)** bus. To operate external modules:

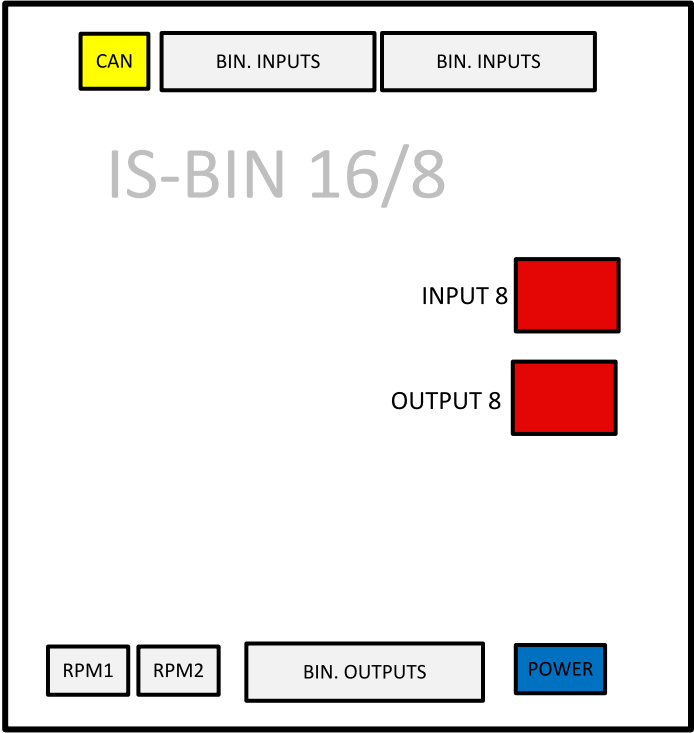
- Connect all external modules to CAN1 bus line
- On each module adjust I/O CAN1 address in the range of 1 to 7 for IS-BIN16/8 output, 1,3,5,7,9,11,13 for IS-BIN18/8 inputs
- In case of use generic module in configuration you can set CAN address from 1 – 12
- In case of set 0 CAN address - inputs/ outputs are deactivated
- Input output address is displayed on the front panel LCD's
- Use PC configuration tool to configure controller according external modules setting

IS-BIN16/8 module has two separate CAN1 addresses for binary inputs Group 1, Group 2 and binary output Group (total three addresses). The CAN1 address for BI Group 1 and for BO Group 2 can be adjusted on the IS-BIN16/8. The address for BI Group 2 is set automatically to the address following BI Group 1.

**Note:** CAN address 0 disables corresponding CAN message (Group data are not send).



Terminals



CAN	CAN1 line
BINARY INPUTS	16 binary inputs
BINARY OUTPUT	8 binary output
RPM1, RPM2	2 frequency inputs
POWER	Power supply
INPUTS	LDD CAN address
OUTPUT	LDD CAN address

CAN Address

CAN 1 address is setting by following procedure:

- Press Address buttons (for INPUTS address and OUTPUT address) during IS-BIN8 power supply on to switch to addressing mode.
- Then repeatedly press or keep pressed address button to adjust required address according to CONTROLLER configuration.
- After setting requested address, release the buttons and wait until the digits blink – it indicates write the changed address to EEPROM memory.

	CAN 1 Address	
	Inputs	Output
1. IS-BIN16/8	1	1
2. IS-BIN16/8	3	2
3. IS-BIN16/8	5	3



4. IS-BIN16/8	7	4
5. IS-BIN16/8	9	5
6. IS-BIN16/8	11	6
7. IS-BIN16/8	16	7

Table 7.10 Table of recommended CAN1 address setting

### SW version check

Let suppose IS-AIN8 of SW version 1.4. Shortly press address button. Following sequence appears on the display: number "1", one second pause, number "4", two second pause, number "1", one second pause, number "4", two second pause and finally IS-AIN8 actual address.

Error message (e.g. SD BOUT2) appears on Controller screen when Binary input or output Address x is configured but corresponding unit is not recognized (no message is received from CAN bus). Check IS configuration and corresponding external IS-AIN, IS-BIN unit address setting.

### LED indication

Tx			Rx		
Dark	Blink	Light	Dark	Blink	Light
Any data are transmitted on the CAN1 line	Data are transmitted on the CAN1 line		Any data are received on the CAN1 line	Data are received on the CAN1 line	

Table 7.11 Tx / Rx LED status

### Wiring

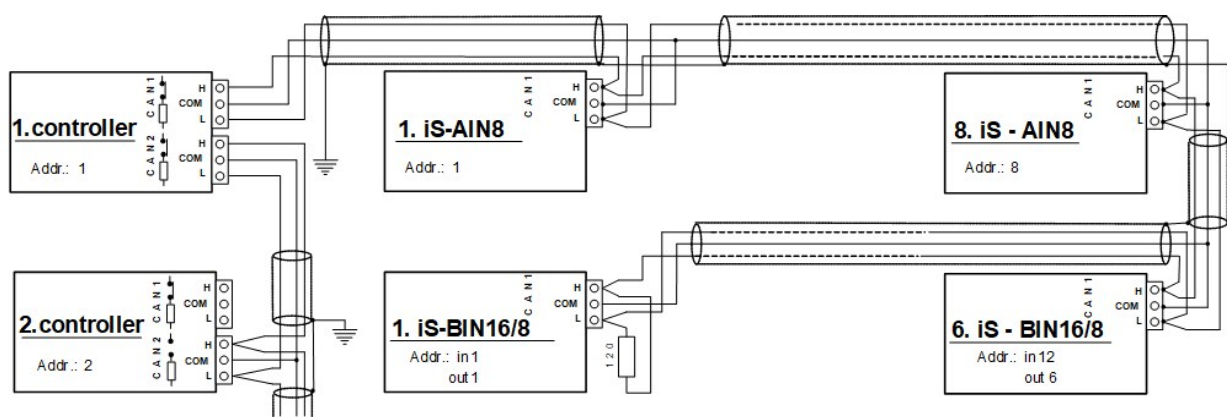


Image 7.57 CAN bus line has to be terminated by 120 ohm resistors on the both ends.

**Note:** CAN bus line has to be terminated by 120 ohm resistors on the both ends.

For longer distances is recommended to connect CAN COM terminals between all controllers and cable shielding to the **ground in one point!**

Recommended CAN bus data cables see in Chapter Technical data.

External units can be connected on the CAN bus line in any order, but line arrangement (no tails no star) is necessary-

Recommended CAN bus data cables see in Chapter Technical data.

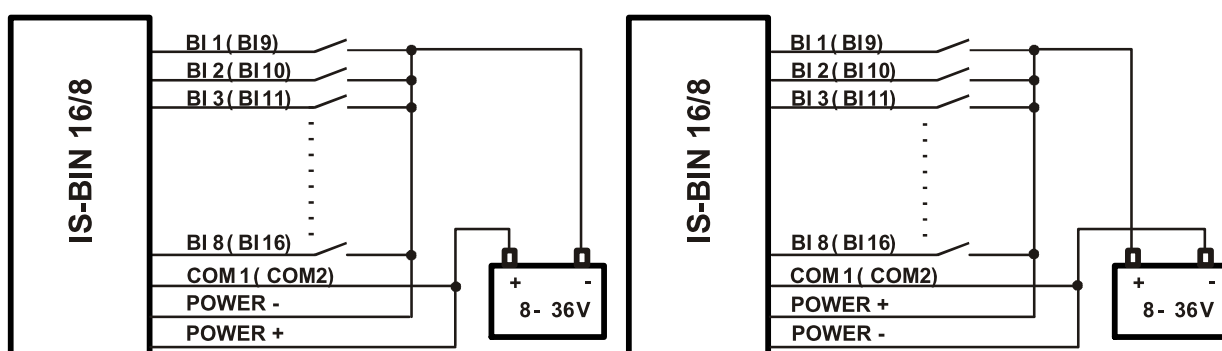
## Binary inputs

There are two groups of eight Binary inputs BI1 to BI8 and BI9 to BI16. Each group has a separate Common terminal COM1 and COM2. The Common terminal can be connected to positive or negative pole – see following drawing. Binary inputs are galvanically separated from IS-BIN16/8 power supply.

**Note:** See the *Theory of binary inputs and outputs (page 697)* (Pull Up, Pull Down, High side switch, Low side switch).

Binary inputs Common terminal is connected to **positive** supply terminal, Binary inputs contacts are closed to **negative** supply terminals.

Binary inputs common terminal is connected to **negative** supply terminal, Binary inputs contacts are closed to **positive** supply terminals.



Input voltage range for opened contact is from 8 VDC to Power supply VDC. Input voltage range for closed contact is from 0 to 2 VDC. Voltage level is defined between Binary input and Binary input COM terminal and does not depend on "positive" or "negative" connection.

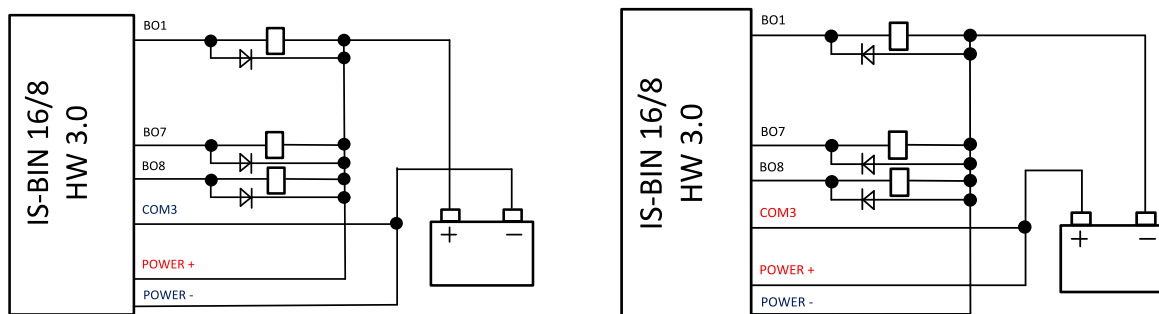
**IMPORTANT: Impulse inputs are not supported by the controller.**

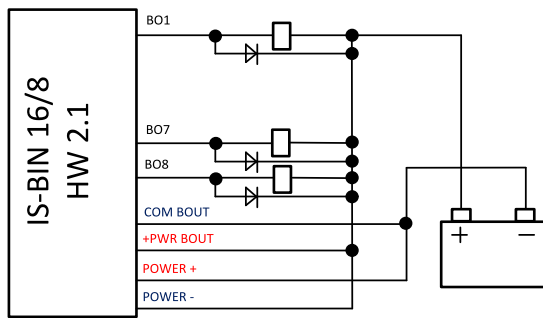
## Binary output

The Common terminal can be connected to positive or negative pole (HW3.0 only) – see following drawing. Binary outputs are galvanic separated from IS-BIN16/8 power supply (have a look at technical data). The maximum load values are 0.5 A / 36V for one output.

Binary output common terminal is connected to **negative** supply terminal, Binary output contacts are closed to **positive** supply terminals.

Binary output common terminal is connected to **positive** supply terminal, Binary output contacts are closed to **negative** supply terminals.





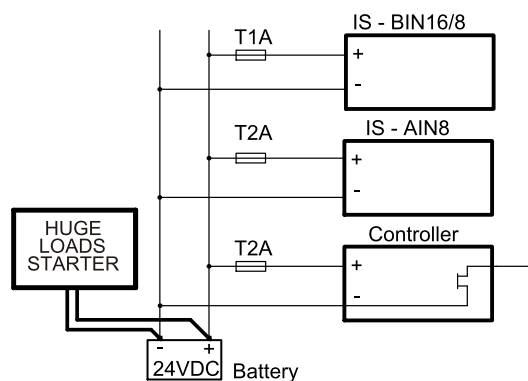
## Power supply fusing

A (2) respectively (1) amp fuse should be connected in-line with the power to the controller and modules, these items should never be connected directly to the starting battery.

Take care for proper controller, extension units and relays power supply fusing. Fuse value and type depends on number of connected devices and wire length.

Controller or unit	Fuse
Controller	T1A or T2A
IS-AIN8	T2A
IS-BIN16/8	T1A

Table 7.12 Recommended fuse (not fast) types



For more extension units use separate fusing according to the table above.

Controller power supply should never be connected to starter terminals.

## Technical data

Dimension (W × H × D)	146 × 160 × 46 mm (5.79' × 6.6' × 1.83')
Interface to controller	CAN1
<b>Binary inputs (galvanic separated)</b>	
<i>Voltage level is defined between binary input and binary input COM terminal</i>	
Number of inputs	8 + 8
Input resistance	3000 Ω

Input voltage range	0-36 VDC
Input voltage level for open contact	8 to Power supply VDC
Input voltage level for close contact	0 to 2 VDC

<b>Frequency inputs* (for IS-CU only)</b>	
<b>RPM1</b>	
Type of sensor	Magnetic pick-up
Minimum input voltage	2 Vpk-pk (from 4 Hz to 4 kHz)
Maximum input voltage	50 Veff
Maximum measured frequency	8 kHz (min. input voltage 6Vpk-pk), frequency mode
<b>RPM2</b>	
Type of sensor	Contact or Active sensor
Minimal pulse width	10 ms, integration mode
Maximum measured frequency	60 Hz, integration mode

<b>Relays outputs (<i>galvanic separated</i>) only HW 3.0 (<i>non galvanic separated</i>) HW 2.1</b>	
Number of output	8
Maximum current	0.5A DC
Maximum switching voltage	36 VDC

Power supply	8 to 36 V DC
Protection front panel	IP20
Current consumption	250 mA** at 24 V
Humidity	95% without condensation
Storage temperature	-40 °C to +80 °C
Operating temperature	- 30 °C to + 70 °C
Heat radiation	2 W

<b>Standard conformity</b>	
Number of output	8
Low Voltage Directive	EN 61010-1:95 +A1:97
Electromagnetic Compatibility	EN 50081-1:94, EN 50081-2:96 EN 50082-1:99, EN 50082-2:97

\*RPM1, RPM2 are available in IS-CU only

\*\*During powering up current can be up to 1.5A

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