CPC12PN *ControlPlex*®
CONTROLLER

Instruction manual

ENGINEERING TECHNOLOGY

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1 GENERAL INFORMATION

1.1 Safety Instructions

This manual points out possible danger for your personal safety and gives instruction how to avoid property damage. The following safety symbols are used to draw the reader's attention to the safety instructions included in this manual.

DANGER!
Danger to life and limb unless the following safety precautions are taken.

WARNING!
Danger to machinery, materials or the environment unless the following safety precautions are taken.

NOTE!
Information is provided to allow a better understanding.

CAUTION!
Electrostatically sensitive devices (ESD). Devices must exclusively be opened by the manufacturer.

DISPOSAL GUIDELINES
Packaging can be recycled and should generally be brought to re-use.

1.2 Qualified Personnel

This user manual must exclusively be used by qualified personnel, who are able - based on their training and experience - to realise arising problems when handling the product and to avoid related hazards. These persons must ensure that the use of the product described here meets the safety requirements as well as the requirements of the presently valid directives, standards and laws.

1.3 Use

The product is part of a continuous enhancement process. Therefore, there might be deviations between the product in hand and this documentation. These deviations will be remedied by a regular review and resulting corrections in future editions. The right to make changes without notice is reserved. Errors and omissions excepted.

1.4 Delivery State

The product is supplied with a defined hardware and software configuration. Any changes in excess of the documented options are not permitted and lead to liability exclusion.

2 GENERAL DESCRIPTION

The customer’s demands for consistent quality and increased quantities of their products pose high challenges on the machine construction and process control. At the same time, globalisation leads to worldwide value streams and production chains. Machines and plants that were organised only region- ally some years ago are connected via global networks today. These developments increase the requirements of machine and system control as well as the used components. An increasing number of measuring data must be recorded, analysed, evaluated and stored. This increases transparency and the system availability of production processes.

Even the DC 24 V power distribution is affected by this development. The control voltage supplies the essential components of machines or systems. They include not only the programmable controls, but e.g. actuators and sensors. Therefore, it plays an important part in all production processes. Their availability and stability are essential for the system availability and the quality of the produced goods. The REX system meets these requirements. It includes electronic circuit protectors, which are connected without requiring further accessories via an integral contact arm. The EM12 supply module can supply the circuit protectors with max. 40 A. The new CPC12 bus controller provides access to all system relevant data of the superordinate control systems via a PROFINET interface and an Ethernet interface.

This is how the CPC12 connects the circuit protectors with the superordinate control system. The connection from the REX product group to the intelligent circuit protectors are realised via the internal **ELBus®** interface. The CPC12 allows entire access to all required parameters of the electronic circuit protectors, their control unit and the visualisation of the device data, either via the field bus interface of the superordinate control unit or via the RJ45 interface for operation on site. The system provides a fully parametrisable protection for DC 24 V circuits and ensures the selective overcurrent protection of sensors and actuators, decentralised periphery modules etc. and their supply lines.

1 For a clear presentation and description, the intelligent circuit protectors are only named with their system designation REX. This indication includes the REX12D and REX22D circuit protectors.

2.1 Design of the Entire System

The CPC12 bus controller is the centre of the ***ControlPlex***® system. It allows consistent communication between the electronic circuit protectors and the superordinate control level, connected HMIs and even up to the Cloud.

The PROFINET interface connection to the superordinate control unit is realised with two RJ45 sockets. It allows connection of the required control unit with the ***ControlPlex***® system and therefore, to display, analyse and diagnose the individual measuring values. The individual electronic circuit protectors can be con- trolled selectively. The integral web server of the bus controller can be directly accessed via an additional Ethernet interface. Service staff can access the system on site. Furthermore, the connected infrastructure of the company can be accessed from all over the world. In the future, OPC UA and MQTT provide the option to transmit all measuring values and status information, independent from the control system, e.g. to a superordinate Cloud application. Any changes of the measuring values of all electronic circuit protectors are also signalled to the automation system. This enables the user to have unrestricted access to the safety-relevant functions even in the event of an interruption. Any occurring failures will be detected quickly and can be remedied without delay. The ***ControlPlex***® system effectively reduces system downtimes and significantly increases productivity.

Up to 16 double-channel electronic circuit protectors can be connected to the CPC12 bus controller.

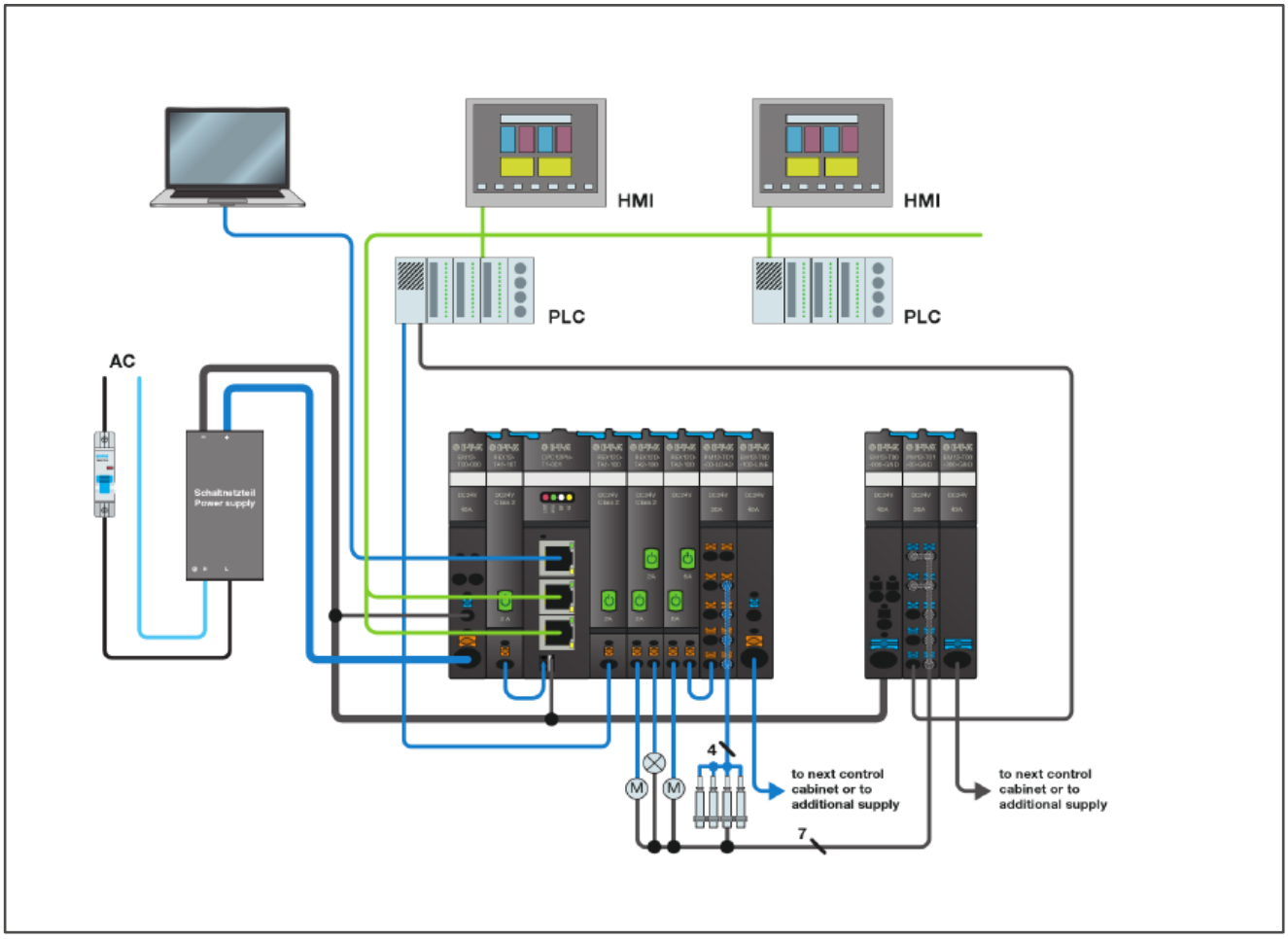


Figure 1: System Overview

2.2 CPC12XX-TX Dimensions

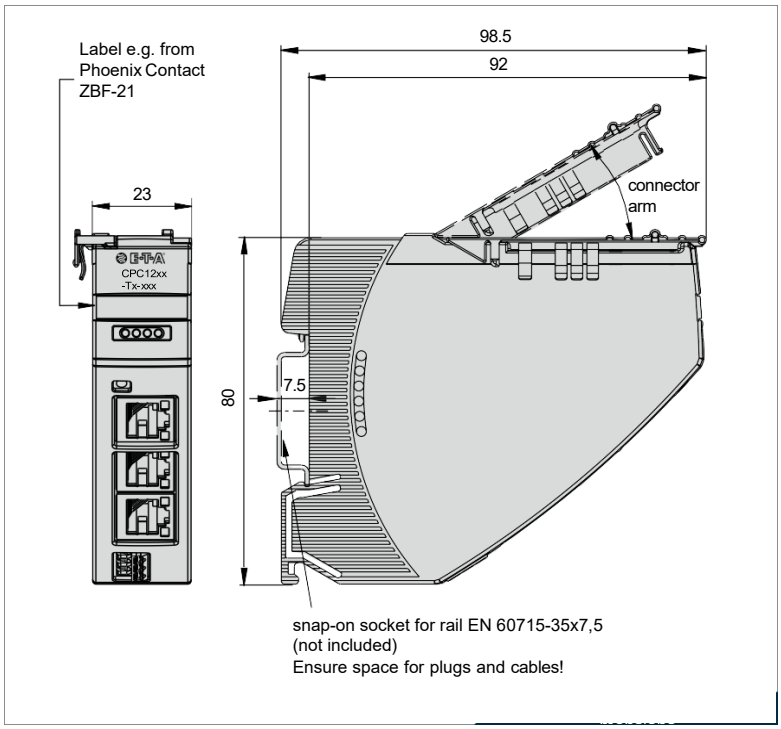


Figure 2: CPC12 dimensions

2.3 Status Indication and Terminals

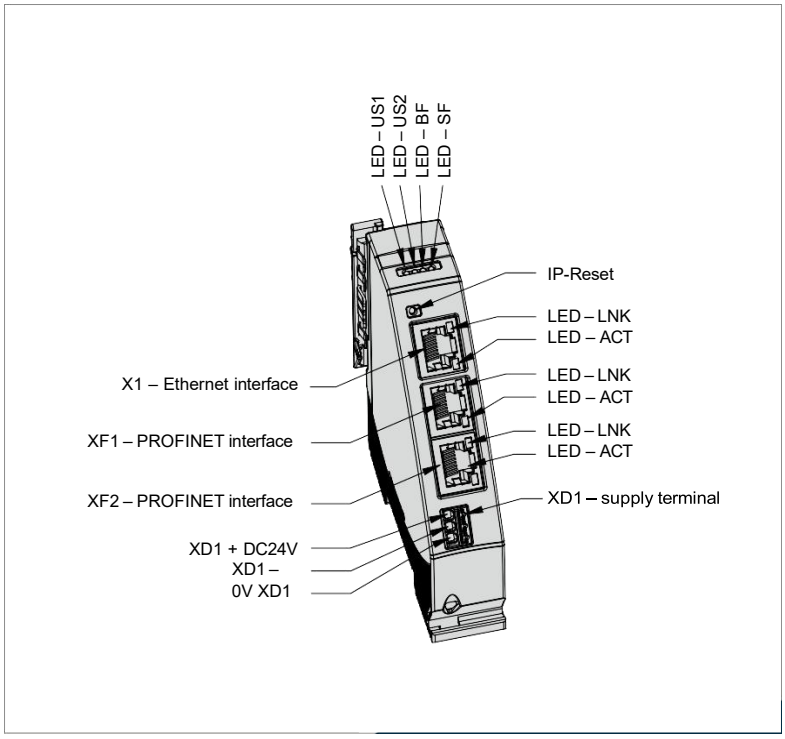


Figure 3: CPC12 Status Indication and Terminals

2.3.1 Terminals for Voltage Supply

XD1 supply

Rated voltage:	DC 24 V (±5 % → 18 ... 30 V)	
Rated current:	typ. 75 mA	
Terminal design:	3 x push-in terminals (+/0V/FE)	
	Connection capacity rigid	0.2 – 1.5 mm2
	Flexible with wire end ferrule (without plastic sleeve)	0.2 – 1.5 mm2
	Flexible with wire end ferrule (with plastic sleeve)	0.2 – 0.75 mm2
	Cable cross section	AWG24 – AWG16 str.
	Stripping length	8 mm

Using a supply voltage outside the indicated operating range can lead to malfunctions or the destruction of the device.

The voltage supply of the CPC12 bus controller is ensured via the supply module and the corresponding connection arm. Using the supply terminals is optional.

2.3.2 PROFINET Interfaces with Integral Switch, XF1, XF2 Sockets

XF1 Connection to bus system PROFINET
Type: RJ45

XF2 Connection to bus system PROFINET
Type: RJ45

When wiring and connecting to the PROFINET bus system the installation and wiring regulations of the PROFIBUS User Organisation (PNO) must be observed.

2.3.3 Ethernet Interface, Connector X1

X1 Connection to the CPC12 bus controller and the integral web server
Type: RJ45

2.3.4 LED Status Indication

Visual status indication by means of multicoloured LED:

Operating mode	Indication of operating mode			
	LED US1	LED US2	LED BF	LED SF
Bus fault	Green	Green	Red	OFF
System fault	Green	Green	OFF	Red
Firmware update	OFF	OFF	OFF	OFF
No actuator voltage	n.a.	Red	n.a.	n.a.
No device connected or bus error	n.a.	blinking orange	n.a.	n.a.
PROFINET device localisation	n.a.	n.a.	n.a.	blinking red
PROFINET connection active	Green	Green	OFF	OFF

Figure 4: LED status indication

n.a. = not applicable

Optical signalling of the RJ45 interfaces

LED LNK

Operating mode	Indication of operating mode
Link available	Green
No Link available	OFF

LED ACT

Operating mode	Indication of operating mode
Act available	blinking orange
No Act available	OFF

Figure 5: RJ45 sockets LED indication

3 MOUNTING AND INSTALLATION

The preferred mounting position of the ***ControlPlex***® system is horizontal.

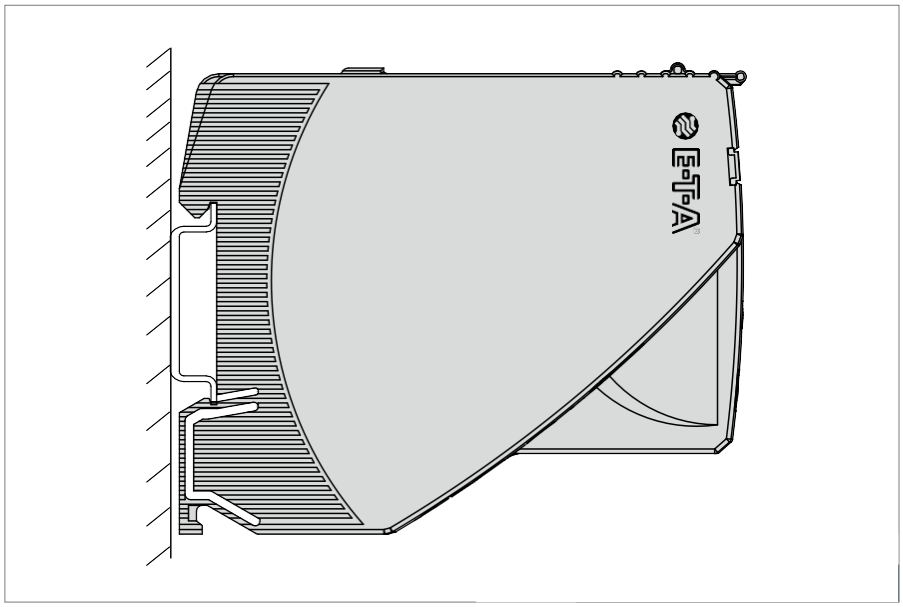


Figure 6: CPC12 Installation Drawing

4 OPERATING MODES OF THE CPC12 BUS CONTROLLER

Independent of the respective operating mode, the system has a basic safety function. As soon as a circuit protector channel is switched off manually, it cannot be switched on again via the control or the web server. The channel must be switched on manually again.

4.1 Operating Mode: Start-Up Mode

The CPC12 bus is initialised by applying the supply voltage. The device carries out internal programme memory tests and self-test routines. Communication via the interfaces is not possible in this time.

4.2 Operating Mode: System Error Mode

If a failure is detected during the self-test routines, the bus controller will change into the System Error operating mode. You can only exit this operating mode by re-starting the device and it prevents the data exchange via the interfaces. If the bus controller is in the aforementioned operating mode, it is unable to control the electronic circuit protectors and they will remain in the stand-alone mode (overcurrent protection).

4.3 Operating Mode: Configuration Error Mode

If there are no valid or invalid configuration data available at the Modbus controller, it will change into this operating mode. This operating mode only allows a non-cyclical data exchange. The cyclical data exchange is prevented. You can exit this operating mode upon receipt of the correct module and slot parameters and configuration data.

4.4 Operating Mode: Stand-Alone Mode

During normal operation, there is a connection between the bus controller and the superordinate control unit. The CPC12 bus controller will automatically take over the control and parametrisation of the electronic circuit protectors, as all required data sets are stored there. You can access the electronic circuit protectors and their status and parameters via the Ethernet interface by means of the web server. This way, you can change e.g. the parameter data of the various electronic circuit protectors. After the failure on the communication level is remedied, you can exit this operating mode and the superordinate control unit will take over control again as master. If a parameter was changed during the time when no communication was available, this will be signalled to the superordinate control unit. This helps the user define the control behaviour accordingly and programme it in the programmable control unit. This allows the users to select a reaction perfectly adapted to their requirements.

4.5 Operating Mode: Slave Mode

In this operating mode, the CPC12 bus controller is integrated in a PROFINET system. The communication to the CPC12 bus controller works faultlessly and the controller can be addressed and controlled via the superordinate control unit. If communication breaks down, this will have no influence on the protective function of the circuit protectors. You can determine the bus controller behaviour in case of parallel use of the field bus interface and the web server via the device configuration of the superordinate control unit. You can specify whether the Ethernet interface or the web server only has reader access or reader and editor access. The editor access allows to make changes to the parametrisation of the electronic circuit protectors as well as to the field bus system. These parameter changes will then be transmitted to the superordinate control system and can be taken over by it or overwritten. The user can select the behaviour accordingly.

4.6 Operating Mode: Firmware Update Mode

The devices are supplied with a software programmed according to their functionality. If the function scope of the devices is extended, the new functions are added via the firmware update. If you want to use the new function, you must carry out a firmware update.

The firmware updates of the bus controller can be downloaded via the integral web server. You can find further information on this in the instruction manual of the web server. The current firmware file is available in the download portal of the ***ControlPlex***® systems via the E-T-A homepage.

INSTRUCTION MANUAL
WEB SERVER

DOWNLOAD PORTAL LINK
CONTROLPLEX SYSTEMS

5 BASIC FUNCTIONS OF THE ENTIRE SYSTEM

5.1 Internal Cycle Times

The cycle time of the system depends on the number of connected electronic circuit protectors and the internal baud rate. The internal baud rate can amount to 9600 Baud or 19200 Baud. The baud rate only amounts to 19200 when all connected circuit protectors support this function. These are normally REX22D circuit protectors and REX12D devices with the software version 2.0.2 printed on their enclosure.* The software version can be found below the white type label on the front side of the REX12D. The baud rate is displayed in the cyclical data in the “Status Controller”. The current cycle time can be requested via the non-cyclic access to the “dynamic CPC12 information”.

The cycle time for 16 circuit protectors at an internal baud rate of 9600 Baud is about 480 ms for the cyclic data, i.e. 30 ms per device. A time window of 130 ms is reserved for non-cyclic data. This makes a total cycle time of max. 610 ms. With an internal Baud rate of 19200 Baud the cycle time for cyclical data is reduced to about 240 ms, i.e. 15 ms per device. A time window of 100 ms is reserved for non-cyclic data. This makes a total cycle time of max. 340 ms.

5.2 Hot Swap of the Circuit Protectors

If a new circuit protector is installed at an existing application, it is automatically parametrised with the parameters designated for this circuit protector address. The parameter transmission will be done without interruption of the cyclical data exchange between the CPC and the electronic circuit protectors.

5.3 Additional Ethernet Interface

The additional Ethernet interface (X1) expands the function scope of the bus controller. The following functions are provided via this interface:

5.3.1 Web Server

The web server provides all measuring data, status information, parametrisation options and control functions of the CPC12 bus controller. The parametrisation of the interface is explained separately.

5.3.2 Default X1 IP address

The default IP address of the CPC12 is:

IP Address	192.168.1.1
Netmask	255.255.255.0
Gateway	192.168.1.254

The web server can be reached via this IP address. By pressing the IP reset button for 3 seconds, the IP address is reset to the default value.

*Customer-specific solutions are excluded from this regulation.

5.3.3 Username and Password

The user must have the necessary access authorisation to be able to carry out configurations via the web server. This authorisation is defined in the user administration.

The default setting is:

User	admin
Password	admin

It is highly recommended to individually adjust the device settings during the first operation.
Please note that it is not possible to automatically reset the user and password to the default settings.

6 COMMUNICATION VIA PROFINET

6.1 *ControlPlex*® Device Model

The power distribution system with CPC12 controller includes a passive EM12-T00-000-DC24V-40A supply module and up to 16 intelligent circuit protectors of the REX product group. In the sub-slot 2 of the second slot, you can configure the maximum number of circuit protectors. This configuration has influence on the length of the cyclic data.

The ***ControlPlex***® power distribution system uses the following PROFINET device model:

Figure 7: Device Model

PROFINET	CPC12PN
Slot 0	The PROFINET interface requires the Device Access Point (DAP) in slot 0. The DAP serves as access point for communication with the master and is described in the GSD file. It needs no further configuration.
Slot 1	Slot 1 represents the CPC12PN controller. SubSlot 1 is reserved for the permanently assigned module with the CPC12PN I/O data. This sub-module contains 2 input and output bytes which are described in more detail in 7.1 CPC12 Controller I/O Data Module. This slot is firmly installed and cannot be removed.
Slot 2	Slot 2 represents the power distribution with the circuit protectors connected to the CPC12PN. SubSlot 1: Total current of all connected channels. This module is permanently assigned. SubSlot 2: Status, control bytes and measuring values of the circuit protectors. In this sub-slot the number of circuit protectors can be configured by selecting the module (from the GSDML file). The process data image of the PLC includes 10 input and 2 output bytes for each circuit protector described in 7.2 Power Distribution Module. Depending on the application, the number of regularly exchangeable process data can be determined. When less circuit protectors are installed than are configured, the input data of the missing circuit protectors are indicated as “not connected”. When more circuit protectors are connected than were configured, they cannot be controlled via the PLC. You can configure between 1 to 16 circuit protectors via the CPC12.

Figure 8: Communication Properties

6.2 GSDML File

The GSDML file is available in the download area of the E-T-A website and can be downloaded there.

6.3 I&M Data – Identification & Maintenance

The following I&M device data are provided by the CPC12 controller:

I&M data	Length	Data set	Meaning	
VENDOR_ID	2 bytes	I&M0	Manufacturer identification	Value manufacturer ID 696
ORDER_ID	20 bytes	I&M0	Purchase order number	
SERIAL_NUMBER	16 bytes	I&M0	Serial number	
HARDWARE_REVISION	2 bytes	I&M0	Revision index	
SOFTWARE_REVISION	4 bytes	I&M0	Firmware version	
REVISION_COUNTER	2 bytes	I&M0		
PROFILE_ID	2 bytes	I&M0	Profile ID	0000h
PROFILE_TYP	2 bytes	I&M0	Profile-specific coding	0005h
IM_VERSION	2 bytes	I&M0	I&M data version	0101h
IM_SUPPORTED	2 bytes	I&M0	Supported data sets	001Eh
TAG_FUNCTION	32 bytes	I&M1	Clear indication throughout the entire system	
TAG_LOCATION	22 bytes	I&M1	Installation area	
INSTALLATION_DATE	16 bytes	I&M2	Installation date and time YYYY-MM-DD HH:MM	
DESCRIPTOR	54 bytes	I&M3	Comments	

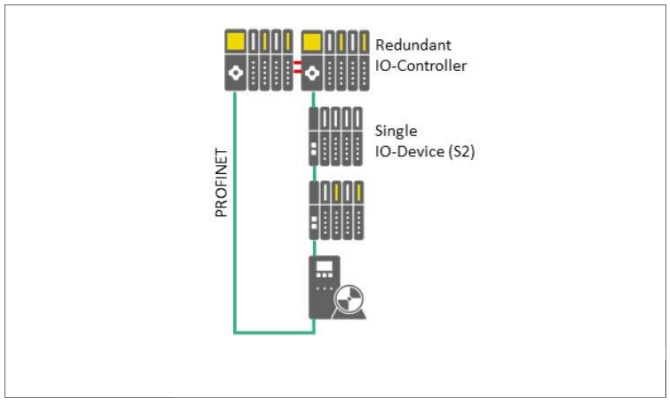
Figure 9: I&M Data

6.4 System Redundancy

The CPC12PN supports the system redundancy S2 and the MRP media redundancy.

6.4.1 S2 System Redundancy

The S2 system redundancy enables a simple communication between the CPC12 and a redundant control. The redundant IO controller is connected at the end of the PROFINET line, see Figure 10. The IO devices provide two connections to this controller, one to the “left”, one to the “right”. One of the two connections is active and connects the IO device to the active part of the redundant IO controller. If the active connection is interrupted or if the active control fails, a quick change to the second connection takes place.



Source: PROFIBUS Nutzerorganisation e. V. (PROFIBUS User Organisation e. V), PROFINET system description - Technology and application, p. 20, fig. 28

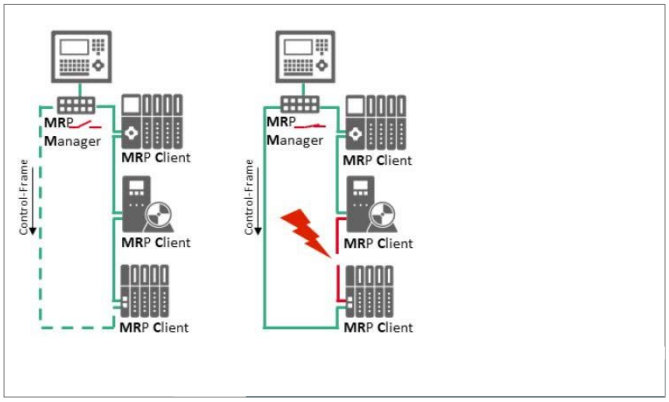
Figure 10: S2 System Redundancy with PROFINET

6.4.2 MRP Media Redundancy

The acronym MRP stands for Media Redundancy Protocol and refers to a PROFINET redundancy function. For this function, the typical time for the new configuration of the communication paths for TCP/IP and RT frames in the event of a failure are below 200 ms. Several media redundancy clients (MRC) and a media redundancy man- ager (MRM) are arranged in a ring structure to increase the fail-safety, see Figure 11. The role of the redundancy Manager (MRM) is to test the defined ring structure for its functionality. For this purpose, test frames are sent in regular intervals. When the MRM receives the sent test frames back, the ring structure is intact. For all other data packages the redundancy manager interrupts the ring structure.

As soon as the ring is interrupted, the redundancy manager cannot receive back the sent test frames. In order to recreate the line structure it closes the switch. This is where the media redundancy clients come into play that serve as switch and therefore as “transit station” for frames. They can be integrated into the ring structure if they have at least two switch ports.

The next Media Redundancy for Planned Duplication (MRPD) development version, that is specifically used for IRT connections, is not supported by the CPC12PN.



Source: PROFIBUS Nutzerorganisation e. V. (PROFIBUS User Organisation e. V), PROFINET system description - Technology and application, p. 19, fig. 27

Figure 11: MRP Media Redundancy with PROFINET

7 CYCLICAL I/O DATA

Depending on the selected module in Slot 2, SubSlot 2, a varying number of data bytes are exchanged in the non-cyclical data traffic.
The GSDML file made available for the projecting tool allows the related configuration, the system recognizes all permitted configurations and processes the cyclical data defined in the projection.
Only the CPC12 I/O data module is firmly installed in Slot 1 and cannot be removed because the input bytes hold vital failure and diagnostic information as described in the following.

7.1 CPC12 Controller I/O Data Module

The 2 bytes input data contain the following global error and diagnostic messages.
This module contains 2 output data Bytes, which are reserved for later expansions and are currently not used.

	Byte	Type	Range	Description
Status controller	0 HighByte 1 LowByte	UInt16	0xFFFF	Bit0 = No configuration data available Bit1 = Invalid configuration data Bit2 = Connected device type does not match with the configuration Bit3 = Parameters restored Bit4 = Command memory overflow Bit5 = No communication to the **ELBus®** 1 Bit6 = Reserve Bit7 = Reserve Bit8 = Reserve Bit9 = CPC temporary failure Bit10 = CPC hardware failure Bit11 = **ELBus® 1**, communication speed: 0=9600, Baud, 1=19200 Baud Bit12 = Reserve Bit13 = Reserve Bit14 = Reserve Bit15 = Writing authorisation deactivated via webserver = 1, authorised = 0

Figure 12: CPC12 Cyclic Diagnosis Data

7.2 Power Distribution Module

This module contains the total current of the sub-slot 1 and the cyclic input and output data of the circuit protectors of the SubSlot 2.

7.2.1 Total Current Submodule

The total current submodule supplies a standardised 16-bit value with the calculated total current of all circuit protectors entered in the slot (2-byte input data).

The submodule does not have output data. The measuring value is indicated as follows:

	Byte	Type	Range	Description
Total current	0 HighByte 1 LowByte	UInt16	0...65535	A standardised 16-bit-value with a solution of 10 mA is made available. Example for calculating the measuring values: Value (1320) / 100 ≙ 13.20 Ampere

Figure 13: Total Current

7.2.2 Circuit Protectors Submodule

Each circuit protector has up to two channels. Input and output data are always transmitted for both possible channels of the circuit protector.

For each circuit protector, depending on the number of configured circuit protectors, the submodule can transmit 10 bytes of input data including the status of the channel, the load current and the load voltage and 2 bytes of output data for controlling the circuit protector. If the used circuit protector only has one channel, the status of the second channel is marked as not available (0xFF) and the load current and load voltage are set to 0.

Circuit protector input data:

Structure of the input bytes per circuit protector are as follows:

	Byte	Type	Range	Description
Status channel 1	0	Byte	0...255	0xFF (255) ≙ No device available or wrong configuration Bit0 = Load output on Bit1 = Short circuit Bit2 = Overload Bit3 = Undervoltage Bit4 = Reserve Bit5 = Reserve Bit6 = Current threshold value Bit7 = Event / or button actuated “True” means that the status is active.
Load current channel 1	1 HighByte	UInt16	0...65535	A standardised 16-bit-value with a solution of 10 mA is made available. Example for calculating the measuring values: Value (150) / 100 ≙ 1.50 Ampere
Load voltage channel 1	2 LowByte	UInt16	0...65535	A standardised 16-bit-value with a solution of 10 mV is made available. Example for calculating the measuring values: Value (2512) / 100 ≙ 25.12 Volt
Status channel 2	3 HighByte	Byte	0...255	0xFF (255) ≙ No device available, incorrect configuration or 1-channel device connected Bit0 = Load output on Bit1 = Short circuit Bit2 = Overload Bit3 = Undervoltage Bit4 = Reserve Bit5 = Reserve Bit6 = Current threshold value Bit7 = Event / or button actuated “True” means that the status is active.
Load current channel 2	4 LowByte	UInt16	0...65535	A standardised 16-bit-value with a solution of 10 mA is made available. Example for calculating the measuring values: Value (150) / 100 ≙ 1.50 Ampere
Load voltage channel 2	5	UInt16	0...65535	A standardised 16-bit-value with a solution of 10 mV is made available. Example for calculation the measuring values: Value (2512) / 100 ≙ 25.12 Volt

Figure 14: Circuit Protector Input Data

Circuit protector output data:

Structure of the output bytes (actuation) per circuit protector are as follows:

	Byte	Type	Range	Description
Control Channel 1	0	Byte	0...255	Bit0 = Switching load output on/off Bit1 = Reset load output (only reacts to a rising edge 0 -> 1) Bit2 = Reserve Bit3 = Reserve Bit4 = Reserve Bit5 = Reserve Bit6 = Reserve Bit7 = Reserve “True” means that the status is active.
Control Channel 2	1	Byte	0...255	Bit0 = Switching load output on/off Bit1 = Reset load output (only reacts to a rising edge 0 -> 1) Bit2 = Reserve Bit3 = Reserve Bit4 = Reserve Bit5 = Reserve Bit6 = Reserve Bit7 = Reserve “True” means that the status is active.

Figure 15: Circuit Protector Input Data

Sample configuration:

8 REX devices with 16 channels are configured in the circuit protectors of the sub-module. This makes 80 Byte input bytes for status information and measuring values as well as 16 Byte output data.

Addressing the output data follows the REX order:

Circuit protector 1: Channel 1.1 actuation: Byte address [0]

Circuit protector 1: Channel 1.2 actuation: Byte address [1]

Circuit protector 2: Channel 2.1 actuation: Byte address [2]

Circuit protector 2: Channel 2.2 actuation: Byte address [3]

Circuit protector 3: Channel 3.1 actuation: Byte address [4]

……

Addressing the input data follows the REX order:

Circuit protector 1: Channel 1.1 status: Address [0], load current: Address [1..2], load voltage: Address [3..4]

Circuit protector 1: Channel 1.2 status: Address [5], load current: Address [6..7], load voltage: Address [8..9]

Circuit protector 2: Channel 2.1 status: Address [10], load current: Address [11..12], load voltage: Address [13..14]

Circuit protector 2: Channel 2.2 status: Address [15], load current: Address [16..17], load voltage: Address [18..19]

……

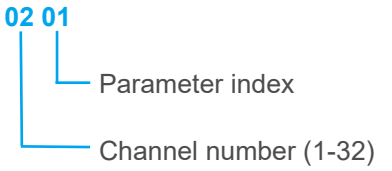
8 NON-CYCLICAL DATA

It is possible to exchange further data with the CPC12 controller and the circuit protectors via the non-cyclical PROFINET services. The access allows direct addressing of a circuit protector. This is done by using the PROFINET index and the slot number. Slot 1 is used to read and write the CPC12 data. Slot 2 is used to read and write the circuit protector data. The circuit protectors can be accessed via channels. Two channels are intended for each circuit protector.

The PROFINET index is set up as follows:

Scope	Index item	Description
Channel number at the ELBUS®	Decimal numbers 10^3 and 10^2	Number of the channel to be requested. Valid value range: 01 … 32.
Parameter index	Decimal numbers 10^1 and 10^0	The parameter index defines the data scope and the type of the data to be read/written. Valid value range: 01 … 10

Figure 16: PROFINET Index Structure



Profinet index = channel number * 100 + parameter index Example for calculating channel 1 and parameter index 2:

102 = 1*100+2

The non-cyclical access of the CPC12 data is structured as follows:

Slot	Parameters Index	Channel Number	Number of data bytes	Reading (R) Writing (W)	Description
1	02	0	19	R	CPC12 controller device information (see chapter 8.1.1)
1	03	0	5	R/W	CPC12 controller configuration data (see chapter 8.1.2)
1	05	0	1	W	Action commands for all channels and the CPC12 controller (see chapter 8.1.3)
1	06	0	4	R	CPC12 controller dynamic information (see chapter 8.1.4)

Figure 17: Division of parameter index CPC12

Slot	Parameters Index	Channel Number	Number of data bytes	Reading (R) Writing (W)	Description
2	01	01 … 32	2	R	Device parameters of one channel (see chapter 8.2.1)
2	02	01 … 32	19	R/W	Device information of one channel (see chapter 8.2.2)
2	03	01 … 32	2	W	Configuration data of one channel (see chapter 8.2.3)
2	04	01 … 32	1	R	Event message of one channel (see chapter 8.2.4)
2	05	01 … 32	1	W	Action commands for one channel (see chapter 8.2.5)
2	06	01 … 32	22	R	Diagnosis data of one channel (see chapter 8.2.6)

Figure 18: Division of parameter index channel

8.1 CPC12 Controller

The following chapters describe the non-cyclical controller parameters.

8.1.1 CPC12 Controller Device Information

The device information for one channel consist of 19 Bytes.
Access: Slot = 1, channel = 0 and parameter index = 2
The following table contains all device information with their possible conditions.

	Byte	Type	Scope	Description
Circuit breaker p/n	0 HighByte 1 LowByte	UInt16	0 ... 65535	16405 = CPC12PN-T1 This list can be extended by future circuit controllers.
Hardware version	2 HighByte 3 LowByte	UInt16	0 ... 65535	Holds the hardware version number of the installed product
Internal production order number	4 HwHb 5 HwLB 6 LwHB 7 LwLB	UInt32	0 ... 4294967295	Holds the production order number of the installed product
Production plant number	8 HwHb 9 HwLB 10 LwHB 11 LwLB	UInt32	0 ... 4294967295	Holds the production plant number of the installed product
Serial number	12 HwHb 13 HwLB 14 LwHB 15 LwLB	UInt32	0 ... 4294967295	Contains the serial number of the installed product
Software version (major.x.x)	16	Byte	0 ... 255	Contains the major software version of the installed product
Software version (x.minor.x)	17	Byte	0 ... 255	Contains the minor software version of the installed product
Software version (x.x.build)	18	Byte	0 ... 255	Contains the build software version of the installed product

Figure 19: CPC12 device information

8.1.2 CPC12 Controller Configuration Data

The configuration data for the controller consist of 5 Bytes.
Access: Slot = 1, channel = 0 and parameter index = 3
The following table contains all configuration data with their possible conditions.

	Byte	Type	Scope	Description
CPC12 configuration data	0	Byte	0 ... 255	Bit 0 = Writing via the webserver is permitted. Allows to change parameters via the webserver even when the fieldbus connection is active. Bit1 True: In the event of a fieldbus interruption, the status of the load outputs is preserved. False: In the event of a fieldbus interruption, all load outputs will be set into the OFF status. Bit2 = Energy-saving mode, the LEDs are dimmed to reduce power consumption. Bit3 = Reserve Bit4 = Reserve Bit5 = Reserve Bit6 = Reserve Bit7 = Reserve Unless stated otherwise, »True« means that the function is active.
PLC Lock: Control commands disable ELBus® 1 at the CPC channel 1 … 16	1 HigByte 2 LowByte	UInt16	0 ... 65535	Each Bit represents one channel. (Bit0 = channel 1; Bit1 = Channel 2 ...) Setting the bit means that the channel cannot be switched on or off via the control unit.
PLC Lock: Control commands disable ELBus® 1 at the CPC channel 17 … 32	3 HigByte 4 LowByte	UInt16	0 ... 65535	Each Bit represents one channel. (Bit0 = channel 17; Bit1 = Channel 18 ...) Setting the bit means that the channel cannot be switched on or off via the control unit.
Reserve	5 HigByte 6 LowByte	UInt16	0	Reserve
Reserve	7 HigByte 8 LowByte	UInt16	0	Reserve

Figure 20: Configuration data CPC12

8.1.3 CPC12 Controller Action Commands

The device action commands for one channel consist of 1 Byte. All action commands sent to the CPC12 execute the action for all channels.
Access: Slot = 1, channel = 0 and parameter index = 5
The following table contains all action commands with their possible conditions.

	Byte	Type	Scope	Description
Action commands	0	Byte	0 ... 255	116 = Reset trip counter 118 = Reset device parameters to factory settings including CPC12[1)] 131 = Back to Box[2)] 132 = Adjust device configuration to connected devices (cf. chapter 8.2.3) 192 = Reset minimum value statistics 196 = Reset maximum value statistics 220 = Reset average value statistics. No other values are accepted.

Figure 21: Action commands CPC12

[1)] The command “118 = Reset device parameter to factory settings including CPC12” within the action com- mands for the CPC12 resets the following data:

- Parameters (rated current = 10 A, load current limit value = 80 %) of each channel
- PLC-Lock bit of each channel (default = True, channel cannot be controlled via the PLC)
- **Not** the configured device types
- **Not** the statistic values (min, max, avg) of the channels
- **Not** the error memory, trip counter and trip reason of the channels
- Configuration data:
    - Energy-saving mode = False = LEDs normal
    - Load output behaviour in the event of fieldbus interruption = True = Status is preserved
    - Writing via webserver permitted = True

2) The command “131 = Back-to-Box” within the action commands for the CPC12 resets the following data:

- Parameters (rated current = 10 A, load current limit value = 80 %) of each channel
- PLC-Lock bit of each channel (default = True, channel cannot be controlled via the PLC)
- configured device types (default = REX12D-TA1 = 0x9009 = 36873)
- the statistical values (min, max, avg) of the channels
- the error memory, trip counter and trip reason of the channels
- configuration data:
    - Energy saving mode = False = LEDs normal
    - Behaviour of the load outputs on fieldbus interruption = True = Status is maintained
    - Writing via web server allowed = True
- IP configuration of the third ETH port X1:
    - IP address = 192.168.1.1
    - Netmask = 255.255.255.0
    - Gateway = 192.168.1.254
    - DHCP = False
- User data:
    - Name = “admin”
    - Password = “admin”

8.1.4 Dynamic Information CPC12 Controller

	Byte	Type	Scope	Description
cycle time ELBus® 1	0 HighByte 1 LowByte	UInt16	0 ... 65535	Holds the internal cycle time of the **ELBus®** in milliseconds [ms].
Reserve	2 HighByte 3 LowByte	UInt16	0 ... 65535	Reserve

Figure 22: Dynamic information CPC12

8.2 Circuit Protectors/Channels

The parameters of the circuit protectors are described in the following chapters. The parameters are organised in channels.

8.2.1 Device Parameters for one Channel

The device parameters for one channel consist of 2 bytes.
Access: Slot = 2, channel = 1 ... 32 and parameter index = 1
The following table contains all device parameters with their possible conditions.

	Byte	Type	Scope	Description
Rated current	0	Byte	1 ... maximum rated current of the circuit protector	Contains the rated current of the channel. With adjustable devices, you can set a new current rating here and transmit with a write command. 1 = 1 A rated current 2 = 2 A rated current 3 = 3 A rated current ... 10 = 10 A rated current (default value)
Limit value load current	6	Byte	50 ... 100	Determines the percentage of the rated current of a channel at which the limit value is exceeded. Exceeding the limit is signalled with one Bit in the "Channel status" of the cyclical data. The range is from 50 % to 100 %. The default value is 80 %.

Figure 23: Device parameters channel

8.2.2 Device Information for one Channel

The device information for one channel consists of 19 Bytes.
Access: Slot = 2, channel = 1 ... 32 and parameter index = 2
The following table contains all device information with their possible conditions.

	Byte	Type	Scope	Description
Circuit breaker p/n	0 HighByte 1 LowByte	UInt16	0 ... 65535	36873 = REX12D-TA1-100 36874 = REX12D-TA2-100 36878 = REX12D-TE2-100 36910 = REX12D-TE2-100-CL2 36905 = REX12D-TB1-100 36937 = REX12D-TA1-100-CL2 36969 = REX12D-TB1-100-CL2 36906 = REX12D-TA2-100-CL2 36942 = REX12D-TE2-101 36974 = REX12D-TE2-101-CL2 37001 = REX12D-TA1-101 36938 = REX12D-TA2-101 37033 = REX12D-TB1-101 37065 = REX12D-TA1-101-CL2 37097 = REX12D-TB1-101-CL2 36970 = REX12D-TA2-101-CL2 37130 = REX22D-TD2-100-CL2 37162 = REX22D-TD2-100 37129 = REX22D-TD1-100 37161 = REX22D-TA1-100 37134 = REX22D-TE2-100 37166 = REX22D-TE2-100-CL2 37194 = REX22D-TD2-101-CL2 37226 = REX22D-TD2-101 37193 = REX22D-TD1-101 37225 = REX22D-TA1-101 37198 = REX22D-TE2-101 37230 = REX22D-TE2-101-CL2 This list may be extended by future circuit protectors.
Hardware version	2 HighByte 3 LowByte	UInt16	0 ... 65535	Contains the hardware version number of the installed product
Internal production order number	4 HwHb 5 HwLB 6 LwHB 7 LwLB	UInt32	0 ... 4294967295	Contains the production order number of the installed product
Production plant number	8 HwHb 9 HwLB 10 LwHB 11 LwLB	UInt32	0 ... 4294967295	Contains the production plant number of the installed product
Serial number	12 HwHb 13 HwLB 14 LwHB 15 LwLB	UInt32	0 ... 4294967295	Contains the serial number of the installed product
Software version	16	Byte	0 ... 255	Contains the major software version of the installed product

(major.x.x)				
Software version (x.minor.x)	17	Byte	0 ... 255	Contains the minor software version of the installed product
Software version (x.x.build)	18	Byte	0 ... 255	Contains the build software version of the installed product

Figure 24: Device information channel

8.2.3 Configuration Data for one Channel

The device information for one channel consists of 2 Bytes.
Access: Slot = 2, channel = 1 ... 32 and parameter index = 1
The following table contains all device parameters with their possible conditions.

	Byte	Type	Scope	Description
Circuit breaker	0 HighByte 1 LowByte	UInt16	0 ... 65535	The expected device type is adjusted here for the channel. The device type always influences a circuit protector, i.e. both possible channels. 36873 = REX12D-TA1-100 36874 = REX12D-TA2-100 36878 = REX12D-TE2-100 36910 = REX12D-TE2-100-CL2 36905 = REX12D-TB1-100 36937 = REX12D-TA1-100-CL2 36969 = REX12D-TB1-100-CL2 36906 = REX12D-TA2-100-CL2 36942 = REX12D-TE2-101 36974 = REX12D-TE2-101-CL2 37001 = REX12D-TA1-101 36938 = REX12D-TA2-101 37033 = REX12D-TB1-101 37065 = REX12D-TA1-101-CL2 37097 = REX12D-TB1-101-CL2 36970 = REX12D-TA2-101-CL2 37130 = REX22D-TD2-100-CL2 37162 = REX22D-TD2-100 37129 = REX22D-TD1-100 37161 = REX22D-TA1-100 37134 = REX22D-TE2-100 37166 = REX22D-TE2-100-CL2 37194 = REX22D-TD2-101-CL2 37226 = REX22D-TD2-101 37193 = REX22D-TD1-101 37225 = REX22D-TA1-101 37198 = REX22D-TE2-101 37230 = REX22D-TE2-101-CL2 This list may be extended by future circuit protectors.

Figure 25: Configuration data channel

8.2.4 Event Message for one Channel

The device information for one channel consists of 1 Byte.
Access: Slot = 2, channel = 1 ... 32 and parameter index = 4
The following table contains all event messages with their possible conditions.

	Byte	Type	Scope	Description
Event	0	Byte	0 … 255	bit 0 = waiting for parameterisation bit 1 = reserve bit 2 = new current rating available bit 3 = channel off via momentary switch/switch bit 4 = reserve bit 5 = reserve bit 6 = reserve bit 7 = device error detected “True” means the status is active.

Figure 26: Event messages channel

8.2.5 Action Commands for one Channel

The Action commands information for one channel consist of 1 Byte.
Access: Slot = 2, channel = 1 ... 32 and parameter index = 5
The following table contains all action commands with their possible conditions.

	Byte	Type	Scope	Description
Action commands	0	Byte	0 … 255	116 = reset trip counter 118 = reset device parameters to factory settings [1)] 131 = back to box [2)] 192 = reset statistics minimum values 196 = reset statistics maximum values 220 = reset statistics mean values Other values will not be accepted.

Figure 27: Action commands channel

[1)] The command “118 = reset device parameters to factory settings” within the action commands per channel shall reset the following data:

- parameters (current ratings = 10 A, limit value load current = 80 %) of each channel
- PLC lock bit of each channel (default = True, i.e. channel not to be controlled by the PLC)
- **not** the configured device types
- **not** the statistical values (min, max, avg) of the channels
- **not** the error memory, trip counter and trip reason of the channels

[2)] The command “131 = back-to-box” within the action commands per channel shall reset the following data:

- Parameters (rated current = 10 A, limit value load current = 80 %) of each channel
- PLC lock bit of each channel (default = True, i.e. channel not controllable by PLC)
- configured device types (default = REX12D-TA1 = 0x9009 = 36873)
- the statistical values (min = 655.35 A/V, max = 0 A V, avg- 0 A/V) of the channel
- the error memory, trip counter and trip reason of the channel

8.2.6 Diagnostic Data for one Channel

The dynamic information for one channel consists of 22 Byte.
Access: Slot = 2, channel = 1 ... 32 and parameter index = 6
The following table contains all dynamic information with their possible conditions.

	Byte	Type	Scope	Description
Error memory	0 HighByte 1 LowByte	UInt16	0 ... 65535	bit 0 = no parameters available bit 1 = error parameter memory bit 2 = error programme memory bit 3 = error data memory bit 4 = error control unit bit 5 = reset through watchdog bit 6 = reserve bit 7 = reserve bit 8 = reserve bit 9 = reserve bit 10 = reserve bit 11 = reserve bit 2 = reserve bit 3 = reserve bit 4 = reserve bit 5 = reserve “True” means the status is active.
Trip counter	2 HighByte 3 LowByte	UInt16	0 ... 65535	The number of trippings since the last reset of is shown here.
Reason for trip	4	Byte	0 … 255	0 = no trip 1 = short circuit 2 = overload 3 = device temperature too high 4 = internal device failure
Min. Load voltage	5 HighByte 6 LowByte	UInt16	0 ... 65535	Contains the lowest measured voltage of the channel since the last reset. A standardised 16-bit-value with a resolution of 10 mV is made available. Example for calculation of the measuring value: value (2512)/100 ≙ 25.12 Volt
Max. Load voltage	7 HighByte 8 LowByte	UInt16	0 ... 65535	Contains the highest measured voltage of the channel since the last reset. A standardised 16-bit-value with a resolution of 10 mV is made available. Example for calculation of the measuring value: value (2512)/100 ≙ 25.12 Volt
Medium value Load voltage	9 HighByte 10 LowByte	UInt16	0 ... 65535	Contains the mean voltage value of the channel since the last reset. A standardised 16-bit-value with a resolution of 10 mV is made available. Example for calculation of the measuring value: value (2512)/100 ≙ 25.12 Volt
Min. Load current	11 HighByte 12 LowByte	UInt16	0 ... 65535	Contains the lowest measured current of the channel since the last reset. A standardised 16-bit-value with a resolution of 10 mA is made available. Example for calculation of the measuring value: value (150)/100 ≙ 1.50 Amps

	Byte	Type	Scope	Description
Max. Load current	13 HighByte 14 LowByte	UInt16	0 ... 65535	Contains the highest measured current of the channel since the last reset. A standardised 16-bit-value with a resolution of 10 mA is made available. Example for calculation of the measuring value: value (150)/100 ≙ 1.50 Amps
Medium value load current	15 HighByte 16 LowByte	UInt16	0 ... 65535	Contains the mean current value of the channel since the last reset. A standardised 16-bit-value with a resolution of 10 mA is made available. Example for calculation of the measuring value: value (150)/100 ≙ 1.50 Amps
Reserve	17 HighByte 18 LowByte	UInt16	0 ... 65535	Reserve
Reserve	19 HighByte 20 LowByte	UInt16	0 ... 65535	Reserve
Diagnostic information of the channel	21	Byte	0 … 255	0 = OK 1 = available device type does not match the configured type 2 = no device detected 3 = unused channel 144 = device parameters not plausible 146 = channel off via momentary switch/switch 147 = detected undervoltage 148 = detected excess temperature 149 = reset command required 150 = command was processed correctly 151 = parameterisation required 152 = Internal failure detected 153 = unknown command 154 = set length error 155 = rated current available, check sum error 156 = current rating selector switch was actuated

Figure 28: Dynamic information

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