ENGINEERING TECHNOLOGY

# User Manual

## *ControlPlex*® Controller CPC12EN


EtherNet/IP™

# 1 Table of contents

# 2 General information

## 2.1 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.

## 2.2 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 have to 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.

## 2.3 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. Error and omissions excepted.

## 2.4 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.

# 3 General description

The customers' demands for a constant quality of the produced goods, while at the same time increasing the quantities, pose great challenges to the mechanical and plant engineering industry. At the same time, globalisation is creating worldwide value flows and production chains. Machines and plants that had still been regionally organised just a few years ago are now networked worldwide. These developments extend the requirements of machine and plant control as well as of the installed components. An ever growing number of measuring data need to be recorded, analysed, evaluated and saved. This increases the transparency of the manufacturing process and thus system availability.

The DC 24 V power distribution is also affected by this development. The control voltage supplies all essential components of the machine or system. These include, besides programmable control units, for example actuators and sensors. Therefore, the control voltage has a special importance in the entire production process. Its availability and stability are crucial for system availability and quality of the produced goods. The REX system is equal to the task. It consists of electronic circuit protectors which are connected with each other via an integrated connector arm without requiring additional components. Power supply is via the EM12 supply module which can supply the circuit protectors with max. 40 A. The new CPC12 bus controller additionally allows access to all system-relevant data of the superordinate control systems. This can be done via the EtherNet/IP™ interface as well as via an additional Ethernet interface.

The CPC12 connects the circuit protectors with the superordinate control unit. Its internal **ELBus®** interface realises the connection with the REX intelligent circuit protectors[1]. The CPC12 allows entire access on all required parameters of the electronic circuit protectors, their control unit and the visualisation of the device data.

This is made available at the fieldbus interface for the superordinate control unit and also at the third RJ45 interface for further connection. Thus the system offers a fully parameterisable protection of the DC 24 V circuits and ensures selective overcurrent protection of sensors and actuators, decentralised peripheral sub-assemblies etc. and there supply lines.

[1] To simplify presentation and explanation, the naming of intelligent circuit breakers is limited to the system designation REX. This designation includes the REX12D and REX22D circuit breakers.

## 3.1 Design of the entire system

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

The EtherNet/IP™ interface to the superordinate control unit is implemented as two RJ45 connectors. It allows connection of the required control unit with the ***ControlPlex***® system. This enables display, analysis as well as diagnosis of the individual measuring values. In addition, it allows control of the individual electronic circuit protectors. An additional Ethernet interface enables direct access of the integral web server of the bus controller. Service staff can thus directly access the system on site. Moreover, access via the connected infrastructure of the company is enables and thus global access. OPC UA and MQTT allow transmission of all measuring values and status information independently of the control system, e.g. to a superordinate cloud application. Revised measuring values of all electronic circuit protectors are also forwarded 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 the productivity.

The CPC12 bus controller allows connection of up to 16 double channel electronic circuit protectors:.

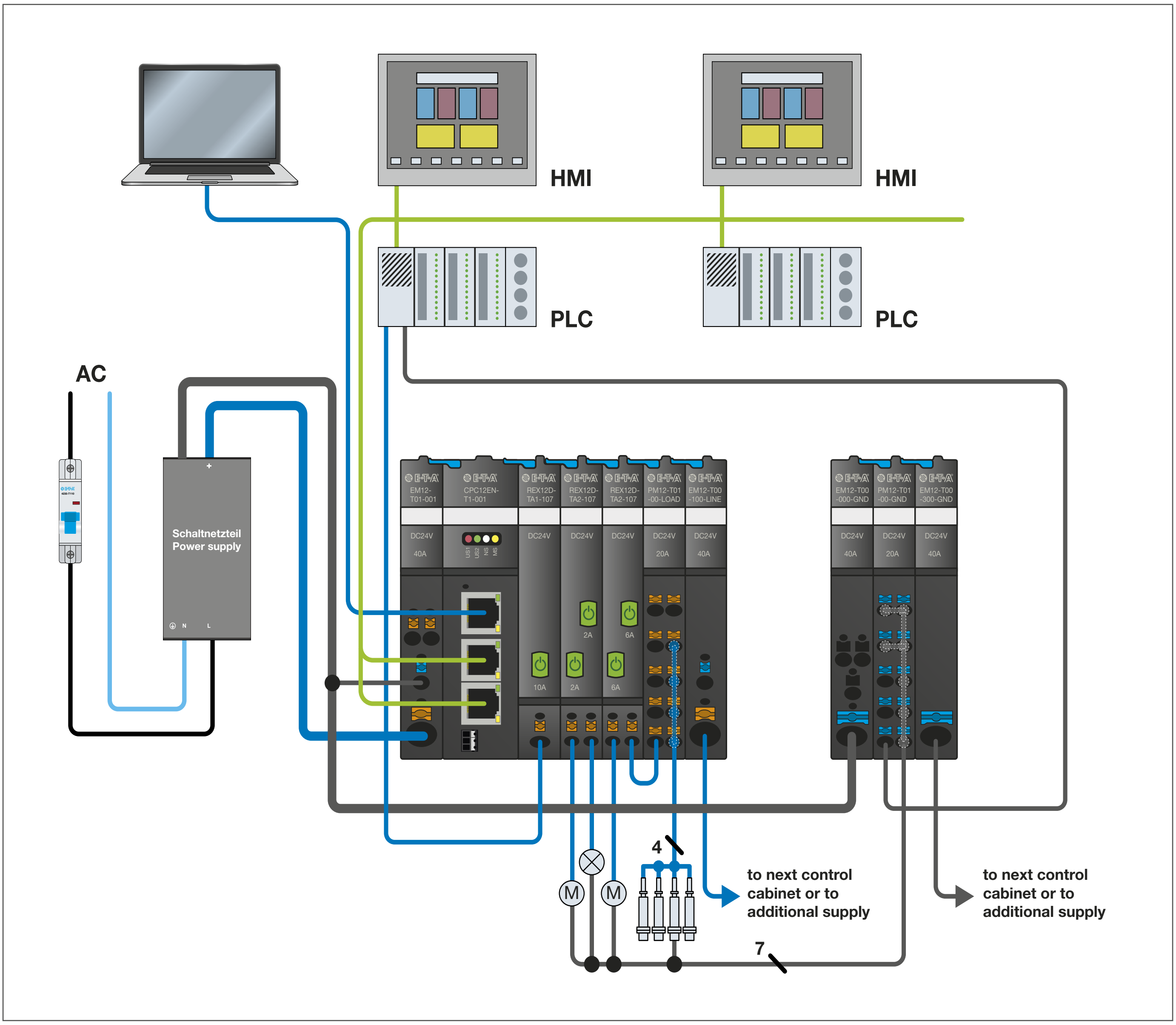


*fig. 1: System overview*

## 3.2 Dimensions CPC12xx-Tx

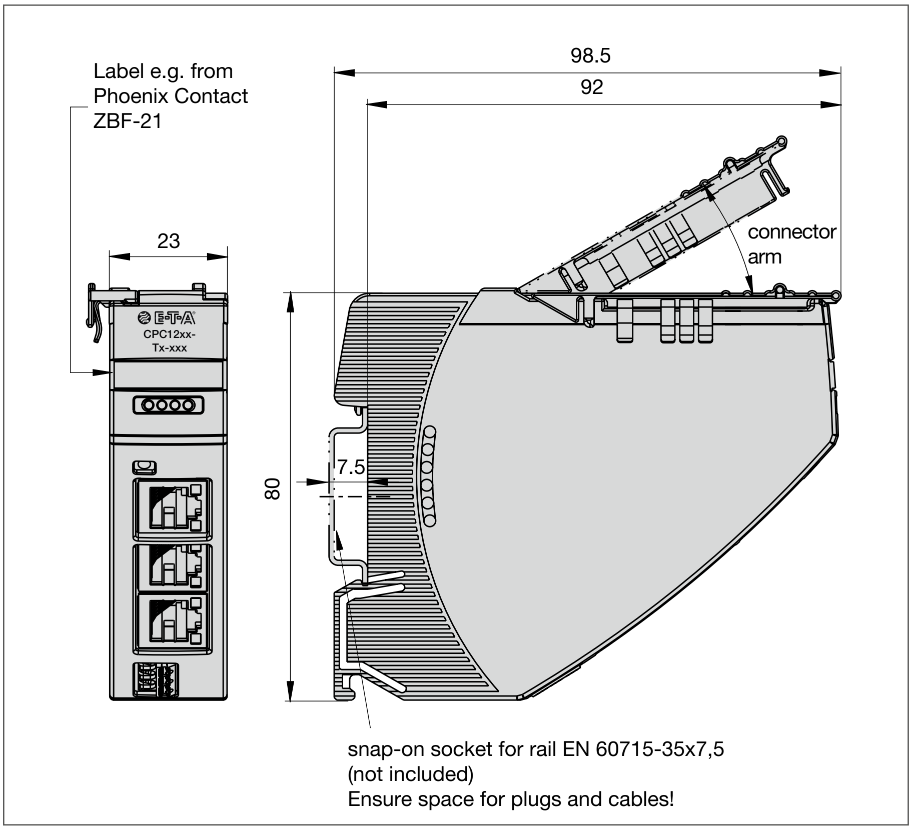


*fig. 2: Dimensions CPC12*

## 3.3 Status indication and terminals

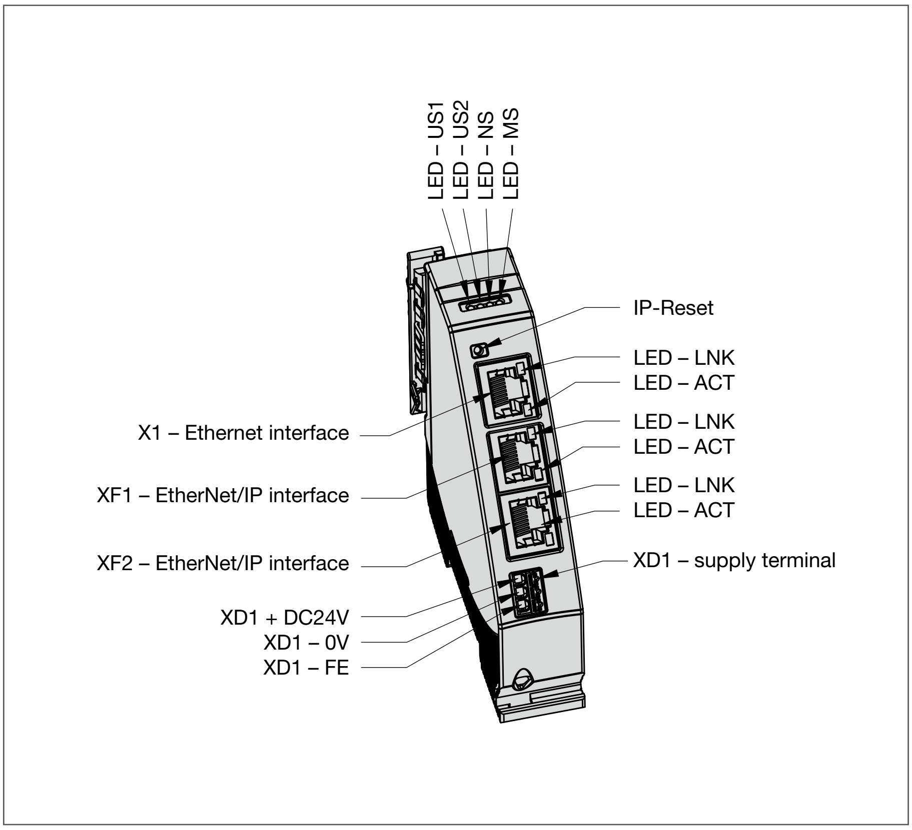


*fig. 3: Status indication and terminals*

### 3.3.1 Terminals for voltage supply

Supply XD1

Voltage ratings: DC 24 V(± 5 % 18 ... 30 V)
Rated current: typically 75 mA

| | | |
|---|---|---|
| Terminal design: | 3 x push-in terminals (+/0V/ FE) | |
| | Max. cable cross section rigid | 0.2 – 1.5 mm$^2$ |
| | flexible with wire end ferrule (without plastic sleeve) | 0.2 – 1.5 mm$^2$ |
| | flexible with wire end ferrule (with plastic sleeve) | 0.2 – 0.75 mm$^2$ |
| | cable cross section | AWG24 – AWG16 str. |
| | stripping length | 8 mm |

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

The power supply of the CPC12 bus controller is also ensured by the EM12 supply module through the integrated connector arm. The use of the power supply terminal XD1 is optional.

### 3.3.2 EtherNet/IP interfaces with integral switch, connection sleeve XF1, XF2

XF1 Connection to bus system EtherNet/IP
Type: RJ45

When wiring and connecting to the bus system EtherNet/IP, the installation and wiring regulations of the EtherNet/IP™ Specification have to be observed.

XF2 Connection to bus system EtherNet/IP
Type: RJ45

When wiring and connecting to the bus system EtherNet/IP, the installation and wiring regulations of the EtherNet/IP™ Specification have to be observed.

### 3.3.3 ETHERNET interface, connection sleeve X1

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

### 3.3.4 LED status indication

Visual status indication by means of multicolored LED

| Operating mode | Indication of operating mode | |
|---|---|---|
| | LED US1 | LED US2 |
| **Supply voltage OK** | green | n.a. |
| **Firmware update** | off | off |
| **Actuator voltage OK** | green | green |
| **No actuator voltage** | green | red |
| **No connected device or bus error** | green | orange blinking |

***fig. 4: Display status LEDs***
n.a. = not applicable

**LED NS (Network Status)**

| Operating mode | Indication of operating mode |
|---|---|
| **No IP-Address** | off |
| **Valid IP-Address, no CIP-Connection** | green blinking |
| **Active CIP-Connection** | green |
| **CIP-Connection timeout** | red blinking |
| **Double IP detected** | red |

**LED MS (Module Status)**

| Operating mode | Indication of operating mode |
|---|---|
| **Switched off** | off |
| **Operation mode** | green |
| **Device not configured** | green blinking |
| **Severe but recoverable error** | red blinking |
| **Severe not recoverable error** | red |

***fig. 5: Display fieldbus status LEDs***

Visual signaling of 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** | orange blinking |
| **No Act available** | off |

***fig. 6: Display LEDs RJ45 connectors***

# 4 Mounting and installation

## 4.1 Mounting of the system

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

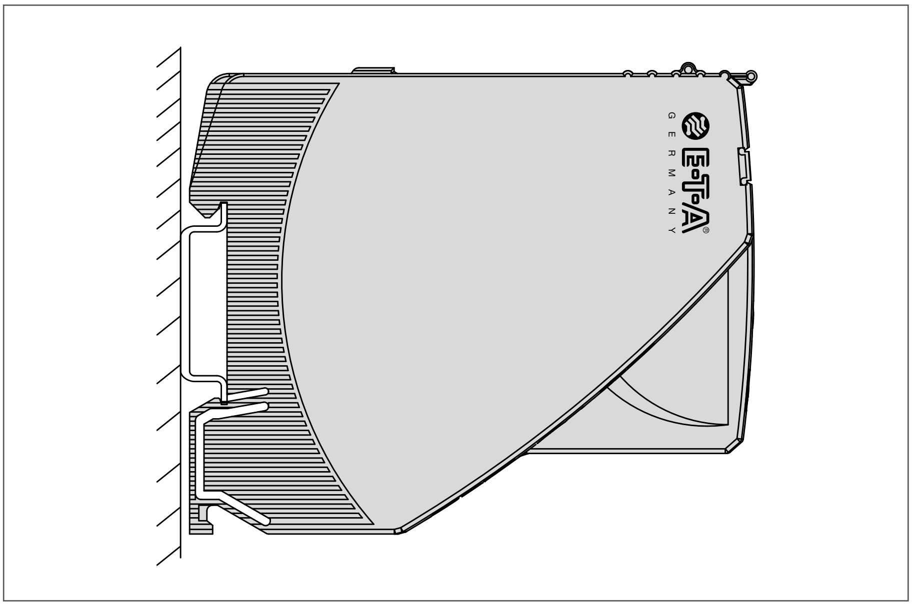

***fig. 6: Installation drawing***

# 5 Operating modes of the CPC12 bus controller

## 5.1 Operating mode: Start-up mode

The CPC12 bus controller is initialised by applying the supply voltage. The device will carry out internal program memory tests and self test routines. During this time a communication via the interfaces is not possible.

## 5.2 Operating mode: System error mode

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

## 5.3 Operating mode: Configuration error mode

If there are no valid or invalid configuration data available in the bus controller, it will change into this operating mode. This operating mode only allows non-cyclical data exchange. Cyclical data exchange is prevented. Leave this operating mode upon receipt of the correct slot parameters and configuration data.

## 5.4 Operating mode: Stand-alone mode

In this operating mode there is no connection between the bus controller and the superordinate control unit. In this case the CPC12 bus controller will automatically adopt the control and parameterisation of the electronic circuit protectors, because all required data sets are saved within the CPC12. By means of the web server, the electronic circuit protectors, their status and parameters can be accessed via the Ethernet interface. It is thus possible to change e.g. parameter data of the various electronic circuit protectors. After a fieldbus connection is established, this operating mode will be left and the control unit will take over control again as master. If during this time a parameter was changed while there was no communication, this will be signaled to the superordinate control unit. In this case the user can correspondingly define the control behavior and it can be programmed in the programmable control unit. This allows the user to select a reaction meeting his requirements.

## 5.5 Operating mode: Slave mode

In this operating mode, the CPC12 is connected to a EtherNet/IP system. Communication to the CPC12 bus controller works faultlessly and the controller can be addressed and controlled by the superordinate control unit. Should the communication fail, this has no influence on the protective function of the circuit protectors. The behavior of the bus controller with simultaneous use of a field bus interface and of the web server interface can be determined by means of the configuration of the device in the superordinate control unit.

It can be pre-selected there that Ethernet interface or the Web Server are granted either only reader access or reader and editor access. In the event of editor access, changes of the parameterisation of the electronic circuit protectors can be carried out in parallel to the field bus system. These parameter changes will then be advised to the superordinate control system and can be adopted by it or also overwritten. The user can select the behavior accordingly.

## 5.6 Operating mode: Firmware Update Mode

The devices are supplied with a software programmed according to their functionality. If the functions of the devices are extended, they will be added by firmware update. It is therefore necessary to carry out a firmware update if the new functionality shall be used.

# 6 Basic functions of the entire system

## 6.1 Internal cycle times

The cycle time of the system depends on the number of electronic circuit protectors connected and on the internal baud rate. The internal baud rate can be 9600 or 19200 baud. The baud rate is only changed to 19200 when all connected circuit protectors support this function. The baud rate is signaled in the cyclical data in the »Status Controller«. The current cycle time can be retrieved with the non-cyclical access to the »dynamic information of the CPC12«.

The cycle time in the case of 16 circuit protectors and an internal baud rate of 9600 baud is approx. 480 ms for the cyclical data, i.e. 30 ms per unit. A window of 130 ms is kept free for non-cyclical data. In total, this is a max. cycle time of 610 ms.

An internal baud rate of 19200 baud reduces the cycle time for the cyclical data to some 240 ms, i.e. 15 ms per unit. A window of 100 ms is kept free for non-cyclical data. In total, this is a max. cycle time of 340 ms.

## 6.2 Hot swap of circuit protectors

If a new circuit protector is added to an existing application, it will automatically be parameterised with the available parameters for address slot. Transmission of the parameters will be without interruption of the cyclical data exchange between the CPC and the electronic circuit protector.

## 6.3 About the additional Ethernet interface

The additional Ethernet interface (X1) extends the functional scope of the bus controller. The following functionalities are provided via this interface.

### 6.3.1 Web Server

The web server offers the entire scope of measuring data, status information, parameterisation options and control function of the CPC12 bus controller. The parameterisation of the interface is described separately.

### 6.3.2 Default IP address -X1

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.

### 6.3.3 User name and password

In order to be able to carry out configurations, the user has to have the required access authorisation. It is defined in user administration.
The default settings are:

| | |
|---|---|
| **User** | admin |
| **Password:** | admin |

We urgently recommend to individually adjust these settings upon startup of the device.

### 6.3.4 OPC UA

This functionality will only be included and described in a later version.

### 6.3.5 MQTT

This functionality will only be included and described in a later version.

# 7 Communication via EtherNet/IP™

EtherNet/IP™ is a network adaption of the Common Industrial Protocol (CIP™) developed by the ODVA organization. CIP uses abstract object modeling to describe the available communication services and data provided by a product. Objects and their components are addressed by an addressing scheme consisting of Node Address (IP-Address), Class Identifier (Class ID), Instance Identifier (Instance ID), Attribute Identifier (Attribute ID) and a Service Code. Assembly objects are used for I/O messages by combining several I/O data into one block.
The IP-Address is typically assigned by a DHCP-server within the network.
Supported EtherNet/IP Features: Address Conflict Detection (ACD), Quality of Service (QoS), Device Level Ring (DLR) - Media Redundancy

## 7.1 *ControlPlex®* device model

The power distribution system with CPC12 controller consists of a passive supply module EM12-T00-000-DC24V-40A and up to 16 intelligent circuit protectors of the REX series.
The power distribution system ***ControlPlex®*** uses the following EtherNet/IP model:

| EtherNet/IP | CPC12EN |
|---|---|
| **Class 0x01, 0x06, 0x47, 0xF5, 0xF6** | The EtherNet/IP interface requires several mandatory objects. These are the identity object (0x01), the connection manager object (0x06), the device level ring object (DLR, 0x47), the TCP/IP interface object (0xF5) and the ethernet link object (0xF6). |
| **Class 100** | Class 100 represents the CPC12EN controller.<br>All system wide information and settings can be accessed through this class. Details are described in Chapter 9.<br>The I/O data of the CPC12EN are described in chapter 8.1. |
| **Class 101** | Class 101 represents the circuit protectors connected to the CPC12EN.<br>All circuit breaker specific information and settings can be accessed through this class. Details are described in Chapter 9.<br>The I/O data of each circuit protector contain the control byte, the status byte and measuring values. The process data image of the PLC holds 10 input bytes and 2 output bytes for each circuit protector. Details are described in chapter 8.2. The quantity of cyclically exchanged process data is adjustable.<br>If fewer circuit protectors are connected than configured, the status of the missing circuit protectors is marked as »not available«.<br>If more circuit protectors than configured are connected, these cannot be accessed by the PLC.<br>The CPC12 allows configuration of 1 to max. 16 circuit protectors. |

*fig. 8: Communication properties*

## 7.2 EDS file

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

## 7.3 Identity Object (Class ID: 0x01)

The identity object supports only instance 1.
Service codes Get_Attributes_All (1) and Get_Attribute_Single (14) are supported.
Further details are provided by the EtherNet/IP™ Specification.

| Name | Attribute ID | Data Type | Description |
|---|---|---|---|
| Vendor ID | 1 | UINT | Vendor identification |
| Device Type | 2 | UINT | General type of product |
| Product Code | 3 | UINT | Product code of vendor |
| Revision | 4 | USINT, USINT | Revision of the item |
| Status | 5 | WORD | Summary status of device |
| Serial Number | 6 | UDINT | Serial number of device |
| Product Name | 7 | SHORT_ STRING | Profile ID |
| State | 8 | USINT | 2 = Standby<br>3 = Operational<br>4 = Major Recoverable Fault<br>5 = Major Unrecoverable Fault |
| Configuration Consistency Value | 9 | UINT | |
| Heartbeat Interval | 10 | USINT | |

***fig. 9: Identity Object Attributes***

## 7.4 TCP/IP Interface Object (Class ID: 0xF5)

The TCP/IP interface object supports only instance 1.
Service codes Get_Attributes_All (1) and Get_Attribute_Single (14) are supported.
Further details are provided by the EtherNet/IP™ Specification.

| Name | Attribute ID | Data Type | Description |
|---|---|---|---|
| Status | 1 | DWORD | Interface status |
| Configuration Capability | 2 | DWORD | Interface capability flags |
| Configuration Control | 3 | DWORD | 0 = Statically-assigned IP configuration<br>1 = IP-configuration via BOOTP<br>2 = IP-configuration via DHCP |
| Physical Link Object | 4 | STRUCT | Path to physical link object |
| Interface Configuration:<br>IP Address,<br>Network Mask,<br>Gateway Address,<br>Name Server,<br>Name Server 2,<br>Domain Name | 5 | STRUCT of:<br>UDINT,<br>UDINT,<br>UDINT,<br>UDINT,<br>UDINT,<br>STRING | IP-configuration |
| Host Name | 6 | STRING | Host name |

***fig. 10: TCP/IP Interface Object Attributes***

# 8 Cyclical I/O data

EtherNet/IP™ provides the exchange of cyclical process data from an originator (e.g. PLC) to the target (CPC12EN) O→T and vice versa T→O. The number of exchanged I/O data bytes can be varied.
The Forward_Open request to the connection manager initiates the I/O communication and determines the requested packet interval (RPI), the priority, the data size and the connection path. Valid RPI range for the CPC12EN is between 1 ms and 1000 ms. One exclusive owner, one listen only and one input only connection is supported simultaneously.

The O→T connection includes a Run/Idle Header which account for the first 4 bytes.
The O→T assembly (100) data size is adjustable between 0 and 32 bytes.
The T→O assembly (101) data size is adjustable between 0 and 164 bytes.
The connection path must be set to 0x20 04 24 00 2C 64 2C 65 because no configuration assembly is used.

The EDS file made available for the projecting tool allows the related configuration.

## 8.1 I/O data input: CPC12 controller

Originator→Target bytes 0…1
The 2 input bytes contain the following global error and diagnostic messages.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| status controller | 0 HighByte<br>1 LowByte | UInt16 | 0xFFFF | bit 0 = no configuration data available<br>bit 1 = invalid configuration data<br>bit 2 = connected device type differs from configuration<br>bit 3 = reserve<br>bit 4 = command buffer overflow<br>bit 5 = no communication to **ELBus®** 1<br>bit 6 = reserve<br>bit 7 = reserve<br>bit 8 = reserve<br>bit 9 = CPC temporary error<br>bit 10 = CPC hardware error<br>bit 11 = **ELBus®** 1<br>communication speed: 0=9600 Baud, 1=19200 Baud<br>bit 12 = reserve<br>bit 13 = reserve<br>bit 14 = reserve<br>bit 15 = writing access via web server deactivated = 1, allowed = 0 |

*fig. 11: Cyclical diagnostic data CPC12*

## 8.2 I/O data input: total current

Originator→Target bytes 2…3
The total current supplies a standardized 16-bit value with the calculated total current of all circuit protectors (2 byte input data).

The measuring value is indicated as follows:

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Total current | 0 HighByte<br>1 LowByte | UInt16 | 0 ... 65535 | A standardised 16-bit-value with a resolution of 10 mA is made available.<br>Example for calculation of the measuring value:<br>value (1320)/ 100 ≙ 13.20 Amps |

*fig. 12: Total current*

## 8.3 I/O data input: circuit protectors

Originator→Target bytes 4…163

Each circuit protector has up to two channels. The input and output data are always transmitted for both possible channels.

10 bytes input data are exchanged for each circuit breaker containing the status of the channel, the load current and the load voltage. If the circuit protector used has only one channel, the status of the second channel is marked as not available (0xFF) and the load current and the load voltage are set to 0.

Design of the input bytes per circuit protector is as follows:

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Status channel | 0 | byte | 0 ... 255 | 0xFF (255) ≙ no device available or wrong configuration<br>bit 0 = load output ON<br>bit 1 = short circuit<br>bit 2 = overload<br>bit 3 = low voltage<br>bit 4 = reserve<br>bit 5 = reserve<br>bit 6 = limit value current<br>bit 7 = event / or button pressed<br>»True« means the status is active. |
| Load current channel 1 | 1 HighByte<br>2 LowByte | UInt16 | 0 ... 65535 | A standardised 16-bit-value with a resolution of 10 mA is made available.<br>Example for calculation of the measuring value:<br>value (150)/100 ≙ 1.50 Amps |
| Load voltage channel 1 | 3 HighByte<br>4 LowByte | UInt16 | 0 ... 65535 | A standardised 16-bit-value with a resolution of 10 mV is made available.<br>Example for calculation of the measuring value:<br>value (2512)/100 ≙ 25.12 Volt |
| Status channel 2 | 5 | byte | 0 ... 255 | 0xFF (255) ≙ no device available, wrong configuraiton or 1-channel device used<br>bit 0 = load output ON<br>bit 1 = short circuit<br>bit 2 = overload<br>bit 3 = low voltage<br>bit 4 = reserve<br>bit 5 = reserve<br>bit 6 = limit value current<br>bit 7 = event / or button pressed<br>»True« means the status is active. |
| Load current channel 2 | 6 HighByte<br>7 LowByte | UInt16 | 0 ... 65535 | A standardised 16-bit-value with a resolution of 10 mA is made available.<br>Example for calculation of the measuring value:<br>value (150)/100 ≙ 1.50 Amps |
| Load voltage channel 2 | 8 HighByte<br>9 LowByte | UInt16 | 0 ... 65535 | A standardised 16-bit-value with a resolution of 10 mV is made available.<br>Example for calculation of the measuring value:<br>value (2512)/100 ≙ 25.12 Volt |

***fig. 13: Input data circuit protector***

## 8.4 I/O data output: circuit protectors

Target→Originator bytes 0…31

2 bytes output data are exchanged controlling the circuit protector.

Design of the output bytes per circuit protector is as follows:

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Control channel 1 | 0 | byte | 0 ... 255 | bit 0 = load output ON/OFF<br>bit 1 = reset load output (only responds to rising edge 0 -> 1)<br>bit 2 = reserve<br>bit 3 = reserve<br>bit 4 = reserve<br>bit 5 = reserve<br>bit 6 = reserve<br>bit 7 = reserve<br>»True« means the status is active. |
| Control channel 2 | 1 | byte | 0 ... 255 | bit 0 = load output ON/OFF<br>bit 1 = reset load output (only responds to rising edge 0 -> 1)<br>bit 2 = reserve<br>bit 3 = reserve<br>bit 4 = reserve<br>bit 5 = reserve<br>bit 6 = reserve<br>bit 7 = reserve<br>»True« means the status is active. |

*fig. 14: Output data circuit protector*

**Sample configuration:**

8 REX circuit breakers with 16 channels are connected to the CPC12EN. The O→T data size can be configured to 84 input bytes and 16 bytes T→O data are provided.

Addressing of the output data is corresponding to the REX sequence.
circuit protector 1: channel 1.1 control input byte address[0]
circuit protector 1: channel 1.2 control input byte address[1]
circuit protector 2: channel 2.1 control input byte address[2]
circuit protector 2: channel 2.2 control input byte address[3]
circuit protector 3: channel 3.1 control input byte address[4]
…….

Addressing of the input data data is corresponding to the REX sequence.

Status controller: address [0..1],
total current: address [2..3]
circuit protector 1: channel 1.1 status: address [4], load current: address [5..6], load voltage: address [7..8]
circuit protector 1: channel 1.2 status: address [9], load current: address [10..11], load voltage: address [12..13]
circuit protector 2: channel 2.1 status: address [14], load current: address [15..16], load voltage: address [17..18]
circuit protector 2: channel 2.2 status: address [19], load current: address [20..21], load voltage: address [22..23]
…….

# 9 Non-cyclical data

Explicit EtherNet/IP messages allow exchange of further data with the CPC12 controller and the circuit protectors. Access also allows direct addressing of a circuit protector. EtherNet/IP Class, Instance and Attribute are required. For reading and editing CPC12 data, Class 100 is used. Class 101 is used for reading and editing the data of circuit protectors. The access to the circuit protectors is divided into channels. Two channels are provided per circuit protector.

The non-cyclical access to the data of CPC12 is divided as follows:
Class 100 and Class 101 support only service codes Get_Attribute_Single (14) and Set_Attribute_Single (16).

| Class ID | Instance ID | Attribute ID | Number of data bytes | Reading (R) writing (W) | Description |
|---|---|---|---|---|---|
| 100 | 1 | 1 | 19 | R | Device information of CPC12 controller (see chapter 9.1.1). |
| 100 | 1 | 3 | 5 | R/W | Configuration data of CPC12 controller (see chapter 9.1.2). |
| 100 | 1 | 4 | 1 | W | Action commands for all channels and the CPC12 controller (see chapter 9.1.3). |
| 100 | 1 | 2 | 4 | R | Dynamic information of CPC12 controller (see chapter 9.1.4). |

*fig. 15: CPC12 Object Attributes*

The non-cyclical access to the data of circuit protectors and/or channels is divided as follows:

| Class ID | Instance ID | Attribute ID | Number of data bytes | Reading (R) writing (W) | Description |
|---|---|---|---|---|---|
| 101 | 01 … 32 | 3 | 2 | R/W | Device parameters of a channel (see chapter 9.2.1). |
| 101 | 01 … 32 | 1 | 19 | R | Device information of a channel (see chapter 9.2.2). |
| 101 | 01 … 32 | 6 | 2 | R/W | Configuration data of a channel (see chapter 9.2.3). |
| 101 | 01 … 32 | 5 | 1 | R | Event message of a channel (see chapter 9.2.4). |
| 101 | 01 … 32 | 4 | 1 | W | Action commands for a channel (see chapter 9.2.5). |
| 101 | 01 … 32 | 2 | 22 | R | Diagnosis data of a channel (see chapter 9.2.6). |

*fig. 16: Channel Object Attributes*

## 9.1 CPC12 controller

The non-cyclical parameters of the controller are described in the following chapters.

### 9.1.1 Device information CPC12 controller

The device information of the controller consists of 19 bytes.

Class ID = 100, Instance ID = 1 and Attribute ID = 1

Service Code: Get_Attribute_Single (14)

All device information with possible conditions are described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Device Type | 0 HighByte<br>1 LowByte | UInt16 | 0 … 65535 | 16469 = CPC12EN-T1<br>This list may be extended by future controllers. |
| Hardware version | 2 HighByte<br>3 LowByte | UInt16 | 0 … 65535 | Holds the hardware version of the installed product |
| Internal assembly order numbers | 4 HwHb<br>5 HwLB<br>6 LwHB<br>7 LwLB | UInt32 | 0 … 4294967295 | Holds the assembly order number of the installed product |
| Internal order split number | 8 HighByte<br>9 LowByte | UInt16 | 0 … 65535 | Holds the internal order split number of the installed product |
| Production facilities number | 10 HighByte<br>11 LowByte | UInt16 | 0 … 65535 | Holds the production facilities number of the installed product |
| Serial number | 12 HwHb<br>13 HwLB<br>14 LwHB<br>15 LwLB | UInt32 | 0 … 4294967295 | Holds the serial number of the installed product |
| Software version (major.x.x) | 16 | byte | 0 … 255 | Holds the major software version of the installed product |
| Software version (x.minor.x) | 17 | byte | 0 … 255 | Holds the minor software version of the installed product |
| Software version (x.x.build) | 18 | byte | 0 … 255 | Holds the build software version of the installed product |

*fig. 17: Device information CPC12*

## 9.1.2 Configuration data CPC12 controller

The device configuration data for the controller consists of 5 bytes.

Class ID = 100, Instance ID = 1 and Attribute ID = 3

Service Code: Get_Attribute_Single (14), Set_Attribute_Single (16)

All configuration data with possible conditions are described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Configuration data of the CPC | 0 | byte | 0 ... 255 | bit 0 = writing via web server permitted. Allows changing of parameters via the server even when the bus connection is active.<br>bit 1<br>True: In the event of a fieldbus interruption, the status of the load outputs is maintained.<br>False: In the event of a fieldbus interruption, all load outputs will be set to the status OFF.<br>bit 2 = power saving mode, the LEDs will be dimmed for power reduction.<br>bit 3 = reserve<br>bit 4 = reserve<br>bit 5 = reserve<br>bit 6 = reserve<br>bit 7 = reserve<br>If not described otherwise, »True« means that the function is active. |
| Control commands disable **ELBus**® 1 on CPC channel 1 ... 16 | 1 HighByte<br>2 LowByte | UInt16 | 0 ... 65535 | Each bit represents a channel.<br>(bit 0 = channel 1; bit1 = channel 2 ...)<br>If the bit is set, this means that the channel cannot be switched on or off via the control unit or the web server. |
| Control commands disable **ELBus**® 1 on CPC channel 17 ... 32 | 3 HighByte<br>4 LowByte | UInt16 | 0 ... 65535 | Each bit represents a channel.<br>(bit 0 = channel 17; bit1 = channel 18 ...)<br>If the bit is set, this means that the channel cannot be switched on or off via the control unit or the web server. |
| Reserve | 5 HighByte<br>6 LowByte | UInt16 | 0 | Reserve |
| Reserve | 7 HighByte<br>8 LowByte | UInt16 | 0 | Reserve |

***fig. 18: Configuration data CPC12***

### 9.1.3 Action commands CPC12 controller

The action commands of the controller consist of 1 byte. All action commands being sent to the CPC12 carry out the action for all channels.

Class ID = 100, Instance ID = 1 and Attribute ID = 4

Service Code: Set_Attribute_Single (16)

Action commands with possible conditions are described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Action commands | 0 | byte | 0 ... 255 | 116 = reset trip counter<br>118 = reset device parameters to factory settings including CPC12[1)]<br>131 = back to box [2)]<br>132 = adopt device type configurations to connected devices (see chapter 9.2.3).<br>192 = reset statistics minimum values<br>196 = reset statistics maximum values<br>220 = reset statistics mean values<br>Other values will not be accepted. |

***fig. 19: Action commands CPC12***

[1)] The command »118 = reset device parameters to factory settings including CPC12« within the action commands for the CPC12 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
- configuration data
  - power saving mode = False = LEDs normal
  - behavior of load outputs after fieldbus interruption = True = status is maintained
  - writing via web server permitted = True

[2)] The command »131 = back-to-box« within the action commands for the CPC12 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, max, avg) of the channels
- the error memory, trip counter and trip reason of the channels
- configuration data
  - power saving mode = False = LEDs normal
  - behavior of the load outputs on fieldbus interruption = True = Status is maintained
  - Writing via web server permitted = 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«

### 9.1.4 Dynamic information CPC12 controller

The dynamic information for the controller consists of 4 bytes.

Class ID = 100, Instance ID = 1 and Attribute ID = 2

Service Code: Get_Attribute_Single (14)

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Cycle time **ELBus®** 1 | 0 HighByte<br>1 LowByte | UInt16 | 0 ... 65535 | Holds the internal cycle time of the **ELBus®** in milliseconds [ms]. |
| Reserve | 2 HighByte<br>3 LowByte | UInt16 | 0 ... 65535 | Reserve |

***fig. 20: Dynamic information CPC12***

## 9.2 Circuit protectors/channels

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

### 9.2.1 Device parameters for one channel

The device parameters for one channel consist of 2 bytes.

Class ID = 101, Instance ID = 1…32 and Attribute ID = 3

Service Code: Get_Attribute_Single (14), Set_Attribute_Single (16)

All device parameters with possible conditions are described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Rated current | 0 | byte | 1 ... max. rated current of the circuit breaker | Holds the current rating of the channel.<br>With adjustable devices, you can set a new current rating here and transmit with a write command.<br>1 = 1A current rating<br>2 = 2A current rating<br>3 = 3A current rating<br>...<br>10 = 10A current rating (default value) |
| Limit value load current | 6 | byte | 50 ... 100 | Determines at which percentage of the current rating of a channel the limit value is exceeded. Exceedance is signaled with a bit in the »status channel« of the cyclical data.<br>The range is from 50 % to 100 %.<br>The default value is 80 %. |

***fig. 21: Device parameters channel***

### 9.2.2 Device information for one channel

The device information for one channel consists of 19 bytes.

Class ID = 101, Instance ID = 1…32 and Attribute ID = 1

Service Code: Get_Attribute_Single (14)

All device information with possible conditions are described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Circuit breaker p/n | 0 HighByte<br>1 LowByte | UInt16 | 0 ... 65535 | 36873 = REX12D-TA1-100<br>36874 = REX12D-TA2-100<br>36873 = REX12D-TA1-100<br>36874 = REX12D-TA2-100<br>36878 = REX12D-TE2-100<br>36910 = REX12D-TE2-100-CL2<br>36905 = REX12D-TB1-100<br>36937 = REX12D-TA1-100-CL2<br>36969 = REX12D-TB1-100-CL2 |

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Circuit breaker p/n | 0 HighByte<br>1 LowByte | UInt16 | 0 ... 65535 | 36906 = REX12D-TA2-100-CL2<br>36942 = REX12D-TE2-101<br>36974 = REX12D-TE2-101-CL2<br>37001 = REX12D-TA1-101<br>36938 = REX12D-TA2-101<br>37033 = REX12D-TB1-101<br>37065 = REX12D-TA1-101-CL2<br>37097 = REX12D-TB1-101-CL2<br>36970 = REX12D-TA2-101-CL2<br>37130 = REX22D-TD2-100-CL2<br>37162 = REX22D-TD2-100<br>37129 = REX22D-TD1-100<br>37161 = REX22D-TA1-100<br>37134 = REX22D-TE2-100<br>37166 = REX22D-TE2-100-CL2<br>37194 = REX22D-TD2-101-CL2<br>37226 = REX22D-TD2-101<br>37193 = REX22D-TD1-101<br>37225 = REX22D-TA1-101<br>37198 = REX22D-TE2-101<br>37230 = REX22D-TE2-101-CL2<br>This list may be extended by future circuit protectors. |
| Hardware version | 2 HighByte<br>3 LowByte | UInt16 | 0 ... 65535 | Holds the hardware version of the installed product |
| Internal assembly order | 4 HwHb<br>5 HwLB<br>6 LwHB<br>7 LwLB | UInt32 | 0 ... 4294967295 | Holds the assembly order number of the installed product |
| Internal order split number | 8 HighByte<br>9 LowByt | UInt16 | 0 ... 65535 | Holds the internal order split number of the installed product |
| Production facilities number | 10 HighByte<br>11 LowByte | UInt16 | 0 ... 65535 | Holds the production facilities number of the installed product |
| Serial number | 12 HwHb<br>13 HwLB<br>14 LwHB<br>15 LwLB | UInt32 | 0 ... 4294967295 | Holds the serial number of the installed product |
| Software version (major.x.x) | 16 | byte | 0 ... 255 | Holds the major software version of the installed product |
| Software version (x.minor.x) | 17 | byte | 0 ... 255 | Holds the minor software version of the installed product |
| Software version (x.x.build) | 18 | byte | 0 ... 255 | Holds the build software version of the installed product |

***fig. 22: Device information channel***

### 9.2.3 Configuration data for one channel

The configuration data for one channel consist of 2 bytes.

Class ID = 101, Instance ID = 1…32 and Attribute ID = 6

Service Code: Get_Attribute_Single (14), Set_Attribute_Single (16)

All configuration data with possible conditions are described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Circuit breaker p/n | 0 HighByte<br>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.<br><br>36873 = REX12D-TA1-100<br>36874 = REX12D-TA2-100<br>36873 = REX12D-TA1-100<br>36874 = REX12D-TA2-100<br>36878 = REX12D-TE2-100<br>36910 = REX12D-TE2-100-CL2<br>36905 = REX12D-TB1-100<br>36937 = REX12D-TA1-100-CL2<br>36969 = REX12D-TB1-100-CL2<br>36906 = REX12D-TA2-100-CL2<br>36942 = REX12D-TE2-101<br>36974 = REX12D-TE2-101-CL2<br>37001 = REX12D-TA1-101<br>36938 = REX12D-TA2-101<br>37033 = REX12D-TB1-101<br>37065 = REX12D-TA1-101-CL2<br>37097 = REX12D-TB1-101-CL2<br>36970 = REX12D-TA2-101-CL2<br>37130 = REX22D-TD2-100-CL2<br>37162 = REX22D-TD2-100<br>37129 = REX22D-TD1-100<br>37161 = REX22D-TA1-100<br>37134 = REX22D-TE2-100<br>37166 = REX22D-TE2-100-CL2<br>37194 = REX22D-TD2-101-CL2<br>37226 = REX22D-TD2-101<br>37193 = REX22D-TD1-101<br>37225 = REX22D-TA1-101<br>37198 = REX22D-TE2-101<br>37230 = REX22D-TE2-101-CL2<br><br>This list may be extended by future circuit protectors. |

*fig. 23: Configuration data channel*

### 9.2.4 Event message for one channel

The event messages for one channel consist of 1 byte.

Class ID = 101, Instance ID = 1…32 and Attribute ID = 5

Service Code: Get_Attribute_Single (14)

All event messages with possible conditions are described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Event | 0 | byte | 0 ... 255 | bit 0 = waiting for parameterisation<br>bit 1 = reserve<br>bit 2 = new current rating available<br>bit 3 = channel off via momentary switch/switch<br>bit 4 = reserve<br>bit 5 = reserve<br>bit 6 = reserve<br>bit 7 = device error detected<br>»True« means the status is active. |

*fig. 24: Event messages channel*

### 9.2.5 Action commands for one channel

The action commands for one channel consist of 1 byte.

Class ID = 101, Instance ID = 1…32 and Attribute ID = 4

Service Code: Set_Attribute_Single (16)

All action commands with possible conditions are described in the following table.

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

*fig. 25: 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

### 9.2.6 Diagnostic data for one channel

The dynamic information for one channel consists of 22 bytes.

Class ID = 101, Instance ID = 1…32 and Attribute ID = 2

Service Code: Get_Attribute_Single (14)

All dynamic information with possible conditions is described in the following table.

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Error memory | 0 HighByte<br>1 LowByte | UInt16 | 0 ... 65535 | bit 0 = no parameters available<br>bit 1 = error parameter memory<br>bit 2 = error programme memory<br>bit 3 = error data memory<br>bit 4 = error control unit<br>bit 5 = reset through watchdog<br>bit 6 = reserve<br>bit 7 = reserve<br>bit 8 = reserve<br>bit 9 = reserve<br>bit 10 = reserve<br>bit 11 = reserve<br>bit 12 = reserve<br>bit 13 = reserve<br>bit 14 = reserve<br>bit 15 = reserve<br>»True« means the status is active. |
| Trip counter | 2 HighByte<br>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<br>1 = short circuit<br>2 = overload<br>3 = device temperature too high<br>4 = internal device failure |
| Min.<br>Load voltage | 5 HighByte<br>6 LowByte | UInt16 | 0 ... 65535 | Contains the highest measured voltage of the channel since the last reset.<br>A standardised 16-bit-value with a resolution of 10 mV is made available.<br>Example for calculation of the measuring value:<br>value (2512)/100 ≙ 25.12 Volt |
| Max.<br>Load voltage | 7 HighByte<br>8 LowByte | UInt16 | 0 ... 65535 | Contains the highest measured voltage of the channel since the last reset.<br>A standardised 16-bit-value with a resolution of 10 mV is made available.<br>Example for calculation of the measuring value:<br>value (2512)/100 ≙ 25.12 Volt |
| Medium value<br>Load voltage | 9 HighByte<br>10 LowByte | UInt16 | 0 ... 65535 | Contains the mean voltage value of the channel since the last reset.<br>A standardised 16-bit-value with a resolution of 10 mV is made available.<br>Example for calculation of the measuring value:<br>value (2512)/100 ≙ 25.12 Volt |
| Min. load current | 11 HighByte<br>12 LowByte | UInt16 | 0 ... 65535 | Contains the lowest measured current of the channel since the last reset.<br>A standardised 16-bit-value with a resolution of 10 mA is made available.<br>Example for calculation of the measuring value:<br>value (150)/100 ≙ 1.50 Amps |

| | Byte | Type | Range | Description |
|---|---|---|---|---|
| Max. load current: | 13 HighByte<br>14 LowByte | UInt16 | 0 ... 65535 | Contains the highest measured current of the channel since the last reset.<br>A standardised 16-bit-value with a resolution of 10 mA is made available.<br>Example for calculation of the measuring value:<br>value (150)/100 ≙ 1.50 Amps |
| Medium value load current | 15 HighByte<br>16 LowByte | UInt16 | 0 ... 65535 | Contains the mean current value of the channel since the last reset.<br>A standardised 16-bit-value with a resolution of 10 mA is made available.<br>Example for calculation of the measuring value:<br>value (150)/100 ≙ 1.50 Amps |
| Supply voltage / actuator voltage | 17 HighByte<br>18 LowByte | UInt16 | 0 ... 65535 | Holds the supply voltage / actuator voltage of the channel.<br>A standardised 16-bit-value with a resolution of 10 mV is made available.<br>Example for calculation of the measuring value:<br>value (2512)/100 ≙ 25.12 Volt |
| Reserve | 19 HighByte<br>20 LowByte | UInt16 | 0 ... 65535 | Reserve |
| Diagnostic information of the channel | 21 | byte | 0 ... 255 | 0 = OK<br>1 = available device type does not match the configured type<br>2 = no device detected<br>3 = unused channel<br>144 = device parameters not plausible<br>146 = channel off via momentary switch/switch<br>147 = detected undervoltage<br>148 = detected excess temperature<br>149 = reset command required<br>150 = command was processed correctly<br>151 = parameterisation required<br>152 = Internal failure detected<br>153 = unknown command<br>154 = set length error<br>155 = rated current available, check sum error<br>156 = current rating selector switch was actuated |

***fig. 26: Dynamic information***

# 10 Appendix

## 10.1 List of pictures

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