User Manual

ControlPlex® Controller CPC12MB

1 Table of contents

1 Table of contents 2

2 General information 4
2.1 Safety instructions 4
2.2 Qualified personnel 4
2.3 Use 4
2.4 Delivery state 4

3 General description 5
3.1 Design of the entire system 6
3.2 Dimensions CPC12xx-Tx 7
3.3 Status indication and terminals 7
3.3.1 Terminals for voltage supply 8
3.3.2 Modbus TCP interfaces with integral switch, connection sleeve XF1, XF2 8
3.3.3 ETHERNET interface, connection sleeve X1 8
3.3.4 LED status indication 8

4 Mounting and installation 9
4.1 Mounting of the system 9

5 Operating modes of the CPC12 bus controller 10
5.1 Operating mode: Start-up mode 10
5.2 Operating mode: System error mode 10
5.3 Operating mode: Configuration error mode 10
5.4 Operating mode: Stand-alone mode 10
5.5 Operating mode: Slave mode 10
5.6 Operating mode: Firmware Update Mode 10

6 Basic functions of the entire system 11
6.1 Internal cycle times 11
6.2 Hot swap of circuit protectors 11
6.3 About the additional Ethernet interface 11
6.3.1 Web Server 11
6.3.2 Default IP address -X1 11
6.3.3 User name and password 11
6.3.4 OPC UA 11
6.3.5 MQTT 11

7 Communication via Modbus TCP 12
7.1 ***ControlPlex***® device model 12
7.2 Channel allocation 12

8 Modbus Register Overview 13

9 Modbus Register Content 15
9.1.1 CPC12 Status 15
9.1.2 Total current 15
9.1.3 Device information CPC12 controller 16
9.1.4 Configuration data CPC12 controller 17
9.1.5 Action commands CPC12 controller 18
9.1.6 Dynamic information CPC12 controller 19
9.2 Circuit protectors/channels 19
9.2.1 Status for one channel 19
9.2.2 Load voltage for one channel 19
9.2.3 Load current for one channel 19
9.2.4 Control output for one channel 20
9.2.5 Device parameters for one channel 20
9.2.6 Device information for one channel 21
9.2.7 Configuration data for one channel 22
9.2.8 Event message for one channel 23
9.2.9 Action commands for one channel 23
9.2.10 Diagnostic data for one channel 24

10 Appendix 26
10.1 List of pictures 26

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 Modbus TCP 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 Modbus TCP 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:.

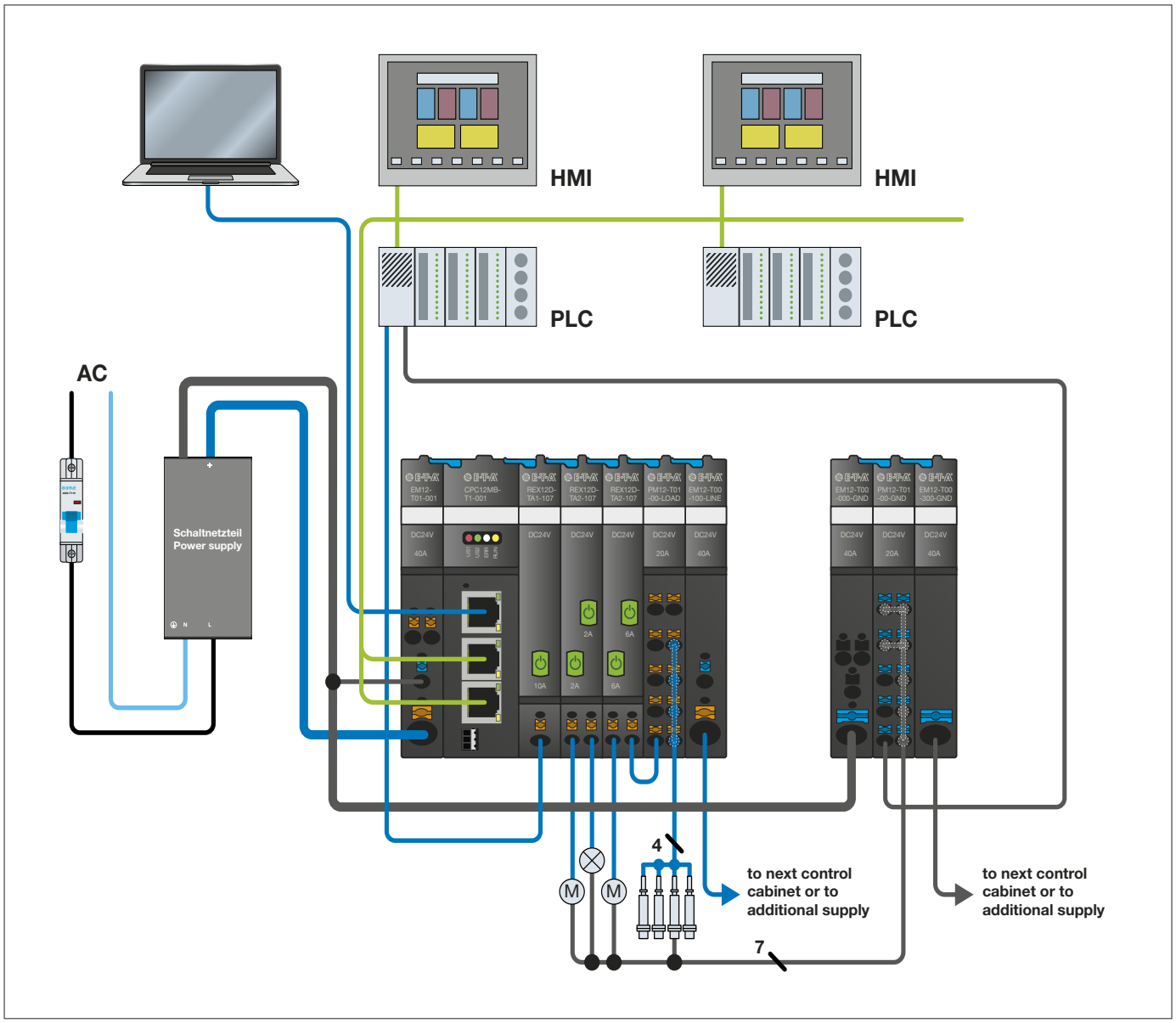

fig. 1: System overview

3.2 Dimensions CPC12xx-Tx

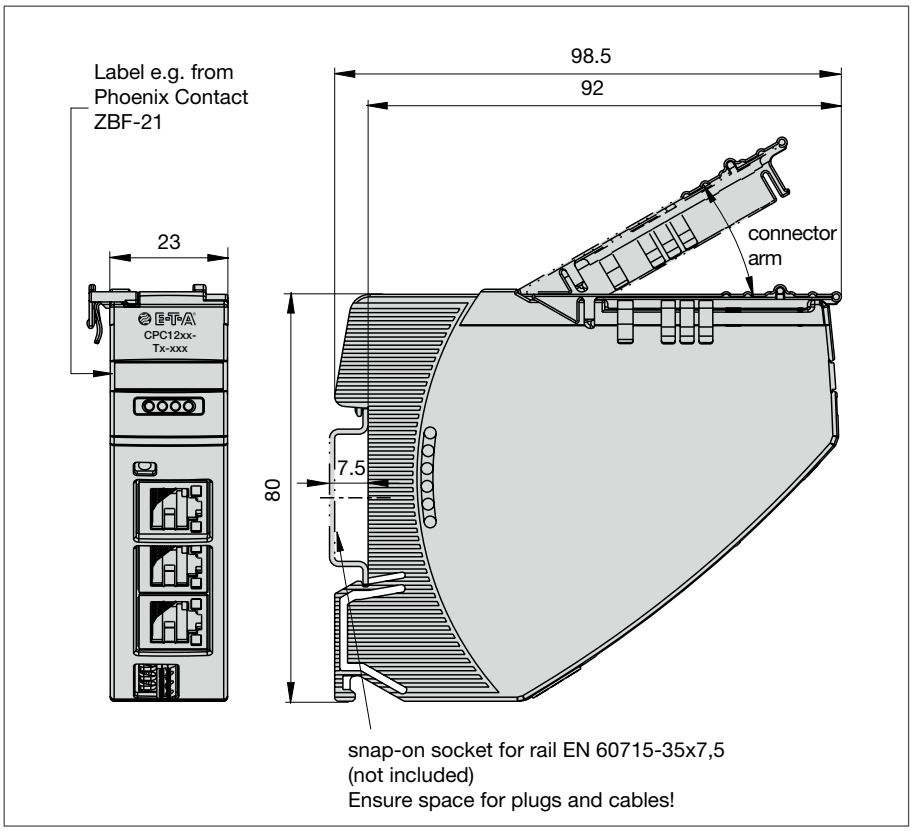

fig. 2: Dimensions CPC12

3.3 Status indication and terminals

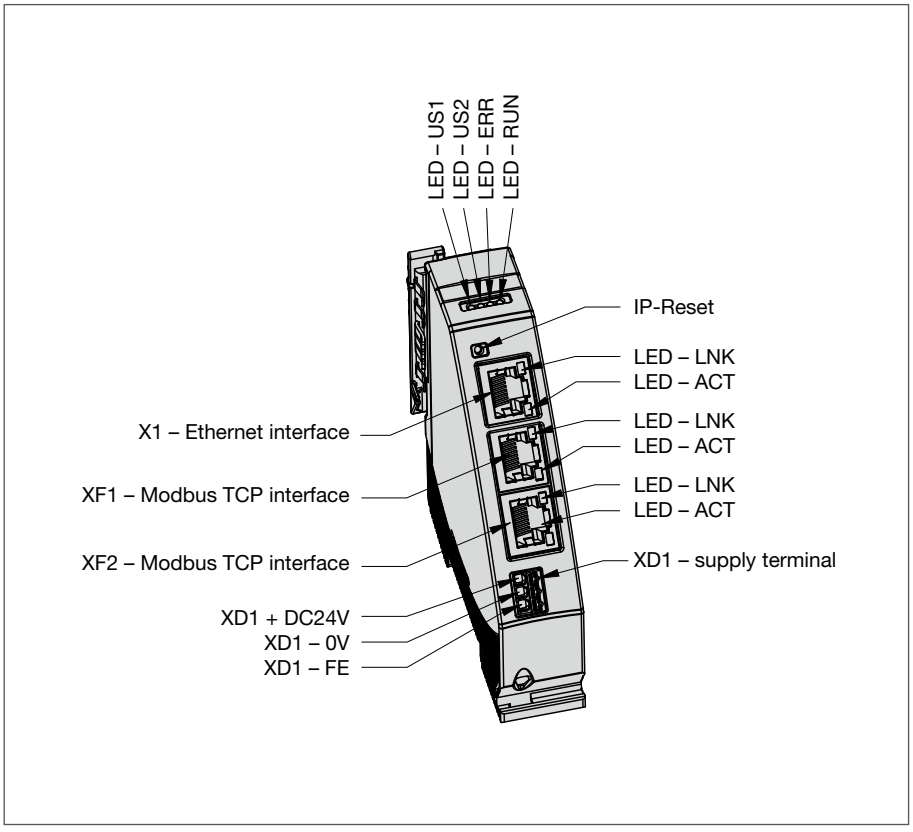

fig. 3: Status indication and terminals

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 Modbus TCP interfaces with integral switch, connection sleeve XF1, XF2

XF1 Connection to bus system Modbus TCP
Type: RJ45
When wiring and connecting to the bus system Modbus TCP, the installation and wiring regulations of the Modbus TCP Specification have to be observed.

XF2 Connection to bus system Modbus TCP
Type: RJ45
When wiring and connecting to the bus system Modbus TCP, the installation and wiring regulations of the Modbus TCP 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 ERR (Communication Error)

Operating mode	Indication of operating mode
No error	off
Communication error	red
Internal error	red blinking

LED RUN (Communication Status)

Operating mode	Indication of operating mode
TCP connected	green
Waiting for communication	green blinking (5 Hz)
Internal configuration	green blinking (1 Hz)
Not ready	off

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.

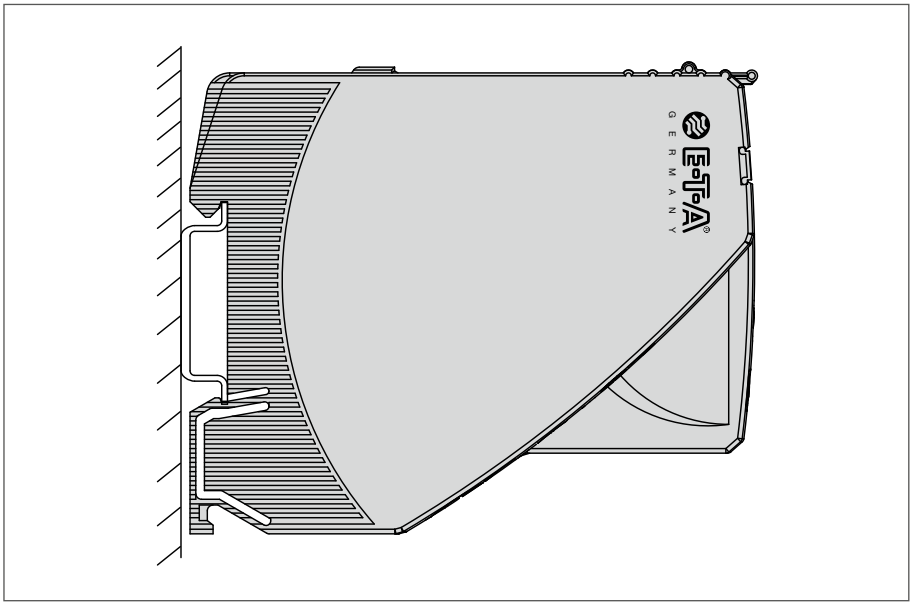

fig. 7: Installation drawing

5 Operating modes of the CPC12 bus controller

5.1 Operating mode: Start-up mode

The CPC12 bus controller is initialized by applying the supply voltage. The device will carry out internal program memory tests and self test routines. During this time, 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 parameterization 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 the 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 Modbus TCP 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 parameterization 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 Modbus TCP

Modbus is an application layer messaging protocol, positioned at level 7 of the OSI model, which provides client/server communication between devices. The default TPC/IP port for Modbus is 502.
Modbus is a request/reply protocol and offers services specified by function codes and register addresses. Each Modbus register contains two bytes of data.
The default IP address for CPC12MB on connector XF1 and XF2 is:

IP-Address	192.168.0.10
Netmask	255.255.255.0
Gateway	192.168.0.254

By pressing the IP-Reset button for 3 seconds, the Modbus TCP IP address is reset to the default value.

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 Modbus TCP model:

Modbus address	CPC12MB
40001 - 40099	This address range represents the CPC12 controller. All system wide information and settings can be accessed through this class. Details are described in Chapter 9.
40100 – 49999	This address range represents the circuit protectors connected to the CPC12. All circuit breaker specific information and settings can be accessed as described in Chapter 9. If more than 16 circuit protectors are connected, these cannot be accessed by the PLC.  The CPC12 allows configuration of 1 to max. 16 circuit protectors.

fig. 8: Communication properties

7.2 Channel allocation

Each of the circuit protectors is represented by 2 channels even if the connected circuit breaker contains only one output channel.
Channels are counted in ascending order as follows.
circuit protector 1, load output 1: channel 1
circuit protector 1, load output 2: channel 2
circuit protector 2, load output 1: channel 3
circuit protector 2, load output 2 not available: channel 4
circuit protector 3, load output 1: channel 5
circuit protector 3, load output 2: channel 6

8 Modbus Register Overview

The CPC12MB supports following function codes:
3 Read Holding Registers: Address Range 40001 - 49999
6 Write Single Register: Address Range 40001 - 49999
16 Write Multiple Registers: Address Range 40001 - 49999
4 Read Input Registers: Address Range 30001 - 39999
All registers available with function code 03 are also available with function code 04 within its address range.

The access to the data of CPC12 is grouped as follows:

Modbus address	Number of registers	Function code	Reading (R) writing (W)	Description
47500	1	3, 4	R	Status information of CPC12 controller (see chapter 9.1.1).
47401	1	3, 4	R	Total current of all circuit protectors (see chapter 9.1.2).
40020 - 40030	11	3, 4	R	Device information of CPC12 controller (see chapter 9.1.3).
40001 - 40003	3	3, 4, 6, 16	R/W	Configuration data of CPC12 controller (see chapter 9.1.4).
40050	1	6, 16	W	Action commands for all channels and the CPC12 controller (see chapter 9.1.5).
40031	1	3, 4	R	Dynamic information of CPC12 controller (see chapter 9.1.6).

fig. 9: Modbus Registers CPC12

The access to each circuit protectors is divided into two channels.
The access to the data of each channels is grouped as follows:

Modbus address	Number of registers	Function code	Reading (R) writing (W)	Description
47201 - 47232	32	3, 4	R	Status information of channel 1 - 32 (see chapter 9.2.1).
47001 - 47032	32	3, 4	R	Load voltage of channel 1 - 32 (see chapter 9.2.2).
47101 - 47132	32	3, 4	R	Load current of channel 1 - 32 (see chapter 9.2.3).
47301 - 47332	32	6, 16	W	Control output of channel 1 - 32 (see chapter 9.2.4).
40101 - 40132 40201 - 40232	32	3, 4, 6, 16	R/W	Device parameters of channel 1 - 32 (see chapter 9.2.5).
42001 – 42032 42101 – 42132 42201 – 42232 42301 – 42332 42401 – 42432 42501 – 42532 42601 – 42632 42701 – 42732 42801 – 42832 42901 – 42932 43001 – 43032	32	3, 4	R	Device information of channel 1 - 32 (see chapter 9.2.6).
41001 - 41032	32	3, 4, 6, 16	R/W	Configuration data of channel 1 - 32 (see chapter 9.2.7).
45101 - 45132	32	3, 4	R	Event message of channel 1 - 32 (see chapter 9.2.8).
45001 – 45032	32	6, 16	W	Action commands for channel 1 - 32 (see chapter 9.2.9).

Modbus address	Number of registers	Function code	Reading (R) writing (W)	Description
43101 – 43132 43201 – 43232 43301 – 43332 43401 – 43432 43501 – 43532 43601 – 43632 43701 – 43732 43801 – 43832 43901 – 43932 44001 – 44032 44101 – 44132 44201 – 44232	32	3, 4	R	Diagnosis data of channel 1 - 32 (see chapter 9.2.10).

fig. 10: Modbus Registers Channels

9 Modbus Register Content

9.1.1 CPC12 Status

The 2 bytes contain the following global error and diagnostic messages.

This register is only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Status controller	47500	UInt16	0xFFFF	bit 0 = no configuration data available bit 1 = invalid configuration data bit 2 = connected device type differs from configuration bit 3 = reserve bit 4 = command buffer overflow bit 5 = no communication to **ELBus®** 1 bit 6 = reserve bit 7 = reserve bit 8 = reserve bit 9 = CPC temporary error bit 10 = CPC hardware error bit 11 = **ELBus®** 1 communication speed: 0=9600 Baud, 1=19200 Baud bit 12 = reserve bit 13 = reserve bit 14 = reserve bit 15 = writing access via web server deactivated = 1, allowed = 0

fig. 11: CPC12 status

9.1.2 Total current

This register is only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Total current	47401	UInt16	0 ... 65535	A standardised 16-bit-value with a resolution of 10 mA is made available. Example for calculation of the measuring value: value (1320)/ 100 ≙ 13.20 Amps

fig. 12: Total current

9.1.3 Device information CPC12 controller

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Device Type	40020	UInt16	0 ... 65535	16565 = CPC12MB-T1 This list may be extended by future controllers.
Hardware version	40021	UInt16	0 ... 65535	Holds the hardware version of the installed product
Internal assembly order numbers	High word: 40022 Low word: 40023	UInt32	0 ... 4294967295	Holds the assembly order number of the installed product
Internal order split number	40024	UInt16	0 ... 65535	Holds the internal order split number of the installed product
Production facilities number	40025	UInt16	0 ... 65535	Holds the production facilities number of the installed product
Serial number	High word: 40026 Low word: 40027	UInt32	0 ... 4294967295	Holds the serial number of the installed product
Software version (major.x.x)	40028	byte	0 ... 255	Holds the major software version of the installed product
Software version (x.minor.x)	40029	byte	0 ... 255	Holds the major software version of the installed product
Software version (x.x.build)	40030	byte	0 ... 255	Holds the build software version of the installed product

fig. 13: Device information CPC12

9.1.4 Configuration data CPC12 controller

These registers are readable and writeable. Function codes 3, 4, 6 and 16 are available.

	Modbus address	Type	Range	Description
Configuration data of the CPC	40001	byte	0 ... 255	bit 0 = writing via web server permitted. Allows changing of parameters via the server even when the bus connection is active. bit 1 True: In the event of a fieldbus interruption, the status of the load outputs is maintained. False: In the event of a fieldbus interruption, all load outputs will be set to the status OFF. bit 2 = power saving mode, the LEDs will be dimmed for power reduction. bit 3 = reserve bit 4 = reserve bit 5 = reserve bit 6 = reserve bit 7 = reserve If not described otherwise, »True« means that the function is active.
Control commands disable **ELBus®** 1 on CPC channel 1 ... 16	40002	UInt16	0 ... 65535	Each bit represents a channel. (bit 0 = channel 1; bit1 = channel 2 ...) 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	40003	UInt16	0 ... 65535	Each bit represents a channel. (bit 0 = channel 17; bit1 = channel 18 ...) If the bit is set, this means that the channel cannot be switched on or off via the control unit or the web server.

fig. 14: Configuration data CPC12

9.1.5 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.

This register is only writeable. Function codes 6 and 16 are available.

	Modbus address	Type	Range	Description
Action commands	40050	byte	0 ... 255	116 = reset trip counter 118 = reset device parameters to factory settings including CPC12[1)] 131 = back to box [2)] 132 = adopt device type configurations to connected devices (see chapter 9.2.3). 192 = reset statistics minimum values 196 = reset statistics maximum values 220 = reset statistics mean values Other values will not be accepted.

fig. 15: 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«

9.1.6 Dynamic information CPC12 controller

This register is only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Cycle time **ELBus®** 1	40031	UInt16	0 ... 65535	Holds the internal cycle time of the **ELBus®** in milliseconds [ms].

fig. 16: Dynamic information CPC12

9.2 Circuit protectors/channels

The parameters of the circuit protectors are described in the following chapters. The parameters are organized in channels. Each circuit protector has up to two channels.

9.2.1 Status for one channel

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Status channel	47201 - 47232	byte	0 ... 255	0xFF (255) ≙ no device available or wrong configuration bit 0 = load output ON bit 1 = short circuit bit 2 = overload bit 3 = low voltage bit 4 = reserve bit 5 = reserve bit 6 = limit value current bit 7 = event / or button pressed »True« means the status is active.

fig. 17: Status channel

9.2.2 Load voltage for one channel

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Load voltage channel	47001 - 47032	UInt16	0 ... 65535	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

fig. 18: Load voltage channel

9.2.3 Load current for one channel

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Load current channel	47101 - 47132	UInt16	0 ... 65535	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

fig. 19: Load current channel

9.2.4 Control output for one channel

These registers are only writeable. Function codes 6 and 16 are available.

	Modbus address	Type	Range	Description
Control channel	47301 - 47332	byte	0 ... 255	bit 0 = load output ON/OFF bit 1 = reset load output (only responds to rising edge 0 -> 1) bit 2 = reserve bit 3 = reserve bit 4 = reserve bit 5 = reserve bit 6 = reserve bit 7 = reserve »True« means the status is active.

fig. 20: Control channel

9.2.5 Device parameters for one channel

These registers are readable and writeable. Function codes 3, 4, 6 and 16 are available.

	Modbus address	Type	Range	Description
Rated current	40201 - 40232	byte	1 ... max. rated current of the circuit breaker	Holds the current rating of the channel. With adjustable devices, you can set a new current rating here and transmit with a write command. 1 = 1A current rating 2 = 2A current rating 3 = 3A current rating ... 10 = 10A current rating (default value)
Limit value load current	40201 - 40232	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. The range is from 50 % to 100 %. The default value is 80 %.

fig. 21: Device parameters channel

9.2.6 Device information for one channel

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Circuit breaker device type	42001 – 42032	UInt16	0 ... 65535	36873 = REX12D-TA1-100 36874 = REX12D-TA2-100 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	42101 – 42132	UInt16	0 ... 65535	Holds the hardware version of the installed product
Internal assembly order	High words: 42201 – 42232 Low words: 42301 – 42332	UInt32	0 ... 4294967295	Holds the assembly order number of the installed product
Internal order split number	42401 – 42432	UInt16	0 ... 65535	Holds the internal order split number of the installed product
Production facilities number	42501 – 42532	UInt16	0 ... 65535	Holds the production facilities number of the installed product
Serial number	High words: 42601 – 42632 Low words: 42701 – 42732	UInt32	0 ... 4294967295	Holds the serial number of the installed product
Software version (major.x.x)	42801 – 42832	byte	0 ... 255	Holds the major software version of the installed product
Software version (x.minor.x)	42801 – 42832	byte	0 ... 255	Holds the major software version of the installed product
Software version (x.x.build)	43001 – 43032	byte	0 ... 255	Holds the build software version of the installed product

fig. 22: Device information channel

9.2.7 Configuration data for one channel

These registers are readable and writeable. Function codes 3, 4, 6 and 16 are available.

	Modbus address	Type	Range	Description
Circuit breaker device type	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 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.

fig. 23: Configuration data channel

9.2.8 Event message for one channel

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Event	45101 - 45132	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.

fig. 24: Event messages channel

9.2.9 Action commands for one channel

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Action commands	45001 – 45032	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.

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

9.2.10 Diagnostic data for one channel

These registers are only readable. Function codes 3 and 4 are available.

	Modbus address	Type	Range	Description
Error memory	43101 – 43132	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 12 = reserve bit 13 = reserve bit 14 = reserve bit 15 = reserve »True« means the status is active.
Trip counter	43201 – 43232	UInt16	0 ... 65535	The number of trippings since the last reset of is shown here.
Reason for trip	43301 – 43332	byte	0 ... 255	0 = no trip 1 = short circuit 2 = overload 3 = device temperature too high 4 = internal device failure
Min. load voltage	43401 – 43432	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
Max. load voltage	43501 – 43532	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	43601 – 43632	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	43701 – 43732	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

	Modbus address	Type	Range	Description
Max. load current:	43801 – 43832	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	43901 – 43932	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
Supply voltage / actuator voltage	44001 – 44032	UInt16	0 ... 65535	Holds the supply voltage / actuator voltage of the channel. 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
Reserve	44101 – 44132	UInt16	0 ... 65535	Reserve
Diagnostic information of the channel	44201 – 44232	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

fig. 26: Dynamic information

10 Appendix

10.1 List of pictures

fig. 1: System overview 6
fig. 2: Dimensions CPC12 7
fig. 3: Status indication and terminals 7
fig. 4: Display status LEDs 8
fig. 5: Display fieldbus status LEDs 9
fig. 6: Display LEDs RJ45 connectors 9
fig. 7: Installation drawing 9
fig. 8: Communication properties 12
fig. 9: Modbus Registers CPC12 13
fig. 10: Modbus Registers Channels 14
fig. 11: CPC12 status 15
fig. 12: Total current 15
fig. 13: Device information CPC12 16
fig. 14: Configuration data CPC12 17
fig. 15: Action commands CPC12 18
fig. 16: Dynamic information CPC12 19
fig. 17: Status channel 19
fig. 18: Load voltage channel 19
fig. 19: Load current channel 19
fig. 20: Control channel 20
fig. 21: Device parameters channel 20
fig. 22: Device information channel 21
fig. 23: Configuration data channel 22
fig. 24: Event messages channel 23
fig. 25: Action commands channel 23
fig. 26: Dynamic information 25

Notes

www.e-t-a.de/qr1046/

Bedienungsanleitung/Instruction manual CPC12MB-Tx-xxx (ENG)
Bestell-Nr. / Ref. number Y31370002 - Index: -
Issue 01/2021

ENGINEERING TECHNOLOGY

E-T-A Elektrotechnische Apparate GmbH
Industriestraße 2-8 · 90518 Altdorf
GERMANY
Phone +49 9187 10-0 · Fax +49 9187 10-397
E-mail: info@e-t-a.de · www.e-t-a.de