CPC12EC *ControlPlex*® CONTROLLER

Instruction manual

ENGINEERING TECHNOLOGY

CONTENTS

1 General Information 4
1.1 Safety Instructions 4
1.2 Qualified Personnel 4
1.3 Use 4
1.4 Delivery State 4

2 General Description 5
2.1 Design of the Entire System 6
2.2 CPC12XX-TX Dimensions 7
2.3 Status Indication and Terminals 7
2.3.1 Terminals for Voltage Supply 8
2.3.2 EtherCAT Interfaces with Integral Switch, XF1, XF2 Sockets 8
2.3.3 Ethernet Interface, Connector X1 8
2.3.4 LED Status Indication 9

3 Mounting and Installation 10

4 Operating Modes of the CPC12 Bus Controller 11
4.1 Operating Mode: Start-Up Mode 11
4.2 Operating Mode: System Error Mode 11
4.3 Operating Mode: Configuration Error Mode . 11
4.4 Operating Mode: Stand-Alone Mode 11
4.5 Operating Mode: Slave Mode 12
4.6 Operating Mode: Firmware Update Mode 12

5 Basic Functions of the Entire System 13
5.1 Internal Cycle Times 13
5.2 Hot Swap of the Circuit Protectors 13
5.3 Additional Ethernet Interface 13
5.3.1 Web Server 13
5.3.2 Default X1 IP address 13
5.3.3 Username and Password 14

6 Communication via EtherCAT 15
6.1 *ControlPlex*® device model 15
6.2 ESI file 19

7 Cyclical I/O Data 20
7.1 Cyclical Data CPC12 Controller 20
7.1.1 I/O Data CPC12 Controller 20
7.1.2 Total Current CPC12 Controller 20
7.2 Cyclical Data of Circuit Protectors 21
7.2.1 Cyclical Input Data of Circuit Protectors 21
7.2.2 Cyclical Output Data of Circuit Protectors 22

8 Non-cyclical Data 23
8.1 CPC12 Controller 24
8.1.1 Device Information CPC12 Controller 24
8.1.2 Configuration Data CPC12 Controller 25
8.1.3 Action Commands CPC12 Controller 26
8.1.4 Dynamic Information CPC12 Controller 27
8.2 Circuit Protectors / Channels 27
8.2.1 Device Parameters for one Channel 27
8.2.2 Device Information for one Channel . 28
8.2.3 Configuration Data for one Channel . 29

CONTENTS

8.2.4 Event Message for one Channel 30
8.2.5 Action Commands for one Channel . 30
8.2.6 Diagnostic Data for one Channel 31

9 Appendix 33

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 reuse.

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 EtherCAT 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 EtherCAT 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.

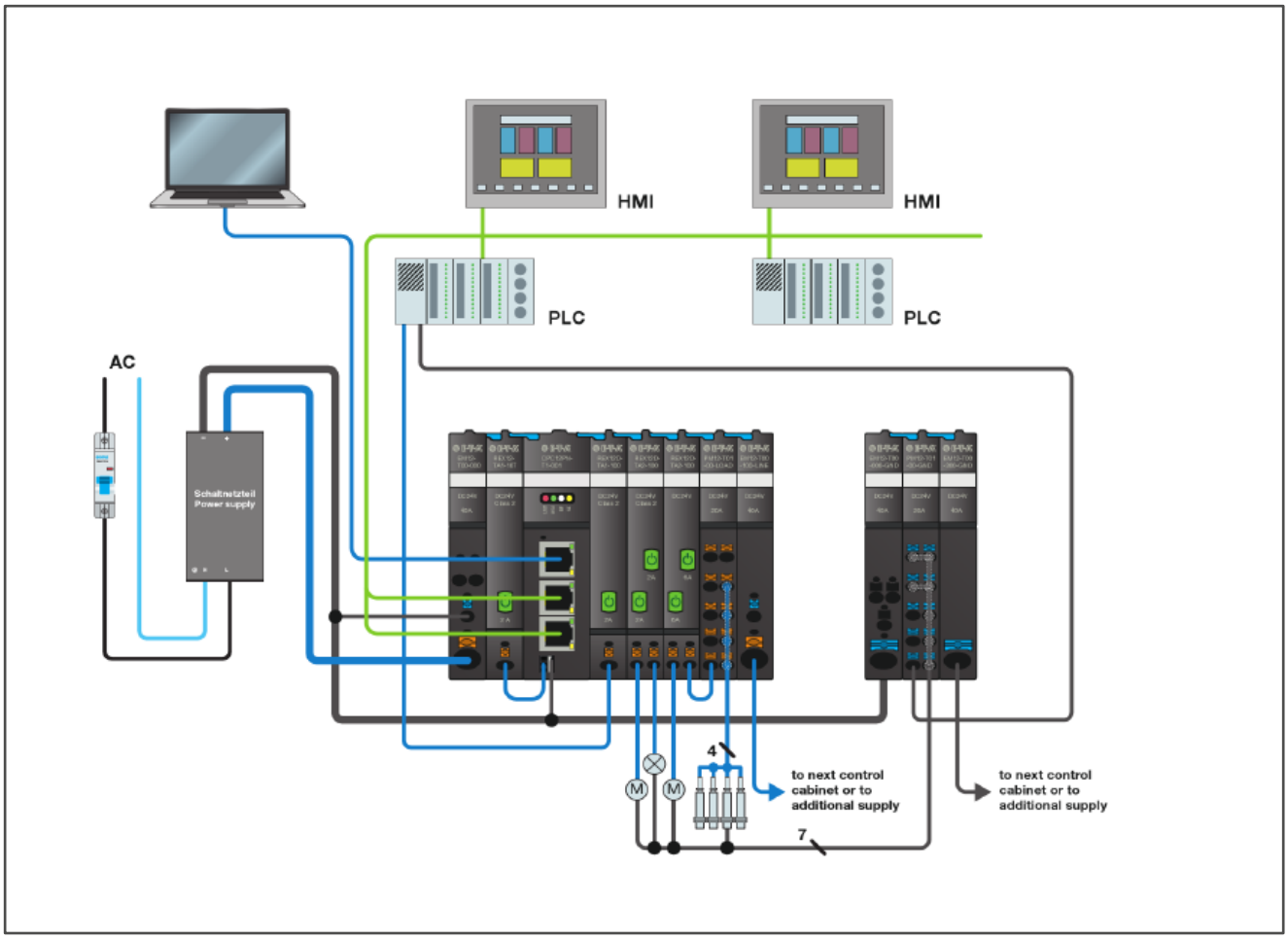

Figure 1: System Overview

2.2 CPC12XX-TX Dimensions

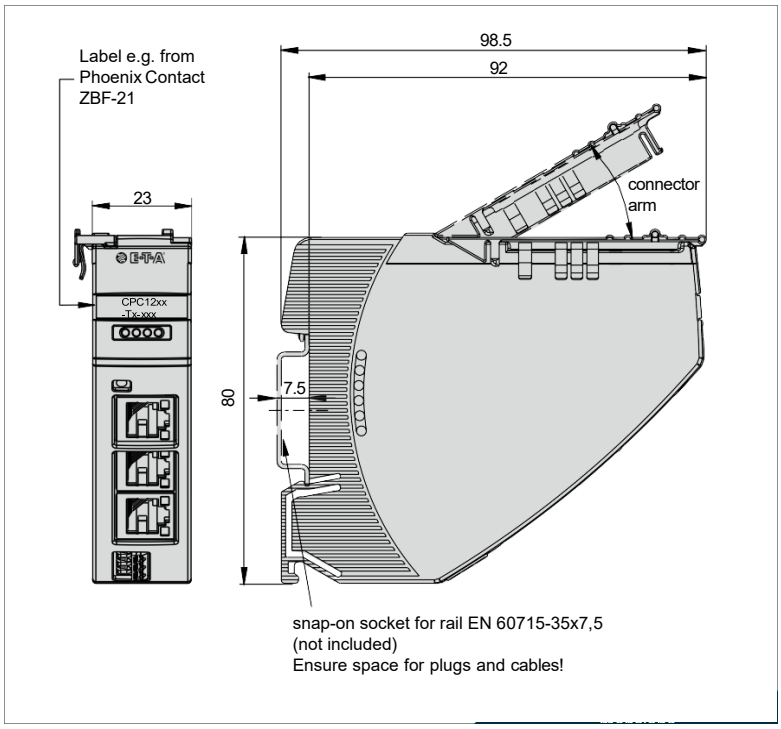

Figure 2: CPC12 dimensions

2.3 Status Indication and Terminals

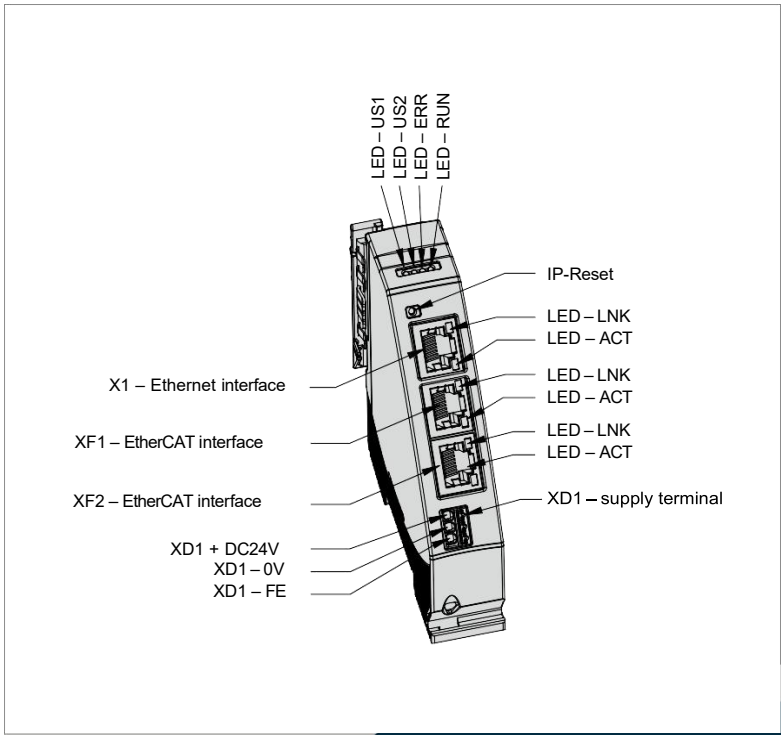

Figure 3: CPC12 Status Indication and Terminals

2.3.1 Terminals for Voltage Supply

Supply XD1

Voltage ratings:	DC 24 V (±5 % → 18 ... 30 V)	
Rated current:	typ. 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.

2.3.2 EtherCAT Interfaces with Integral Switch, XF1, XF2 Sockets

XF1 Connection to bus system EtherCAT
Type: RJ45

XF2 Connection to bus system EtherCAT
Type: RJ45

When wiring and connecting to the bus system EtherCAT, the installation and wiring regulations of the EtherCAT Technology Group (ETG) have to 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 ERR	LED RUN
EtherCAT Init-State	n.a.	n.a.	n.a.	Off
EtherCAT Pre-Operational-State	n.a.	n.a.	n.a.	Green blinking (0.2 s on / 0.2 s off)
EtherCAT Safe-Operational-State	n.a.	n.a.	n.a.	Green blinking (0.2 s on / 1 s off)
EtherCAT Operational-State	n.a.	n.a.	n.a.	Green
EtherCAT error	n.a.	n.a.	Red	n.a.
No EtherCAT error	n.a.	n.a.	Off	n.a.
Voltage supply OK	Green	n.a.	n.a.	n.a.
Firmware update	Off	Off	Off	Off
Actuator voltage ok	n.a.	Green	n.a.	n.a.
No actuator voltage	n.a.	Red	n.a.	n.a.
No connected device or bus error	n.a.	Orange blinking (0.5 s on / 0.5 s off)	n.a.	n.a.

Figure 4: LED status indication

n.a. = not applicable

Optical signalling of the RJ45 interface X1:

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

Figure 5: RJ45 socket X1 - LED indication

Optical signalling of the RJ45 interfaces XF1 and XF2:

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	Green blinking
No act available	Off

Figure 6: RJ45 sockets XF1 & XF2 - LED indication

3 MOUNTING AND INSTALLATION

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

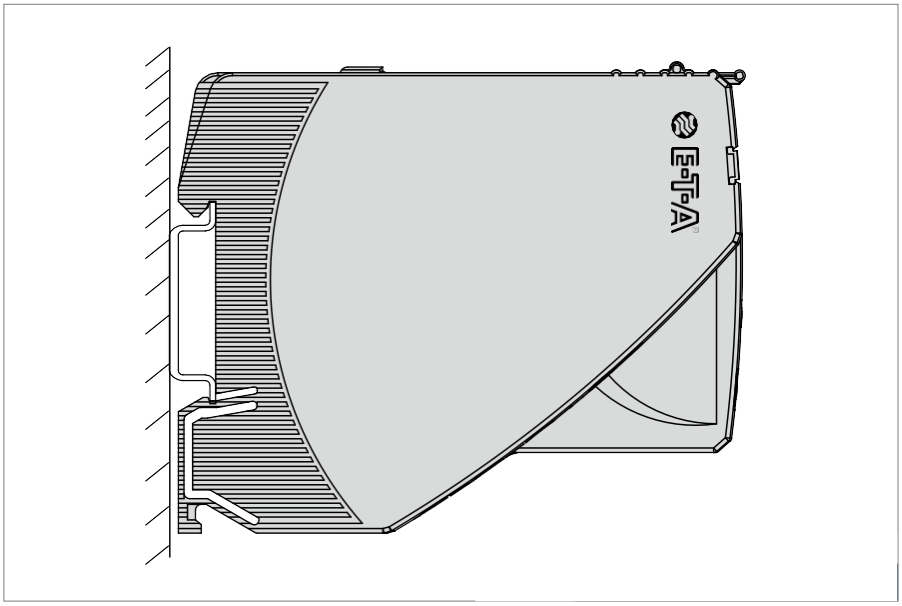

Figure 7: CPC12 installation drawing

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 EtherCAT 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 EtherCAT 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.

* Customised 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 ETHERCAT

6.1 *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 EtherCAT object list:

Index	Subindex	Name	Access	Data length	Data type
0x1000	-	Device Type	r	4 byte	Integer
0x1008	-	Device Name	r		String
0x1009	-	Hardware Version	r		String
0x100A	-	Software version	r		String
0x1018	-	Identity Object	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Vendor ID	r	4 byte	Integer
	2	Product Code	r	4 byte	Integer
	3	Revision Number	r	4 byte	Integer
	4	Serial Number	r	4 byte	Integer
0x1600	-	Channel Control PDO	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Output Mapping Area 1	r	4 byte	Integer
	2	Output Mapping Area 2	r	4 byte	Integer
	3	Output Mapping Area 3	r	4 byte	Integer
	4	Output Mapping Area 4	r	4 byte	Integer
0x1A00	-	Channel status PDO	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Input Mapping Area 1	r	4 byte	Integer
	2	Input Mapping Area 2	r	4 byte	Integer
	3	Input Mapping Area 3	r	4 byte	Integer
	4	Input Mapping Area 4	r	4 byte	Integer
0x1A01	-	Channel Load Voltage PDO	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Input Mapping Area 1	r	4 byte	Integer
	2	Input Mapping Area 2	r	4 byte	Integer
	3	Input Mapping Area 3	r	4 byte	Integer
	4	Input Mapping Area 4	r	4 byte	Integer

Index	Subindex	Name	Access	Data length	Data type
0x1A02	-	Channel Load Current PDO	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Input Mapping Area 1	r	4 byte	Integer
	2	Input Mapping Area 2	r	4 byte	Integer
	3	Input Mapping Area 3	r	4 byte	Integer
	4	Input Mapping Area 4	r	4 byte	Integer
0x1AFF	-	Device Status PDO	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Status Mapping	r	4 byte	Integer
	2	Total current mapping	r	4 byte	Integer
0x1C00	-	Sync Manager Com.Type			-
	0	Number of Entries	r	1 byte	Integer
	1	Subindex 001	r	1 byte	Integer
	2	Subindex 002	r	1 byte	Integer
	3	Subindex 003	r	1 byte	Integer
	4	Subindex 004	r	1 byte	Integer
0x1C12	-	Sync Manager 2 PDO Assignment	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Subindex 001	r	1 byte	Integer
0x1C13	-	Sync Manager 3 PDO Assignment	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Subindex 001	r	1 byte	Integer
	2	Subindex 002	r	1 byte	Integer
	3	Subindex 003	r	1 byte	Integer
	4	Subindex 004	r	1 byte	Integer
0x2100	-	Acyclic Data Controller	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	System commands	w	1 byte	Integer
	2	Configuration data controller	r/w	8 byte	Integer
	3	Device Information	r	19 byte	Integer
	4	Dynamic Information	r	4 byte	Integer

Index	Subindex	Name	Access	Data length	Data type
0x2101	-	Acyclic Data Ch1	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Parameter Channel	r/w	2 byte	Integer
	2	Device Information	r	19 byte	Integer
	3	Device Type Config	r/w	2 byte	Integer
	4	Events	r	1 byte	Integer
	5	Action Commands Channel	w	1 byte	Integer
	6	Dynamic Information	r	22 byte	Integer
0x2102	-	Acyclic Data CH2	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Parameter Channel	r/w	2 byte	Integer
	2	Device Information	r	19 byte	Integer
	3	Device Type Config	r/w	2 byte	Integer
	4	Events	r	1 byte	Integer
	5	Action Commands Channel	w	1 byte	Integer
	6	Dynamic Information	r	22 byte	Integer
…	…	…	…	…	…
0x2120	-	Acyclic Data CH32	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Parameter Channel	r/w	2 byte	Integer
	2	Device Information	r	19 byte	Integer
	3	Device Type Config	r/w	2 byte	Integer
	4	Events	r	1 byte	Integer
	5	Action Commands Channel	w	1 byte	Integer
	6	Dynamic Information	r	22 byte	Integer
0x6000	-	Channel status	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	1.1 Status	r	1 byte	Integer
	2	1.2 Status	r	1 byte	Integer
	3	2.1 Status	r	1 byte	Integer
	…	…	…	…	…
	32	16.2 Status	r	1 byte	Integer

Index	Subindex	Name	Access	Data length	Data type
0x6010	-	Channel Load Voltage	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	1.1 Load Voltage	r	2 byte	Integer
	2	1.2 Load Voltage	r	2 byte	Integer
	3	2.1 Load Voltage	r	2 byte	Integer
	…	…	…	…	…
	32	16.2 Load Voltage	r	2 byte	Integer
0x6020	-	Channel Load Current	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	1.1 Load Current	r	2 byte	Integer
	2	1.2 Load Current	r	2 byte	Integer
	3	2.1 Load Current	r	2 byte	Integer
	…	…	…	…	…
	32	16.2 Load Current	r	2 byte	Integer
0x7000	-	Channel control	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	1.1 Status	w	2 byte	Integer
	2	1.2 Status	w	2 byte	Integer
	3	2.1 Status	w	2 byte	Integer
	…	…	…	…	…
	32	16.2 Status	w	2 byte	Integer
0xF000	-	Modular Device Profile	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Module Index Distance	r	2 byte	Integer
	2	Maximum Number of Profiles	r	2 byte	Integer
0xF030	-	Configured Module List	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Subindex 001	r/w	2 byte	Integer
0xF050	-	Detected Module List	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Subindex 001	r	2 byte	Integer
0xF100	-	Controller Status	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Controller Status	r	2 byte	Integer
0xF120	-	Total Current	-	-	-
	0	Number of Entries	r	1 byte	Integer
	1	Total Current	r	4 byte	Integer

Figure 8: EtherCAT object list

6.2 ESI file

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

7 CYCLICAL I/O DATA

Depending on the selected module, a varying number of data bytes are exchanged in the cyclical data traffic. The ESI file made available for the projecting tool allows the related configuration, the system recognises all permitted configurations and processes the cyclical data defined in the projection.

The module I/O data CPC12 controller is firmly pre-set in slot 2 and cannot be removed because the input bytes hold vital failure and diagnostic information as described in the following.

7.1 Cyclical Data CPC12 Controller

The CPC12 controller cyclically provides status and total current information.

7.1.1 I/O Data CPC12 Controller

The 2 bytes of input data can be queried via register 0xF100 subindex 1. They hold the following global errors and diagnostic messages. This module holds 2 bytes output data which are meant for the later system extensions and which cannot currently be used.

	Byte	Type	Scope	Description
Status controller	0 HighByte 1 LowByte	UInt16	0xFFFF	bit 0 = no configuration data available bit 1 = invalid configuration data bit 2 = Connected device type is not compatible to configuration bit 3 = Parameters restored 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

Figure 9: Cyclical diagnostic data CPC12

7.1.2 Total Current CPC12 Controller

Register 0xF120 subindex 1 contains the total current. A 16-bit value with the calculated total current of all circuit protectors entered in the slot (2 bytes input data) is made available.
The sub-module does not have output data.
The measuring value is indicated as follows:

	Byte	Type	Scope	Description
Total Current	0 HighByte 1 LowByte	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

Figure 10: Total Current

7.2 Cyclical Data of Circuit Protectors

The circuit protectors cyclically supply status, load voltage and load current information. The circuit protectors can additionally be controlled via cyclical output data.

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

7.2.1 Cyclical Input Data of Circuit Protectors

10 bytes input data are provided per configured circuit protector. These consist of 1 byte status per channel and 2 bytes each load current and load voltage values per channel.
The status can be found under index 0x6000 from subindex 1 to 32.
The load voltage is in register 0x6010 from subindex 1 to 32.
The load current is in register 0x6020 from subindex 1 to 32.
The subindex represents the channel number.
Design of the input bytes per circuit protector is as follows:

	Byte	Type	Scope	Description
Status channel	0	byte	0 ... 255	0xFF (255) ≙ no device available or wrong device configured 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 “True” means the status is active.
Load current channel 1	1 HighByte 2 LowByte	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
Load voltage channel 1	3 HighByte 4 LowByte	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

	Byte	Type	Scope	Description
Status channel 2	5	byte	0 ... 255	0xFF (255) ≙ no device available, wrong configuration or 1-channel device used or wrong device configured 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 “True” means the status is active.
Load current channel 2	6 HighByte 7 LowByte	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
Load voltage channel 2	8 HighByte 9 LowByte	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

Figure 11: Input data circuit protector

7.2.2 Cyclical Output Data of Circuit Protectors

Each channel can be switched on or off or reset via the cyclical output data. A subindex (1 to 32) is reserved per channel in register 0x7000. The subindex again represents the channel number.
Design of the output bytes per circuit protector is as follows:

	Byte	Type	Scope	Description
Control channel 1	0	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.
Control channel 2	1	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.

Figure 12: Output data circuit protector

8 NON-CYCLICAL DATA

Non-cyclical services allow exchange of more data with the CPC12 controller and the circuit protectors. Access also allows direct addressing of a circuit protector. The index and subindex are used to read or write the CPC12 data. 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:

Index	Subindex	Number of data bytes	Reading (R) Writing (W)	Description
0x2100	03	19	R	Device information of CPC12 controller (see chapter 8.1.1)
0x2100	02	5	R/W	configuration data of CPC12 controller (see chapter 8.1.2)
0x2100	01	1	W	action commands for all channels and the CPC12 controller (see chapter 8.1.3)
0x2100	04	4	R	dynamic information of CPC12 controller (see chapter 8.1.4)

Figure 13: Division of parameter index CPC12

The non-cyclical access to the data of circuit protectors and/or channels is divided as follows:
Example index for channel 7, 0x2100 + 7 = 0x2107

Index	Sub-index	Number of data bytes	Reading (R) Writing (W)	Description
0x2100 + number of channel	01	2	R/W	Device parameters of a channel (see chapter 8.2.1)
0x2100 + number of channel	02	19	R	Device information of a channel (see chapter 8.2.2)
0x2100 + number of channel	03	2	R/W	Configuration data of a channel (see chapter 8.2.3)
0x2100 + number of channel	04	1	R	Event message of a channel (see chapter 8.2.4)
0x2100 + number of channel	05	1	W	Action commands for a channel (see chapter 8.2.5)
0x2100 + number of channel	06	22	R	Diagnosis data of a channel (see chapter 8.2.6)

Figure 14: Division of parameter index channel

8.1 CPC12 Controller

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

8.1.1 Device Information CPC12 Controller

The device information of the controller consists of 19 bytes.
Access: Index 0x2100, subindex 3
All device information with possible conditions is described in the following table.

	Byte	Type	Scope	Description
Circuit breaker p/n	0 HighByte 1 LowByte	UInt16	0 ... 65535	16437 = CPC12EC-T1 This list may be extended by future controllers.
Hardware version	2 HighByte 3 LowByte	UInt16	0 ... 65535	holds the hardware version of the installed product
Internal assembly order numbers	4 HwHb 5 HwLB 6 LwHB 7 LwLB	UInt32	0 ... 4294967295	holds the assembly order number of the installed product
Production facilities number	8 HwHb 9 HwLB 10 LwHB 11 LwLB	UInt32	0 ... 4294967295	holds the production facilities number of the installed product
Serial number	12 HwHb 13 HwLB 14 LwHB 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

Figure 15: Device information CPC12

8.1.2 Configuration Data CPC12 Controller

The device configuration data for the controller consists of 5 bytes.
Access: Index 0x2100, subindex 2
All configuration data with possible conditions are described in the following table.

	Byte	Type	Scope	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 con nection is active. bit 1 True: In the event of a fieldbus interruption, the status of the load outputs is maintained. False: In the event 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.
PLC-Lock: Control commands disable ELBus® 1 on CPC channel 1 ... 16	1 HighByte 2 LowByte	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.
PLC-Lock: Control commands disable ELBus® 1 on CPC channel 17 ... 32	3 HighByte 4 LowByte	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.
Reserve	5 HighByte 6 LowByte	UInt16	0	Reserve
Reserve	7 HighByte 8 LowByte	UInt16	0	Reserve

Figure 16: Configuration Data CPC12

8.1.3 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.
Access: Index 0x2100, subindex 1
Action commands with possible conditions are described in the following table.

	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 device type (see chapter 8.2.3) 192 = reset statistics minimum values 196 = reset statistics maximum values 220 = reset statistics mean values Other values will not be accepted.

Figure 17: 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
    - behaviour of load outputs in the event of field bus interruption = True = status is preserved
    - writing via webserver allowed = True

[2)] The command »131 = back-to-box« 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)
- configured device types (default = REX12D-TA1 = 0x9009 = 36873)
- 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
    - behaviour of load outputs in the event of field bus interruption = True = status is preserved
    - writing via web server allowed = True
- IP configuration of the third ETH port X1:
    - IP address = 192.168.1.1
    - network mask = 255.255.255.0
    - gateway = 192.168.1.254
    - DHCP = False
- user data:
    - name = “admin”
    - password = “admin”

8.1.4 Dynamic Information CPC12 Controller

Access: Index 0x2100, subindex 4

	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 18: 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: Index 0x2100 + number of channel, subindex 1

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

	Byte	Type	Scope	Description
Rated current	0	Byte	1 ... 25	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 = 1 A current rating 2 = 2 A current rating 3 = 3 A current rating ... 10 = 10 A 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 signalled with a bit in the »status channel« of the cyclical data. The range is from 50 % to 100 %. 100 %. The default value is 80 %.

Figure 19: Device parameters channel

8.2.2 Device Information for one Channel

The device information for one channel consists of 19 bytes.
Access: Index 0x2100 + number of channel, subindex 2
All device information with possible conditions is described in the following table.

	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	holds the hardware version of the installed product
Internal assembly order	4 HwHb 5 HwLB 6 LwHB 7 LwLB	UInt32	0 ... 4294967295	holds the assembly order number of the installed product
Production facilities number	8 HwHb 9 HwLB 10 LwHB 11 LwLB	UInt32	0 ... 4294967295	holds the production facilities number of the installed product
Serial number	12 HwHb 13 HwLB 14 LwHB 15 LwLB	UInt32	0 ... 4294967295	holds the serial number of the installed product

	Byte	Type	Scope	Description
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

Figure 20: Device information channel

8.2.3 Configuration Data for one Channel

The configuration data for one channel consist of 2 bytes.
Access: Index 0x2100 + number of channel, subindex 3
All configuration data with possible conditions are described in the following table.

	Byte	Type	Scope	Description
Circuit breaker p/n	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 21: Configuration data channel

8.2.4 Event Message for one Channel

The event messages for one channel consist of 1 byte.
Access: Index 0x2100 + number of channel, subindex 4
All event messages with possible conditions are described in the following table.

	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 22: Event messages channel

8.2.5 Action Commands for one Channel

The action commands for one channel consist of 1 byte.
Access: Index 0x2100 + number of channel, subindex 5
All action commands with possible conditions are described in the following table.

	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 23: 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 bytes.
Access: Index 0x2100 + number of channel, subindex 6
All dynamic information with possible conditions is described in the following table.

	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 12 = reserve bit 13 = reserve bit 14 = reserve bit 15 = 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

	Byte	Type	Scope	Description
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
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 24: Dynamic information

9 APPENDIX

List of Figures

Figure 1: System Overview....6
Figure 2: CPC12 dimensions....7
Figure 3: CPC12 Status Indication and Terminals....7
Figure 4: LED status indication....9
Figure 5: RJ45 socket X1 - LED indication....9
Figure 6: RJ45 sockets XF1 & XF2 - LED indication....9
Figure 7: CPC12 installation drawing....10
Figure 8: EtherCAT object list....18
Figure 9: Cyclical diagnostic data CPC12....20
Figure 10: Total Current....21
Figure 11: Input data circuit protector....22
Figure 12: Output data circuit protector....22
Figure 13: Division of parameter index CPC12....23
Figure 14: Division of parameter index channel....23
Figure 15: Device information CPC12....24
Figure 16: Configuration Data CPC12....25
Figure 17: Action commands CPC12....26
Figure 18: Dynamic information CPC12....27
Figure 19: Device parameters channel....27
Figure 20: Device information channel....29
Figure 21: Configuration data channel....29
Figure 22: Event messages channel....30
Figure 23: Action commands channel....30
Figure 24: Dynamic information....32

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