User Manual *ControlPlex®*
EM12D-TIO Intelligent Supply Module

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 requirements regarding modern machinery and equipment are constantly growing. System transparency, remote maintenance and remote access are getting more and more important in international competition. Early notification in the event of any disturbances and a fast response to current problems will increase system availability, save costs and improve the overall stability of the production process.

E-T-A provides the ideal solution for the machine building industry with the intelligent protection system comprising the circuit protector and the intelligent EM12D-TIO supply module. The system combines the well-proven quality of DC 24 V overcurrent protection with the communication options of the IO link system. It allows complete transparency of the DC 24 V power supply and provides all necessary information for a reliable production process in this plant sector. Part of the information is the permanent transmission of status indication regarding each channel of the individual circuit protector. In addition, the present load current of the channel on the selected circuit protector is transmitted to the IO link master.

A parameterisable limit value allows creation of a warning threshold which advises the user of changing system conditions.

Any number of the only 12.5 mm wide modules can be mounted side by side. They feature push-in technology with press release buttons and allow no-tool time-saving and maintenance-free wiring. The supply module is designed for DC 24 V and 40 A and accommodates max. 10 mm² with wire end ferrule as a plus (+) supply. On the load output side the circuit protector can be wired with 2.5 mm².

It is exactly tailored to the needs of machine and panel builders. And what is more: no additional accessories are required when connecting the individual components electrically and mechanically. This helps save time and money!

3.1 Design of the entire system
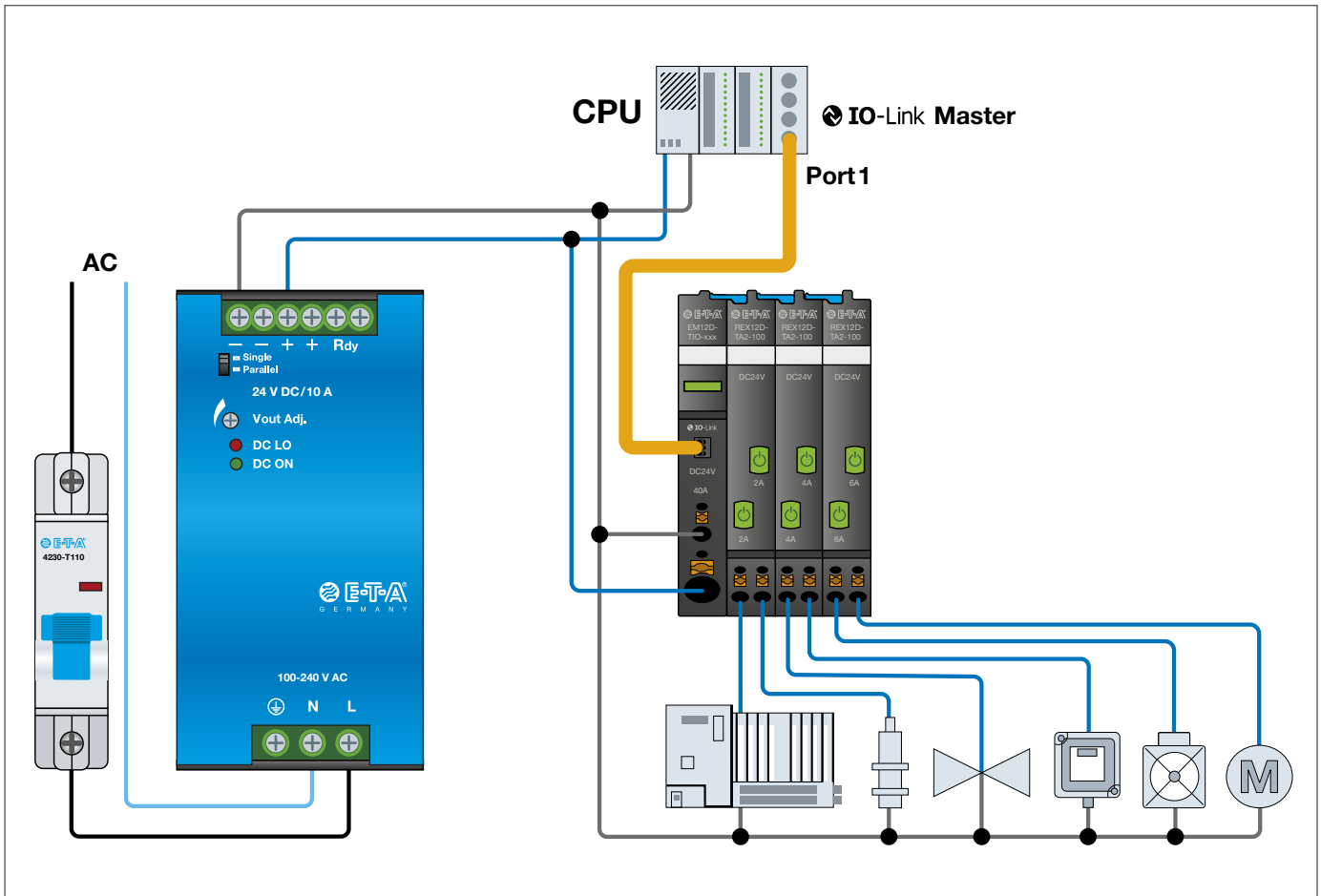
Figure 1: System overview

The intelligent supply module EM12D-TIO is the centre of the **ControlPlex®** system. It collects all information of the electronic circuit protectors and forwards it to the superordinate IO link master and thus to the superordinate control unit.

The IO link interface to the superimposed IO link master is realised with a 3-wire cable. It allows connection of the required IO link master to the **ControlPlex®** system, thus enabling display and analysis of the individual measuring values as well as

diagnosis and control of the individual channels of the electronic circuit protectors. 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.

3.2 Dimensions of the EM12D-TIO intelligent supply module
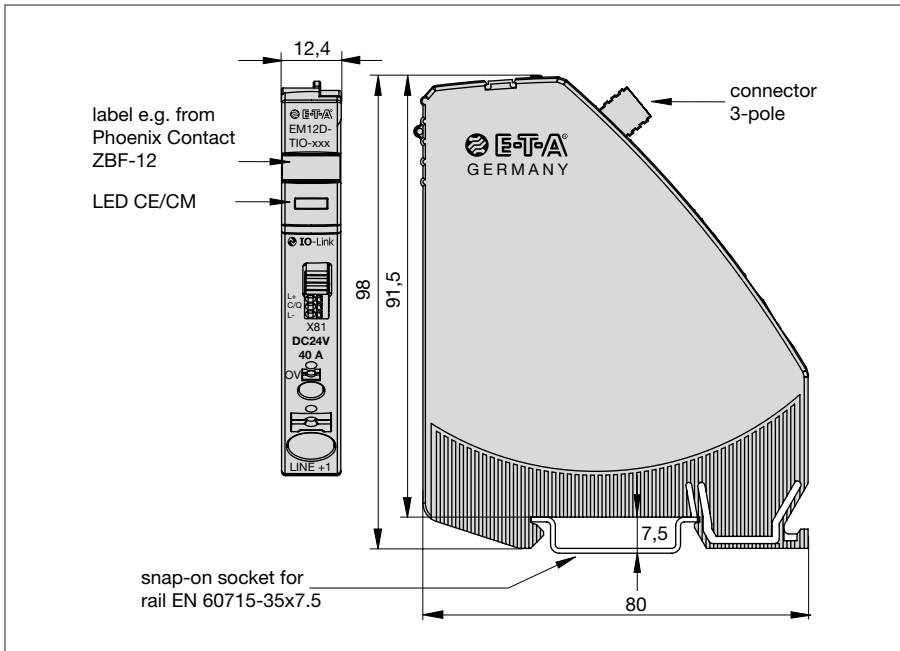
Figure 2: EM12D-TIO

3.3 Status indication and terminals
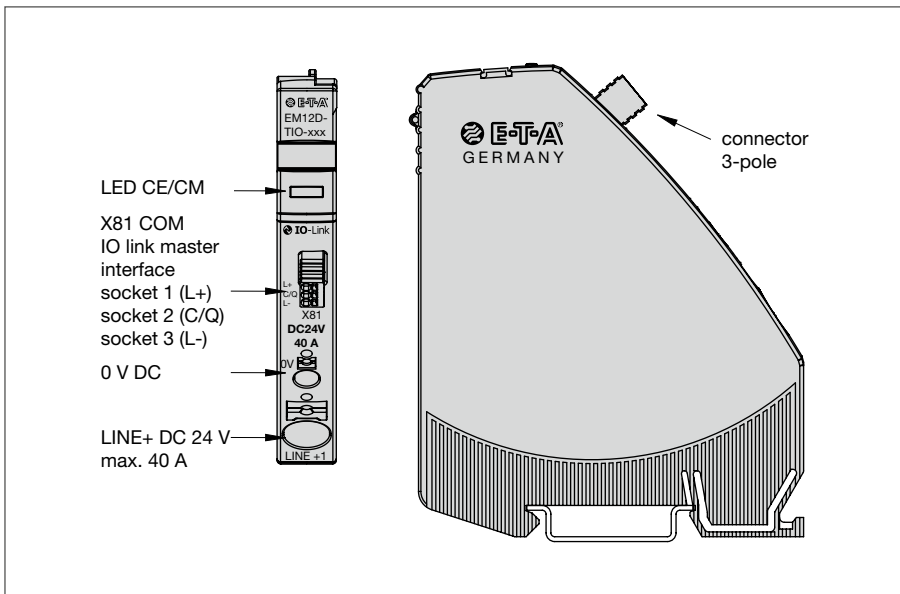
Figure 3: EM12D-TIO status indication and terminals

3.3.1 Terminals for voltage supply and IO link connection

The operating voltage of the device is 24 V DC. Faultless operation of the device is ensured in a voltage range of 18 V to 30 V. The max. current of the supply module is 40 A.

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

3.3.2 Connector socket for the IO link master®, connector socket X81

This connector socket connects the intelligent supply module EM12D-TIO with the superordinate IO link master. Connection of the device with the master is realised with a one-to-one wiring mode. Preferably the connection should be a typical 3-pole sensor cable with a cross section of 0.25 mm² to 0.5 mm² (e.g. FD Li9Y11Y or LifYY). The cable does not have to be shielded specially. The cable length between the IO link master and the IO link device must not exceed 20 m.

⚠ The use of the terminals for applications not provided for in the operation manual or improper connection can lead to malfunction or destruction of the device.

1. supply voltage	IO link L +24V
2. data line	IO link C/Q (to IO link master)
3. supply voltage	IO link L-
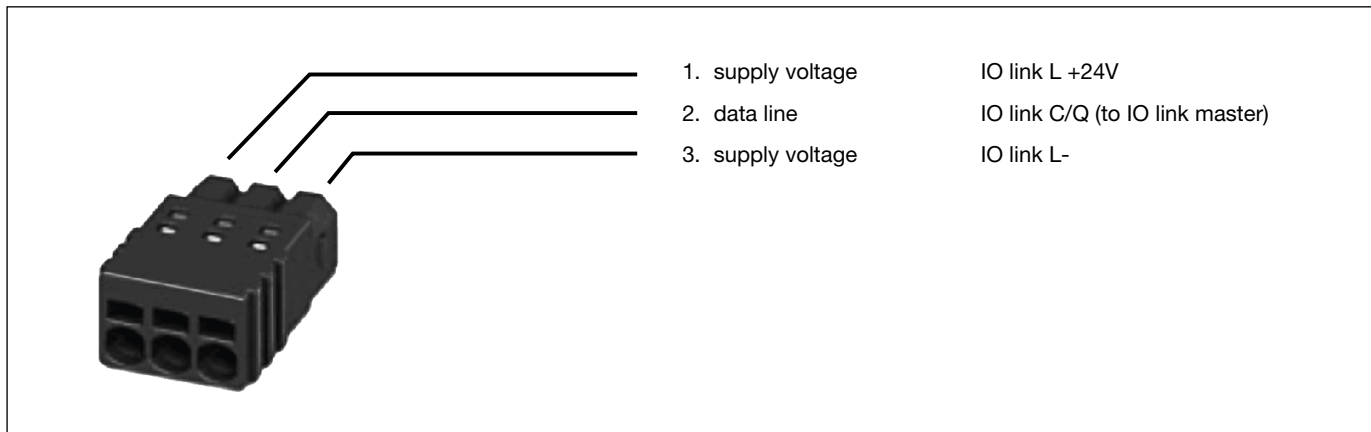
Figure 4: IO link connection

ℹ The EM12D-TIO intelligent supply module is supplied with voltage both via the supply terminals LINE+ and 0 V and via X81 COM. The voltages are decoupled reciprocally.

3.3.3 LED »CE/CM«

The LED CE/CM shows the status of the communication unit. Available LED colours are red, green and orange. For further details please see fig. 9, illustration of operating modes.

3.4 Representations of the manufacturing date, the device ID and revision status of the software
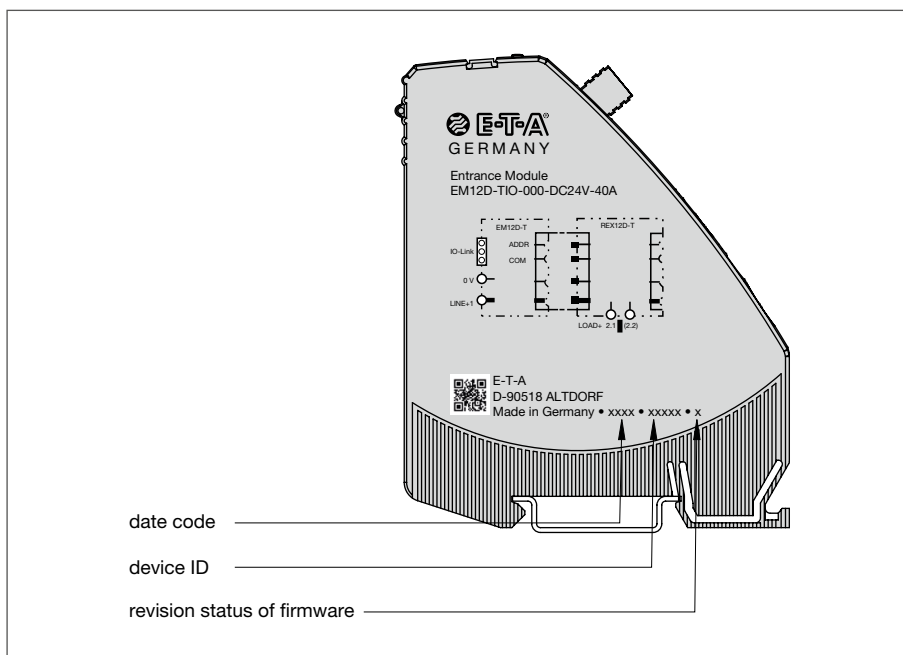
Figure 5: Marking of date code

4 Mounting and installation

4.1 Mounting of the system

The preferred mounting position of the EM12D-TIO is horizontal.
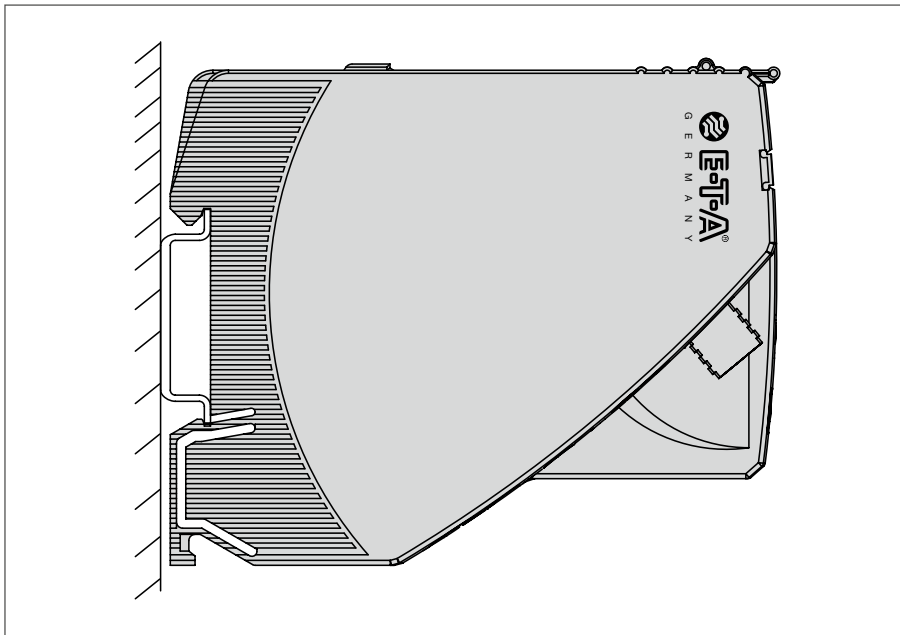
Figure 6: Mounting position

4.2 Wiring and connection of the EM12D-TIO intelligent supply module

IO link connection
X81 COM

0 V terminal
push-in PT 2.5
0.14 mm² ... 2.5 mm²

wire stripping length
8 mm ...10 mm

LINE+ terminal
Push-in PT 10
0.5 mm² ...10 mm²

wire stripping length
18 mm
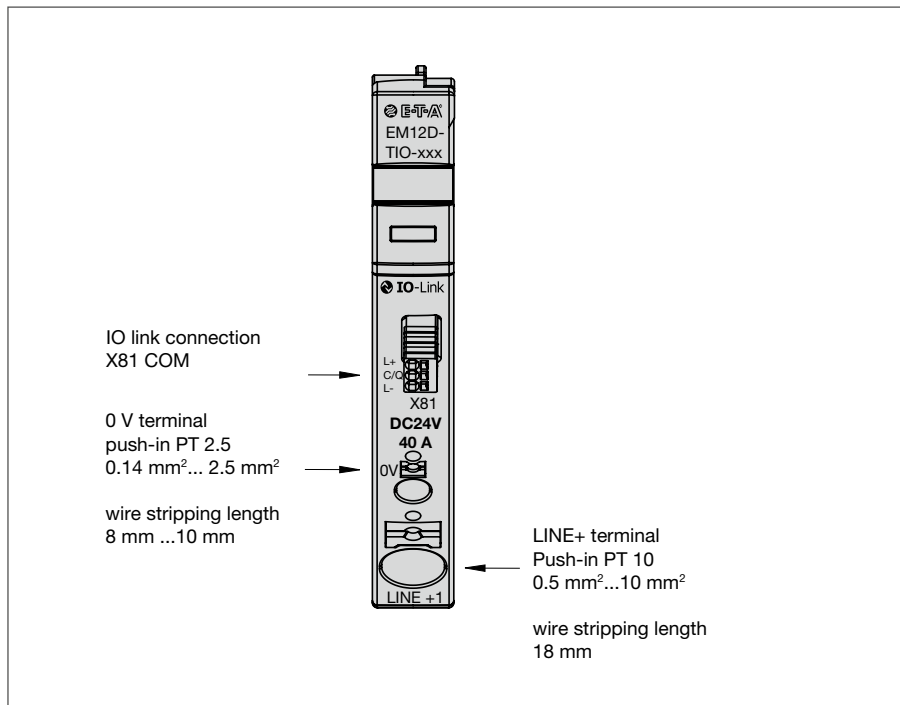
Figure 7: EM12D-TIO terminals

4.2.1 Supply by means of IO link connector X81 COM

Rated voltage: DC 24 V (18 ... 30 V)

Terminal L+:   IO link®   DC +24 V (line +)
Terminal C/Q: Data cable IO link® (COM)
Terminal L-:   IO link®   GND

⚠️ Use of the terminals for applications not provided for in the operation manual or improper connection can lead to malfunction or destruction of the device.

4.2.2 Connection to EM12D-TIO intelligent supply module (-X81)

X81 COM: **connection to IO link bus system**
cable length: max. 20 m
typically: FD Li9Y11Y or LifYY   max. 0.5 mm² (sensor line)

connector 1:   supply voltage   IO link L +24V

connector 2:   data line   IO link C/Q (to master)

connector 3:   supply voltage   IO link L-
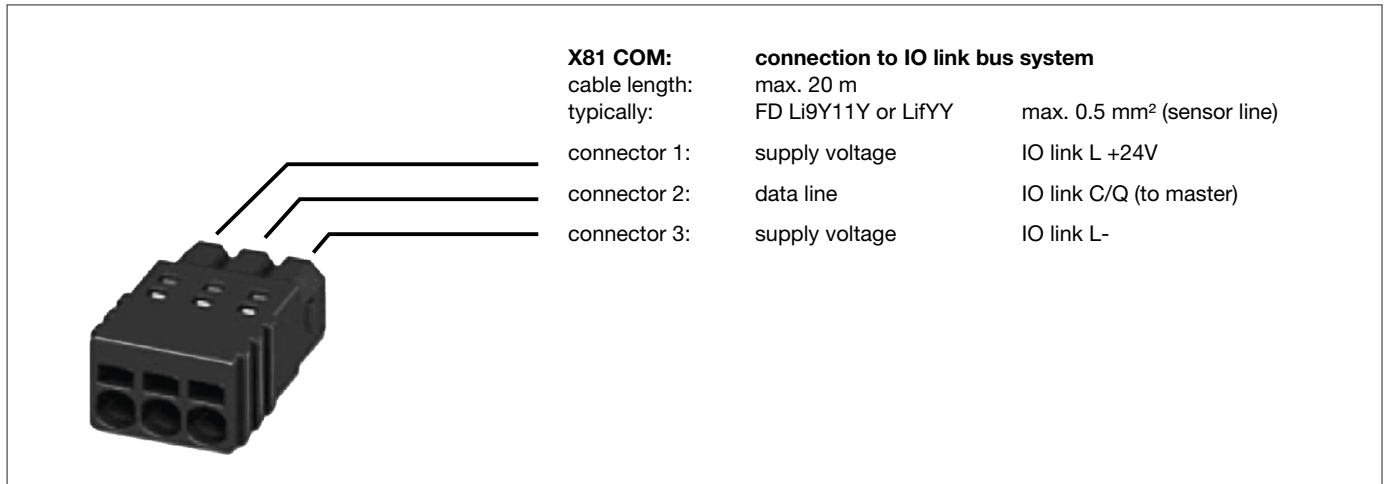
Figure 8: IO link connector

When wiring and connecting to the IO link bus system, the installation and wiring regulations of the PROFIBUS Nutzerorganisation (PNO) have to be observed.

⚠️ The intelligent supply module EM12D-TIO is supplied with voltage both via the supply terminals LINE+ and 0 V and via X81 COM . The voltages are decoupled reciprocally.

5 Operating modes and signalling

5.1 Operating mode: (system start)

When applying the supply voltage the EM12D-TIO intelligent supply module will be initialised. The device will carry out implemented programme memory tests and self test routines. During this time a communication via the interfaces is not possible.

5.2 Operating mode: (critical failure)

If a failure is detected during the self test routines, the EM12D-TIO intelligent supply module will change into operating mode »Critical failure«. In the event of a critical failure, the device will also change into this operating mode. 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 EM12D-TIO intelligent supply module is in this operating mode, no communication is possible with the superordinate control unit. The electronic circuit protectors cannot be controlled by it and remain OFF.

5.3 Operating mode: (non-critical failure)

If there are invalid or no configuration data at all available in the EM12D-TIO intelligent supply module, it will change into this operating mode. This operating mode only allows restricted non-cyclical data exchange. Cyclical data exchange is prevented. This operating mode will be left upon receipt of the correct module and slot parameters and configuration data. The circuit protectors remain OFF.

5.4 Operating mode: (independent operation)

If no connection to the superordinate control unit is recognised after the supply voltage was applied, the module will change into the operating mode »independent operation«. Thus the parameters stored in the EM12D-TIO will be transmitted to the electronic circuit protectors. If there is a connection between the EM12D-TIO and the superordinate IO link master and there is no critical failure, the operating mode »independent operation« will be quitted. Should the connection between the EM12D-TIO and the superordinate control unit be interrupted during operation, the EM12D-TIO will automatically change into the operating mode »independent operation«.

By means of the non-cyclical parameter, the behaviour of the EM12D-TIO can be defined in the event of an interruption of the superordinate IO link master. Either the condition of the circuit protector is frozen (FREEZE) or all circuit protectors are switched off (UNFREEZE).

Should the connection between the EM12D-TIO and the superordinate IO link master be interrupted and the non-cyclical parameter »UNFREEZE« be set, all circuit protectors will be switched off before changing into the operating mode »independent operation«.

Should the connection between the EM12D-TIO and the superordinate IO link master be interrupted and the non-cyclical parameter »FREEZE« be set, the condition of the circuit protectors will remain unchanged before changing into the operating mode »independent operation«.

Should the connection between the IO link device and the superordinate IO link master be restored after a previous interruption, the EM12D-TIO will automatically change into the operating mode »faultless operation«.

5.5 Operating mode: (Faultless operation)

If there is no fault and a connection is in place to the superordinate IO link master, the EM12D-TIO will change into the operating mode »faultless operation«.

The parameters will transmitted from the superordinate IO link master to the EM12D-TIO and be saved there. Subsequently they will be forwarded to the electronic circuit protectors. The configuration data and the parameters will be exchanged as non-cyclical data between the IO link master (superordinate control) and the EM12D-TIO.

5.6 Signalling of operating modes on EM12D-TIO supply module

The different operating modes of the EM12D-TIO are indicated as follows:

Operating mode	Indication of operating mode	IO link communication
Independent operation	blinking green	not connected
Faultless operation	green	connected
Critical failure detected	red	not connected
Uncritical failure detected	orange	connected
Uncritical failure detected	blinking orange	not connected
System start (1 second)	orange	not connected

Figure 9: EM12D-TIO operating modes

5.7 Signalling of operating conditions on circuit protector

The different operating modes of a channel of the circuit protectors are indicated as follows:

Operating condition	LED for signalling	Condition of load output
Channel switched off by momentary switch	dark	off
Channel on by momentary switch and off by IO link	orange	off
Channel on by momentary switch and IO link	green	on
Selected threshold value exceeded	blinking green/orange	on
Overload detected	orange	on
Trip by short circuit or overload	red	off
Low voltage detected	red	off

Figure 10: Signalling of operating conditions of the circuit protectors

6 Basic functionalities of the entire system

6.1 Internal cycle time

The cycle time via the **ELBus®** is 340 ms. During the aforementioned period the status and the load current of each circuit protector is cyclically transmitted to the EM12D-TIO intelligent supply module.

Cyclic Data 16 x 15 ms = 240 ms	Acyclic Data 100 ms
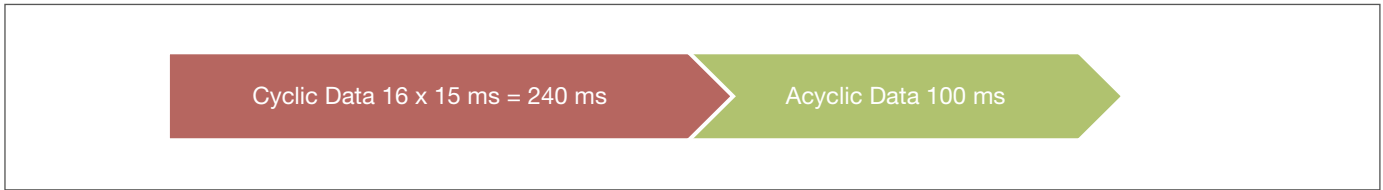
Figure 11: Cycle time of the system

The cycle times indicated refer to circuit protectors from index I onwards.

6.2 Hot swap of circuit protectors

The electronic circuit protector can at any time be mounted side by side with a supply module or to an existing system. By closing the connector arm a voltage supply of the device is available. Also, the device is connected to the internal **ELBus®**.

⚠️ Opening the connector arm is only permitted in the OFF condition. Opening under load can damage the device or cause undefined system conditions.

After plugging in a circuit protector, it will automatically be identified and parameterised if parameters are available for the slot in question. **During this procedure the cyclical data will be marked as invalid for a short period of time.**

6.3 Communication via port configuration tool

The port configuration tool is made available by the manufacturer of the IO link master.
It allows the IO link master direct access to the EM12D-TIO IO link device. Thus it is possible to parameterise the individual devices, indicate the status and receive diagnostic information.

If the slot parameters are changed, the change will be signalled to the superordinate control unit via the IO link master. The user will thus be able to process these changes in his control accordingly.

7   Communication types

7.1 SIO mode, group signal at PLC input

Commencing with revision F, the SIO mode is available in the supply module.

It is possible to connect the EM12D-TIO directly to a PLC input. In this case, it is not the IO link information that is going to be transmitted, but only the group status signal.

The data line IO link C/Q to X81 carries a high signal if no circuit protector has tripped. As soon as a circuit protector trips, the data line IO link C/Q to X81 carries a low signal.

Trip is acknowledged via the momentary switch on the circuit protector in question.

7.2 Model of the EM12D-TIO intelligent supply module

The EM12D-TIO has an internal **ELBus®** interface enabling the communication with the electronic circuit protectors. There are two different models of the supply module. The choice of the model in question is determined by the IODD used.

7.2.1 Models for the operation of 32 channels

Up to 16 devices with max. 32 channels can be connected to the supply module. Only the status is transmitted cyclically with this model. It is possible to fit single-channel or dual-channel circuit breakers or a mixed configuration of these circuit breakers.

7.2.2 Models for the operation of 16 channels

Up to 16 channels can be connected to the supply module. This extended version not only provides cyclical transmission of the status, but also the present current of the load circuits. Due to the limited transmission width with IO link of 32 bytes, the number of channels is limited to 16 due to the higher number of data to be transmitted. It is possible to fit single-channel or dual-channel circuit breakers or a mixed configuration of these circuit breakers.

7.2.3 Population errors

If a double channel device is connected as channel 16/17 or 32/33, the control unit will receive the information that a device is available at channel 16 or 32.

When reading out the Cominfo of the circuit protector, the message that the circuit protector has wrong parameters is displayed. The channels cannot be operated (cannot be switched on).

7.2.4 Error device addressing

Due to mechanical problems, there may be addressing errors. This is displayed as follows: some channels are off after voltage on. They cannot even be switched on by means of the button (LED orange or green). Possible causes are deformed or missing contacts in the connector arm.

7.3 IODD file

The IODD file is in the download area of the E-T-A website and can be downloaded there. It is set up according to the regulations of the IO link user organisation (PROFIBUS Nutzerorganisation e.V.).

Various IODDs are available.

A revision has been inserted informing about the previous functional extensions.

ETA-EM12D-TIO-00 J-16-... Extended version, communication with up to 16 channels

ETA-EM12D-TIO-00 J-116-... Standard version, communication with up to 32 channels

This revision index can also be found on the supply module.

If the revision index on the device and the revision index of the loaded IODD are identical, all options of the device can be exploited. Should the revision index of the supply module be higher than the IODD used, only the options of the IODD will be supported (downward compatible).

However, no device with a lower revision index than that of the IODD can be used.

Please observe that the IODD used also determines the model of the supply module. The extended version allows communication with 32 channels. However, this version only cyclically transmits the status of the circuit protectors. The standard version allows communication with max. 16 channels. Besides transmission of the status, this version also allows cyclical transmission of the present load current.

7.4 Software versions of EM12D

In the context of functional or portfolio extensions, the firmware used in the supply module is extended or adjusted. Downward compatibility is ensured with all devices. Former devices do not support new functionalities nor corresponding portfolio extensions because these are not implemented in the old firmware.

The attached table lists the functional scope and the IODD to be used for the corresponding version.

Version	Device ID	Firmware	Device types	Functionality	IODD
A	11	v1.0.2	REX12D-TA1-100-DC24V-xA; REX12D-TA2-100-DC24V-xA/xA	16 channels (max. 16 devices), cyclical: current value, status; non-cyclical: load voltage, diagnosis; standard rated current 1A: data storage	ETA-EM12D-TIO-20160714-IODD1.1
E	12	v1.1.7	—	PLC-Look functionality; statistical information (Min.Max.Avg)	ETA-EM12D-TIO-000-E-201-0311-IODD1.1
F	13	v1.1.9	REX12D-TE2-100-DC24V-1A-10A	SIO mode supported; standard current rating 10A	ETA-EM12D-TIO-000-F-20181031-IODD1.1
H	15	v1.2.1	REX12D-TE2-100-DC24V-1A-4A-CL2 (Class2)	—	ETA-EM12D-TIO-000-H-20190308-IODD1.1
I	16	v1.3.0	REX12D-TA1-100-DC24V-xA; REX12D-TA2-100-DC24V-xA/xA; REX12D-TE2-100-DC24V-1A-10A; REX12D-TE2-100-DC24V-1A-4A-CL2: from software version 2.0.0 (All-In-One)	faster **ELBus®** cycle time	ETA-EM12D-TIO-000-I-16-20190312-IODD1.1
	116			faster ELBus® cycle time; 32 channels (max. 16 devices); non-cyclical: current value	ETA-EM12D-TIO-000-I-116-20190312-IODD1.1
J	17	v1.3.2	REX22D, REX12D 101 product versions	backwards compatibility with H index	ETA-EM12D-TIO-000-J-17-20201214-IODD1.1
	117				ETA-EM12D-TIO-000-J-117-20201214-IODD1.1

Figure 12: EM12D software versions

8 Cyclical I/O data

The IODD file defines the data communication between the IO link master and the EM12D-TIO intelligent supply module. In detail these are the status and the load current of the electronic circuit protectors. In addition it is possible to switch the devices on or off or reset them in the event of a failure.

8.1 Data model for max. 16 channels

8.1.1 Data from IO link master to EM12D-TIO (16 channels)

Each channel of each electronic circuit protector can be switched on or off or reset via the cyclical data. In addition, status information and measuring values are transmitted.

Inputs

Parameters	Byte	Series	Range	Description
Load current F1 Load current F2 Load current F3 Load current F4 Load current F5 Load current F6 Load current F7 Load current F8 Load current F9 Load current F10 Load current F11 Load current F12 Load current F13 Load current F14 Load current F15 Load current F16	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Byte Byte Byte Byte Byte Byte Byte Byte Byte Byte Byte Byte Byte Byte Byte Byte	0 – 255	A standardised value with a resolution of 100 mA is made available. Example for calculation of the measuring value: Value (15): 10 = 1.5 Ampere
Status ON/OFF (channel status)	16 HighByte 17 LowByte	Word	0xFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16

Parameters	Byte	Series	Range	Description
Overload (channel = overload)	18 HighByte 19 LowByte	Word	0xFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16
Short circuit (channel shortcircuit)	20 HighByte 21 LowByte	Word	0xFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16
Limit value (channel threshold)	22 HighByte 23 LowByte	Word	0xFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16

Parameters	Byte	Series	Range	Description
Hardware lock (device locked off)	24 HighByte 25 LowByte	Word	0xFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16
System width information (overall status)	26	Byte	0xFF	bit 0 = low voltage bit 1 = permanently ON (for diagnostic purposes) bit 2 = EL-Bus error (from index I) bit 3 = reserve bit 4 = reserve bit 5 = reserve bit 6 = reserve bit 7 = reserve
Reserve (reserve)	27	Byte	0xFF	The reserve byte was put in for reasons of compatibility, it is intended for a later use.
Input voltage (supply voltage)	28 HighByte 29 LowByte	Word	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 13: Reading data with 16 channels

Outputs

Parameters	Byte	Series	Range	Description
Acknowledge channel (channel 1 to 32 (reset))	0 HighByte 1 LowByte	Word	0xFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16
Switch channel ON/OFF (channel 1 to 32) (on/off))	2 HighByte 3 LowByte	Word	0xFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16

Figure 14: Writing data with 16 channels

8.2 Data model for max. 32 channels

8.2.1 Data from IO link master to EM12D-TIO (32 channels)

Each channel of each electronic circuit protector can be switched on or off or reset via the cyclical data. In addition, status information and measuring values are transmitted.

Inputs

Parameters	Byte	Series	Range	Description
Status ON/OFF (channel status)	0 HHByte 1 HByte 2 LByte 3 LLByte	Dword	0xFFFFFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16 bit 16 = channel 17 bit 17 = channel 18 bit 18 = channel 19 bit 19 = channel 20 bit 20 = channel 21 bit 21 = channel 22 bit 22 = channel 23 bit 23 = channel 24 bit 24 = channel 25 bit 25 = channel 26 bit 26 = channel 27 bit 27 = channel 28 bit 28 = channel 29 bit 29 = channel 30 bit 30 = channel 31 bit 31 = channel 32

Parameters	Byte	Series	Range	Description
Overload (channel = overload)	4 HHByte 5 HByte 6 LByte 7 LLByte	Dword	0xFFFFFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16 bit 16 = channel 17 bit 17 = channel 18 bit 18 = channel 19 bit 19 = channel 20 bit 20 = channel 21 bit 21 = channel 22 bit 22 = channel 23 bit 23 = channel 24 bit 24 = channel 25 bit 25 = channel 26 bit 26 = channel 27 bit 27 = channel 28 bit 28 = channel 29 bit 29 = channel 30 bit 30 = channel 31 bit 31 = channel 32
Short circuit (channel shortcircuit)	8 HHByte 2 HByte 10 LByte 11 LLByte	Dword	0xFFFFFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16 bit 16 = channel 17 bit 17 = channel 18 bit 18 = channel 19 bit 19 = channel 20 bit 20 = channel 21 bit 21 = channel 22 bit 22 = channel 23 bit 23 = channel 24 bit 24 = channel 25 bit 25 = channel 26 bit 26 = channel 27 bit 27 = channel 28 bit 28 = channel 29 bit 29 = channel 30 bit 30 = channel 31 bit 31 = channel 32

Parameters	Byte	Series	Range	Description
Limit value (channel threshold)	12 HHByte 13 HByte 14 LByte 15 LLByte	Dword	0xFFFFFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16 bit 16 = channel 17 bit 17 = channel 18 bit 18 = channel 19 bit 19 = channel 20 bit 20 = channel 21 bit 21 = channel 22 bit 22 = channel 23 bit 23 = channel 24 bit 24 = channel 25 bit 25 = channel 26 bit 26 = channel 27 bit 27 = channel 28 bit 28 = channel 29 bit 29 = channel 30 bit 30 = channel 31 bit 31 = channel 32
Hardware lock (device locked off)	16 HHByte 17 HByte 18 LByte 19 LLByte	Dword	0xFFFFFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16 bit 16 = channel 17 bit 17 = channel 18 bit 18 = channel 19 bit 19 = channel 20 bit 20 = channel 21 bit 21 = channel 22 bit 22 = channel 23 bit 23 = channel 24 bit 24 = channel 25 bit 25 = channel 26 bit 26 = channel 27 bit 27 = channel 28 bit 28 = channel 29 bit 29 = channel 30 bit 30 = channel 31 bit 31 = channel 32

Parameters	Byte	Series	Range	Description
System width information (overall status)	20	Byte	0xFF	bit 0 = low voltage bit 1 = permanently ON (for diagnostic purposes) bit 2 = EL-Bus error (from index I) bit 3 = reserve bit 4 = reserve bit 5 = reserve bit 6 = reserve bit 7 = reserve
Reserve (reserve)	21	Byte	0xFF	The reserve byte was put in for reasons of compatibility, it is intended for a later use.
Input voltage (supply voltage)	22 HighByte 23 LowByte	Word	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 15: Reading data with 32 channels

Outputs

Parameters	Byte	Series	Range	Description
Acknowledge channel (channel 1 to 32 (reset))	0 HHByte 1 HByte 2 LByte 3 LLByte	Dword	0xFFFFFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16 bit 16 = channel 17 bit 17 = channel 18 bit 18 = channel 19 bit 19 = channel 20 bit 20 = channel 21 bit 21 = channel 22 bit 22 = channel 23 bit 23 = channel 24 bit 24 = channel 25 bit 25 = channel 26 bit 26 = channel 27 bit 27 = channel 28 bit 28 = channel 29 bit 29 = channel 30 bit 30 = channel 31 bit 31 = channel 32

Parameters	Byte	Series	Range	Description
Switch channel ON/ OFF (channel 1 to 32) (on/off))	4 HHByte 5 HByte 6 LByte 7 LLByte	Dword	0xFFFFFFFF	bit 0 = channel 1 bit 1 = channel 2 bit 2 = channel 3 bit 3 = channel 4 bit 4 = channel 5 bit 5 = channel 6 bit 6 = channel 7 bit 7 = channel 8 bit 8 = channel 9 bit 9 = channel 10 bit10 = channel 11 bit 11 = channel 12 bit 12 = channel 13 bit 13 = channel 14 bit 14 = channel 15 bit 15 = channel 16 bit 16 = channel 17 bit 17 = channel 18 bit 18 = channel 19 bit 19 = channel 20 bit 20 = channel 21 bit 21 = channel 22 bit 22 = channel 23 bit 23 = channel 24 bit 24 = channel 25 bit 25 = channel 26 bit 26 = channel 27 bit 27 = channel 28 bit 28 = channel 29 bit 29 = channel 30 bit 30 = channel 31 bit 31 = channel 32

Figure 16: Writing data with 32 channels

9 Non-cyclical I/O data

The non-cyclical data communication allows to exchange more information between the control unit and the individual circuit protectors than via the limited cyclical range. Depending on the selected index, a varying number of data bytes are exchanged in the non-cyclical data traffic.

The table gives an overview over the parameter ranges, with which index they can be queried or changed.

Parameters index [dec.]	Parameters index [hex.]	Slot number	No. of bytes	Reading (R) Writing (W)	Description
2	2	EM12D-TIO	1	W	System commands
19	13	EM12D-TIO		R	Product type
21	15	EM12D-TIO		R	Serial number
22	16	EM12D-TIO		R	Hardware version
23	17	EM12D-TIO		R	Software version
24	18	EM12D-TIO	32	R/W	Application specific tag
36	24	EM12D-TIO		R	Device status
37	25	EM12D-TIO		R	Extended device status
40	28	EM12D-TIO		R	Process data input
41	29	EM12D-TIO		R	Process data output
198	C6	EM12D-TIO	2	R	Internal cycle time [2]
199	C7	EM12D-TIO	2 / 4 [2]	R/W	PLC lock channel not controllable [1]
200	0C8	EM12D-TIO	1	R/W	Configuration data EM12D-TIO controller
300	12C	EM12D-TIO	2	R	Diagnostic information EM12D-TIO
The version with 16 and 32 channels is different from parameter index number 101. *From this parameter on, both versions must be considered separately.*					
Parameters for the version with 16 channels					
101 – 116	065 - 074	1 – 16	2	R/W	Parameter channel
301 – 316	12D-13C	1 – 16	1	R	Diagnostic information channel
401 – 416	191-1A0	1 – 16	2	R	Load voltage per channel
501 – 516	1F5-204	1 – 16	3	R	Extended diagnostic information channel
601 – 616	259 - 268	1 – 16	1	W	Action commands channel
701 – 716	2BD-2CC	1 – 16	10	R	**ELBus®** device information
801 – 816	312 - 321	1 – 16	12	R/W	Statistical information [1]
Parameters for the version with 32 channels					
101 – 132	065 - 084	1 – 32	2	R/W	Parameter channel
301 – 332	12D-14C	1 – 32	1	R	Diagnostic information channel
401 – 432	191-1B0	1 – 32	4	R	Load voltage and load current per channel
501 – 532	1F5-274	1 – 32	3	R	Extended diagnostic information channel
601 – 632	259 - 278	1 – 32	1	W	Action commands channel
701 – 732	2BD-2DC	1 – 32	10	R	**ELBus®** device information
801 – 832	312 - 331	1 – 32	12	R/W	Statistical information [1]

Figure 17: Overview parameter index

[1] available from revision D
[2] number of bytes depends on the version used and thus on the number of channels

9.1 Identical data model for max. 16 channels and 32 channels

9.1.1 System commands IO link EM12D-TIO (index 2)

One byte is transmitted to the master, which carries out the following functions depending on its value.

9.1.1.1 Store adjustments in master (data storage)

If the value 5 is transmitted to the master, all parameters will be saved in the IO link master and, depending on the setting of the master, can be restored automatically after exchange of the device.

9.1.1.2 Reset to factory settings

If the value 130 is transmitted to the IO link master, the standard values stored in the IODD are transferred to the device.

9.1.1.3 Reset statistical information [1]

If the value 250 is transmitted to the IO link master, the statistical information of all channels is set back to 0.

9.1.2 Device information IO link EM12D-TIO (index 19, 21, 22, 23)

9.1.2.1 Device type (index 19)

The string holds information on the device type of the EM12D-TIO intelligent supply module.

9.1.2.2 Serial number (index 21)

The string holds information on the serial no. of the EM12D-TIO intelligent supply module.

9.1.2.3 Hardware version (index 22)

The string holds information on the hardware version of the EM12D-TIO intelligent supply module.

9.1.2.4 Software version (index 23)

The string holds the software version of the EM12D-TIO intelligent supply module.

9.1.2.5 Application Specific Tag

The device supports the IO link property »Application Specific Tag« (index 24)". The max. data length is at least 16 bytes and max. 32 bytes.
Please also see »IOL-Interface-Spec 10002 Version 1.1.2« of 13.07.2013.

9.1.2.6 Device Status

The device supports the IO link property »Device Status« (index 36). The data length is 1 byte.
The following values were defined:

Value [dec.]	Definition	Explanation
0	DEVICE IS OPERATING PROPERLY	In all other events this value is transmitted
1	MAINTENANCE REQUIRED	This value is transmitted if one of the circuit protectors tripped due to short circuit or overload
2	OUT OF SPECIFICATION	This value is transmitted if one of the circuit protectors detected an undervoltage
3	FUNCTIONAL CHECK	Not supported
4	DEVICE FAILURE	This value is transmitted if one of the connected circuit protectors has set the error-bit in **ELBus**® Device Status.

Figure 18: Device status

9.1.2.7 Extended Device Status

The device supports the IO link property »Extended Device Status« (index 37).

Please also see »IOL-Interface-Spec 10002 Version 1.1.2« of 13.07.2013.

The data length is 64x3 byte.

Below please find the table B14 in detail - Detailed Device Status on page 227 of the spec.

Sub-index [dec.]	Object name	Data type	Explanation
1	Error_Warning_1	3 Byte	All bytes with 0x00: No error warning Byte 1: Event qualifier Byte 2 and 3: Event code
2	Error_Warning_2	3 byte	
3	Error_Warning_3	3 byte	
4	Error_Warning_4	3 Byte	
...			
n	Error_Warning_n	3 Byte	

Figure 19: Extended device status

9.1.2.8 Process Data Input

The device supports reader access to the IO link Process Data Input (Index 40).

The index holds the latest valid process input data from the application.

The data type and the structure are identical with the process data in the corresponding process communication channel.

Please also see »IOL-Interface-Spec 10002 Version 1.1.2« of 13.07.2013.

9.1.2.9 Process Data Output

The device supports reader access to the IO link Process Data Output (Index 41).

The index holds the latest valid process output data from the application.

The data type and the structure are identical with the process data in the corresponding process communication channel.

Please also see »IOL-Interface-Spec 10002 Version 1.1.2« of 13.07.2013.

9.2 Data model for max. 16 channels

9.2.1 Configuration data of the EM12D-TIO intelligent supply module

9.2.1.1 Internal cycle time (index 198) [2]

When reading the 198 index, one word is returned.

The internal cycle time depends on the number of connected circuit protectors.

Value range: 100ms – 610ms

Data length: 1 word (unsigned integer)

9.2.1.2 Configure controllability of the channels with 16 channels (PLCLock Index 199)[1]

When reading index 199, one byte is returned, this index can also be edited.

The status PLCLock value is fed back for all possible 16 channels via one word

with one bit each representing the status of a channel:

Value range: 0 – 65535

Data length: 1 word (unsigned integer)

Byte [0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
PLCLock channel 1								0/1
PLCLock channel 2							0/1	
PLCLock channel 3						0/1		
PLCLock channel 4					0/1			
PLCLock channel 5				0/1				
PLCLock channel 6			0/1					
PLCLock channel 7		0/1						
PLCLock channel 8	0/1							

Byte [1]	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
PLCLock channel 9								0/1
PLCLock channel 10							0/1	
PLCLock channel 11						0/1		
PLCLock channel 12					0/1			
PLCLock channel 13				0/1				
PLCLock channel 14			0/1					
PLCLock channel 15		0/1						
PLCLock channel 16	0/1							

Figure 20: PLC Lock (controllability) of channels

Setting the bit means that the channel cannot be switched on or off via the control unit. This means that voltage is applied to the output of the channel when the supply voltage is switched on (provided the channel has not tripped previously).

[1] available from revision D

[2] available from revision I

9.2.1.3 Configuration data of the EM12D-TIO intelligent supply module (index 200)

When reading index 200, one byte is returned, this index can also be edited.

This byte holds the configuration data of the EM12D-TIO intelligent supply module. Evaluation is bit-wise.

Value range: 0 – 255

Default value: Power saving mode de-activated, freeze active.

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Reserve								
Offline behaviour (unfreeze/freeze)							0/1	
Power saving mode						0/1		
Reserve								
Reserve								
Reserve								
Reserve								
Reserve								

Figure 21: EM12D-TIO configuration data

Bit 1   Unfreeze = 0 all load outputs (channels) of the circuit protectors are switched off and the EM12D-TIO changes into the operating mode »Independent operation«.
Freeze = 1 all load outputs (channels) of the circuit protectors remain in their current condition and the EM12D-TIO changes into the operating mode »Independent operation«.

Bit 2   Power saving mode   deactivated = 0
Power saving mode   activated = 1

9.2.2 Diagnostic information of the EM12D-TIO intelligent supply module (index 300)

When reading index 300, two bytes are returned, the 2 bytes input data contain the following global errors and diagnostic messages. Evaluation is bit-wise.

Value range: 0 – 65535

Data length: 1 word (unsigned integer)

Byte [0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
TN_SysNoConfig								0/1
TN_SysConfigMismatch							0/1	
						0/1		
					0/1			
TN_SysQueueFull				0/1				
			0/1					
		0/1						
TN_ELBusDown	0/1							
Byte [1]	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
								0/1
TN_SysWatchdogReset							0/1	
TN_SysHardwareError						0/1		
(TN_SysBrownout) voltage dip [1]					0/1			
				0/1				
			0/1					
(TN_SysNetworkError) network error [1]/[2]		0/1						
	0/1							

Figure 22: Diagnostic data

[1] error/diagnosis not available = 0 / error/diagnosis available = 1

[2] available from revision D

9.2.3 Parameters of channel for 16 channels

When reading the index 101 – 116, two bytes each are returned (with 16 channels).

9.2.3.1 Current rating for 16 channels

The parameter in Byte [1] returns the current rating of the channel in Ampere.

The edit command of this value will be ignored for devices with fixed current ratings and will be adopted for the adjustable ones.

Value range: 1 – 10 (integer)
Default value: -
Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 2	0	0	0	0	0	0	1	0

Figure 23: Device parameters channel: current ratings

9.2.3.2 Limit value load current for 16 channels

The parameter in Byte [2] determines at how many percent of the rated current the channel will signal »limit value exceeded«

This parameter allows read/write transactions.

Value range: 50 % – 100 % (whole numbers)
Default value: 80 %
Data length: 1 Byte (unsigned character)

Byte [2]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 100%	0	1	1	0	0	1	0	0

Figure 24: Device parameters channel: limit value load current

9.2.4 Diagnostic information channel with 16 channels

When reading the index 301– 316, one byte each is returned.

If the channel contains errors, these will be returned here as values between 0 and 255.

For the meaning of the values please see the following table.

Value range: 0 – 255

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Detected unsupported device A circuit protector which is not supported was included in the system.	0	0	0	0	0	0	0	1
The transmitted device parameters were rejected by the circuit protector, because they are outside of the valid range.	1	0	0	1	0	0	0	0
Reserve	1	0	0	1	0	0	0	1
Channel locked The channel was locked out by actuating the integral momentary switch and cannot be switched on by the IO link master.	1	0	0	1	0	0	1	0
Low voltage detected The operating voltage is below the safe range	1	0	0	1	0	0	1	1
Reserve	1	0	0	1	0	1	0	0
Device tripped. A reset command has to be sent	1	0	0	1	0	1	0	1
No error	0	0	0	0	0	0	0	0
Circuit protector is not parameterised	1	0	0	1	0	1	1	1
Internal error detected	1	0	0	1	1	0	0	0
Reserve	1	0	0	1	1	0	0	1
Reserve	1	0	0	1	1	0	1	0
Internal **ELBus®** ® error detected (temporary disruption) This error can be caused by strong EMI	1	0	0	1	1	0	1	1
Reserve	1	0	0	1	1	1	0	0
No device available	0	0	0	0	0	0	1	0

Figure 25: Diagnostic information channel

9.2.5 Load voltage channel for 16 channels

When reading the index 401 – 416, two bytes each are returned (with 16 channels).

Byte [1] - Byte [2] contain the load voltage of the channel.

Value range: 0 – 65535

Data length: 1 word (unsigned integer)

Byte [1] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [2] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 26: Load voltage channel

The load voltage is made available as a standardised 16-bit-value with a solution of 10 mV.

Example: Measuring value operating voltage = 2512

-> real measuring value = 25.12 Volt.

9.2.6 Extended diagnostic messages (dynamic info) channel for 16 channels

When reading the index 501 – 516, three bytes each are returned (with 16 channels).

9.2.6.1 Error memory for 16 channels

Byte [1] holds the internal error memory of the circuit protector.

Value range: 0 – 255

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
No parameters available								0/1*
Error parameter memory							0/1*	
Error programme memory						0/1*		
Error data memory					0/1*			
Error control unit				0/1*				
Reset through watchdog			0/1*					
Reserve								
Reserve								

Figure 27: Diagnosis channel: error memory

* error not available = 0 / error available = 1

9.2.6.2 Trip counter for 16 channels

Byte [2] contains the number of trippings since the trip counter was last reset.

Value range: 0 ... 255

Data length: 1 Byte (unsigned character)

Byte [2]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 28: Diagnosis channel: trip counter

9.2.6.3 Reason for trip for 16 channels

Byte [3] holds the latest reason for trip of the channel.

Value range: 0, 1, 2, 4

Data length: 1 Byte (unsigned character)

Byte [3]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
No reason for trip available (0)	0	0	0	0	0	0	0	0
Short circuit (1)	0	0	0	0	0	0	0	1
Overload (2)	0	0	0	0	0	0	1	0
Internal failure (4)	0	0	0	0	0	1	0	0

Figure 29: Diagnosis channel: reason for trip

9.2.7 Action commands channel for 16 channels

One byte is transmitted, which carries out the following functions depending on its value (with 16 channels).

Value range: 115 – 116

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Reset error memory (115)	0	1	1	1	0	0	1	1
Reset trip counter (116)	0	1	1	1	0	1	0	0
Reset minimum statistics (117) [1]	0	1	1	1	0	1	0	1
Reset maximum statistics (118) [1]	0	1	1	1	0	1	1	0
Reset medium value statistics (119) [1]	0	1	1	1	0	1	1	1

Figure 30: Action commands channel

If these commands are carried out with a 2-channel device, both trip counters of the device are deleted. The same is true for the error memory.

[1] available from revision D

9.2.8 Device information channel for 16 channels

When reading the index 701 – 716, 10 bytes each are returned (with 16 channels).

9.2.8.1 Device type for 16 channels

Byte [9] and [10] hold information on the device type of the circuit protector.

The REX12D and REX22D circuit protector types must be differentiated.

Value range: 0 – 255 each

Error: Byte [9] device type not available (255)

Data length: 2 Byte (unsigned character)

REX12D type:

Byte [9]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
REX12D (144)	1	0	0	1	0	0	0	0
Byte [10]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
TA1-100 (9)	0	0	0	0	1	0	0	1
TA2-100 (10)	0	0	0	0	1	0	1	0
TE2-100 (14)	0	0	0	0	1	1	1	0
TE2-100-CL2 (46)	0	0	1	0	1	1	1	0
TB1-100 (41)	0	0	1	0	1	0	0	1
TA1-100-CL2 (73)	0	1	0	0	1	0	0	1
TB1-100-CL2 (105)	0	1	1	0	1	0	0	1
TA2-100-CL2 (42)	0	0	1	0	1	0	1	0
TE2-101 (78)	0	1	0	0	1	1	1	0
TE2-101-CL2 (110)	0	1	1	0	1	1	1	0
TA1-101 (137)	1	0	0	0	1	0	0	1
TA2-101 (74)	0	1	0	0	1	0	1	0
TB1-101 (169)	1	0	1	0	1	0	0	1
TA1-101-CL2 (201)	1	1	0	0	1	0	0	1
TB1-101-CL2 (233)	1	1	1	0	1	0	0	1
TA2-101-CL2 (106)	0	1	1	0	1	0	1	0

Figure 31: Device information channel: REX12D device type

REX22D type:

Byte [9]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
REX22D (145)	1	0	0	1	0	0	0	1
Byte [10]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
TD2-100-CL2 (10)	0	0	0	0	1	0	1	0
TD2-100 (42)	0	0	1	0	1	0	1	0
TD1-100 (9)	0	0	0	0	1	0	0	1
TA1-100 (41)	0	0	1	0	1	0	0	1
TE2-100 (14)	0	0	0	0	1	1	1	0
TE2-100-CL2 (46)	0	0	1	0	1	1	1	0
TD2-101-CL2 (74)	0	1	0	0	1	0	1	0
TD2-101 (106)	0	1	1	0	1	0	1	0
TD1-101 (73)	0	1	0	0	1	0	0	1
TA1-101 (105)	0	1	1	0	1	0	0	1
TE2-101 (78)	0	1	0	0	1	1	1	0
TE2-101-CL2 (110)	0	1	1	0	1	1	1	0
TE1-100 (13)	0	0	0	0	1	1	0	1
TE1-101 (45)	0	0	1	0	1	1	0	1

Figure 32: Device information channel: REX22D device type

9.2.8.2 Hardware version for 16 channels

Byte [7] – Byte [8] contain the hardware version of the corresponding channel.

The hardware version is made available in whole numbers.

Value range:	0 ... 65535
Error:	Hardware version not available (65535)
Data length:	1 word (unsigned integer)

Byte [7] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [8] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 33: Device information channel: hardware version

9.2.8.3 Software version for 16 channels

Byte [5] – Byte [6] contain the hardware version of the corresponding channel.

The software version is made available BCD coded. It is coded as follows:

Software version = X.Y.Z

High Byte (Bit 12 – Bit 15) = 0

High Byte (Bit 8 – Bit 11) = X

Low Byte (Bit 4 – Bit 7) = Y

Low Byte (Bit 0 – Bit 3) = Z

Value range: 0 ... 65535

Error: Software version not available (65535)

Data length: 1 word (unsigned integer)

Byte [5] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [6] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0	0	0	0/1	0/1	0/1	0/1

Figure 34: Device information channel: software version

9.2.8.4 Serial number for 16 channels

Byte [1] – Byte [4] contain the serial number of the corresponding channel.

Value range: 0 ... 4294967295

Error: Serial number not available (4294967295)

Data length: 4 Byte (unsigned long)

Byte [1] (LOW)	Bit 3	Bit 2	Bit 1	Bit 0
Description	8	4	2	1
Value	0/1	0/1	0/1	0/1
Byte [1] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4
Description	128	64	32	16
Value	0/1	0/1	0/1	0/1

Byte [2]	Bit 11	Bit 10	Bit 9	Bit 8
Description	2048	1024	512	256
Value	0/1	0/1	0/1	0/1
Byte [2]	Bit 15	Bit 14	Bit 13	Bit 12
Description	32768	16384	8192	4096
Value	0/1	0/1	0/1	0/1

Byte [3]	Bit 19	Bit 18	Bit 17	Bit 16
Description	524288	262144	131072	65536
Value	0/1	0/1	0/1	0/1
Byte [3]	Bit 23	Bit 22	Bit 21	Bit 20
Description	8388608	4194304	2097152	1048576
Value	0/1	0/1	0/1	0/1

Byte [4] (HIGH)	Bit 27	Bit 26	Bit 25	Bit 24
Description	134217728	67108864	33554432	16777216
Value	0/1	0/1	0/1	0/1
Byte [4] (HIGH)	Bit 31	Bit 30	Bit 29	Bit 28
Description	2147483648	1073741824	536870912	268435456
Value	0/1	0/1	0/1	0/1

Figure 35: Device information channel: serial number

9.2.9 Statistical information for 16 channels [1]

When reading the index 801 – 816, 12 bytes each are returned (with 16 channels).

9.2.9.1 Minimum current for 16 channels [1]

Byte [11] – Byte [12] contain the lowest current value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [11] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [12] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 36: Minimum current channel

The minimum current is made available as standardised 16 bit value with a resolution of 10 mA (resolution of the channel is one decimal place, for simplification it is shown identically with the voltage with 2 decimal places).

Example: Measuring value operating voltage = 710

-> real measuring value = 7.10 Ampere.

9.2.9.2 Maximum current for 16 channels [1]

Byte [9] – Byte [10] contain the highest current value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [9] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [10] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 37: Maximum current channel

The maximum current is made available as standardised 16 bit value with a resolution of 10 mA (resolution of the channel is one decimal place, for simplification it is shown identically with the voltage with 2 decimal places).

Example: Measuring value operating voltage = 710

-> real measuring value = 7.10 Ampere.

[1] available from revision D

9.2.9.3 Mean value current for 16 channels [1]

Byte [7] – Byte [8] contain the mean current value of the channel since the last reset.

Value range: 0 ... 65535
Data length: 1 word (unsigned integer)

Byte [7] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [8] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 38: Mean value current channel

The mean current value is made available as standardised 16 bit value with a resolution of 10 mA (resolution of the channel is one decimal place, for simplification it is shown identically with the voltage with 2 decimal places).

Example: Measuring value operating voltage = 710

-> real measuring value = 7.10 Ampere.

9.2.9.4 Minimum voltage for 16 channels [1]

Byte [5] – Byte [6] contain the lowest mean current value of the channel since the last reset.

Value range: 0 ... 65535
Data length: 1 word (unsigned integer)

Byte [5] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [6] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 39: Minimum voltage channel

The minimum voltage is made available as a standardised 16-bit-value with a resolution of 10 mV.

Example: Measuring value operating voltage = 2512

-> real measuring value = 25.12 Volt.

9.2.9.5 Maximum voltage for 16 channels [1]

Byte [3] – Byte [4] contain the highest measured voltage of the channel since the last reset.

Value range: 0 ... 65535
Data length: 1 word (unsigned integer)

Byte [3] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [4] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 40: Maximum voltage channel

The maximum voltage is made available as a standardised 16-bit-value with a resolution of 10 mV.

Example: Measuring value operating voltage = 2512

-> real measuring value = 25.12 Volt.

[1] available from revision D

9.2.9.6 Mean value voltage for 16 channels [1]

Byte [1] – Byte [2] contain the mean voltage value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [1] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [2] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 41: Mean value voltage channel

The maximum voltage is made available as a standardised 16-bit-value with a resolution of 10 mV.

Example: Measuring value operating voltage = 2512

-> real measuring value = 25.12 Volt.

9.3 Data model for 32 channels

9.3.1 Configuration data of the EM12D-TIO intelligent supply module

9.3.1.1 Internal cycle time (index 198) [2]

When reading the 198 index, one word is returned.

The internal cycle time depends on the number of connected circuit protectors.

Value range: 100ms – 610ms

Data length: 1 word (unsigned integer)

9.3.1.2 Configure controllability of the channels with 32 channels (PLCLock Index 199)[1]

When reading index 199, one byte is returned, this index can also be edited.

The status PLCLock value is fed back for all possible 32 channels via one word

with one bit each representing the status of a channel:

Value range: 0 – 65535

Data length: 1 double word (unsigned integer)

Byte [0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
PLCLock channel 1								0/1
PLCLock channel 2							0/1	
PLCLock channel 3						0/1		
PLCLock channel 4					0/1			
PLCLock channel 5				0/1				
PLCLock channel 6			0/1					
PLCLock channel 7		0/1						
PLCLock channel 8	0/1							

Byte [1]	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
PLCLock channel 9								0/1
PLCLock channel 10							0/1	
PLCLock channel 11						0/1		
PLCLock channel 12					0/1			
PLCLock channel 13				0/1				
PLCLock channel 14			0/1					
PLCLock channel 15		0/1						
PLCLock channel 16	0/1							

Byte [2]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
PLCLock channel 17								0/1
PLCLock channel 18							0/1	
PLCLock channel 19						0/1		
PLCLock channel 20					0/1			
PLCLock channel 21				0/1				
PLCLock channel 22			0/1					
PLCLock channel 23		0/1						
PLCLock channel 24	0/1							

Byte [3]	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
PLCLock channel 25								0/1
PLCLock channel 26							0/1	
PLCLock channel 27						0/1		
PLCLock channel 28					0/1			
PLCLock channel 29				0/1				
PLCLock channel 30			0/1					
PLCLock channel 31		0/1						
PLCLock channel 32	0/1							

Figure 42: PLC Lock (controllability) of channels

Setting the bit means that the channel cannot be switched on or off via the control unit. This means that voltage is applied to the output of the channel when the supply voltage is switched on (provided the channel has not tripped previously).

[1] available from revision D

9.3.1.3 Configuration data of the EM12D-TIO intelligent supply module (index 200)

When reading index 200, one byte is returned, this index can also be edited.

This byte holds the configuration data of the intelligent supply module EM12D-TIO. Evaluation is bit-wise.

Value range: 0 – 255

Default value: Power saving mode de-activated, freeze active.

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Reserve								
Offline behaviour (unfreeze/freeze)							0/1	
Power saving mode						0/1		
Reserve								
Reserve								
Reserve								
Reserve								
Reserve								

Figure 43: EM12D-TIO configuration data

Bit 1   Unfreeze = 0 all load outputs (channels) of the circuit protectors are switched off and the EM12D-TIO changes into the operating mode »Independent operation«.

Ffreeze = 1 all load outputs (channels) of the circuit protectors remain in their current condition and the EM12D-TIO changes into the operating mode »Independent operation«.

Bit 2   Power saving mode   deactivated = 0
Power saving mode   activated = 1

9.3.2 Diagnostic information of the EM12D-TIO intelligent supply module (index 300)

When reading index 300, two bytes are returned, the 2 bytes input data contain the following global errors and diagnostic messages. Evaluation is bit-wise.

Value range: 0 – 65535

Data length: 1 word (unsigned integer)

Byte [0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
TN_SysNoConfig								0/1
TN_SysConfigMismatch							0/1	
						0/1		
					0/1			
TN_SysQueueFull				0/1				
			0/1					
		0/1						
TN_ELBusDown	0/1							
Byte [1]	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
Description	**32768**	**16384**	**8192**	**4096**	**2048**	**1024**	**512**	**256**
								0/1
TN_SysWatchdogReset							0/1	
TN_SysHardwareError						0/1		
(TN_SysBrownout) voltage dip [1]					0/1			
				0/1				
			0/1					
(TN_SysNetworkError) network error [1]/[2]		0/1						
	0/1							

Figure 44: Diagnostic data

[1] error/diagnosis not available = 0 / error/diagnosis available = 1

9.3.3 Parameters of channel for 32 channels

When reading the index 101 – 132, two bytes each are returned (with 32 channels).

9.3.3.1 Current rating for 32 channels

The parameter in Byte [1] returns the current rating of the channel in Ampere.

The edit command of this value will be ignored for devices with fixed current ratings and will be adopted for the adjustable ones.

Value range: 1 – 10 (integer)

Default value: -

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 2	0	0	0	0	0	0	1	0

Figure 45: Device parameters channel: current ratings

9.3.3.2 Limit value load current for 32 channels

The parameter in byte [2] determines at how many percent of the rated current the channel will signal »limit value exceeded«

This parameter allows read/write transactions.

Value range: 50 % – 100 % (whole numbers)

Default value: 80 %

Data length: 1 Byte (unsigned character)

Byte [2]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 100%	0	1	1	0	0	1	0	0

Figure 46: Device parameters channel: limit value load current

9.3.4 Diagnostic information channel for 32 channels

When reading the index 301 – 332, one byte each is returned.

If the channel contains errors, these will be returned here as values between 0 and 255.

For the meaning of the values please see the following table.

Value range: 0 – 255

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Detected unsupported device A circuit protector which is not supported was included in the system.	0	0	0	0	0	0	0	1
The transmitted device parameters were rejected by the circuit protector, because they are outside of the valid range.	1	0	0	1	0	0	0	0
Reserve	1	0	0	1	0	0	0	1
Channel locked The channel was locked out by actuating the integral momentary switch and cannot be switched on by the IO link master.	1	0	0	1	0	0	1	0
Low voltage detected The operating voltage is below the safe range	1	0	0	1	0	0	1	1
Reserve	1	0	0	1	0	1	0	0
Device tripped. A reset command has to be sent	1	0	0	1	0	1	0	1
No error	0	0	0	0	0	0	0	0
Circuit protector is not parameterised	1	0	0	1	0	1	1	1
Internal error detected	1	0	0	1	1	0	0	0
Reserve	1	0	0	1	1	0	0	1
Reserve	1	0	0	1	1	0	1	0
Internal **ELBus®** error detected (temporary disruption) This error can be caused by strong EMI	1	0	0	1	1	0	1	1
Reserve	1	0	0	1	1	1	0	0
No device available	0	0	0	0	0	0	1	0

Figure 47: Diagnostic information channel

9.3.5 Load voltage and current channel for 32 channels

When reading the index 401 - 432, four bytes each are returned.

Byte [1] - Byte [2] contain the load voltage of the channel

Value range: 0 – 65535

Data length: 1 word (unsigned integer)

Byte [1] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [2] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 48: Load voltage channel

> ⚠ The load voltage is made available as a standardised 16-bit-value with a solution of 10 mV.
>
> Example: Measuring value operating voltage = 2512
>
> -> real measuring value = 25.12 Volt.

Byte [3] - Byte [4] contain the load current of the channel

Value range: 0 – 65535

Data length: 1 word (unsigned integer)

Byte [3] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [4] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 49: Load current channel

> ⚠ The load current is made available as a standardised 16-bit-value with a resolution of 10 mA.
>
> Example: Measuring value operating voltage = 2512
>
> -> real measuring value = 25.12 Ampere.

9.3.6 Extended diagnostic messages (dynamic info) channel for 32 channels

When reading the index 501– 532, three bytes each are returned.

9.3.6.1 Error memory for 32 channels

Byte [1] holds the internal error memory of the circuit protector.

Value range: 0 – 255

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
No parameters available								0/1*
Error parameter memory							0/1*	
Error programme memory						0/1*		
Error data memory					0/1*			
Error control unit				0/1*				
Reset through watchdog			0/1*					
Reserve								
Reserve								

Figure 50: Diagnosis channel: error memory   * error not available = 0 / error available = 1

9.3.6.2 Trip counter for 32 channels

Byte [2] contains the number of trippings since the trip counter was last reset.

Value range: 0 ... 255

Data length: 1 Byte (unsigned character)

Byte [2]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 51: Diagnosis channel: trip counter

9.3.6.3 Trip reason for 32 channels

Byte [3] holds the latest reason for trip of the channel.

Value range: 0, 1, 2, 4

Data length: 1 Byte (unsigned character)

Byte [3]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
No reason for trip available (0)	0	0	0	0	0	0	0	0
Short circuit (1)	0	0	0	0	0	0	0	1
Overload (2)	0	0	0	0	0	0	1	0
Internal failure (4)	0	0	0	0	0	1	0	0

Figure 52: Diagnosis channel: reason for trip

[1] available from revision D

9.3.7 Action commands channel for 32 channels

One byte is transmitted, which carries out the following functions depending on its value.

Value range: 115 – 116

Data length: 1 Byte (unsigned character)

Byte [1]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Reset error memory (115)	0	1	1	1	0	0	1	1
Reset trip counter (116)	0	1	1	1	0	1	0	0
Reset minimum statistics (117) [1]	0	1	1	1	0	1	0	1
Reset maximum statistics (118) [1]	0	1	1	1	0	1	1	0
Reset medium value statistics (119) [1]	0	1	1	1	0	1	1	1

Figure 53: Action commands channel

If these commands are carried out with a 2-channel device, both trip counters of the device are deleted.

The same is true for the error memory.

[1] available from revision D

9.3.8 Device information channel for 32 channels

When reading the index 701 – 732, ten bytes each are returned.

9.3.8.1 Device type for 32 channels

Byte [9] and [10] hold information on the device type of the circuit protector.
The REX12D and REX22D circuit protector types must be differentiated.

Value range: 0 - 255 each

Error: Byte [9] device type not available (255)
Data length: 2 Byte (unsigned character)

REX12D type:

Byte [9]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
REX12D (144)	1	0	0	1	0	0	0	0
Byte [10]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Description	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
TA1-100 (9)	0	0	0	0	1	0	0	1
TA2-100 (10)	0	0	0	0	1	0	1	0
TE2-100 (14)	0	0	0	0	1	1	1	0
TE2-100-CL2 (46)	0	0	1	0	1	1	1	0
TB1-100 (41)	0	0	1	0	1	0	0	1
TA1-100-CL2 (73)	0	1	0	0	1	0	0	1
TB1-100-CL2 (105)	0	1	1	0	1	0	0	1
TA2-100-CL2 (42)	0	0	1	0	1	0	1	0
TE2-101 (78)	0	1	0	0	1	1	1	0
TE2-101-CL2 (110)	0	1	1	0	1	1	1	0
TA1-101 (137)	1	0	0	0	1	0	0	1
TA2-101 (74)	0	1	0	0	1	0	1	0
TB1-101 (169)	1	0	1	0	1	0	0	1
TA1-101-CL2 (201)	1	1	0	0	1	0	0	1
TB1-101-CL2 (233)	1	1	1	0	1	0	0	1
TA2-101-CL2 (106)	0	1	1	0	1	0	1	0

Figure 54: Device information channel: REX12D device type

[1] available from revision D

REX22D type:

Byte [9]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
REX22D (145)	1	0	0	1	0	0	0	1
Byte [10]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
TD2-100-CL2 (10)	0	0	0	0	1	0	1	0
TD2-100 (42)	0	0	1	0	1	0	1	0
TD1-100 (9)	0	0	0	0	1	0	0	1
TA1-100 (41)	0	0	1	0	1	0	0	1
TE2-100 (14)	0	0	0	0	1	1	1	0
TE2-100-CL2 (46)	0	0	1	0	1	1	1	0
TD2-101-CL2 (74)	0	1	0	0	1	0	1	0
TD2-101 (106)	0	1	1	0	1	0	1	0
TD1-101 (73)	0	1	0	0	1	0	0	1
TA1-101 (105)	0	1	1	0	1	0	0	1
TE2-101 (78)	0	1	0	0	1	1	1	0
TE2-101-CL2 (110)	0	1	1	0	1	1	1	0
TE1-100 (13)	0	0	0	0	1	1	0	1
TE1-101 (45)	0	0	1	0	1	1	0	1

Figure 55: Device information channel: REX22D device type

[1] available from revision D

9.3.8.2 Hardware version for 32 channels

Byte [7] – Byte [8] contain the hardware version of the corresponding channel.

The hardware version is made available in whole numbers.

Value range: 0 ... 65535

Error: Hardware version not available (65535)

Data length: 1 word (unsigned integer)

Byte [7] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [8] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 56: Device information channel: hardware version

9.3.8.3 Software version for 32 channels

Byte [5] – Byte [6] contain the hardware version of the corresponding channel.

The software version is made available BCD coded. It is coded as follows:

Software version = X.Y.Z

High Byte (Bit 12 – Bit 15) = 0

High Byte (Bit 8 – Bit 11) = X

Low Byte (Bit 4 – Bit 7) = Y

Low Byte (Bit 0 – Bit 3) = Z

Value range: 0 ... 65535

Error: Software version not available (65535)

Data length: 1 word (unsigned integer)

Byte [5] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [6] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0	0	0	0/1	0/1	0/1	0/1

Figure 57: Device information channel: software version

[1] available from revision D

9.3.8.4 Serial number for 32 channels

Byte [1] – Byte [4] contain the serial number of the corresponding channel.

Value range: 0 ... 4294967295

Error: Serial number not available (4294967295)

Data length: 4 Byte (unsigned long)

Byte [1] (LOW)	Bit 3	Bit 2	Bit 1	Bit 0
Description	8	4	2	1
Value	0/1	0/1	0/1	0/1
Byte [1] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4
Description	128	64	32	16
Value	0/1	0/1	0/1	0/1

Byte [2]	Bit 11	Bit 10	Bit 9	Bit 8
Description	2048	1024	512	256
Value	0/1	0/1	0/1	0/1
Byte [2]	Bit 15	Bit 14	Bit 13	Bit 12
Description	32768	16384	8192	4096
Value	0/1	0/1	0/1	0/1

Byte [3]	Bit 19	Bit 18	Bit 17	Bit 16
Description	524288	262144	131072	65536
Value	0/1	0/1	0/1	0/1
Byte [3]	Bit 23	Bit 22	Bit 21	Bit 20
Description	8388608	4194304	2097152	1048576
Value	0/1	0/1	0/1	0/1

Byte [4] (HIGH)	Bit 27	Bit 26	Bit 25	Bit 24
Description	134217728	67108864	33554432	16777216
Value	0/1	0/1	0/1	0/1
Byte [4] (HIGH)	Bit 31	Bit 30	Bit 29	Bit 28
Description	2147483648	1073741824	536870912	268435456
Value	0/1	0/1	0/1	0/1

Figure 58: Device information channel: serial number

9.3.9 Statistical information for 32 channels [1)]

When reading the index 801– 816, twelve bytes each are returned..

9.3.9.1 Minimum current for 32 channels [1)]

Byte [11] – Byte [12] contain the lowest current value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [11] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [12] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 59: Minimum current channel

The minimum current is made available as standardised 16 bit value with a resolution of 10 mA (resolution of the channel is one decimal place, for simplification it is shown identically with the voltage with 2 decimal places).

Example: Measuring value operating voltage = 710

-> real measuring value = 7.10 Ampere.

9.3.9.2 Maximum current for 32 channels [1)]

Byte [9] – Byte [10] contain the highest current value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [9] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [10] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 60: Maximum current channel

The maximum current is made available as standardised 16 bit value with a resolution of 10 mA (resolution of the channel is one decimal place, for simplification it is shown identically with the voltage with 2 decimal places).

Example: Measuring value operating voltage = 710

-> real measuring value = 7.10 Ampere.

[1)] available from revision D

9.3.9.3 Mean value current for 32 channels [1]

Byte [7] – Byte [8] contain the mean current value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [7] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [8] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 61: Mean value current channel

The mean current value is made available as standardised 16 bit value with a resolution of 10 mA (resolution of the channel is one decimal place, for simplification it is shown identically with the voltage with 2 decimal places).

Example: Measuring value operating voltage = 710

-> real measuring value = 7.10 Ampere.

9.3.9.4 Minimum voltage for 32 channels [1]

Byte [5] – Byte [6] contain the lowest mean current value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [5] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [6] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 62: Minimum voltage channel

The minimum voltage is made available as a standardised 16-bit-value with a resolution of 10 mV.

Example: Measuring value operating voltage = 2512

-> real measuring value = 25.12 Volt.

[1] available from revision D

9.3.9.5 Maximum voltage for 32 channels [1]

Byte [3] – Byte [4] contain the highest measured voltage of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [3] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [4] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 63: Maximum voltage channel

The maximum voltage is made available as a standardised 16-bit-value with a resolution of 10 mV.

Example: Measuring value operating voltage = 2512

-> real measuring value = 25.12 Volt.

9.3.9.6 Mean value voltage for 32 channels [1]

Byte [1] – Byte [2] contain the mean voltage value of the channel since the last reset.

Value range: 0 ... 65535

Data length: 1 word (unsigned integer)

Byte [1] (LOW)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description	128	64	32	16	8	4	2	1
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte [2] (HIGH)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Description	32768	16384	8192	4096	2048	1024	512	256
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Figure 64: Mean value voltage channel

The maximum voltage is made available as a standardised 16-bit-value with a resolution of 10 mV.

Example: Measuring value operating voltage = 2512

-> real measuring value = 25.12 Volt.

[1] available from revision D

10 Appendix

10.1 List of pictures

10.2 Technical data

For the technical data of EM12D-TIO please see relevant data sheet.

http://www.e-t-a.de/qr1023