

Central Station Coupling-module

Type REG-PED



1. Application

REG-PED operates as a coupling-device or protocol bridge between field devices – IEDs, Voltage regulators etc. and a local RTU or directly to a control center; The REG-PED also operates as a communications processor that supports almost all popular telecontrol protocols.

1.1 Features

The REG-PED...

- Supports many serial & Ethernet Telecontrol Protocols including:
 - IEC 870-5-103
 - DNP 3:00
 - SPABus
 - ModBus
 - IEC 101
 - IEC 104
 - IEC 61850
 - ELAN-Extension via Ethernet
 - NTP to DCF Time Synch Feature

Multiple choices for connection such as copper, RS 485 and RS 232 or fiber-optics, (ST, SMA and LC Connectors)

- Supports multiple Serial Ports
Ethernet ports can be:
 - Fiber ST and LC
 - Copper RJ45
- Coordinates the telegram traffic between one or more substation units, and with all possible connection types to central stations or substations
- Parameters can be set online at any time

1.2 Specification

The REG-PED-board is equipped with a 32 Bit PowerQUICC - processor MPC885 and operates as a standalone computer with an address-range of 1 GByte.

The CPU runs at a speed of 133 MHz. The board has a maximum capacity of 2 RAM modules with 32/128 MB in total as working memory, depending on revision.

Depending on the type of module, the storage capacity is up to 32 MB of flash RAM memory. For saving special system device data, as well as for the specific remote control protocol structure, All 16 hardware-timers are required for the real-time operating system.

One timer is used for the system cycle. All of the processor included UART - modules control the 5 asynchronous V.24-interfaces. Three of these interfaces have their own baud rate timers.

The PARAM interface is able to work from 1200 up to 115200 baud and the other serial interfaces 1-4 from 50 Bd. up to 115200 baud. For serial interfaces using pulse-width-modulation an add-on board is necessary.

All interfaces can be used either in PWM or in PCM (pulse-code-modulation) -mode or as control lines for modems serving up to 4 coupling partners.

Despite the functions running by different software branches on REG-PED, there are supervisory and monitoring functions that protect the REG-PED module against malfunctions. These functions are implemented both in hardware and in software.

1.3 Interfaces

The REG-PED module offers the following interface for communication with a PC for programming and set up and for connection with serial devices depending on the physical connection regime:

- 2x10/100 Mbit Ethernet RJ45 or fiber-optic (ST/LC)
- up to 4 serial interfaces (COMs)
- 2 of those 3 serial interfaces can be RS485
- up to 3 serial fiber-optic interfaces (optional)
- up to 4 COM interfaces have transmitters and receivers with galvanic isolation
- all COM ports are able to work as V.24 interfaces for serial communication and are connected via rack mount or SUB-D connector that include control and data lines.

With the help of parameter driven onboard functions you can adjust the inversion of the specific signals. The status of each channel is shown by the 3 LEDs on the front panel indicating sending activity (green), receive activity (yellow) and an error condition (red).

1.4 Socket Connections on the Front

On the left hand side of the front panel is a 9pin- Sub-D-socket. This is a serial COM port and can be used, for example, for set up and programming.

Also using one of the Ethernet connectors is possible.

You can easily adjust the settings of the REG-PED online at any time.

2. General Functions

In addition to the functions run by different software applications, there are also functions which protect against malfunctions of the device. These functions are realised by hardware implementations and by software routines (watchdog).

2.1 Contact Positions for COMs and Power

A) DIN-C-Connector B1 Release

Pin	d	b	Z
2	COM1 TxD	COM1 RTS	COM1 RxD
4	COM1 CTS	COM1 485-P	COM1 485-N
6	COM2 TxD	COM2 RxD	COM2 GND
8	COM4 TxD	COM4 RTS	COM4 RxD
10	COM4 CTS	COM4 485-P	COM4 485-N
12	COM4 GND	COM1 GND	COM3 GND
14	COM3 TxD	COM3 RTS	COM3 RxD
16	COM3 CTS	COM3 485-P	COM3 485-N
28			P
30		N	
32	PE		

B) DIN-C-Connector B2 Release

Pin	d	b	z
6	COM2 TxD	COM2 RxD	COM2 GND
12			COM3 GND
14	COM3 TxD	COM3 RTS	COM3 RxD
16	COM3 CTS	COM3 485-P	COM3 485-N
28			P
30		N	
32	PE		

C) Connector B2 Release Param/COM1

Pin	Signal	Pin	Signal
1	COM1 485-P	7	Param GND
2	COM1 485-N	8	PE
3	COM1 TxD	9	Param RxD
4	COM1 RxD	10	Param TxD
5	COM1 RTS	11	Param GND
6	COM1 CTS	12	+ 5 V

D) Sub-D-Connectors B3 Release

Pin	Signal	Pin	Signal
1	COM1 485-P	5	COM1 485-N
2	COM1 RxD	6	COM1 GND
3	COM1 TxD	7	COM1 RTS
4	COM1 485-N	8	COM1 CTS

At the B1 type COM1/DB-9 is paralleled with a SUB-D-Connector. N.B.: COM1 may only be connected at one time via DIN-F-Connector or via SUB-D-Connector.

The B3 type has got 4 COM ports (COM3 and 4 under the COM1 of the middle Slot and COM2 at the aux. power slot on right side), which also have the same pinning like COM 1.

2.2 Reset

There are four possibilities to trigger the reset on a REG-PED. A proper restart of REG-PED is guaranteed for each of the following:

- by pressing "RESET" on the front panel
- watchdog runs up
- reconnection and return of power supply
- reset by monitoring software module

2.3 Watchdog

Watchdog is a hardware supplement to monitor the smooth process of the software. It consists of a timer that has to be triggered continuously by a background software program. Lack of retriggering leads to a hardware-reset. The correct status of watchdog is displayed by a LED on the front panel, near the Reset-button at B1 and B2 release. B3 has the Reset-button under the Ethernet connectors.

3. Technical Data

Processor	MPC885
Processor Technology	CMOS
Memory	32/128 MB SDRAM
Operating system	real-time-UNIX
Serial Interfaces	max. 5
Input-resistance	1000 Ohm
Output-resistance	120 Ohm
Input voltage	+ 3...12 V

Power supply REG-PED + 5 V \pm 10% 0,6 A max.

Reference conditions during operation
in a 19" rack or wall mount rack

Temperature: -20...+55°C
Relative humidity: max. 85% at 25°C

Storage:

Temperature: -25...+65C
relative humidity: max. 80% at 25°C

3.1 Parameterized REG-PED

A generated file is transferred via serial interface from a standard PC into REG-PED. Data is kept in flash memory.

3.2 Applied Rules and Standards

- IEC 61010-1 / EN61010-1
- IEC 60255-22-1 / EN 60255-22-1
- IEC 60529 / EN 60529
- ICE 60068-1 / EN 60068-1
- ICE 61000-6-2 / EN 61000-6-2
- ICE 61000-6-4 / EN 61000-6-4

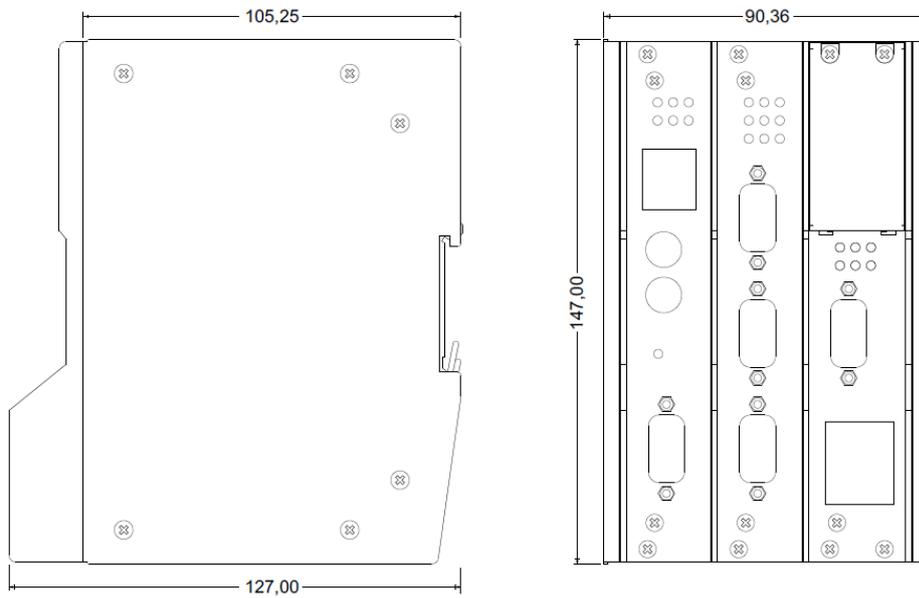


3.3 Mechanical Construction Release B3

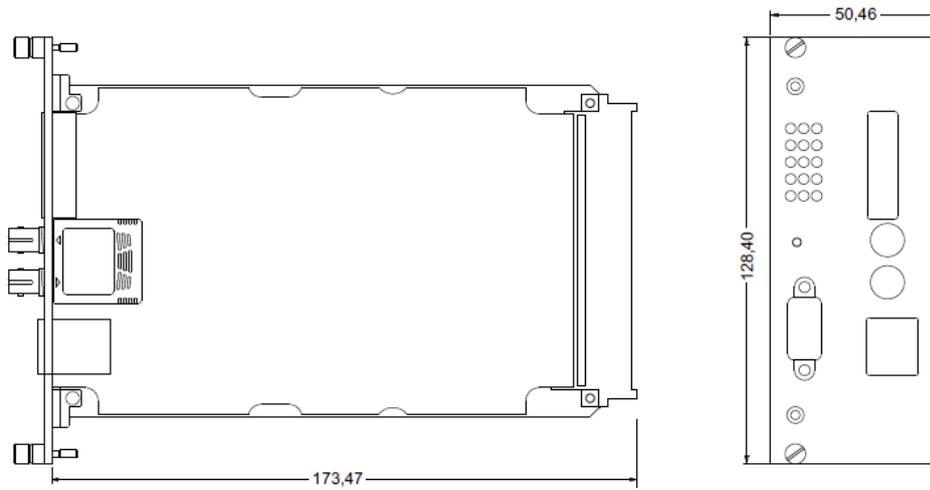
front panel	Stainless Steel, Wst. 1.4301 0,1mm
height, width, depth	3U, 6T (147 mm, 90,36 mm, 127 mm (including the lugs on the front panel))
weight	\leq 0,4 kg
protection class	
plug in device	IP 00
terminal block	IP 00
mounting according to	Standard DIN Rail at version B3

3.4 Operating Modes

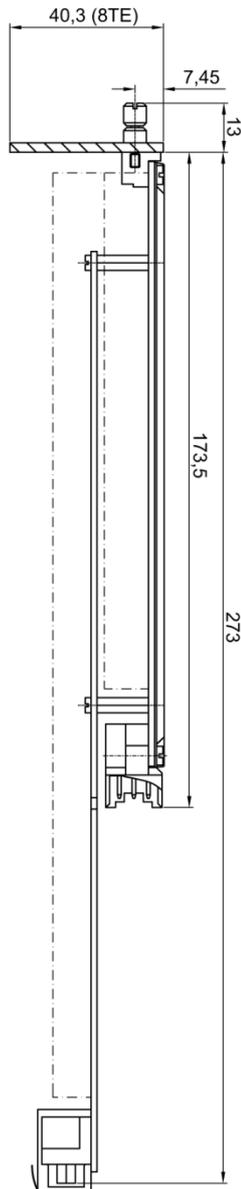
The telecontrol board REG-PED has not got any jumpers on board. In order to switch between the operating modes RS485 and RS232 (fiber optic mode is done via RS232 mode and additional piggy back module), a software parameter has to be set accordingly 8.



Picture 1: Dimensions rack at B3 release.



Picture 2: Dimensions plug-in module at B2 release.



Picture 3: Dimensions plug-in module at B1 release.

3.5 Fiber optic Connectors for COM 1 - 4

The REG-PED has got jumper free settings via software. COM 1-4 may be extended by an additional fiber optic board. This board allows you to switch the idle level via jumpers.

Jumper settings fiber optic board at B1-B2 release

Jumper	Meaning
X5-1	invert RxD
X6-1	invert TxD

4. Electrical Connection

Terminal screws with self-locking protection; clip on connector block.

4.1 Ethernet Connection

The REG-PED is available with either RJ45 or fiber-optic (ST) connectors. The RJ45 connector provides Ethernet at 10 or 100 Mbit (auto switching) whereas the fiber connectors are only available at 100 Mbit speed.

You can order the board with:

- 2 RJ45 or
- 1 RJ45 and 1 ST/LC or
- 2 ST/LC connectors.

4.2 RS485-Processing

In order to terminate the RS485-bus you can connect a termination resistor by soldering according jumpers, depending on the type used on the mainboard.

It can be ordered with preinstalled active termination resistors.

4.3 Electrical Safety

Protection class I

Grade of pollution 2

Overvoltage category, rated isolation voltage

Name	Overvoltage	max. Overvoltage
Serial interfaces	II	50 V front
Serial interfaces	II	350 V back

Transient voltage 5 kV, 1,2/50 ms, 0,5 Ws

Strength Immunity

- Electrostatic Air load 8 kV
- Discharge contact load 4 kV

Electromagnetic fields 80 MHz...1000 MHz 10 V/m
900 MHz ± 5 MHz 10 V/m
pulse modulated

Rapid transient disturbance quantities (Bursts)

Power supply AC 230 V, 2 kV

Contacted RF-disturbance factors

0,15 MHz...80 MHz
U_{eff} = 10 V

50 Hz-magnetic field 30 A / m

Interference emissions Limit class A
according to IEC 61000-3-2

4.4 Commissioning of the Board

For commissioning purposes, a quick guide and user manual with setting guide is provided with the board, and also downloadable on our home page. The parameterizing is done via web browser or a Windows-based application.

4.5 Data Programming Cable

Cable has to be shielded and may not be longer than 3 m.

PC-Sub-D-Connector 9 pol.	Meaning	TK860D Sub-D-Connector 9 pol.
1	n.a.	-
2	TXD SMC1	3
3	RXD SMC1	2
4	n.a.	-
5	GND	5
6	n.a.	-
7	n.a.	-
8	n.a.	-
9	n.a.	-

4.6 Fields of Application

The telecontrol board REG-PED processes the following telecontrol protocols together with a-eberle or other manufacturer devices:

- IEC 60870-5-101
- IEC 60870-5-103
- IEC 60870-5-104
- IEC 61850
- DNP 3.0
- Routers:
 - IEC 60870-5-101 to IEC 60870-5-104
 - IEC 60870-5-103 to IEC 60870-5-101
 - IEC 61850 to IEC 60870-5-104
 - IEC 60870-5-103 to IEC 61850
 - Modbus TCP to IEC 61850
- Modbus RTU
- ELAN-Extension via Ethernet
- NTP to DCF Time Synch Feature
- Other protocols on demand.

The telecontrol connection can be made via RS232 and RS485, via copper or fiber optics.

Settings are done via web browser or a Windows-based application, which is divided in two main sections:

- common part, where only baud rate and device name or address have to be entered and
- Advanced part, where specialist can adjust specifics.

This allows specific parameters such as: timeouts and making protocol requirements in the telecontrol profile.

4.7 Example Applications:

A) COM Server

a) COM Server Only Application: Up to 4 COM ports serve both Ethernet connections, assuming that the 2 Ethernet addresses are different. Example: IP address of Port 1 is set to 192.168.1.214 and IP address of Port 2 is set to 10.0.0.215, or “bonding” in “active backup mode” was selected, then both Ethernet interfaces have same IP and MAC address.

b) ELAN-Extension (CSE, COM Server Ethernet): Extension of ELAN via serial port of REG-PED over Ethernet in order to connect to another REG-PE(D) via Ethernet in order to achieve wide area ELAN. Fully equipped REG-PED provided.

B) Dedicated Protocol Application

a) Working as a telecontrol board for customer specific devices starting with IEC 60870-5-103 or 104 telecontrol protocols e.g.: for the substation connection of a-eberle devices, you can easily update later to IEC 61850 by firmware update, no hardware change is needed.

b) Working as a Protocol Router

- IEC 60870-5-101 to IEC 60870-5-104
Up to 4 COM ports may be used to connect the Router to IEC 60870-5-101 lines of several substations, to multiple control centers via IEC 60870-5-104. The only settings required for this application is to simply entering addresses and baud rate.
- IEC 60870-5-103 to IEC 60870-5-101
With the help of fiber-optic star couplers of you may connect up to 8 IEC 103 devices to one COM port of a REG-PED board, and route information to another COM port with IEC 101 protocol.
- IEC 61850 to IEC 60870-5-104
One Ethernet Port may be connected to IEC 61850

and the other Ethernet port to IEC 60870-5-101, or both protocols may be operated from the same Ethernet port.

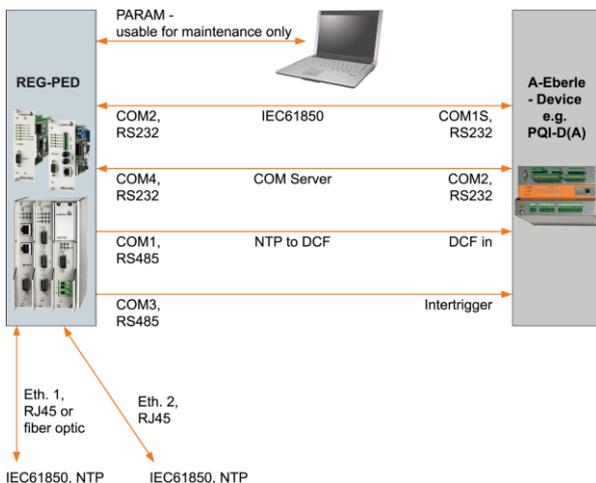
- IEC 61850 to IEC 60870-5-103
Router works as slave for IEC 60870-5-103 master and client for IEC 61850.

C) Mixed Ethernet Operation

If you order one Ethernet port with electrical RJ45 connector, and the other Ethernet port with fiber-optic connector, you are free to choose the connector type. Even combined use of both ports is possible.

D) Optimal Use of all Interfaces

The following scheme shows the one of the optimal use cases of a REG-PED card:



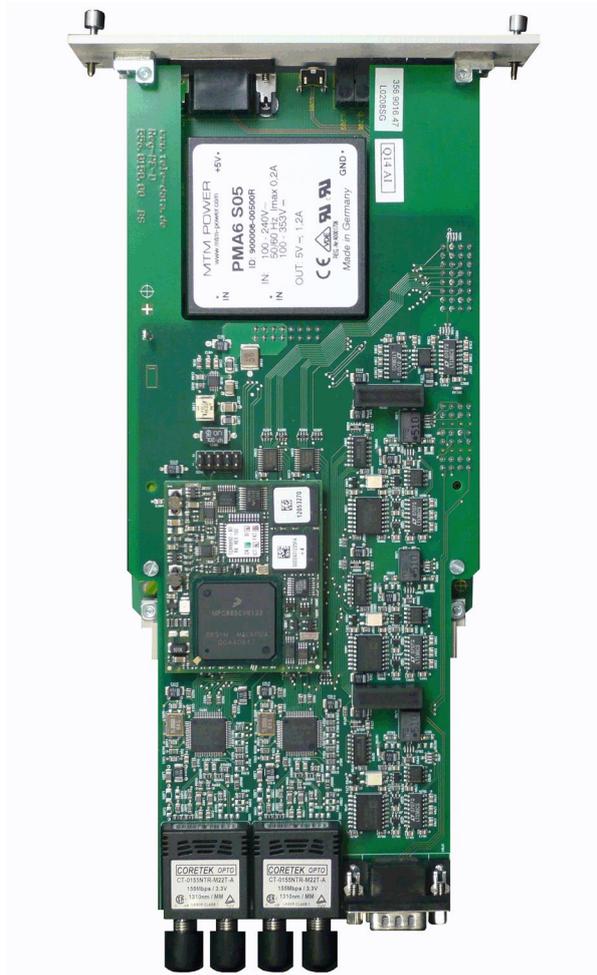
General Information concerning Dual Ethernet Connectors

Both Ethernet connectors may be merged to one logically interface using so called “bonding feature” in “broadcast mode”, where both Ethernet interfaces have same IP and MAC address. Additionally they can be set in PRP as well as RSTP mode.

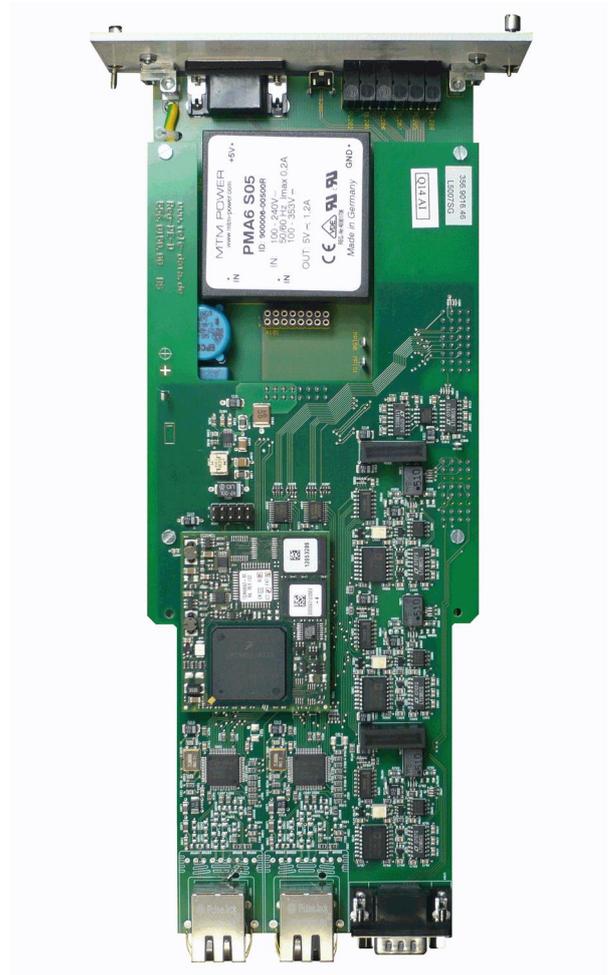
„Modbus Collector“ for REG-PED - a real high-

light: Using Modbus-Master functionality, the device will collect sensor data from arbitrary Modbus-slaves. Use this data for example to support regulation function by sending it to regulating devices or in fact to any receiver via IEC 61850. This functionality is a replacement for the „COM3-Extension“.

IEC61850 support for REG-DGA via Modbus Collector - collect data from up to 32 Modbus devices and make them available via one virtual IEC 61850 device.



Picture 4: Fiber optic (ST) version of B1 release.



Picture 5: Electrical (RJ45) version of B1 release.

REG-PED		only 3 different baud rates in total available						
Mnemonic: REG-PE		ETH1	ETH2	PARAM ¹⁾	COM2 ^{1) 2)}	COM1	COM2	COM3
Base: MPC885								
10/100 Mbit	RJ45	x	x					
	Optical (ST/LC-type, onboard)	x	x					
1200-115200bd	RS232			x	x	x	x	x
	RS485					x	x	x
	Optical (ST or SMA-type):FTR2!				x	x	x	x
19" rack (B1)	Front side			x				
	Back side	x	x		x	x	x	x

wall mount rack of device	Inside	x	x	x		x	x	x
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1) Without hw-handshaking signals

2) Normally used for a connected a-eberle-device

Note: All REG-PE come without a power-supply, whereas REG-PED always comes with a power-supply.

5. Order Details

Only one code of the same capital letter is possible

- When the capital letter is followed by number 9, further details are necessary
- The code can be omitted when the capital letter is followed by zero
- An X code e.g. XP1 cannot be combined freely with other codes

Characteristic	Code
Protocol Interface Unit (8TE, 3HE) for connection of the automatic voltage controller system REGSys™ to SCADA systems <ul style="list-style-type: none"> ● with Power PC MPC 885, ● with 3 x RS232 or with 3 x RS485, ● for protocols IEC 60870-5-101/103, DNP 3.0, Modbus (standard), incl. parameterization tool WinConfig Note: REG-PED could also be used as data concentrator (...103 ==> ..101) or as a Router: (...101 =>...104 or IEC61850 server =>...103 client)	REG-PED
Design <ul style="list-style-type: none"> ● 19" 1plug-in unit (the long release) ● 19" 1plug-in unit with wall mount rack (the short release) ● wall mount rack of device ● installation with other REGSys-components 	B1 B2 B3 B9
Power Supply <ul style="list-style-type: none"> ● AC 85V..110V..264V or DC 100V..220V..280V ● DC 18V...60V...72V 	H1 H2
Type of application: <ul style="list-style-type: none"> ● only as COM-Server with 4 x RS 232 and 3 x RS485 and RJ 45 cont. with feature group "G" ● for telecontrol connection of one device REG-D/DA ● for telecontrol connection of one device REG-DP/DPA ● for telecontrol connection of one device EOR-D ● for telecontrol connection of combinations of devices REG-D/DA, REG-DP/DPA, EOR-D, REG-D, PQI-D, CPR-D etc. Note: L9 can only be used in combination with Z02, Z31, Z92	L0 L1 L2 L3 L9
Type of protocol: <ul style="list-style-type: none"> ● without for connection of the „old“ Protocols IEC 60870-5-101/103, DNP 3.0, Modbus ● with if P0 further with feature group "D" 	P0 P1

We take care of it.

Characteristic	Code
<p>Type of connection only for feature P1</p> <ul style="list-style-type: none"> ● Copper: <ul style="list-style-type: none"> — 1 x RS 232 — RS 485; two-wire operation only ● Fiber optic: cable with FSMA connection <ul style="list-style-type: none"> — glass (wavelength 800...900 nm, distance < 2000 m) — plastic (wavelength 620...680 nm, distance < 50 m) ● Fiber optic: cable with ST connection <ul style="list-style-type: none"> — glass (wavelength 800...900 nm, distance < 2000 m) — plastic (wavelength 620...680 nm, distance < 50 m) 	<p>V10</p> <p>V11</p> <p>V13</p> <p>V15</p> <p>V17</p> <p>V19</p>
<p>Protocol only for feature P1:</p> <ul style="list-style-type: none"> ● IEC 60870-5-103 (please specify the target system) ● IEC 60870-5-101 (please specify the target system) ● DNP 3.00 ● MODBUS RTU and TCP ● You're welcome to ask for other protocols! 	<p>Z01</p> <p>Z02</p> <p>Z20</p> <p>Z23</p>
<p>Type of connection for feature P0 and P1:</p> <ul style="list-style-type: none"> ● 10/100 Mbit/s 2 x RJ 45 ● 100 Mbit/s 2 x Fiber Optic ST ● 10/100-100 Mbit/s 1x RJ 45 und 1 x Fiber Optic ST ● 100 Mbit/s 2 x Fiber Optic LC ● 10/100-100 Mbit/s 1x RJ 45 und 1 x Fiber Optic LC 	<p>D4</p> <p>D5</p> <p>D6</p> <p>D8</p> <p>D9</p>
<p>Protocol for feature P0 and P1:</p> <ul style="list-style-type: none"> ● IEC61850 ● IEC 60870-5-104 ● C37.118 <p>Note: In case of IEC 60870-5-104 please specify the target system. Additionally please note that with Z92 COM-Server function is not available!</p>	<p>Z31</p> <p>Z92</p> <p>Z88</p>
<p>Instruction Manual</p> <ul style="list-style-type: none"> ● German ● English ● You're welcome to ask for other languages! 	<p>G1</p> <p>G2</p> <p>G99</p>

A. Eberle GmbH & Co. KG

Frankenstraße 160
90461 Nuremberg

Tel.: +49 (0) 911 / 62 81 08-0
Fax: +49 (0) 911 / 62 81 08 96
E-Mail: info@a-eberle.de

<http://www.a-eberle.de>

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