



PROTECTA LINE

19AA0991200\$B1

Integrated digital protections for HV and MV electrical installations.

SYSTEM DESIGN

The PROTECTA line protection device family is a scalable hardware platform to adapt to different applications. Data exchange is performed via a 16-bit high-speed digital non-multiplexed parallel bus with the help of a backplane module. Each module is identified by its location and there is no difference between module slots in terms of functionality. The only restriction is the position of the CPU module because it is limited to the "CPU" position. The built-in self-supervisory function minimizes the risk of device malfunctions.

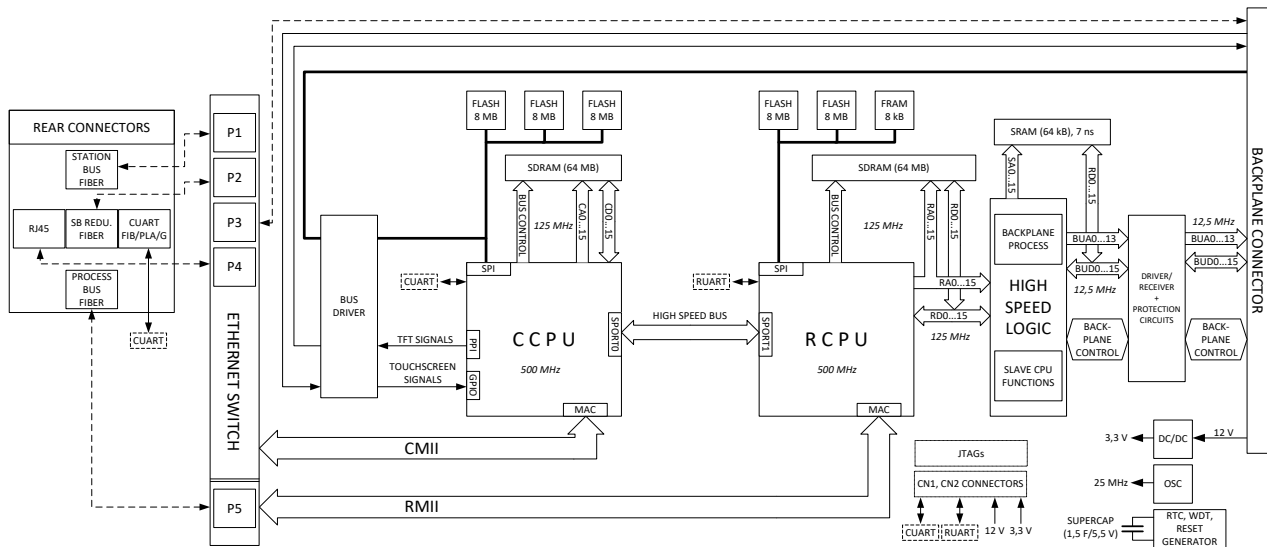


Figure 0-1 CPU block diagram

The backplane board itself is a passive board but it provides a 16-bit bus, power supply distribution, a two-wire interface (TWI) supporting module inventory management and module identification. It is designed to meet the requirements for high-speed digital buses and to comply with electromagnetic emission standards.

HUMAN-MACHINE INTERFACE (HMI) MODULE

The PROTECTA line device HMI consists of the following two main parts:

- Hardware: the HMI module, which is the front panel of the device, this is described here
- Software: the embedded web server and the menu system that is accessible through the HMI module. The web server is accessible via station bus, EOB interface or RJ-45 Ethernet connector. This is described in detail in the Operating Manual (external document).

Remote HMI

Protecta provides an alternative solution in that case if the IED can be only mounted in a non-practical way for managing the device via usual Human-Machine Interface.

By using a remote HMI (*terminal HMI device*), customers can place the HMI up to 3 meters far from the IED itself (*host device*) and mount the IED in any possible way that is applicable. The connection between the remote HMI and the IED is provided by a custom galvanic interface with DA-15 connector on the remote side.





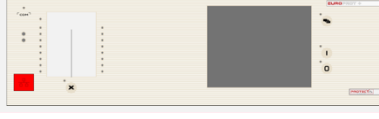


42 HP Remote HMI



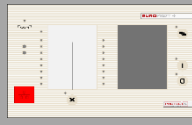


Depending on the size of the HMI module you can use any applicable mounting methods that described in the Mounting methods chapter (Flush mounting, Semi-flush mounting, Rack mounting).






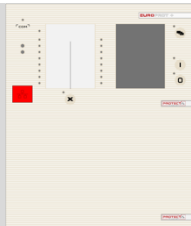



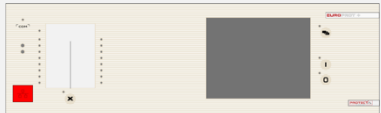
Remote HMI module with its host device

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	RACK DEPTH	ILLUSTRATION
HMIT+/3505	3,5" TFT	EOB	42 HP	Reduced	
			84 HP		
HMIT+/3506	3,5" TFT	RJ-45	42 HP	Reduced	
			84 HP		
HMIT+/5706	5,7" TFT	RJ-45	84 HP	Reduced	







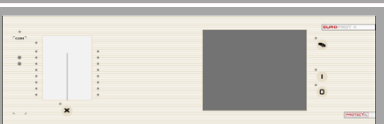
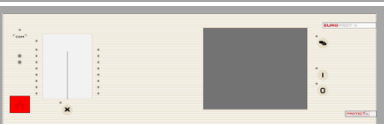
The following modules were made for the previous (now obsolete) racks (see Chapter 00), so they can be found in numerous devices. These became obsolete as well, **they are not recommended for new designs!**

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	RACK DEPTH	ILLUSTRATION
HMIT+/3501	3,5" TFT	EOB	42 HP	Normal	
			84 HP		
HMIT+/3502	3,5" TFT	RJ-45	42 HP	Normal	
			84 HP		
HMIT+/5702	5,7" TFT	RJ-45	84 HP	Normal	

Local HMI modules



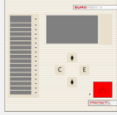

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	RACK DEPTH	ILLUSTRATION
HMI+/3505	3,5" TFT	EOB	42 HP	Reduced	
			84 HP		
HMI+/3506	3,5" TFT	RJ-45	42 HP	Reduced	
			Double 42HP		
			84 HP		
HMI+/5005	5,7" TFT	EOB	42 HP	Reduced	
HMI+/5006	5,7" TFT	RJ-45	42 HP	Reduced	
			Double 42 HP		n/a
HMI+/5706	5,7" TFT	RJ-45	84 HP	Reduced	

The following modules were made for the previous (now obsolete) racks (see Chapter 00), so they can be found in numerous devices. These became obsolete as well, **they are not recommended for new designs!**


MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	RACK DEPTH	ILLUSTRATION
HMI+/3501	3,5" TFT	EOB	42 HP	Normal	
			84 HP		
HMI+/3502	3,5" TFT	RJ-45	42 HP	Normal	
			84 HP		
HMI+/5001	5,7" TFT	EOB	42 HP	Normal	
HMI+/5002	5,7" TFT	RJ-45	42 HP	Normal	
HMI+/5701	5,7" TFT	EOB	84 HP	Normal	
HMI+/5702	5,7" TFT	RJ-45	84 HP	Normal	

S24 HMI

The S24 Smart Line devices have a different HMI family:

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	MOUNTING	ILLUSTRATION
HMI+ /2404	3,5" TFT	RJ-45	24 HP	Normal	
HMI+ /2406	3,5" TFT	RJ-45	24 HP	DIN-rail	
HMI+ /2504	B&W LCD	RJ-45	24 HP	Normal	
HMI+ /2506	B&W LCD	RJ-45	24 HP	DIN-rail	

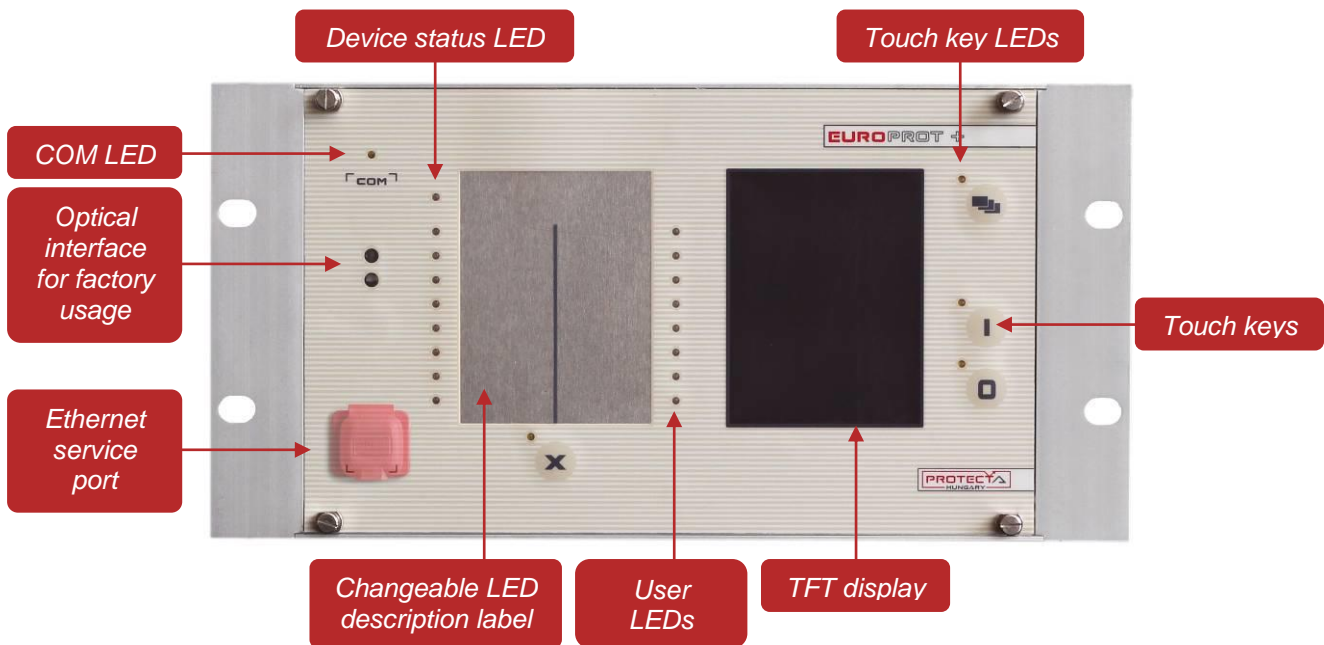
The following module is **obsolete, it is not recommended for new designs!**

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	MOUNTING	ILLUSTRATION
HMI+ /2401*	3,5" TFT	EOB	24 HP	Normal	

Parts of the HMI modules

The PROTECTA line device HMI on the front panel contains the following elements:

Function	Description
16 PIECES USER LEDs	Three-color, 3 mm circular LEDs
COM LED	Yellow, 3 mm circular LED indicating EOB/RJ-45 (on the front panel) communication link and activity
CAPACITIVE TOUCH KEY LEDs	4 pcs yellow, 3 mm circular LEDs indicating touch key actions
DEVICE STATUS LED	1 piece three-color, 3 mm circular LED Green: normal device operation Yellow: device is in warning state Red: device is in error state
DEVICE KEYS (I, O, X, PAGE)	Capacitive touch keys
	Tactile push buttons (24 HP devices)
BUZZER	Audible touch key pressure feedback
CHANGEABLE LED DESCRIPTION LABEL	Describes user LED functionality
DISPLAY	320 × 240 pixel TFT color display with resistive touchscreen interface (3.5" or optional 5.7")
	128 × 64 LCD black & white display
OPTICAL INTERFACE FOR FACTORY USAGE	For debugging and software development purposes <i>Only for 42 HP and 84 HP devices.</i>
EOB CONNECTOR	Ethernet Over Board: communication interface accomplishes isolated, non-galvanic Ethernet connection with the help of a magnetically attached EOB device. The EOB device has an RJ-45 type connector supporting Ethernet connection to the user computer. This is a proprietary and patented solution from Protecta Ltd. EOB1: Supporting 10Base-T Ethernet connection. Passive device with one RJ45 type connector. Obsolete module. EOB2: Supporting 10/100Base-Tx Ethernet connection. An active device that has a USB port in addition to the RJ45 connector for powering up.
ETHERNET SERVICE PORT	IP56 rated Ethernet 10/100-Base-T interface with RJ-45 type connector (IP56 only valid if the cap of the service port is closed.)



HMI signals and controls

LCD dot-defect handling policy

The definitions of dot-defect are as below:

- The defect area of the dot must be bigger than half of a dot.
- For bright dot-defect (sparkle mode), showing black pattern, the dot's brightness must be over 30 % brighter than others at black raster.
- For dark dot-defect (black mode), showing white pattern, the dot's brightness must be under 70 % darker than others at R.G.B. raster.

DOT-DEFECT TYPE		MAXIMUM NUMBER ACCEPTABLE	
		3.5"	5.7"
SPARKLE MODE	1 dot	4	4
	2 dots	2 (sets)	1
	IN TOTAL	4	5
BLACK MODE	1 dot	4	5
	2 dots	2 (sets)	2
	IN TOTAL	4	5
SPARKLE MODE AND BLACK MODE		2 dots	2 (sets)
IN TOTAL		6	10

For further information please contact our Application Team.

CPU AND COM MODULE

CPU+ module

The CPU module contains all the protection, control and communication functions of the PROTECTA line device. Dual 500 MHz high-performance Analog Devices Blackfin processors separate relay functions (RDSP) from communication and HMI functions (CDSP). Reliable communication between processors is performed via high-speed synchronous serial internal bus (SPORT).

Each processor has its own operative memory such as SDRAM and flash memories for configuration, parameter and firmware storage. Both firmwares are stored in a dedicated flash memory independent from the disturbance recorder and event storage. CDSP's operating system (uClinux) utilizes a robust JFFS flash file system, which enables fail-safe operation and the storage of disturbance record files, configuration and parameters.

Module handling

The RDSP core runs at 500 MHz and its external bus speed is 125 MHz. The backplane data speed is limited to approx. 20 MHz, which is more than enough for module data throughput. An additional logic element (CPLD and SRAM) is used as a bridge between the RDSP and the backplane. The CPLD collects analogue samples from CT/VT modules and also controls signaling outputs and inputs.

Fast start-up

After power-up the RDSP processor starts up with the previously saved configuration and parameters. Generally, the power-up procedure for the RDSP and relay functions takes only a few seconds. That is to say, it is ready to trip within this time. CDSP's start-up procedure is longer because its operating system needs time to build its file system, initializing user applications such as HMI functions and the IEC61850 software stack.

HMI and communication tasks

- Embedded WEB-server:
 - Firmware upgrade possibility
 - Modification of user parameters
 - Events list and disturbance records
 - Password management
 - Online data measurement
 - Commands
 - Administrative tasks
- Front panel TFT display handling: the interactive menu set is available through the TFT and the touchscreen interface
- User keys: capacitive touch keys on front panel
- The built-in 5-port Ethernet switch allows PROTECTA line to connect to IP/Ethernet-based networks. The following Ethernet ports are available:
 - Station bus (100Base-FX Ethernet) SBW
 - Redundant station bus (100Base-FX Ethernet) SBR
 - Process bus (100Base-FX Ethernet)
 - EOB2 (Ethernet Over Board) or RJ-45 Ethernet user interface on front panel
 - Optional 10/100Base-T port via RJ-45 connector
- PRP/HSR seamless redundancy for Ethernet networking (100Base-FX Ethernet)
- Other communication:
 - RS422/RS485 interfaces (galvanic interface to support legacy or other serial protocols, ASIF)
 - Plastic or glass fiber interfaces to support legacy protocols, ASIF
 - Proprietary process bus communication controller on COM+ module
 - Telecommunication interfaces: G.703, IEEE C37.94

CPU VERSION	PRIMARY STATION BUS (FIBER) SBW	SECONDARY STATION BUS		LEGACY PORT/PROTOCOL	PROCESS BUS (FIBER) PB	SERVICE PORT ON FRONT PANEL EOB/ RJ45
		STATION BUS (RJ-45)	REDUNDANT STATION BUS (FIBER) SBR			
CPU+/0007	-	-	-	-	-	+
CPU+/0091	-	-	-	-	+ SM SH	+
CPU+/0201*	-	+	-	-	-	+
CPU+/0211*	-	+	-	-	+ MM	+
CPU+/0281	-	+	-	-	+ SM LH	+
CPU+/0291*	-	+	-	-	+ SM SH	+
CPU+/0301	-	-	-	+ POF	-	+
CPU+/0401	-	-	-	+ GS	-	+
CPU+/0501*	-	-	-	+ Galv. RS485/422	-	+
CPU+/1001	+ MM	-	-	-	-	+
CPU+/1004	+ MM	-	-	-	-	+
CPU+/1011	+ MM	-	-	-	+ MM	+
CPU+/1091	+ MM	-	-	-	+ SM SH	+
CPU+/1101*	+ MM	-	+ MM	-	-	+
CPU+/1111	+ MM	-	+ MM	-	+ MM	+
CPU+/1181	+ MM	-	+ MM	-	+ SM LH	+
CPU+/1191	+ MM	-	+ MM	-	+ SM SH	+
CPU+/1201*	+ MM	+	-	-	-	+
CPU+/1211	+ MM	+	-	-	+ MM	+
CPU+/1281	+ MM	+	-	-	+ SM LH	+
CPU+/1291*	+ MM	+	-	-	+ SM SH	+
CPU+/1301	+ MM	-	-	+ POF	-	+
CPU+/1311	+ MM	-	-	+ POF	+ MM	+
CPU+/1331	+ MM	-	-	+ double POF	-	+
CPU+/1381	+ MM	-	-	+ POF	+ SM LH	+
CPU+/1391	+ MM	-	-	+ POF	+ SM SH	+
CPU+/1401	+ MM	-	-	+ GS	-	+
CPU+/1411	+ MM	-	-	+ GS	+ MM	+
CPU+/1481	+ MM	-	-	+ GS	+ SM LH	+
CPU+/1491	+ MM	-	-	+ GS	+ SM SH	+
CPU+/1501	+ MM	-	-	+ Galv. RS485/422	-	+
CPU+/1511	+ MM	-	-	+ Galv. RS485/422	+ MM	+
CPU+/1581	+ MM	-	-	+ Galv. RS485/422	+ SM LH	+
CPU+/1611	+ MM	-	-	+ Galvanic sync	+ MM	+

CPU VERSION	PRIMARY STATION BUS (FIBER) SBW	SECONDARY STATION BUS		LEGACY PORT/PROTOCOL	PROCESS BUS (FIBER) PB	SERVICE PORT ON FRONT PANEL EOB/ RJ45
		STATION BUS (RJ-45)	REDUNDANT STATION BUS (FIBER) SBR			
CPU+/1681	+ MM	-	-	+ Galvanic sync	+ SM LH	+
CPU+/6001	+ MM/LC	-	-	-	-	+
CPU+/6004	+ MM/LC	-	-	-	-	+
CPU+/6093	+ MM/LC	-	-	-	+ SM SH	+
CPU+/6094	+ MM/LC	-	-	-	+ SM SH	+
CPU+/6601*	+ MM/LC	-	+ MM/LC	-	-	+
CPU+/9201	+ SM SH	+	-	-	-	+
CPU+/9291	+ SM SH	+	-	-	+ SM SH	+
CPU+/9501	+ SM SH	-	-	+ Galv. RS485/422	-	+
CPU+/A001*	+ MM/LC PRP/HSR	-	-	-	-	+
CPU+/A004	+ MM/LC PRP/HSR	-	-	-	-	+
CPU+/A011	+ MM/LC PRP/HSR	-	-	-	+ MM	+
CPU+/A081	+ MM/LC PRP/HSR	-	-	-	+ SM LH	+
CPU+/A091	+ MM/LC PRP/HSR	-	-	-	+ SM SH	+
CPU+/A094	+ MM/LC PRP/HSR	-	-	-	+ SM SH	+

For legacy CPU cards (e.g. CPU+0001, ...) see [Product availability](#) chapter.

Legend for CPU version table:

MM: Multimode with ST connector,

MM/LC: Multimode with LC connector,

SM: Single mode with FC/PC connector,

LH: Long Haul with FC/PC connector,

SH: Short Haul with FC/PC connector,

POF: Plastic Optical Fiber with 1 mm fiber connector,

GS: Glass with ST connector,

SB: Station Bus,

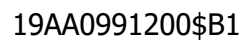
SBW: Station Bus Working,


















































SBR: Station Bus Redundant,

PB: Proprietary Process Bus,

PRP/HSR: PRP/HSR seamless redundancy port A and port B with MM/LC connector

Note: the modules can be equipped with a different handle (narrower and made of aluminum, instead of the standard plastic), if the other modules of the device are equipped with top-screw terminals (see Chapter 00). In these cases, a "T" letter appears on the label of the module (e.g. **CPU+/1201T), but all other properties remain the same.*

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CPU+ 1611	CPU+ 1681	CPU+ 6001	CPU+ 6004	CPU+ 6093	CPU+ 6094	CPU+ 6601	CPU+ 9201	CPU+ 9291	CPU+ 9501	CPU+ A001
MM/ST  SB  - 1 - 2 GND 3 Sy- 4 Sy+ 5 MM/ST  PB 	MM/ST  SB  - 1 - 2 GND 3 Sy- 4 Sy+ 5 SM LH FCPC  PB 	MM/LC 	MM/LC 	MM/LC  SM SH FCPC  PB 	MM/LC  SM SH FCPC  PB 	MM/LC  MM/LC  RJ-45 	SM SH FCPC  SB  RJ-45 	SM SH FCPC  SB  RJ-45  SM SH FCPC  PB 	SM SH FCPC  SB  Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5	PRP/HSR MM/LC   A B I LINK/ACT
			CPU+ A004 PRP/HSR MM/LC   A B I LINK/ACT	CPU+ A011 PRP/HSR MM/LC   A B I LINK/ACT MM/ST  PB 	CPU+ A081 PRP/HSR MM/LC   A B I LINK/ACT SM LH FCPC  PB 	CPU+ A091 PRP/HSR MM/LC   A B I LINK/ACT SM SH FCPC  PB 	CPU+ A094 PRP/HSR MM/LC   A B I LINK/ACT SM SH FCPC  PB 			

CPU versions

Interface types:

- 100Base-FX Ethernet:
 - MM/ST 1300 nm, 50/62.5/125 µm connector, (up to 2 km) fiber
 - SM/FC 1550 nm, 9/125 µm connector, (LH: long haul, up to 120 km)
 - SM/FC 1550 nm, 9/125 µm connector, (SH: short haul, up to 50 km)
 - MM/LC 1300 nm, 50/62.5/125 µm connector, (up to 2 km) fiber
- 10/100 Base-TX Ethernet: RJ-45-8/8
- Service port on HMI:
 - 10/100 Base-T Ethernet: RJ-45-8/8
 - EOB2 interface: attachable to the front panel by a proprietary magnetic connector; the connector box ends in a RJ-45 8/8 plug. It is 10Base-T full duplex interface and it enables 10/100Base TX communication with service computers.
- ASIF: Asynchronous Serial Interface
 - plastic optical fiber (ASIF-POF)
 - glass with ST connector (ASIF-GS)
 - galvanic RS485/422 (ASIF-G)

COM modules

The COM+ modules are responsible for special communication tasks, these are the following:

- binary signal transmission
- line differential protection communication via Ethernet or telecommunication networks
- busbar differential protection communication
- multi-port Ethernet switch using MODBUS/TCP protocol for Remote I/O (RIO) servers

COM modules for binary signal transmission

MODULE TYPE	INTERFACE TYPE	NUMBER OF INTERFACES	UNIT WIDTH	APPLICATION
COM+/1801*	MM/ST 1300 nm, 50/62.5/125 µm and SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	2	4 HP	Line differential protection, binary signal transmission up to 2 km and up to 120 km
COM+/1901*	MM/ST 1300 nm, 50/62.5/125 µm and SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	2	4 HP	Line differential protection, binary signal transmission up to 2 km and up to 50 km
COM+/8882	SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	3	4 HP	3 direction binary signal transmission up to 120 km
COM+/9902	SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	2	4 HP	2 direction binary signal transmission up to 50 km
COM+/9992	SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	3	4 HP	3 direction binary signal transmission up to 50 km

Note: the modules can be equipped with a different handle (narrower and made of aluminum, instead of the standard plastic), if the other modules of the device are equipped with top-screw terminals (see Chapter 00). In these cases, a "T" letter appears on the label of the module (e.g. **COM+/1801T), but all other properties remain the same*


COM+ 1801	COM+ 1901	COM+ 8882	COM+ 9902	COM+ 9992
MM/ST Tx LINE 1 Rx SM LH FCPC Tx LINE 2 Rx	MM/ST Tx LINE 1 Rx SM SH FCPC Tx LINE 2 Rx	SM LH FCPC Tx LINE 1 Rx SM LH FCPC Tx LINE 2 Rx SM LH FCPC Tx LINE 3 Rx	SM SH FCPC Tx LINE 1 Rx SM SH FCPC Tx LINE 2 Rx	SM SH FCPC Tx LINE 1 Rx SM SH FCPC Tx LINE 2 Rx SM SH FCPC Tx LINE 3 Rx

COM modules for binary signal transmission

COM modules for line differential communication

MODULE TYPE	INTERFACE TYPE	NUMBER OF INTERFACES	UNIT WIDTH	APPLICATION
COM+/0091	G703.1 (64 kbit/s)	1	4 HP	Line differential protection via telecom network
COM+/1101	MM/ST 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	2	4 HP	3 terminals / redundant line differential protection up to 2 km
COM+/1801*	MM/ST 1300 nm, 50/62.5/125 µm and SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	2	4 HP	3 terminals / redundant line differential protection up to 2 km and up to 120 km
COM+/1901*	MM/ST 1300 nm, 50/62.5/125 µm and SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	2	4 HP	3 terminals / redundant line differential protection up to 2 km and up to 50 km
COM+/8801	SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	2	4 HP	3 terminals / redundant line differential protection up to 120 km
COM+/9901	SM/FC 1550 nm, 9/125 µm connector, 100Base-FX Ethernet	2	4 HP	3 terminals / redundant line differential protection up to 50 km

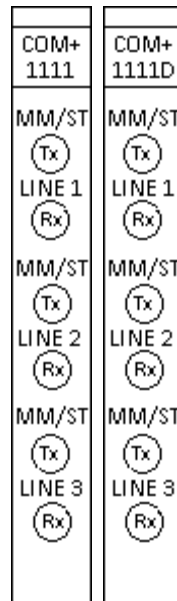
Note: the modules can be equipped with a different handle (narrower and made of aluminum, instead of the standard plastic), if the other modules of the device are equipped with top-screw terminals (see Chapter 00). In these cases, a "T" letter appears on the label of the module (e.g. **COM+/1801T), but all other properties remain the same*

COM+ 0091	COM+ 1101	COM+ 1801	COM+ 1901	COM+ 8801	COM+ 9901
	MM/ST Tx LINE 1 Rx	MM/ST Tx LINE 1 Rx	MM/ST Tx LINE 1 Rx	SM LH FCPC Tx LINE 1 Rx	SM SH FCPC Tx LINE 1 Rx
	MM/ST Tx LINE 2 Rx	SM LH FCPC Tx LINE 2 Rx	SM SH FCPC Tx LINE 2 Rx	SM LH FCPC Tx LINE 2 Rx	SM SH FCPC Tx LINE 2 Rx
signal  G.703 E0					

COM modules for line differential applications

COM modules for busbar differential protection communication

MODULE TYPE	INTERFACE TYPE	NUMBER OF INTERFACES	UNIT WIDTH	APPLICATION
COM+/1111	MM/ST 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	3	4 HP	Busbar protection for 3 bay units up to 2 km
COM+/1111D	MM/ST 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	3	4 HP	Busbar protection for 3x2 bay units (dual) up to 2 km

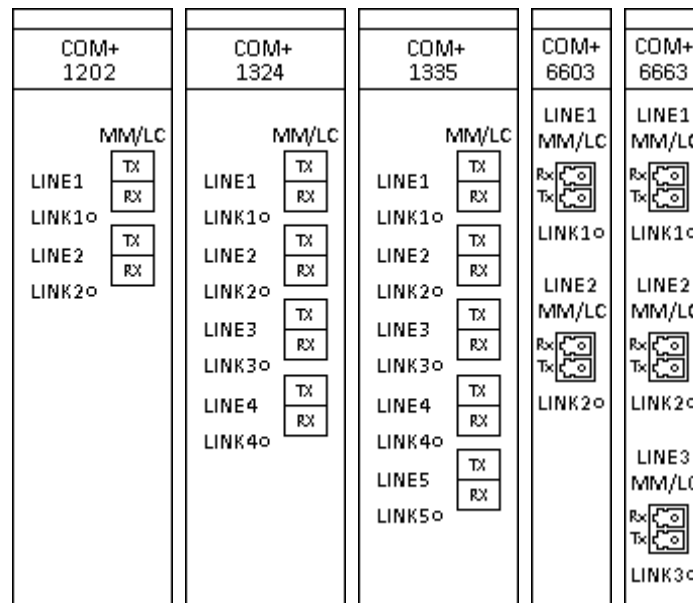


COM modules for busbar differential protections

COM modules for Remote I/O (RIO) servers

MODULE TYPE	INTERFACE TYPE	NUMBER OF INTERFACES	UNIT WIDTH	APPLICATION
COM+/1202*	MM/LC 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	2	8 HP	2-port Ethernet switch for MODBUS via RIO
COM+/1324*	MM/LC 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	4	8 HP	4-port Ethernet switch for MODBUS via RIO
COM+/1335	MM/LC 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	5	8 HP	5-port Ethernet switch for MODBUS via RIO
COM+/6603	MM/LC 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	2	4 HP	2-port Ethernet switch for MODBUS via RIO
COM+/6663	MM/LC 1300 nm, 50/62.5/125 µm connector, 100Base-FX Ethernet	3	4 HP	3-port Ethernet switch for MODBUS via RIO

***Obsolete module. These modules are not recommended for new designs!**


COM modules for RIO servers

Communication interface characteristics
Ethernet multi-mode transmitter and receiver
MM/ST connector

Up to approximately 2 km.

Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL OUTPUT POWER 62.5/125 μm, NA = 0.275 FIBER	P_o	BOL*: -19 EOL*: -20	-	-14	dBm avg.
OUTPUT OPTICAL POWER 50/125 μm, NA = 0.20 FIBER	P_o	BOL*: -22.5 EOL*: -23.5	-	-14	dBm avg.
OPTICAL EXTINCTION RATIO	ER	-	-	10 -10	% dB
CENTER WAVELENGTH	λ_c	1270	1308	1380	nm

* **BOL:** Beginning of life, **EOL:** End of life

*Note: according to field experiences, the **62.5/125 μm** cabling is recommended for applications where the center wavelength is **1300/1310 nm**.*

Receiver sensitivity is measured with $2^{23} - 1$ PRBS pattern within $\text{BER} = 2.5 \times 10^{-10}$

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
SIGNAL DETECT - ASSERTED	P_A	$P_D + 1.5 \text{ dB}$	-	-33	dBm avg.
SIGNAL DETECT - DEASSERTED	P_D	-45	-	-	dBm avg.
SIGNAL DETECT - HYSTERESIS	$P_A - P_D$	1.5	-	-	dB
SIGNAL DETECT ASSERT TIME (OFF TO ON)	AS_Max	0	2	100	μs
SIGNAL DETECT DEASSERT TIME (ON TO OFF)	ANS_Max	0	8	350	μs

MM/LC connector

Up to approximately 2 km.

Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL OUTPUT POWER** 62.5/125 μm, NA = 0.275 FIBER	P_o	BOL*: -19 EOL*: -20	-15.7	-14	dBm avg.
OUTPUT OPTICAL POWER 50/125 μm, NA = 0.20 FIBER	P_o	BOL*: -22.5 EOL*: -23.5	-	-14	dBm avg.
OPTICAL EXTINCTION RATIO	ER	-	0.002 -47	0.2 -27	% dB
CENTER WAVELENGTH	λ_c	1270	1308	1380	nm

* **BOL**: Beginning of life, **EOL**: End of life

*Note: according to field experiences, the **62.5/125 μm** cabling is recommended for applications where the **center wavelength** is **1300/1310 nm**.*

Receiver sensitivity is measured with $2^{23} - 1$ PRBS pattern within $\text{BER} = 2.5 \times 10^{-10}$

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
SIGNAL DETECT - ASSERTED	P_A	$P_D + 1.5 \text{ dB}$	-	-33	dBm avg.
SIGNAL DETECT - DEASSERTED	P_D	-45	-	-	dBm avg.
SIGNAL DETECT - HYSTERESIS	$P_A - P_D$	1.5	-	-	dB
SIGNAL DETECT ASSERT TIME (OFF TO ON)	AS_Max	0	2	100	μs
SIGNAL DETECT DEASSERT TIME (ON TO OFF)	ANS_Max	0	5	100	μs

Ethernet single mode transmitter and receiver

Long haul single mode transceiver

Up to approximately 120 km, with max. 32 dB link attenuation.

Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL OUTPUT POWER	P_O	-6	-	0	dBm avg.
OPTICAL EXTINCTION RATIO	ER	8.3	-	-	dB
CENTER WAVELENGTH	λ_C	1490	1550	1610	nm

Receiver sensitivity is measured with $2^{23} - 1$ PRBS pattern within $BER = 2.5 \times 10^{-10}$

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL INPUT SENSITIVITY	P_{IN}	-	-38	-35	dBm avg.
SATURATION	P_{SAT}	-3	0	-	dBm
CENTER WAVELENGTH	λ_C	1100	-	1600	nm
SIGNAL DETECT - ASSERTED	P_A	-	-	-35	dBm avg.
SIGNAL DETECT - DEASSERTED	P_D	-45	-	-	dBm avg.
HYSTERESIS	P_{HYS}	-	3	-	dB

Short haul single mode transceiver

Up to approximately 50 km, with max. 27 dB link attenuation.

Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL OUTPUT POWER	P_O	-12	-	-6	dBm avg.
OPTICAL EXTINCTION RATIO	ER	8.3	-	-	dB
CENTER WAVELENGTH	λ_C	1490	1550	1610	nm

Receiver sensitivity is measured with $2^{23} - 1$ PRBS pattern within $BER = 2.5 \times 10^{-10}$

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL INPUT SENSITIVITY	P_{IN}	-	-38	-35	dBm avg.
SATURATION	P_{SAT}	-3	0	-	dBm
CENTER WAVELENGTH	λ	1100	-	1600	nm
SIGNAL DETECT - ASSERTED	P_A	-	-	-35	dBm avg.
SIGNAL DETECT - DEASSERTED	P_D	-45	-	-	dBm avg.
HYSTERESIS	P_{HYS}	-	3	-	dB

ASIF-O transmitter and receiver
ASIF-O POF
Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	JUMPER SETTINGS
TRANSMITTER OUTPUT OPTICAL POWER	P_T	-15.3	-	-9	dBm	JP1 2-3
		-23.3	-	-17		JP1 1-2
PEAK EMISSION WAVELENGTH	λ_{PK}	-	660	-	nm	
EFFECTIVE DIAMETER	D	-	1	-	mm	
NUMERICAL APERTURE	NA	-	0.5	-		

Receiver

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT OPTICAL POWER LEVEL LOGIC 0	$P_{R(L)}$	-39	-	-13.7	dBm
INPUT OPTICAL POWER LEVEL LOGIC 1	$P_{R(H)}$	-	-	-53	dBm
EFFECTIVE DIAMETER	D	-	1	-	mm
NUMERICAL APERTURE	NA	-	0.5	-	

These characteristics are valid for both POF interfaces in CPU+1331 module.

ASIF-O GLASS
Transmitter (Output measured out of 1 meter of cable)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	JUMPER SETTINGS
50/125 μ m FIBER CABLE NA = 0.2	P_0	-19.4	-16.4	-14.4	dBm peak	JP1 2-3
		-28.9	-25.9	-23.9		JP1 1-2
62.5/125 μ m FIBER CABLE NA = 0.275	P_0	-15.6	-12.6	-10.6	dBm peak	JP1 2-3
		-22.9	-19.9	-17.9		JP1 1-2

Receiver

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
PEAK OPTICAL INPUT POWER LOGIC LEVEL HIGH ($\lambda_p = 820$ nm)	P_{RH}	-25.4	-	-9.2	dBm peak
PEAK OPTICAL INPUT POWER LOGIC LEVEL LOW	P_{RL}	-	-	-40	dBm peak

ASIF-G transmitter and receiver

The RS422/RS485 interfaces of our CPU+1501, CPU+1511, CPU+1581, CPU+9501 modules provide galvanic interface to support legacy or other serial protocols. For more details see our RS485/422 application note, available on our homepage.

Driver

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
DIFFERENTIAL OUTPUT VOLTAGE (LOADED, $R_L = 100\ \Omega$, RS422)	V_{OD2}	2	-	3.6	V
DIFFERENTIAL OUTPUT VOLTAGE (LOADED, $R_L = 54\ \Omega$, RS485)	V_{OD2}	1.5	-	3.6	V

Receiver

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
DIFFERENTIAL INPUT THRESHOLD VOLTAGE	V_{TH}	-200	-125	-30	mV
INPUT VOLTAGE HYSTERESIS	V_{HYS}	-	15	-	mV
LINE INPUT RESISTANCE	R_{IN}	96	-	-	k Ω

G.703 64 kbit/s co-directional interface (E0)

The PROTECTA line device also supports line differential communication via telecom networks using G.703.1 64 kbit/s co-directional interface type through COM+0091. This type of communication is performed via 2 × 2 wire isolated galvanic type interface. The protection device is connected to a multiplexer or gateway which is responsible for protocol/speed conversion.

- Connector type: Weidmüller: Receptacle: S2L 3.50/12/90 F
Plug: B2L 3.50/12/180 F
- Impedance: 120 Ω
- Cable length: 50 m
- Interface type: G.703.1 64 kbit/s (E0) co-directional, selectable grounding, with optional external clock input

For further information about the cable assembly of this type of interface please see our G.703 E0 cable assembly guide.

Receiver

LOSS OF SIGNAL ALARM LEVEL	± 1.5 dB difference between alarm-on and alarm-off
DYNAMIC RANGE	10 dB maximum cable loss range

Transmitter

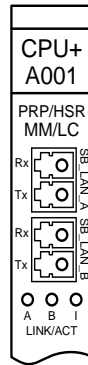
PAIR FOR EACH DIRECTION	One symmetric pair
TEST LOAD IMPEDANCE	120 Ω resistive
NOMINAL PEAK VOLTAGE OF A "MARK" (PULSE)	1.0 V
PEAK VOLTAGE OF A "SPACE" (NO PULSE)	0 V ± 0.10 V
NOMINAL PULSE WIDTH	3.9 ms
RATIO OF THE AMPLITUDES OF POSITIVE AND NEGATIVE PULSES AT THE CENTRE OF THE PULSES INTERVAL	0.95 to 1.05
RATIO OF THE WIDTHS OF POSITIVE AND NEGATIVE PULSES AT THE NOMINAL HALF AMPLITUDE	0.95 to 1.05
MAXIMUM PEAK-TO-PEAK JITTER AT THE OUTPUT PORT	Refer to clause 2/G.823

PRP/HSR redundant Ethernet communication interface

The PRP/HSR redundant Ethernet communication interface supports the two new IEC 62439-3 protocols which provide seamless redundancy for Ethernet networking in substations with zero-time recovery in case of a single failure without frame loss:

- PRP – Parallel Redundancy Protocol (IEC 62439-3 Clause 4)
- HSR – High-availability Seamless Redundancy (IEC 62439-3 Clause 5)

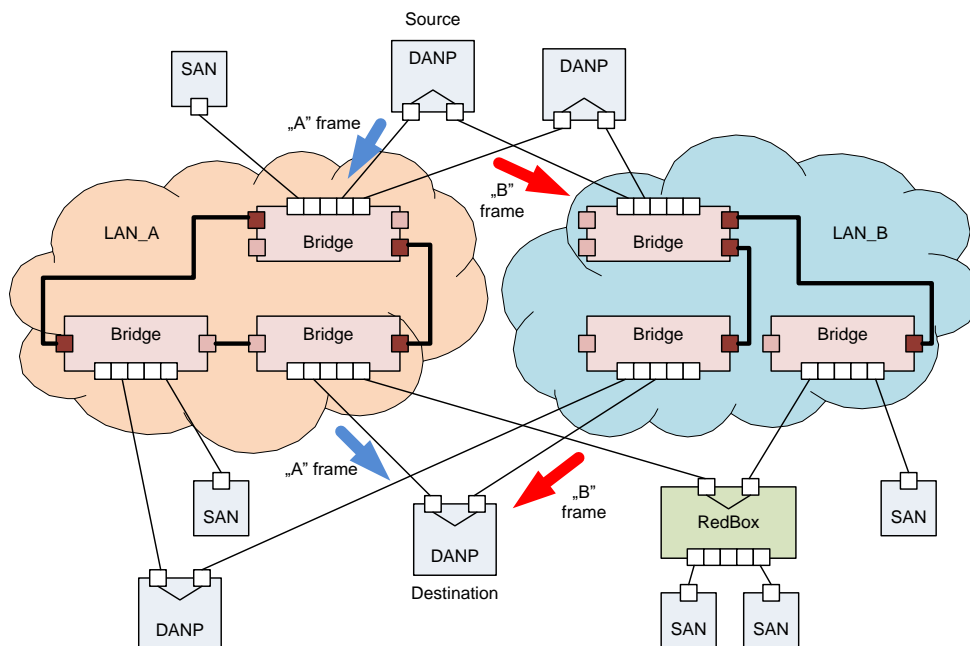
This interface uses two MM/LC connectors for double connection to networks as these protocols are based on the duplication of the sent frames.



PRP/HSR connectors on a CPU+A001 module

Parallel Redundancy Protocol (PRP)

This redundancy protocol implements redundancy in the nodes as they are connected to two independent networks (LAN_A and LAN_B) sending a copy of each frame to both directions. The destination node receives and processes the first copy and discards the other copy of the sent frame.



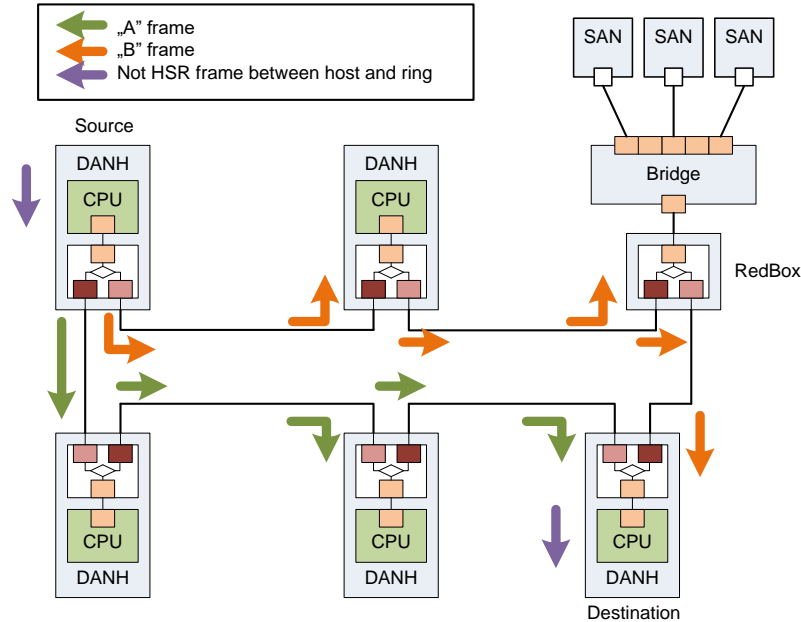
Example of a PRP redundant network

Single attached node (SAN): Network device that connects to a network with only one port.

Double attached node implementing PRP (DANP): Network device which connects to a network with two ports implementing PRP redundancy.

High-availability Seamless Redundancy (HSR)

An HSR network provides redundancy with the same safety as PRP does with a lower cost. The principle of this protocol is also based on the duplication of the sent frames but in this solution the nodes are connected to a closed ring. A source node sends two copy of a frame to both direction and the destination node accepts the first received copy and discards the other one. If a frame returns to its source the node does not let it through itself prevent the possibility of an overload of the ring.



Example of an HSR redundant network

Single attached node (SAN): Network device that connects to a network with only one port.

Double attached node implementing HSR (DANH): Network device which connects to a network with two ports implementing HSR redundancy.

DEVICE HOUSINGS

Three+one versions are available: one is 84 HP wide with 21 module slots, the 42 HP wide, which supports 10 module slots, the double 42 HP wide with 20 module slots, and finally the 24 HP, which supports 6 module slots.






Depending on the installed modules of the configuration, the top and bottom panels of the 84 HP and 42 HP racks can be either solid (default) or perforated by 2 mm holes to prevent overheating. 24 HP housings do not have this feature, as the S24 system is less flexible, their range of the optional modules are narrower.

RACK CONFIGURATION	FREE MODULE SLOTS*	BOTTOM AND TOP PANELS	DISPLAY OPTIONS
84 HP, SINGLE RACK (3 U)	20	Solid, Perforated	3.5" TFT, 5.7" TFT
42 HP, SINGLE RACK (3 U)	9	Solid, Perforated	3.5" TFT, 5.7" TFT
42 HP, DOUBLE RACK (6 U)	19	Solid, Perforated	3.5" TFT
24 HP, PANEL INSTRUMENT CASE	5	Solid	B/W alphanumeric 3.5" TFT

**CPU module is mandatory, it uses up one fixed position*

Previously, a new rack type has been introduced to the 42HP devices. As of April 2021, this type is introduced to the 84HP devices as well. The depth of the box has been reduced from 242 mm to 223 mm. By default, this reduced-depth housing shall be used for newly manufactured devices. For more information about the previous and new size, see Chapter 0.

The following images showcase examples of the different types of available device housings with different kinds of front panel HMI. The available front panels are listed in Chapter **Erreur ! Source du renvoi introuvable.**

<p>84 HP single rack (3 U) with 3.5" TFT display and solid housing</p>	
<p>84 HP single rack (3 U) with 5.7" TFT display and perforated housing</p>	
<p>42 HP single rack (3 U) with 3.5" TFT display and solid housing</p>	
<p>42 HP double rack (6 U) with 3.5" TFT display and solid housing</p>	
<p>24 HP panel instrument case with B/W display (left) TFT display (right)</p>	

Rack configuration illustrations

CURRENT INPUT MODULE

This is an input module with intermediate current transformers to input the phase currents and the zero-sequence current. The rated current for the phase current and for the zero-sequence current can be selectable by parameter.

Main features:

- Rated frequency: 50 Hz, 60 Hz
- *Electronic* iron-core flux compensation

Connector types:

- *The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.*

MODULE TYPE	CT+/0101		CT+/1111*		CT+/1155		CT+/1500	
CHANNEL NUMBER	1 – 4		1 – 4		1 – 4		1 – 3	
SELECTABLE RATED CURRENT, I_N [A]	0.04	0.2	1	5	1	5	1	5
MAX. MEASURED CURRENT ($\pm 10\%$)	$8 \times I_N$		$50 \times I_N$		$12.5 \times I_N$		$2 \times I_N$	
POWER CONSUMPTION AT RATED CURRENT [VA]	0.005	0.1	0.01	0.25	0.02	0.45	0.1	1.55
THERMAL WITHSTAND [A]								
CONTINUOUSLY	7		20		20		7	
10 s	50		175		120		50	
1 s	150		500		380		150	
10 ms	330		1200		850		330	
CONNECTOR TYPE	Default: STVS Options: -		Default: STVS Options: -		Default: STVS Options: -		Default: STVS Options: R	
RECOMMENDED APPLICATION	DEFL earth fault protection		Special disturbance recorder application in wider frequency range		Special protection applications where the overcurrent in the secondary circuit can not exceed $10 \times I_N$		General three-phase measurement	

***Obsolete module. These modules are not recommended for new designs!**

Module Type	CT+/1515*		CT+/2500*		CT+/5101			
Channel Number	1 – 4		1 – 3		1 – 3		4	
Selectable Rated Current, I _N [A]	1	5	1	5	1	5	0.2	1
Max. Measured Current (± 10 %)	2 × I _N		2 × I _N		50 × I _N		12.5 × I _N	
Power Consumption at Rated Current [VA]	0.1	1.55	0.1	1.55	0.01	0.25	0.005	0.1
Thermal Withstand [A]								
Continuously	7		7		20		7	
10 s	50		50		175		50	
1 s	150		150		500		150	
10 ms	330		330		1200		330	
Connector Type	Default: STVS Options: -		Default: STVS Options: -		Default: STVS Options: -			
Recommended Application	Special disturbance recorder application		Generator protections		Extremely sensitive earth-fault applications			

*Obsolete module. These modules are not recommended for new designs!

Module Type	CT+/5102				CT+/5111*			
Channel Number	1 – 3		4		1 – 3		4	
Selectable Rated Current, I _N [A]	1	5	0.2	1	1	5	0.001	0.005
Max. Measured Current (± 10 %)	50 × I _N		50 × I _N		50 × I _N		50 × I _N	
Power Consumption at Rated Current [VA]	0.01	0.25	0.001	0.01	0.01	0.25	0.005	0.1
Thermal Withstand [A]								
Continuously	20		20		20		7	
10 s	175		120		175		50	
1 s	500		380		500		150	
10 ms	1200		850		1200		330	
Connector Type	Default: STVS Options: -				Default: STVS Options: R			
Recommended Application	Sensitive earth-fault applications				Sensitive earth-fault applications			

*Obsolete module. These modules are not recommended for new designs!

MODULE TYPE	CT+5115		CT+5116		CT+/5151		CT+/5152	
CHANNEL NUMBER	1 – 4		1 – 3		1 – 4		1 – 4	
SELECTABLE RATED CURRENT, I_N [A]	1	5	1	5	1	5	1	5
MAX. MEASURED CURRENT ($\pm 10\%$)	$50 \times I_N$		$50 \times I_N$		$50 I_N$		$50 I_N$	
POWER CONSUMPTION AT RATED CURRENT [VA]	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
THERMAL WITHSTAND [A]								
CONTINUOUSLY	20		20		20		20	
10 s	175		175		175		175	
1 s	500		500		500		500	
10 ms	1200		1200		1200		1200	
CONNECTOR TYPE	Default: STVS Options: R		Default: STVS Options: -		Default: STVS Options: R		Default: STVS Options: R	
RECOMMENDED APPLICATION	<ul style="list-style-type: none"> ➤ General protection applications* ➤ Three-phase measurement* 		High-impedance differential protection		General protection applications		Busbar protection bay units	

*The CT+/5115 module handles both applications: it can be connected to the protection and measurement core of the primary CT as well

Module Type	CT+/5153					CT+/5154*				
Channel Number	1 – 3		4			1 – 3		4		
Selectable Rated Current, I _N [A]	1	5	1	0.2	0.2 sens.	1	5	5	1	0.2
Max. Measured Current (± 10 %)	50 × I _N				10 × I _N	50 × I _N				10 × I _N
Power Consumption at Rated Current [VA]	0.06	1.3	0.6	0.004	0.0004	0.06	1.3	1.3	0.06	0.004
Thermal Withstand [A]										
Continuously	20		7			20				
10 s	175		50			175				
1 s	500		150			500				
10 ms	1200		330			1200				
Connector Type	Default: STVS Options: R, T**					Default: STVS Options: R				
Recommended Application	General protection application, extremely sensitive transient earth-fault protections					General protection application, sensitive transient earth-fault protections				

***Obsolete module. These modules are not recommended for new designs!**

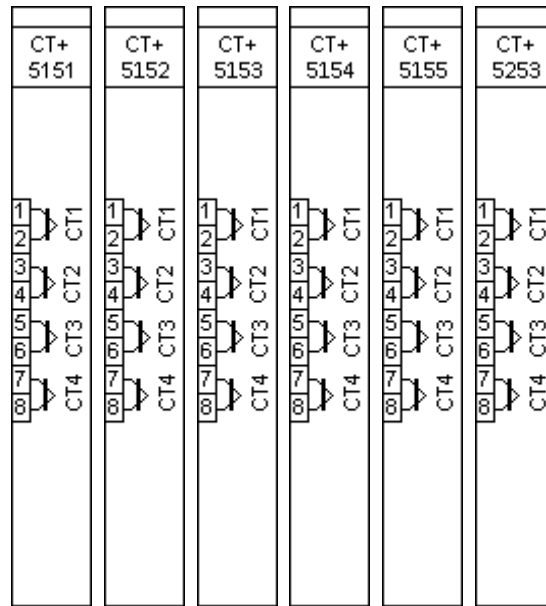
****The connector remains the same STVS, only the handle of the module becomes narrower and will be made of aluminum**

Module Type	CT+/5155*					CT+/5253**				
Channel Number	1 – 3		4			1 – 3		4		
Selectable Rated Current, I _N [A]	1	5	0.25	0.05	0.05 sens.	5	1	0.25	0.05	0.05 sens.
Max. Measured Current (± 10 %)	50 × I _N				10 × I _N	25 × I _N				
Power Consumption at Rated Current [VA]	0.06	1.3	0.6	0.004	0.0004	0.06	1.3	0.6	0.004	0.0004
Thermal Withstand [A]										
Continuously	20		7			20		7		
10 s	175		50			175		50		
1 s	500		150			500		150		
10 ms	1200		330			1200		330		
Connector Type	Default: STVS Options: -					Default: STVS Options: -				
Recommended Application	DMD Special sensitive earth fault protection					Circuit breaker diagnostics				

***Obsolete module. These modules are not recommended for new designs!**

****Special module**

CT+ 0101	CT+ 1111	CT+ 1155	CT+ 1500	CT+ 1515	CT+ 2500	CT+ 5101	CT+ 5102	CT+ 5111	CT+ 5115	CT+ 5116
1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
CT1	CT1	CT1	CT1	CT1	CT1	CT1	CT1	CT1	CT1	CT1
CT2	CT2	CT2	CT2	CT2	CT2	CT2	CT2	CT2	CT2	CT2
CT3	CT3	CT3	CT3	CT3	CT3	CT3	CT3	CT3	CT3	CT3
CT4	CT4	CT4	CT4	CT4	CT4	CT4	CT4	CT4	CT4	CT4



CT modules

VOLTAGE INPUT MODULE

If the device performs voltage and/or frequency related functions and measurements (voltage protections, directional protections, frequency protections etc.), then this module is needed.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

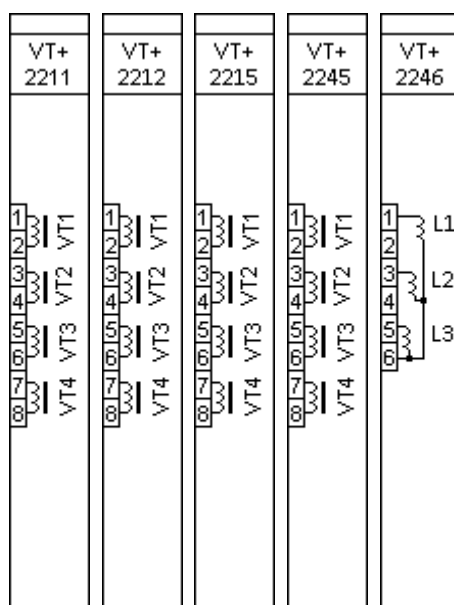
MODULE TYPE	VT+/2211	VT+/2212*	VT+/2215**
CHANNEL NUMBER	4	4	4
SELECTABLE VOLTAGE RANGE	Type 100: $\frac{100}{\sqrt{3}}$, 100 V Type 200: $\frac{200}{\sqrt{3}}$, 200 V	Type 100: $\frac{100}{\sqrt{3}}$, 100 V Type 200: $\frac{200}{\sqrt{3}}$, 200 V	Type 100: $\frac{100}{\sqrt{3}}$, 100 V Type 200: $\frac{200}{\sqrt{3}}$, 200 V
CONTINUOUS VOLTAGE WITHSTAND	200 V	200 V	200 V
SHORT TIME OVERLOAD (1 s)	275 V AC / 350 V DC	275 V AC / 350 V DC	275 V AC / 350 V DC
VOLTAGE MEASURING RANGE (± 10 %)	0.05 U _N – 1.3 U _N	0.05 U _N – 1.3 U _N	0.05 U _N – 1.3 U _N
POWER CONSUMPTION OF VOLTAGE INPUT	0.61 VA at 200 V 0.2 VA at 100 V	0.61 VA at 200 V 0.2 VA at 100 V	ch. 1-3: 0.61 VA at 200 V 0.2 VA at 100 V ch. 4: 50 mVA at 100 V
FREQUENCY MEASUREMENT RANGE	U _x ≥ 25 % of rated voltage	U _x ≥ 25 % of rated voltage	
CONNECTOR TYPE	Default: BLA Options: F, T, R	Default: BLA Options: -	Default: BLA Options: -
RECOMMENDED APPLICATION	General protection applications.	Special disturbance recorder application in wider frequency range	Special protection applications with voltage transformers that require low power consumption on the 4 th channel.

*Obsolete module. These modules are not recommended for new designs!

**Special module

MODULE TYPE	VT+/2245	VT+/2246*
CHANNEL NUMBER	4	3
SELECTABLE VOLTAGE RANGE	Type 200: $\frac{200}{\sqrt{3}}$, 200 V Type 400: $\frac{400}{\sqrt{3}}$	
CONTINUOUS VOLTAGE WITHSTAND	400 V	
SHORT TIME OVERLOAD (1 s)	420 V AC / 560 V DC	
VOLTAGE MEASURING RANGE ($\pm 10\%$)	0.05 U _N – 1.3 U _N	
POWER CONSUMPTION OF VOLTAGE INPUT	0.21 VA at 200 V 0.28 VA at 230 V	
FREQUENCY MEASUREMENT RANGE	U _x \geq 25 % of rated voltage	
CONNECTOR TYPE	Default: BLA Options: T	Default: BLA Options: -
RECOMMENDED APPLICATION	Protection applications for 400 V AC secondary voltage	Special protection applications for 400 V AC secondary voltage and increased isolation to 6 kV

*Special module



VT modules

BINARY INPUT MODULE

The inputs are galvanic isolated, and the module converts high-voltage signals to the voltage level and format of the internal circuits. The inputs of this module can be also programmed to serve as a PPM input for time synchronization.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

Notes for the following tables:

- **Thermal withstand voltage:** continuous with 60 % of the input channels are energized.
- **Clamp voltage:** these are the guaranteed values; the actual ones might differ from those provided here (falling and rising around $0.66 U_N$ and $0.77 U_N$, respectively)

MODULE TYPE	O8+/2401	O8+/4801	O8+/1101	O8+/2201
CHANNEL NUMBER	8	8	8	8
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP
RATED VOLTAGE	24 V	48 V	110 V	220 V
THERMAL WITHSTAND VOLTAGE	72 V	100 V	250 V	320 V
CLAMP VOLTAGE	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$
GROUNDING GROUPS	independent	independent	independent	independent
CONNECTOR TYPE	Default: BLA Options: T	Default: BLA Options: T	Default: BLA Options: T	Default: BLA Options: T

MODULE TYPE	O12+/2401	O12+/4801	O12+/1101	O12+/2201
CHANNEL NUMBER	12	12	12	12
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP
RATED VOLTAGE	24 V	48 V	110 V	220 V
THERMAL WITHSTAND VOLTAGE	72 V	72 V	250 V	320 V
CLAMP VOLTAGE	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$
GROUNDING GROUPS	4 × 3 common ground	4 × 3 common ground	4 × 3 common ground	4 × 3 common ground
CONNECTOR TYPE	Default: BLA Options: T	Default: BLA Options: F, T	Default: BLA Options: F, T	Default: BLA Options: T

MODULE TYPE	O12+/4201*	O12+/2101*
CHANNEL NUMBER	12	12
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP
RATED VOLTAGE	24 V DC / 48 V DC user selectable on channel basis by jumpers	110 V DC / 220 V DC user selectable on channel basis by jumpers
THERMAL WITHSTAND VOLTAGE	72 V	320 V
CLAMP VOLTAGE	falling 0.64 U _N rising 0.8 U _N	falling 0.64 U _N rising 0.8 U _N
GROUNDING GROUPS	4 × 3 common ground	4 × 3 common ground
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> T

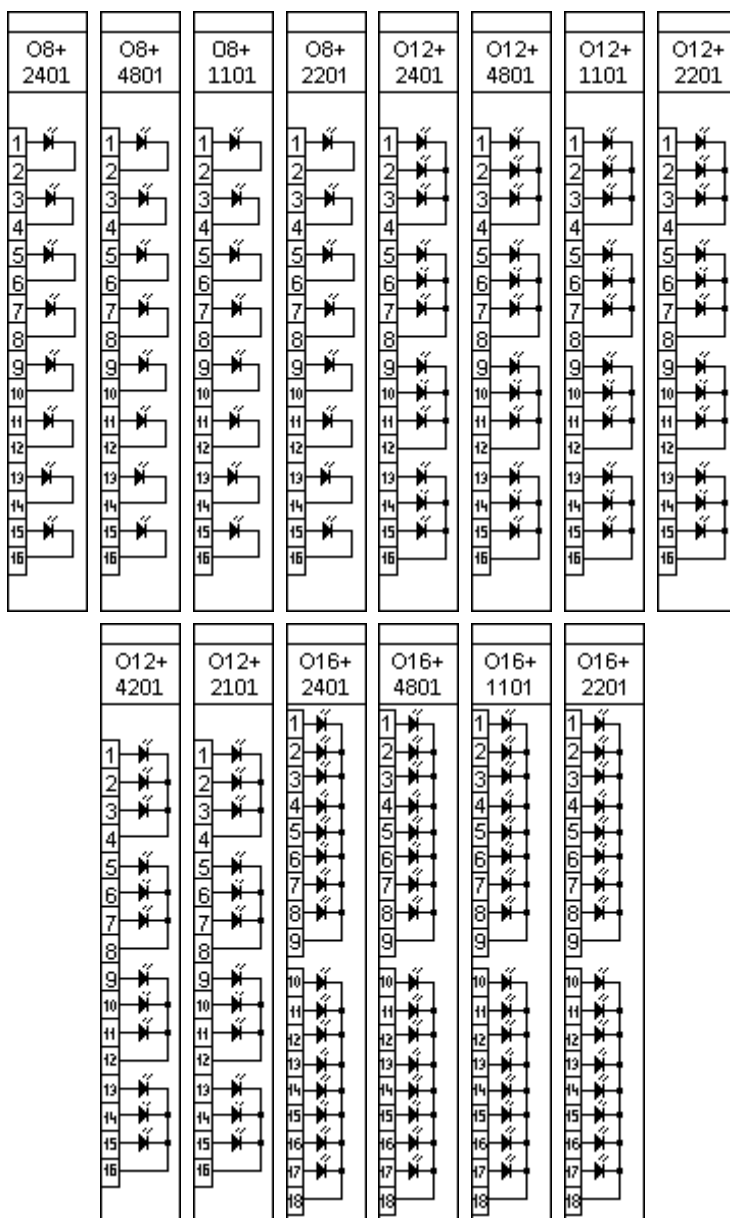
**O12+2101 and O12+4201 modules can be used only in demonstration applications! For further information see our [Product availability](#) chapter.*

MODULE TYPE	O16+/2401	O16+/4801	O16+/1101	O16+/2201
CHANNEL NUMBER	16	16	16	16
TIME SYNCHRONIZATION	-	-	-	-
RATED VOLTAGE	24 V	48 V	110 V	220 V
THERMAL WITHSTAND VOLTAGE	72 V	100 V	250 V	320 V
CLAMP VOLTAGE	falling 0.64 U _N rising 0.8 U _N	falling 0.64 U _N rising 0.8 U _N	falling 0.64 U _N rising 0.8 U _N	falling 0.64 U _N rising 0.8 U _N
GROUNDING GROUPS	2 × 8 common ground	2 × 8 common ground	2 × 8 common ground	2 × 8 common ground
CONNECTOR TYPE	<u>Default:</u> BL 3.5 <u>Options:</u> -	<u>Default:</u> BL 3.5 <u>Options:</u> -	<u>Default:</u> BL 3.5 <u>Options:</u> -	<u>Default:</u> BL 3.5 <u>Options:</u> -



Main features:

- Digitally filtered per channel
- Current drain:
 - max. 1.6 mA per channel at 220 V DC
 - max. 1.8 mA per channel at 110 V DC
 - max. 2 mA per channel at 48 V DC
 - max. 3 mA per channel at 24 V DC
- In such applications where the input voltage is 60 V the modules with 48 V rated voltage can be used.
- Input voltage type can be either DC or AC voltage. If AC voltage is used make sure that the type and the parameters of the binary inputs are configured properly in EuroCap tool.



Binary input modules

SIGNALING MODULE

The signaling module has 4, 8, 12 or 16 relay outputs with dry contacts.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

MODULE TYPE	R4+/01	R8+/00	R8+/80	R8+/C0
RATED VOLTAGE	250 V AC/DC	250 V AC/DC	250 V AC/DC	250 V AC/DC
CONTINUOUS CARRY	8 A	8 A	8 A	8 A
CONTACT VERSIONS	4 CO	8 NO	CH8 NC others NO	CH7 and CH8 NC others NO
GROUP ISOLATION	4 independent	8 independent	8 independent	8 independent
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> F	<u>Default:</u> BLA <u>Options:</u> F, T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T

MODULE TYPE	R8+/FF	R12+/0000	R12+/4000
RATED VOLTAGE	250 V AC/DC	250 V AC/DC	250 V AC/DC
CONTINUOUS CARRY	8 A	8 A	8 A
CONTACT VERSIONS	8 NC	12 NO	CH12 NC others NO
GROUP ISOLATION	8 independent	4 × 3 common	4 × 3 common
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> F, T	<u>Default:</u> BLA <u>Options:</u> F, T

MODULE TYPE	R16+/0000	R16+/8000	R16+/8080
RATED VOLTAGE	250 V AC/DC	250 V AC/DC	250 V AC/DC
CONTINUOUS CARRY	8 A	8 A	8 A
CONTACT VERSIONS	16 NO	CH16 NC others NO	CH16 and CH8 NC others NO
GROUP ISOLATION	2 × 8 common	2 × 8 common	2 × 8 common
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -

MODULE TYPE	R4S+/01*	R4S+/16*	R1T+/0001***
RATED VOLTAGE	250 V AC/DC	250 V AC/DC	320 V AC/DC
CONTINUOUS CARRY	8 A 120 mA**	120 mA	32 A
CONTACT VERSIONS	4 CO (1 SSR, 3 normal)	4 CO (4 SSR)	1 NO
GROUP ISOLATION	4 independent	4 independent	1 independent
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -

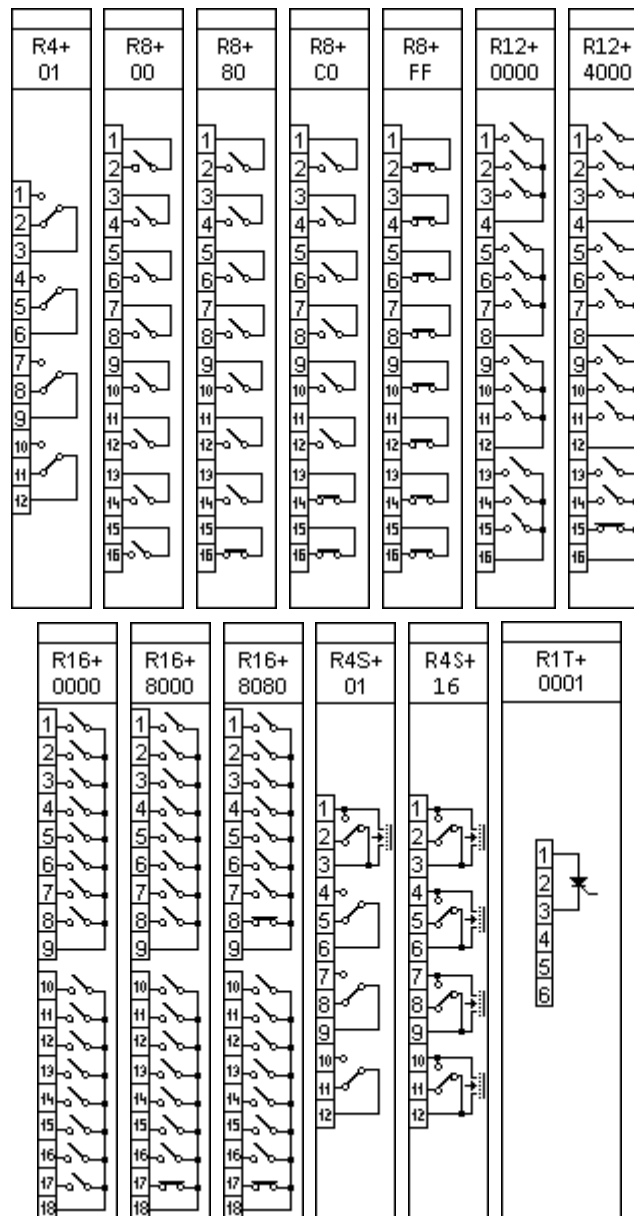
*Modules with **solid-state relays (SSR)**

**If the signaling is performed via the solid-state relay the continuous carry value is 120 mA.

*****Thyristor module.** Can be used only unipolarly. For further information see our [Product availability](#) chapter.

Main features (according to IEC 60255-1):

- Maximum switching voltage: 400 V AC
- Breaking capacity: (L/R=40 ms) at 220 V DC: 0.2 A, at 110 V DC: 0.3 A
- Breaking capacity max.: 2000 VA
- Short time carrying capacity: 1 s, 35 A
- Limiting making current, max. 4 s: 15 A (df = 10 %)
- Initial dielectric strength between open contacts, 1 min: 1000 V_{RMS}
- Mechanical endurance: 10 × 10⁶ cycles
- Circuit closing capability: typically 10 ms, maximally 22 ms, with SSR 0.5 ms.
- Bounce time: typically 6,5 ms, maximally 10 ms, with SSR 0.5 ms.
- Minimal switching requirement: 5 V
- The signaling is also performed via a solid-state relay (SSR) channel on R4S+01 and R4S+16 module



Signaling modules

TRIPPING MODULE

The tripping module is a proprietary and patented solution that facilitates direct control of a circuit breaker.

Connector types:

- The default and optionally available connector types are indicated for each module in the table below. See Chapter 0 for details about each type.

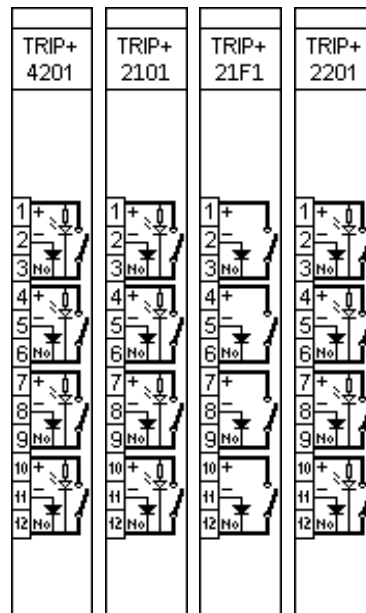
MODULE TYPE	TRIP+ /4201	TRIP+1101*	TRIP+ /2101	TRIP+ /21F1**	TRIP+ /2201
CHANNEL NUMBER	4	4	4	4	4
RATED VOLTAGE	24 V DC and 48 V DC	110 V DC	110 V DC	110 V DC	220 V DC
THERMAL WITHSTAND VOLTAGE	72 V DC	242 V DC	150 V DC	150 V DC	242 V DC
CONTINUOUS CARRY	8 A	8 A	8 A	8 A	8 A
MAKING CAPACITY	0.5 s, 30 A	0.5 s, 30 A	0.5 s, 30 A	0.5 s, 30 A	0.5 s, 30 A
BREAKING CAPACITY	L/R = 40 ms: 4 A DC	L/R = 40 ms: 4 A DC	L/R = 40 ms: 4 A DC	L/R = 40 ms: 4 A DC	L/R = 40 ms: 4 A DC
CONNECTOR TYPE	Default: BLA Options: F, T	Default: BLA Options: -	Default: BLA Options: F, T	Default: BLA Options: T	Default: BLA Options: T

***Obsolete module. These modules are not recommended for new designs!**

****Without trip circuit supervision.**

Main features:

- High-speed operation: with pre-trip 0.5 ms, without pre-trip typically 10 ms, maximally 22 ms.
- Trip circuit supervision for each trip contact, except TRIP+21F1
- With 2-wire wiring, the tripping output can be *dry* contact type, too



Tripping modules

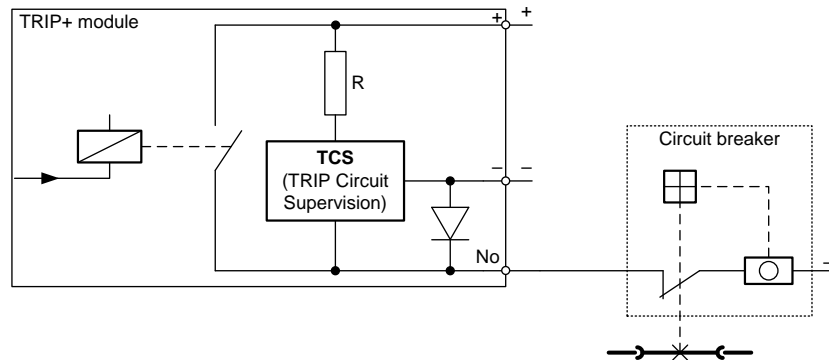
TRIP+ module wiring

The tripping module provides tripping circuit supervision function (TCS). The wiring of these modules can be 2-wire or 3-wire. (TCS function is active for all wiring methods.)

The voltage of the "No" contact is maximized at 15 V by a Zener-diode. Make sure that the voltage caused by the resistance of the circuit breaker and the injected current from the TRIP+ module does not reach 10 V.

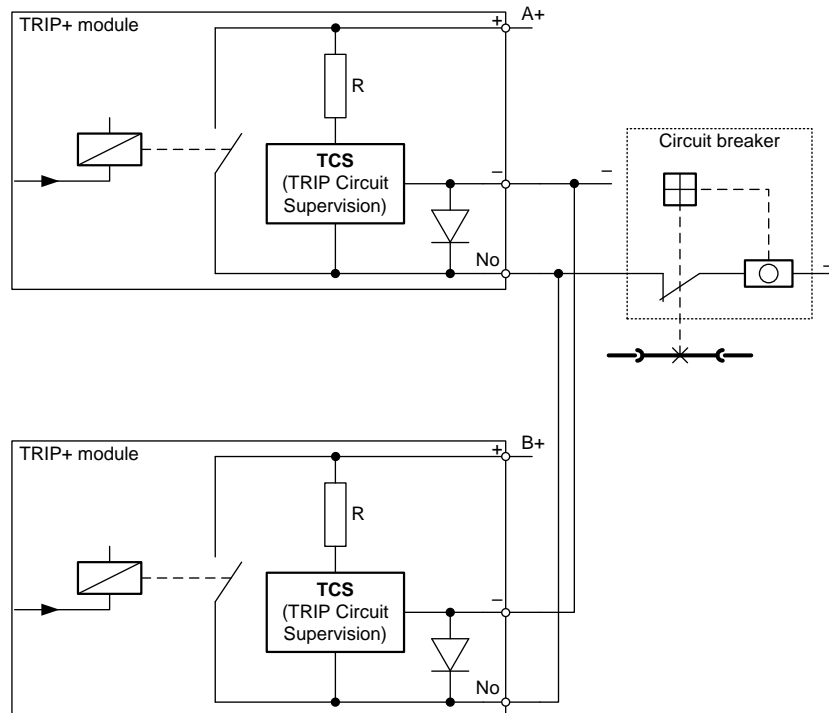
Our TRIP+ modules are improved to switch DC circuits. **Using reversed polarity or AC voltage can cause the damage of the internal circuits. Improper wiring might cause improper operation!**

3-wire TRIP+ wiring methods



3-wire TRIP+ wiring

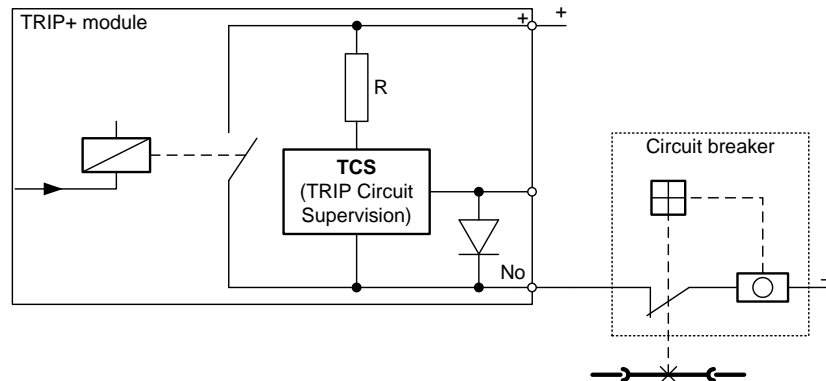
It is possible to use parallel connected TRIP+ modules. In this case the negative contacts must be common.



3-wire TRIP+ wiring using parallel connected TRIP+ modules

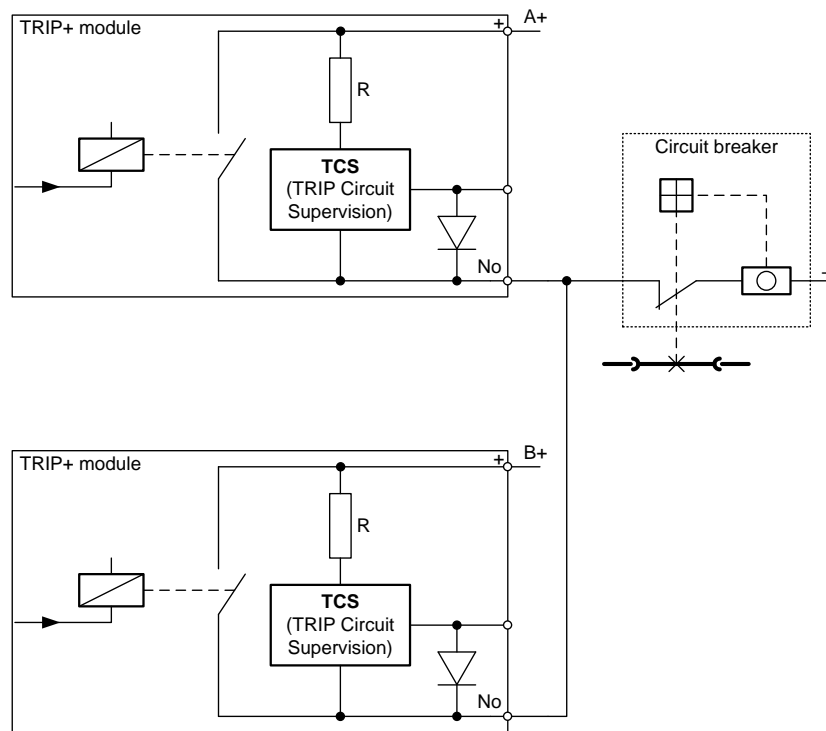
2-wire TRIP+ wiring methods

If necessary, the TRIP+ modules can be wired using only the "+" and the "No" contacts.



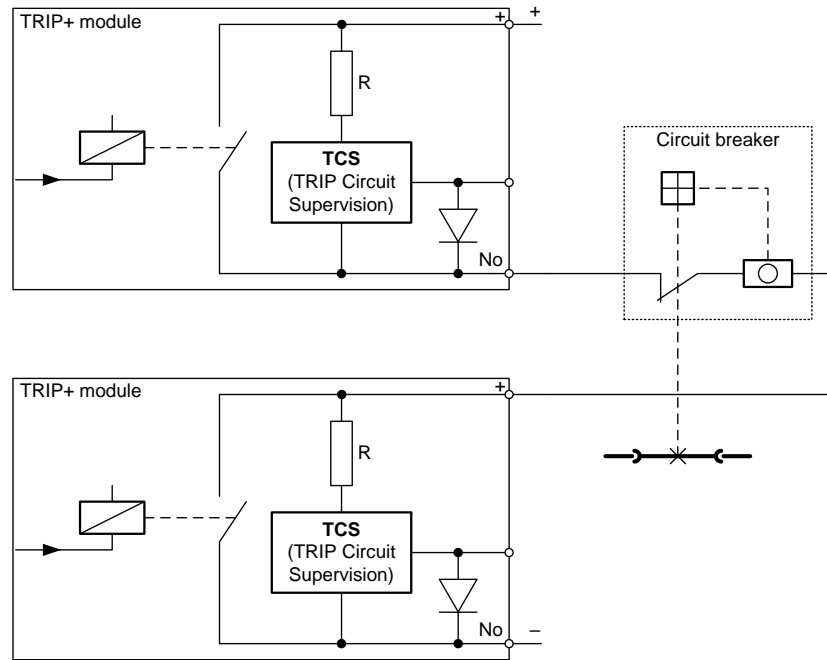
2-wire TRIP+ wiring

It is possible to use parallel connected TRIP+ modules.



2-wire TRIP+ wiring using parallel connected TRIP+ modules

If the circuit breaker needs two-pole switching TRIP+ modules can be connected series as you can see in Figure 9–6.



2-wire TRIP+ wiring using series connected TRIP+ modules

Trip Circuit Supervision (TCS)

Apart from the TRIP+/21F1, all TRIP modules have TCS.

The technical data of the TCS is shown here as well:

MODULE TYPE		TRIP+/4201	TRIP+/2101	TRIP+/2201
VALUE OF R RESISTOR ($\pm 10\%$)		10 k Ω	73 k Ω	130 k Ω
INJECTED CURRENT AT "NO" CONTACT		2.4 mA @ 24 V DC 4.8 mA @ 48 V DC	1.5 mA @ 110 V DC	1.7 mA @ 220 V DC
MAXIMUM RESISTANCE OF THE TRIP COIL	3-WIRE WIRING (MAX. 10 V)	11.8 k Ω @ 24 V DC 3.7 k Ω @ 48 V DC	9.7 k Ω @ 110 V DC 8.4 k Ω @ 125 V DC	8.1 k Ω @ 220 V DC
	3-WIRE WIRING WITH IN PARALLEL (MAX. 10 V)	5.9 k Ω @ 24 V DC 1.8 k Ω @ 48 V DC	4.8 k Ω @ 110 V DC 4.2 k Ω @ 125 V DC	4 k Ω @ 220 V DC
	2-WIRE METHOD (1 mA MIN. CURRENT)	14 k Ω @ 24 V DC 38 k Ω @ 48 V DC	37 k Ω @ 110 V DC 52 k Ω @ 125 V DC	90 k Ω @ 220 V DC

RTD INPUT MODULE

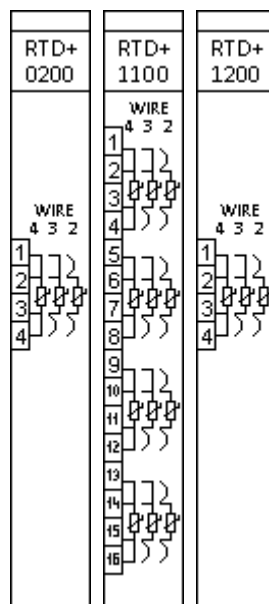
The RTD+1100 module is used to measure the temperature through the variation of resistance of temperature detectors. RTD+0200 and RTD+1200 are special modules for Petersen coil controllers (DRL) measuring the resistance of the potentiometer.

Connector types:

- The default and optionally available connector types are indicated for each module in the table below. See Chapter 0 for details about each type

MODULE TYPE	RTD+/0200*	RTD+/1100	RTD+/1200*
CHANNEL NUMBER	1	4	1
MEASUREMENT METHOD	3 wire configuration	2, 3 or 4 wire configuration	3 wire configuration
RELATIVE ACCURACY	$\pm 0.5 \% \pm 1$ digit	$\pm 0.5 \% \pm 1$ digit	$\pm 0.5 \% \pm 1$ digit
SENSOR TYPE	Service-Ohm	Pt100/Ni100 Ni120/Ni120US Pt250/Ni250 Pt1000/Ni1000 Cu10 Service-Ohm (60 Ω ... 1.6 k Ω)	Service-Ohm
MEASUREMENT RANGES	2 Ω ... 200 Ω	- 50 $^{\circ}\text{C}$ – +150 $^{\circ}\text{C}$	10 Ω ... 1000 Ω
CONNECTOR TYPE	Default: BLA Options: -	Default: BLA Options: T	Default: BLA Options: -
RECOMMENDED APPLICATION	Arc suppression coil controller	General resistance-based temperature measurement	Arc suppression coil controller

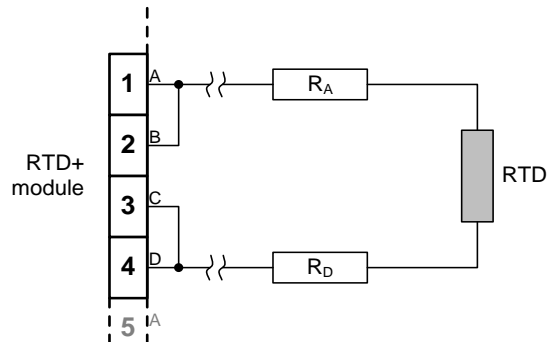
*Special module



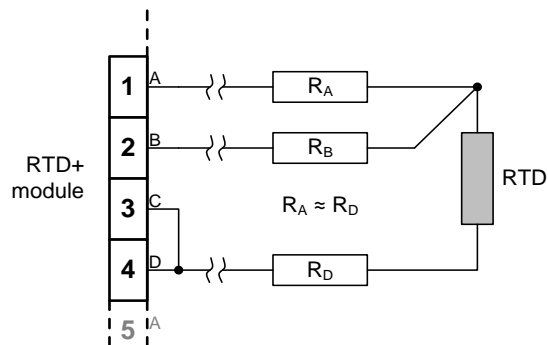
RTD input modules

RTD module wiring

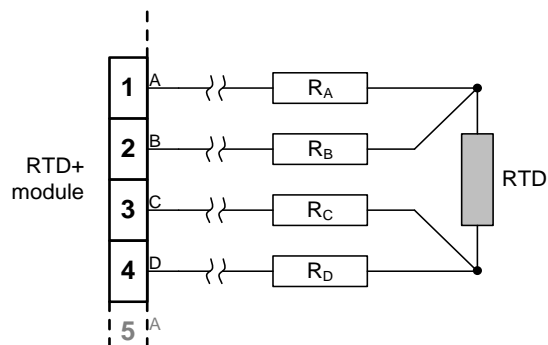
If 2-wire wiring is used you have to make sure that the value of R_A and R_D resistors are set correctly in the "parameters" menu of the web server.



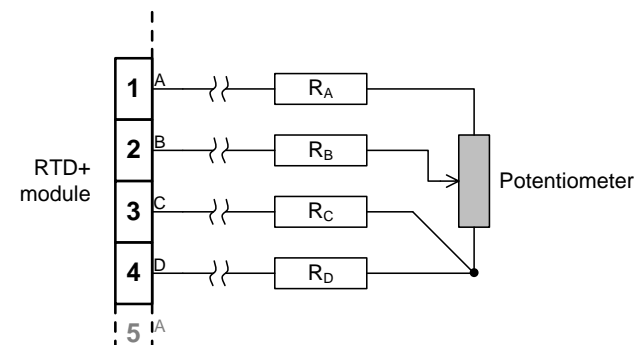
2-wire RTD wiring



3-wire RTD wiring



4-wire RTD wiring



4-wire RTD wiring of potentiometer

**ANALOG INPUT MODULE (AI)**

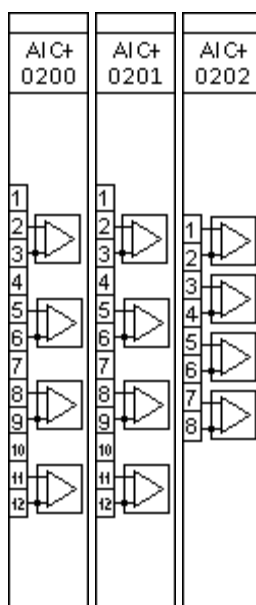
The analog input module accepts transducers current or voltage outputs. The AIC module can measure unipolar and bipolar current values in wide ranges.

Connector types:

- The default and optionally available connector types are indicated for each module in the table below. See Chapter 0 for details about each type.

MODULE TYPE	AIC+ /0200*	AIC+ /0201*	AIC+ /0202
CHANNEL NUMBER	4	4	4
MEASUREMENT METHOD	2 wire inputs	2 wire inputs with optional 12 V excitation	2 wire inputs
RELATIVE ACCURACY	$\pm 0.5 \% \pm 1$ digit	$\pm 0.5 \% \pm 1$ digit	$\pm 0.5 \% \pm 1$ digit
MEASUREMENT RANGES	$\pm 20 \text{ mA}$ (typical 0-20, 4-20 mA) $R_{\text{LOAD}} = 56 \Omega$	$\pm 20 \text{ mA}$ (typical 0-20, 4-20 mA) $R_{\text{LOAD}} = 56 \Omega$	$\pm 20 \text{ mA}$ (typical 0-20, 4-20 mA) $R_{\text{LOAD}} = 56 \Omega$
CONNECTOR TYPE	Default: BLA Options: -	Default: BLA Options: -	Default: BLA Options: F, T

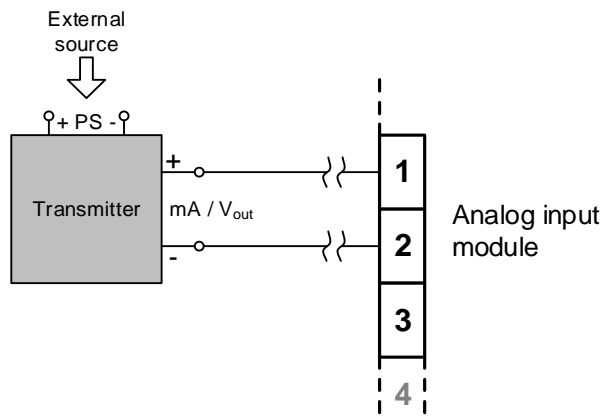
***Obsolete module. These modules are not recommended for new designs!**



Analog input modules

AI module wiring

The following wiring method can be applied.



AI wiring

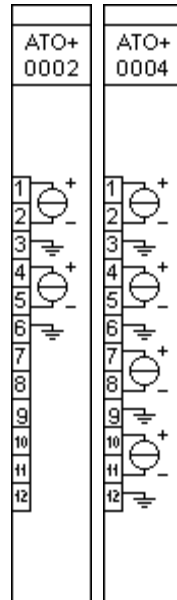
ANALOG OUTPUT MODULE (ATO)

The analog output module transmits current or voltage signals. The ATO module can be used in wide ranges in unipolar and bipolar mode.

Connector types:

- The default and optionally available connector types are indicated for each module in the table below. See Chapter 0 for details about each type.

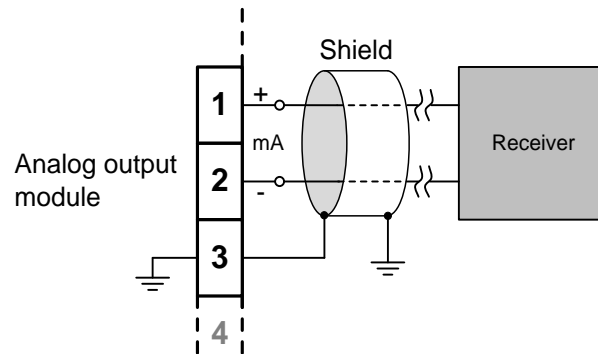
MODULE TYPE	ATO+/0002	ATO+/0004
CHANNEL NUMBER	2	4
OUTPUT MODE	2 wire output	2 wire output
MAXIMUM LOAD ($R_{\text{CABLE}} + R_{\text{RECEIVER}}$)	500 Ω	500 Ω
OUTPUT RANGES	± 20 mA 0 - 20 mA 4 - 20 mA	± 20 mA 0 - 20 mA 4 - 20 mA
CONNECTOR TYPE	Default: BLA Options: T	Default: BLA Options: -



Analog output modules

ATO module wiring

The analog output module should be connected according to the following wiring diagram.



Analog output module wiring diagram

SENSOR INPUT MODULE

The sensor modules receive low-level signals of current and voltage sensors (low-power instrument transformers).

Connector types:

- The default and optionally available connector types are indicated for each module in the table below. See Chapter 0 for details about each type.

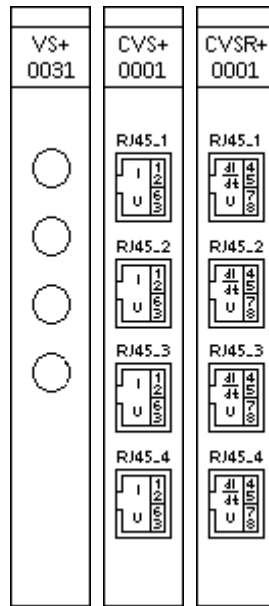
MODULE TYPE	CVS+/0001		CVSR+/0001		VS+/0031*
CHANNEL NUMBER	4 U	4 I	4 U	4 I	4 U
NOMINAL VALUES	3.25 V	0.225 V*	1.27 V	0.150 V**	3.25 V
CONTINUOUS VOLTAGE WITHSTAND	35 V DC		35 V DC		35 V DC
SHORT TIME OVERLOAD (1 s)	40 V AC / 56 V DC		40 V AC / 56 V DC		40 V AC / 56 V DC
MAX. MEASURED CURRENT ($\pm 10\%$)	1.8 U _N	50 I _N	2.1 U _N	50 I _N	1.6 U _N
RELATIVE ACCURACY	$\leq 0.5\%$ (0.1 U _N – 1.2 U _N)		$\leq 0.5\%$ (0.1 U _N – 1.2 U _N)		$\leq 0.5\%$ (0.1 U _N – 1.2 U _N)
FREQUENCY RANGE	DC – 1 kHz		DC – 1 kHz		DC – 1 kHz
INPUT RESISTANCE	200 k Ω $\pm 1\%$	21 k Ω $\pm 1\%$	10 M Ω $\pm 1\%$	1.1 M Ω $\pm 1\%$	200 k Ω $\pm 1\%$
INPUT CAPACITANCE	300 pF (1 kHz)	300 pF (1 kHz)	300 pF (1 kHz)	300 pF (1 kHz)	300 pF (1 kHz)
CONNECTOR TYPE	RJ45 – 8 pole, shielded connector, isolated shielding		RJ45 – 8 pole, shielded connector, grounded shielding		M8 3-pin connector Receptacle: Hirschmann ELST 3308 RV FM 8 05 Plug: Binder 768 99-3360-00 03

*Voltage proportional to current

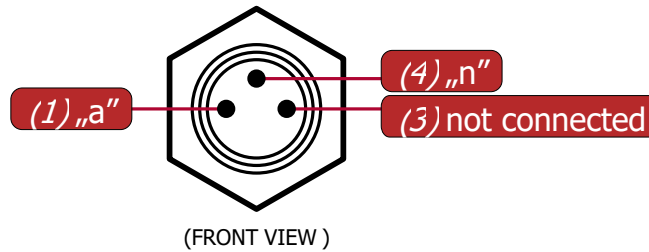
**Voltage proportional to current change (Rogowski coil)

*****Obsolete module. These modules are not recommended for new designs!**

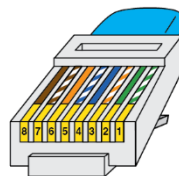
For more information about more available nominal values please contact our Application Team. (<https://www.microener.com>)



Voltage sensor modules

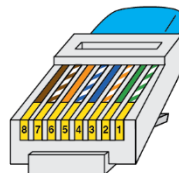


M8 connector pinout



- 1.: S1
- 2.: S2
- 3.: "a"
- 6.: "n"

CVS module connector pinout



- 4.: S1
- 5.: S2
- 8.: "n"
- 7.: "a"

CVSR module connector pinout

INJ MODULE

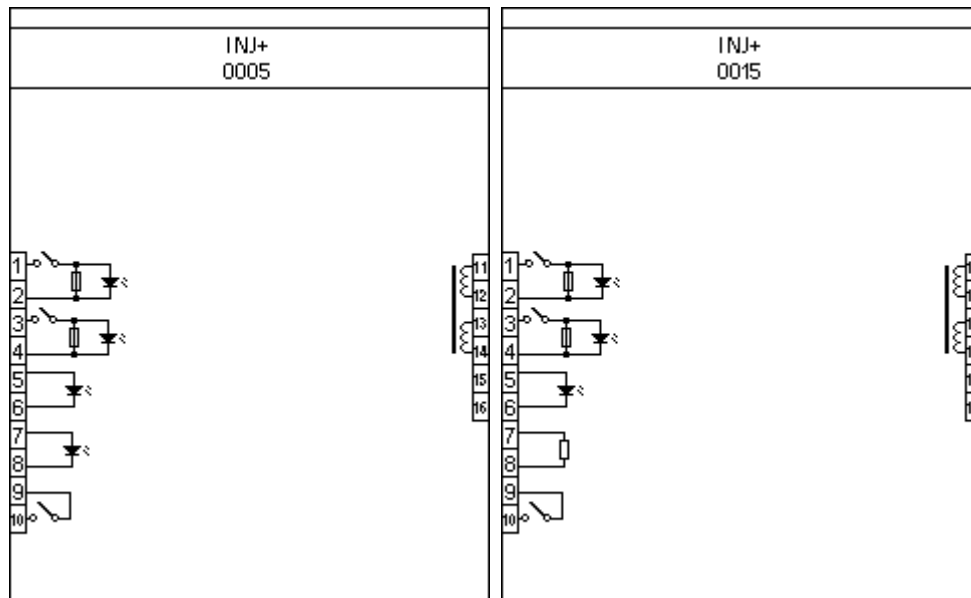
Complex module for controlling the Petersen coil, which contains an injector function for the measurements, an enabling and a blocking input, and a fault relay indicating if there is any fault in the injection circuit.

Connector types:

- The default and optionally available connector types are indicated for each module in the table below. See Chapter 0 for details about each type.

MODULE TYPE	INJ+/0005	INJ+/0015*
INJECTED CURRENT	2 A	4 A
ENABLING INPUT CLAMP VOLTAGE	85 V AC	Not available function
BLOCKING INPUT CLAMP VOLTAGE	200 V AC	200 V AC
ADDITIONAL RESISTANCE FOR VOLTAGE INPUT	Not available function	265 kΩ ± 1%
CONNECTOR TYPE	Default: STVS6, BLA10 Options: -	
RECOMMENDED APPLICATION	Arc suppression coil controller	Network compensation level measurement on resonant grounded networks

*Special module



INJ modules

GENERATOR PROTECTION MODULES

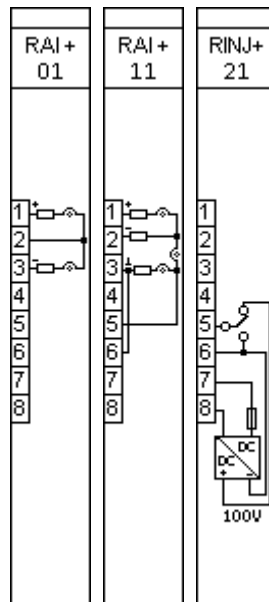
Special generator protection modules whose system measures and produces the necessary analog signals.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

MODULE TYPE	RAI+/01	RAI+/11	RINJ+/21
NOMINAL VOLTAGE	-	-	110 V / 220 V
INPUT VOLTAGE RANGE	-	-	88 - 264 V DC 80 - 250 V AC
OUTPUT VOLTAGE	-	-	100V DC \pm 2 %
MEASUREMENT RANGE	\pm 20 mA	\pm 20 mA	-
THERMAL WITHSTAND CONTINUOUS: 30 SEC:	15 mA 20 mA	10 mA 20 mA	20 mA
CONNECTOR TYPE	<u>Default:</u> STVS8 <u>Options:</u> -	<u>Default:</u> STVS8 <u>Options:</u> T*	<u>Default:</u> STVS8 <u>Options:</u> T*
RECOMMENDED APPLICATION	Rotor earth-fault protection of middle-grounded rotors	Rotor earth-fault protection of ungrounded (isolated) rotors	Rotor earth-fault protection of ungrounded (isolated) rotors

*By choosing this option, the connector remains the same, only the handle is changed



Generator protection modules

Auxiliary boxes for rotor earth fault protection

These DIN-rail mounted external boxes serve as couplings between the rotor (exciter circuit) of the generator and the corresponding RAI module of the protection device.

Note: the data about the resistances and capacitors provided here does not tell the actual time constants of the measured values, as those can be determined on-site only, when the rotor earth fault protection is being tested on the actual generator itself.

MODULE TYPE	RAI+01 BOX	RAI+11 BOX BASE	RAI+11 BOX EXTENSION*
MAXIMUM INPUT VOLTAGE	200 V, 300 V, 400 V, 500 V**	600 V	1200 V
SERIES RESISTANCE ON SIDES	10 kΩ, 15 kΩ, 20 kΩ, 25 kΩ**	35 kΩ	30 kΩ
FILTER CAPACITORS	4x10 μF	2x1 μF	-
CONNECTOR TYPE	Default: STVS6 Options: -	Default: STVS6 Options: -	Default: STVS6 Options: -
RECOMMENDED APPLICATION	Middle-grounded rotors	Ungrounded (isolated) rotors	Ungrounded (isolated) rotors

*This extension module can only be used together with RAI+11 BOX BASE module

**According to the chosen wiring

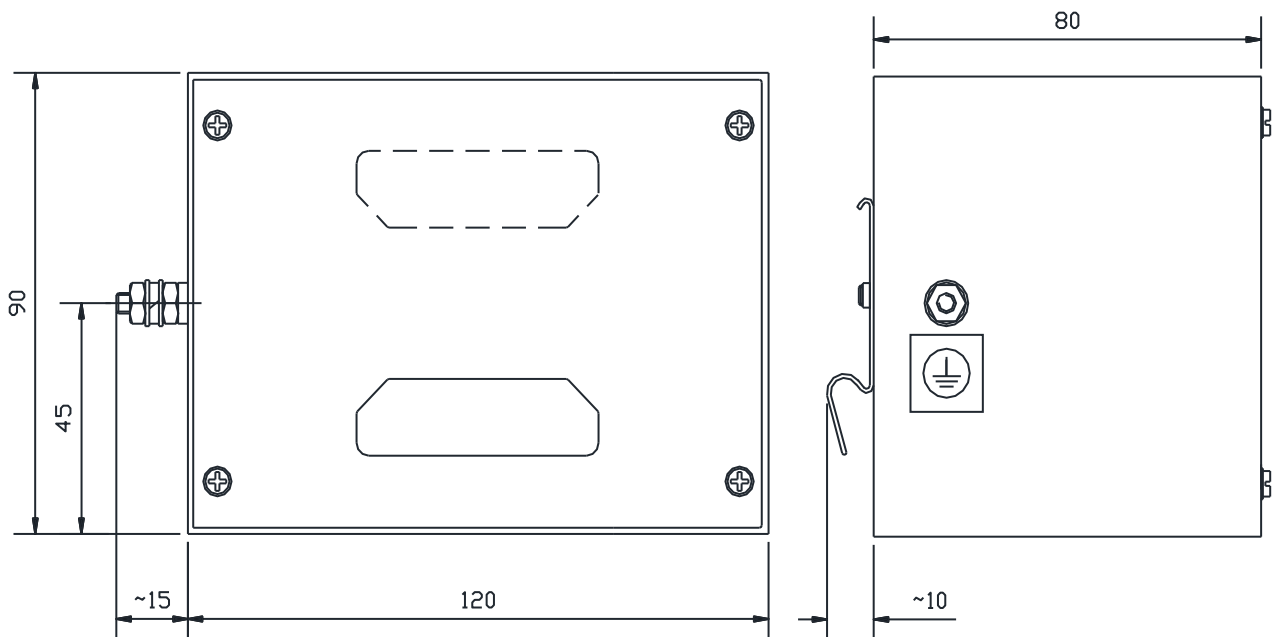
Use of auxiliary boxes

- Ungrounded (isolated) rotors:**

If the excitation voltage is lower than 600 V, then it is enough to use the RAI+11 BOX BASE auxiliary box. If the excitation voltage is higher than 600 V, the RAI+11 BOX EXTENSION auxiliary box shall be used *additionally*, so the protection can connect to up to 1200 V excitation voltage.

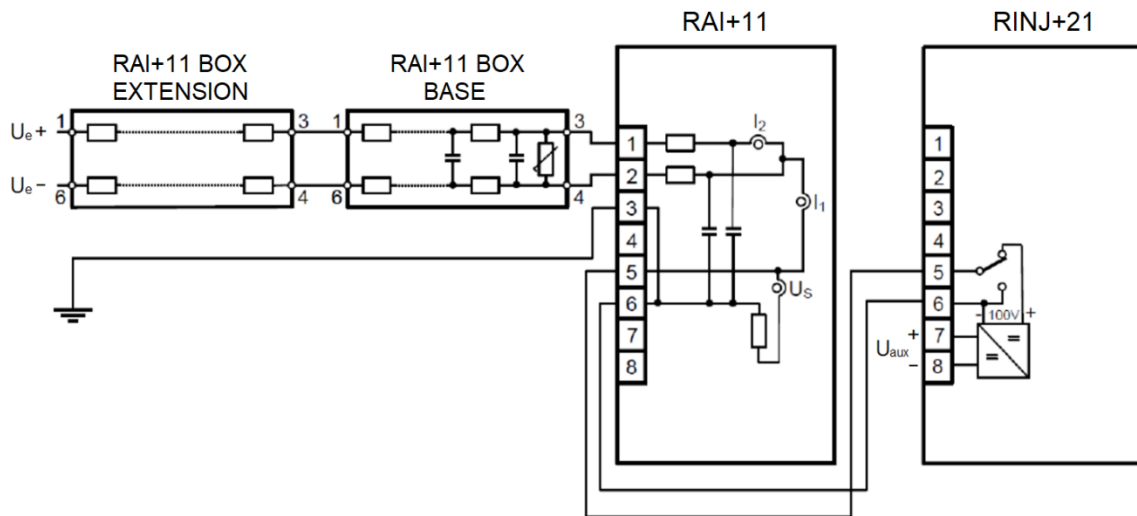
- Middle-grounded rotors**

Front drawings near the connectors on the box itself indicate the available maximum voltages. The choice from these shall be made according to the excitation voltage. Wiring shall be done according to the chosen voltage.

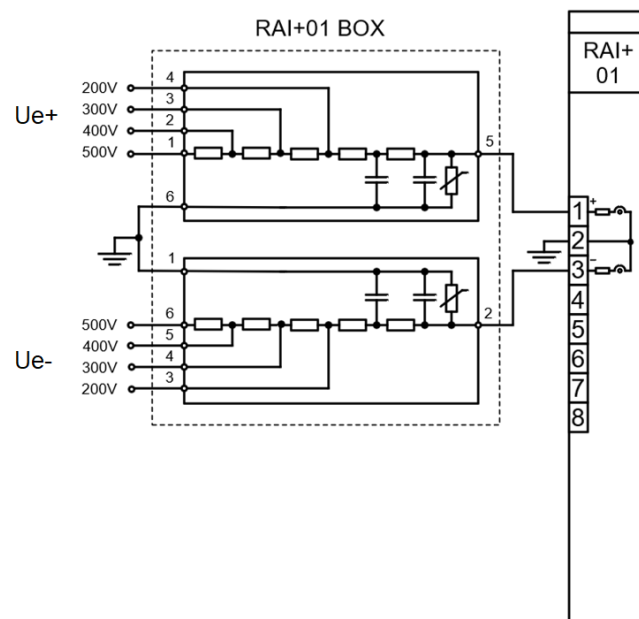


Size of the auxiliary boxes

Wiring of the rotor earth fault protection modules



Wiring for ungrounded (isolated) rotors



Wiring for middle-grounded rotors

POWER SUPPLY MODULE

The power supply module converts primary AC and/or DC voltage to required system voltages. In most applications, one power supply module is sufficient to provide the required power to the system. Redundant power supply modules extend system availability in case of the outage of any power source.

IMPORTANT

Depending on the hardware configuration, the power consumption of the devices can be different. We reserve the right to make the decision about which PS+ module must be used.

For most applications where the power consumption does not reach 30 W we use one of our 4 HP wide PS+ modules.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

MODULE TYPE	PS+ /4201 (4 HP wide)	PS+ /2101 (4 HP wide)
NOMINAL VOLTAGE	24 V DC / 48 V DC / 60 V DC	110 V DC / 220 V DC
INPUT VOLTAGE RANGE	19.2 - 72 V DC	88 - 264 V DC 80 - 250 V AC
NOMINAL POWER	20 W	20 W
INPUT VOLTAGE INTERRUPTION TIME (AT NOMINAL LOAD)	50 ms at nominal input voltages min. 40 ms in the specified input voltage range	min. 100 ms in the specified input voltage range
INTERNAL FUSE	3.15A/250V	3.15A/250V
CONNECTOR TYPE	Default: BLA Options: T	Default: BLA Options: F, T

IMPORTANT

In case of the power consumption of the device reach or exceed 20 W we select from the following 8 HP wide modules.

MODULE TYPE	PS+ /1301	PS+ /1303**	PS+ /2301	PS+ /2303**	PS+ /1030*
NOMINAL VOLTAGE	110 V DC	110 V DC	220 V DC	220 V DC	110 V DC / 220 V DC
INPUT VOLTAGE RANGE	88 - 132 V DC 85 - 130 V AC	88 - 150 V DC 85 - 130 V AC	176 - 264 V DC 160 - 250 V AC	176 - 264 V DC 160 - 250 V AC	88 - 264 V DC 85 - 250 V AC
NOMINAL POWER	30 W	30 W	30 W	30 W	25 W
INPUT VOLTAGE INTERRUPTION TIME (AT NOMINAL LOAD)	100 ms at nominal input voltages min. 50 ms in the specified input voltage range	100 ms at nominal input voltages min. 50 ms in the specified input voltage range	100 ms at nominal input voltages min. 50 ms in the specified input voltage range	100 ms at nominal input voltages min. 50 ms in the specified input voltage range	100 ms at nominal input voltages min. 20 ms in the specified input voltage range
INTERNAL FUSE	2.5A/250V	2.5A/250V	2.5A/250V	2.5A/250V	2.5A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> F, T

*Special module, available only in custom configurations.

**Can be connected in parallel.

MODULE TYPE	PS+ /1060*	PS+ /1601	PS+ /1602*	PS+ /2601	PS+ /4301***
NOMINAL VOLTAGE	110 V DC / 220 V DC	110 V DC	110 V DC	220 V DC	48 V DC
INPUT VOLTAGE RANGE	88 - 264 V DC	88 - 132 V DC 95 - 130 V AC	88 - 132 V DC 95 - 130 V AC	176 - 264 V DC 160 - 250 V AC	38.4 - 57.6 V DC
NOMINAL POWER	60 W	60 W	60 W	60 W	25 W
INPUT VOLTAGE INTERRUPTION TIME (AT NOMINAL LOAD)	100 ms at nominal input voltages min. 20 ms in the specified input voltage range	100 ms at nominal input voltages min. 50 ms in the specified input voltage range	100 ms at nominal input voltages min. 50 ms in the specified input voltage range	100 ms at nominal input voltages min. 50 ms in the specified input voltage range	40 ms at nominal input voltages min. 20 ms in the specified input voltage range
INTERNAL FUSE	3.15A/250V	2.5A/250V	2.5A/250V	2.5A/250V	3.15A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> F, T	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> F	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -

*Special module, available only in custom configurations. PS+1602 supports **auxiliary voltage measurement**. The module is calibrated to DC voltage measurement.

***Obsolete module. These modules are not recommended for new designs!

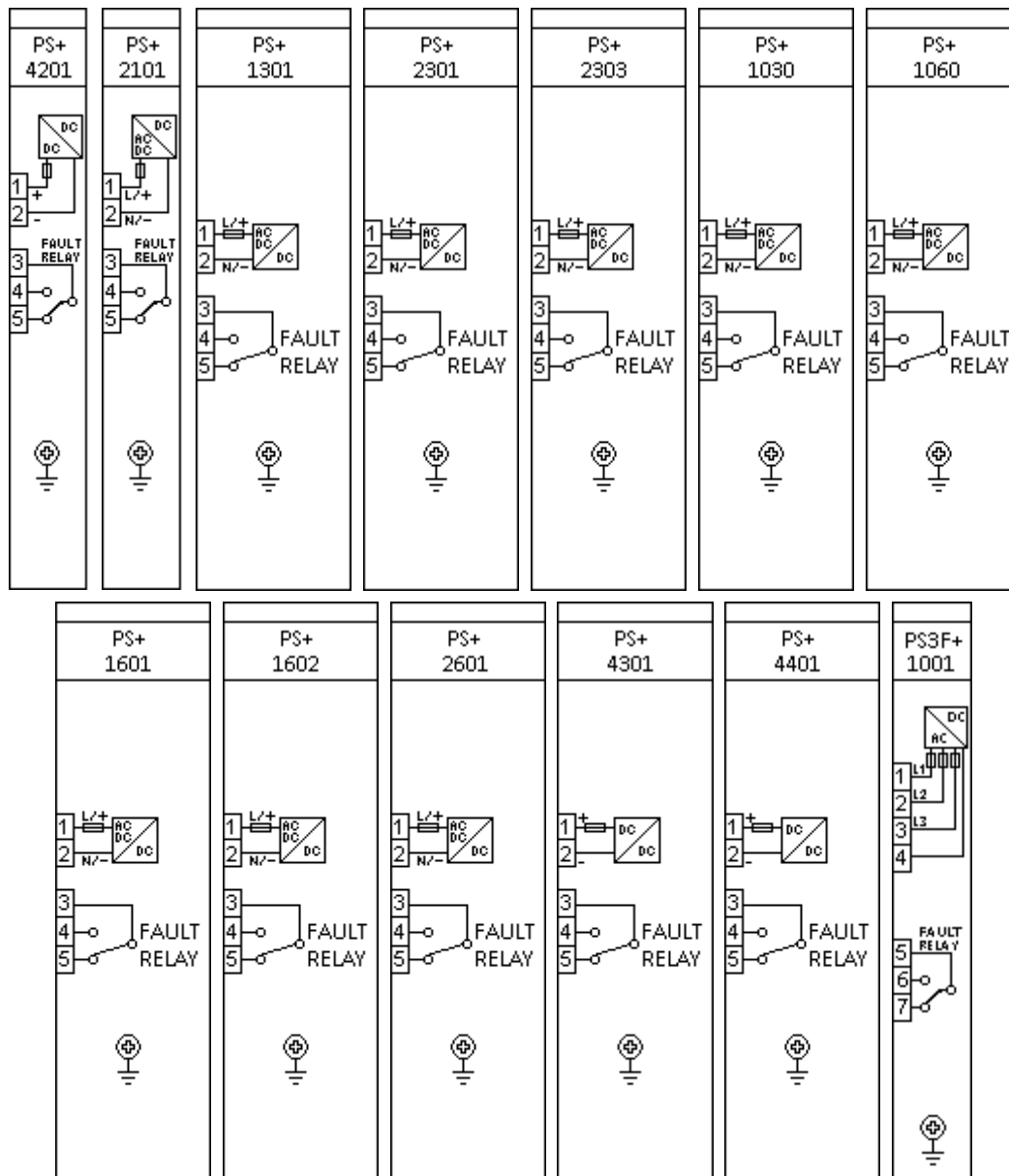
MODULE TYPE	PS+ /4401**	PS3F+ /1001*
NOMINAL VOLTAGE	48 V DC / 60 V DC	3x100 V AC (line voltage)
INPUT VOLTAGE RANGE	38.4 - 72 V DC	80 - 120 V AC
NOMINAL POWER	30 W	20 W
INPUT VOLTAGE INTERRUPTION TIME (AT NOMINAL LOAD)	40 ms at nominal input voltages min. 20 ms in the specified input voltage range	100 ms at nominal input voltages min. 50 ms in the specified input voltage range
INTERNAL FUSE	3.15A/250V	2.5A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> F	<u>Default:</u> BLA <u>Options:</u> -

***Special module.** At least 2 healthy phase voltage needed for the operation of the PS3F+1001 module. LEDs on the front of the module indicates the presence of healthy phase voltages. For the correct internal signals connect the common point of the supplying 3 phase voltage to the 4th connector ("N").

****Can be connected in parallel.**

Main features:

- Fault relay contacts (NC and NO): device fault contact and also assignable to user functions. All the three relay contact points are accessible to users.
- Redundant applications (nominal power and reliability can be increased by using parallel power supplies)
- On-board self-supervisory circuits: temperature and voltage monitors
- Short-circuit-protected outputs
- Efficiency: > 70 %, power consumption = nominal power / efficiency
- Passive heatsink
- Early power failure indication signals to the CPU for the possibility of power outage, thus the CPU has enough time to save the necessary data to non-volatile memory
- Inrush current (until 0.1 s): < 10 A for all types excluding PS+4401 which has < 21 A inrush current.
- Common features for internal fuses:
 - 5 mm x 20 mm (0.20" x 0.79")
 - TT characteristics (very inverse time-lag)
 - 35 A @ 250 V AC rated breaking capacity
- Recommended external protection: miniature circuit breaker, 6 A (C char.)



Power supply modules

SAMPLING SYNCHRONIZATION MODULE

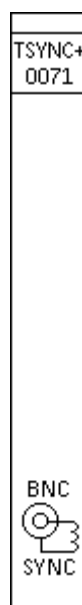
The IED sampling system is synchronized via this module to an external source (IRIG-B) in PMU (Phasor Measurement Unit) applications. The PLL of the module handles the setting of the phase and frequency if valid IRIG-B signal is received. Note that the sampling signal is generated even if the IRIG-B signal is not present, however in that case, it runs independently.

MODULE TYPE	TSYNC+ /0071
IRIG-B TYPE	B000 (unmodulated)
INPUT TYPE	BNC (coaxial)
SIGNAL THRESHOLD	5 VDC CMOS max. 5.5 VDC
MAX. CABLE LENGTH	50 m
CLAMP VOLTAGES	falling 1.7 VDC rising 3.1 VDC
SAMPLING ACCURACY*	< 100 ns
IRIG SYNCH. TIME	max. 1 minute
HOLDOVER TIME**	30 s
SAMPLING FREQUENCY	2 kHz @ 50 Hz 2.4 kHz @ 60 Hz
SAMPLING ACCURACY IN INDEPENDENT MODE***	< 1 ppm

*max. time difference between synchronized systems connecting to different GNSS (e.g. GPS)

**the sampling accuracy stays below the given value during this time if the IRIG-B signal is lost

***the accuracy of the 2/2.4 kHz sampling signal if an IRIG-B signal is not present



Sampling synchronization module

MIXED FUNCTION MODULES
PSTP+ module
IMPORTANT

PSTP+ modules can be used only if the power consumption of the device does not reach 20 W and maximum 2 TRIP contacts are needed. If the application does not meet any of these two requirements it is not allowed to use these cards. In this case separate PS+ and TRIP+ modules must be used.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

Note for the following tables:

- **Thermal withstand voltage:** continuous with 60 % of the input channels are energized.

MODULE TYPE	PSTP+ /2101	PSTP+ /2102*	PSTP+ /2131**
	POWER SUPPLY CHARACTERISTICS		
NOMINAL VOLTAGE	110 V / 220 V	110 V / 220 V	110 V / 220 V
INPUT VOLTAGE RANGE	88 - 264 V DC 80 - 250 V AC	88 - 264 V DC 80 - 250 V AC	88 - 264 V DC 80 - 250 V AC
NOMINAL POWER	20 W	20 W	20 W
INPUT VOLTAGE INTERRUPTION TIME (AT NOMINAL LOAD)	min. 100 ms in the specified input voltage range	min. 100 ms in the specified input voltage range	min. 100 ms in the specified input voltage range
INTERNAL FUSE	3.15A/250V	3.15A/250V	3.15A/250V
CONNECTOR TYPE	Default: BLA Options: F, T	Default: BLA Options: F, T	Default: BLA Options: T
	TRIPPING CHARACTERISTICS		
CHANNEL NUMBER	2	2	2
RATED VOLTAGE	110 V DC and 220 V DC or dry contacts	110 V DC and 220 V DC or dry contacts	110 V DC and 220 V DC or dry contacts
THERMAL VOLTAGE WITHSTAND	242 V DC	242 V DC	242 V DC
CONTINUOUS CARRY	8 A	8 A	8 A
MAKING CAPACITY	0.5 s, 30 A	0.5 s, 30 A	0.5 s, 30 A
BREAKING CAPACITY	L/R = 40 ms: 4 A DC	L/R = 40 ms: 4 A DC	L/R = 40 ms: 4 A DC
CONNECTOR TYPE	Default: BLA Options: F, T	Default: BLA Options: F, T	Default: BLA Options: T

*Special module that supports **auxiliary voltage measurement**. The module is calibrated to DC voltage measurement.

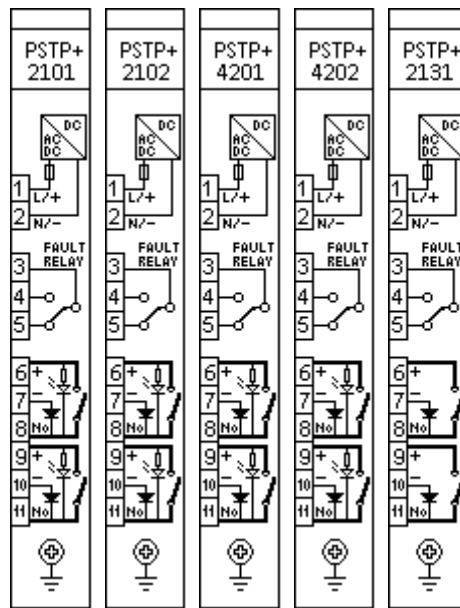
**Without trip circuit supervision

MODULE TYPE	PSTP+/4201	PSTP+/4202*
	POWER SUPPLY CHARACTERISTICS	
NOMINAL VOLTAGE	24 V / 48 V / 60 V	24 V / 48 V / 60 V
INPUT VOLTAGE RANGE	19.2 - 72 V DC	19.2 - 72 V DC
NOMINAL POWER	20 W	20 W
INPUT VOLTAGE INTERRUPTION TIME (AT NOMINAL LOAD)	50 ms at nominal input voltages min. 40 ms in the specified input voltage range	50 ms at nominal input voltages min. 40 ms in the specified input voltage range
INTERNAL FUSE	3.15A/250V	3.15A/250V
CONNECTOR TYPE	Default: BLA Options: T	Default: BLA Options: T
	TRIPPING CHARACTERISTICS	
CHANNEL NUMBER	2	2
RATED VOLTAGE	24 V DC and 48 V DC or dry contacts	24 V DC and 48 V DC or dry contacts
THERMAL WITHSTAND VOLTAGE	72 V DC	72 V DC
CONTINUOUS CARRY	8 A	8 A
MAKING CAPACITY	0.5 s, 30 A	0.5 s, 30 A
BREAKING CAPACITY	L/R = 40 ms: 4 A DC	L/R = 40 ms: 4 A DC
CONNECTOR TYPE	Default: BLA Options: T	Default: BLA Options: T

***Special module** that supports **auxiliary voltage measurement**. The module is calibrated to DC voltage measurement.

Main features:

- High-speed operation: with pre-trip 0.5 ms, without pre-trip typically 10 ms, maximally 22 ms.
- Trip circuit supervision for each trip contact
- 1 unit wide (4 HP) modules
- Inrush current (until 0.1 s): < 10 A
- Common features for internal fuses:
 - 5 mm x 20 mm (0.20" x 0.79")
 - TT characteristics (very inverse time-lag)
 - 35 A @ 250 V AC rated breaking capacity
- Recommended external protection: miniature circuit breaker, 6 A (C char.)



Power supply with 2 Ch. TRIP modules

Trip Circuit Supervision (TCS) in PSTP modules

Apart from the PSTP+/2131, all PSTP modules have TCS.

The technical data of the TCS in PSTP modules:

MODULE TYPE		PSTP+/4201 PSTP+/4202	PSTP+/2101 PSTP+/2102
MAXIMUM RESISTANCE OF THE TRIP COIL	INJECTED CURRENT AT "NO" CONTACT	1.5 mA	1.5 mA
	3-WIRE WIRING (1 mA CURRENT)	8 kΩ (max. 8 V)	13 kΩ (max. 13 V)
	3-WIRE WIRING IN PARALLEL	4 kΩ (max. 8 V)	6.5 kΩ (max. 13 V)
	2-WIRE METHOD (1 mA MIN. CURRENT)	24 kΩ @ 24 V DC 48 kΩ @ 48 V DC 60 kΩ @ 60 V DC	110 kΩ @ 110 V DC 220 kΩ @ 220 V DC

PSR2+ module
IMPORTANT

PSR2+ modules can be used only if the power consumption of the device does not reach 20 W and maximum 2 contacts are needed. If the application does not meet any of these two requirements it is not allowed to use these cards. In this case separate PS+ and TRIP+ modules must be used.

Connector types:

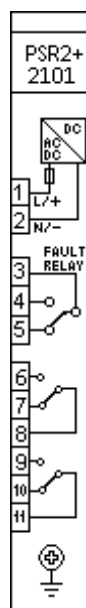
- The default and optionally available connector types are indicated for each module in the table below. See Chapter 0 for details about each type.

MODULE TYPE	PSR2+ / 2101
POWER SUPPLY CHARACTERISTICS	
NOMINAL VOLTAGE	110 V / 220 V
INPUT VOLTAGE RANGE	88 - 264 V DC 80 - 250 V AC
NOMINAL POWER	20 W
INPUT VOLTAGE INTERRUPTION TIME (AT NOMINAL LOAD)	min. 100 ms in the specified input voltage range
INTERNAL FUSE	3.15A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T
SIGNALING RELAY CHARACTERISTICS	
CHANNEL NUMBER	2
RATED VOLTAGE	250 V AC/DC
CONTINUOUS CARRY	8 A
MAKING CAPACITY	0.5 s, 30 A
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T



Main features (according to IEC 60255-26):

- Maximum switching voltage: 400 V AC
- Breaking capacity: (L/R=40 ms) at 220 V DC: 0.2 A, at 110 V DC: 0.3 A
- Breaking capacity max.: 2000 VA
- Short time carrying capacity: 1 s, 35 A
- Limiting making current, max. 4 s: 15 A (df = 10 %)
- Initial dielectric strength between open contacts, 1 min: 1000 V_{RMS}
- Mechanical endurance: 10×10^6 cycles
- Circuit closing capability: typically 10 ms, maximally 22 ms.
- Bounce time: typically 6,5 ms, maximally 10 ms.
- Minimal switching requirement: 5 V



Power supply with 2 Ch. signaling modules

O6R5+ module

The O6R5+ module contains 6 binary input channels in one grounding group, and 5 relay outputs with 2 × 2 NO contacts and one CO contact.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

Notes for the following table:

- **Thermal withstand voltage:** continuous with 60 % of the input channels are energized.
- **Clamp voltage:** these are the guaranteed values; the actual ones might differ from those provided here (falling and rising around 0.66 U_N and 0.77 U_N , respectively)

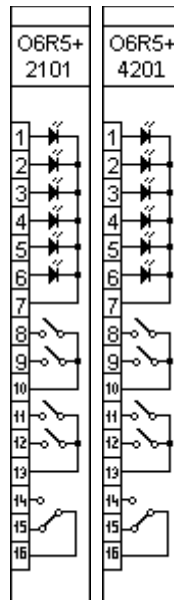
MODULE TYPE	O6R5+ /2101	O6R5+ /4201
BINARY INPUT CHARACTERISTICS		
CHANNEL NUMBER	6	6
RATED VOLTAGE	110 V / 220 V user selectable on channel basis by jumpers	24 V / 48 V user selectable on channel basis by jumpers
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP
THERMAL WITHSTAND VOLTAGE	320 V	72 V
CLAMP VOLTAGE	falling 0.64 U_N rising 0.8 U_N	falling 0.64 U_N rising 0.8 U_N
GROUNDING GROUPS	1 × 6 common ground	1 × 6 common ground
RELAY OUTPUT CHARACTERISTICS		
RATED VOLTAGE	250 V AC/DC	250 V AC/DC
CONTINUOUS CARRY	8 A	8 A
CONTACT VERSIONS	4 NO, 1 CO	4 NO, 1 CO
GROUP ISOLATION	2 × 2 common, 1 independent	2 × 2 common, 1 independent
CONNECTOR TYPE FOR BOTH BINARY INPUT AND RELAY OUTPUT	Default: BLA Options: T	Default: BLA Options: T

Main features for binary inputs:

- Digitally filtered per channel
- Current drain:
 - max. 1.6 mA per channel at 220 V DC
 - max. 1.8 mA per channel at 110 V DC
 - max. 2 mA per channel at 48 V DC
 - max. 3 mA per channel at 24 V DC
- In such applications where the input voltage is 60 V the modules with 48 V rated voltage can be used.
- Input voltage type can be either DC or AC voltage. If AC voltage is used make sure that the type and the parameters of the binary inputs are configured properly in EuroCap tool.

Main features for signaling outputs:

- Maximum switching voltage: 400 V AC
- Breaking capacity, (L/R=40 ms) at 220 V DC: 0.1 A, at 110 V DC: 0.2 A
- Breaking capacity max.: 2000 VA
- Short time carrying capacity: 1 s, 35 A
- Limiting making current, max. 4 s: 15 A (df = 10 %)
- Initial dielectric strength between open contacts, 1 min: 1000 VRMS
- Circuit closing capability: typically 10 ms, maximally 22 ms.
- Bounce time: typically 6,5 ms, maximally 10 ms.
- Mechanical endurance: 10×10^6 cycles
- Circuit closing capability



Binary input/output modules

Binary input module with time synchronization

The inputs are galvanically isolated and the module converts high-voltage signals to the voltage level and format of the internal circuits. This module is also used as an external IRIG-B synchronization (**IRIG-B000, unmodulated**), PPM or PPS input. Dedicated synchronization input is used for this purpose.

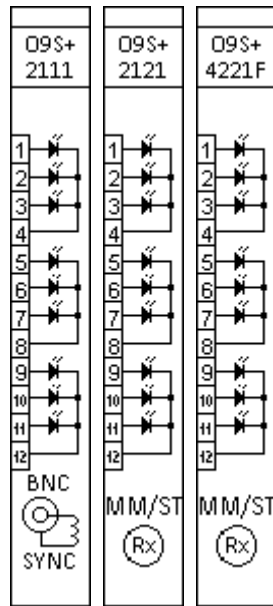
Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

Notes for the following table:

- **Thermal withstand voltage:** continuous with 60 % of the input channels are energized.
- **Clamp voltage:** these are the guaranteed values; the actual ones might differ from those provided here (falling and rising around $0.66 U_N$ and $0.77 U_N$, respectively)

MODULE TYPE	09S+/2111	09S+/2121	09S+/4221
CHANNEL NUMBER	9	9	9
SYNCHRON CHANNEL TYPE AND NUMBER	1 isolated BNC connector	1 850 nm multimode fiber with ST connector	1 850 nm multimode fiber with ST connector
RATED VOLTAGE	110 V DC / 220 V DC user selectable by jumpers	110 V DC / 220 V DC user selectable by jumpers	24 V DC / 48 V DC user selectable by jumpers
THERMAL WITHSTAND VOLTAGE	320 V	320 V	72 V
WITHSTAND VOLTAGE FOR SYNC. INPUT	35 V _{PEAK}	-	-
CLAMP VOLTAGE	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$
GROUNDING GROUPS	9 (3 × 3 common ground)	9 (3 × 3 common ground)	9 (3 × 3 common ground)
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> F, T	<u>Default:</u> - <u>Options:</u> F



Binary input modules with time synchronization

Externally driven trip module

The R4MC+01 is a special TRIP module, which can be operated from the connector side. It also has two diode inputs with cathodes which are connected and led to the connector side.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 0 for details about each type.

Module type	R4MC+ /01*
CHANNEL NUMBER	2
RATED VOLTAGE	110 V DC
THERMAL WITHSTAND VOLTAGE	132 V DC
CONTINUOUS CARRY	8 A
MAKING CAPACITY	0.5 s, 30 A
BREAKING CAPACITY	L/R = 40 ms: 4 A DC
DIODE PROPERTIES	1 A, 1000 V DC
CONNECTOR TYPE	Default: BLA Options: F

*Special module



Externally driven TRIP module

**GENERAL DATA**

- Storage temperature: - 40 °C ... + 70 °C
- Operation temperature: - 20 °C ... + 55 °C
- Humidity: 10 % ... 93 %
- Altitude: up to 2000 m
- Atmospheric pressure: 86 ... 106 kPa

Standard conformance

- Electrostatic discharge immunity (ESD), IEC-EN 60255-26:2013, Level 4
 - Test voltages: 15 kV air discharge, 8 kV contact discharge
- Radiated, radio-frequency, electromagnetic field immunity, IEC-EN 60255-26:2013 Level 3
 - Test field strength: 10 V/m
- Electrical fast transient/burst immunity (EFT/B), IEC-EN 60255-26:2013, Level 4
 - Test voltage: 4 kV
- Surge immunity test, IEC-EN 60255-26:2013
 - Test voltages: 4 kV line-to-earth, 2 kV line-to-line
- Immunity to conducted disturbances, induced by radio-frequency fields, IEC-EN 60255-26:2013, Level 3
 - Test voltage: 10 V
- Damped oscillatory wave immunity test, IEC-EN 60255-26:2013
 - Test frequency: 1 MHz
 - Test voltage: 2.5 kV in common mode, 1 kV in differential mode
- Voltage dips, short interruptions and voltage variations immunity, IEC-EN 60255-26:2013
 - Voltage dips: 40 % (200 ms), 70 % (500 ms), 80 % (5000 ms)
- Ripple on d.c. input power port immunity, IEC-EN 60255-26:2013
 - Level 4, 15 % of rated d.c. value
- Power frequency magnetic field immunity test, IEC-EN 60255-26:2013, Level 5
 - Test field strength: 100 A/m continuous, 1000 A/m for 3 s
- Power frequency immunity test on the binary inputs, IEC-EN 60255-26:2013, Class A
 - Test voltages: 300 V in common mode, 150 V in differential mode
- Insulation tests, IEC-EN 60255-27:2013
 - Impulse voltage test
 - Test levels: 5 kV (1 kV for transducer and temperature measuring inputs)
 - Dielectric test
 - Test levels: 2 kV AC 50 Hz (0.705 kV DC for transducer inputs)
 - Insulation resistance
 - Insulation resistance > 15 GΩ
- Radiated emission, IEC-EN 60255-26:2013
 Limits:

• 30 MHz to 230 MHz:	50 dB(μV/m) quasi peak, 3 m
• 230 MHz to 1 000 MHz:	57 dB(μV/m) quasi peak, 3 m
• 1 GHz to 3 GHz:	76 dB(μV/m) peak, 3 m
• 3 GHz to 6 GHz:	80 dB(μV/m) peak, 3 m
- Conducted emission, IEC-EN 60255-26:2013
 Limits:

• 0,15 MHz to 0,50 MHz:	79 dB(μV) quasi peak, 66 dB(μV) average
• 0,5 MHz - 30 MHz:	73 dB(μV) quasi peak, 60 dB(μV) average
- Vibration, shock, bump and seismic tests on measuring relays and protection equipment
 - Vibration tests (sinusoidal), Class I, IEC 60255-21-1:1988
 - Shock and bump tests, Class I, IEC 60255-21-2:1988
 - Seismic tests, Class I, IEC 60255-21-3:1993



MECHANICAL DATA

General mechanical data

- Construction: chromate aluminum surface with built-in EMC accessories
 - If the power consumption of a 84 HP or 42 HP device does not exceed 30 W (84 HP) or 14 W (42 HP), the construction will be built with solid top and bottom cover panels.
 - If the power consumption exceeds 30 W (84 HP) or 14 W (42 HP), the construction will be built with (honeycomb) perforated top and bottom cover panels.
- EMC rack protects against electromagnetic environmental influences and protects the environment from radiation from the interior
- IP protection:
 - 24 HP panel instrument case: IP4x; optionally IP54 (front)
 - 84 HP and 42 HP (including double) rack: IP4x from front side, IP2x from rear side; optionally IP54 (front)
- Size:
 - 19" (84 HP), 3 U, single rack
 - 1/2 19" (42 HP), 3 U, single rack
 - 1/2 19" (42 HP), 6 U, double rack
 - 24 HP, panel instrument case
- Weight:
 - 84 HP: max. 8 kg
 - 42 HP, 3 U: max. 4.5 kg
 - 42 HP, 6 U: max. 8 kg
 - 24 HP: max. 3 kg

Connectors

Optionally, certain modules can be equipped with different terminals for different connectors. The available choices are listed among each module's technical data with their *short ID* (see the first column of the table below).

The type of the used terminal is indicated on the module's label with its *short ID* (see the following example). The actual type of the connector is chosen according to the number of the available pins of the module.

Example: the *VT+/2211* module may have four types of connectors. In its description (Chapter 0), these are indicated with their ID:

- The default terminal is indicated with nothing attached (*VT+/2211*), only its name (BLA) is mentioned. Since it has 8 pins, the type is BLA 8/180
- The flanged terminal's short ID is F, so the module's label will be "*VT+/2211F*", if it is equipped with this terminal (BLA 8B/180)
- Top-screw terminal: T, the label becomes "*VT+/2211T*" (BLT 5.08HC/08/180F)
- Ring-lug terminal: R, so the module's label shall be "*VT+/2211R*"

CONNECTOR NAME (SHORT ID)	CONNECTOR TYPES	STRIP LENGTH [MM]	CONDUCTOR AREA [MM ²]	CONDUCTOR DIAMETER [MM]	TIGHTENING TORQUE [NM]	MINIMUM BEND RADIUS*
BLA (-)	Weidmüller BLA 2/180, BLA 3/180, BLA 4/180, BLA 6/180, BLA 8/180, BLA 10/180, BLA 12/180, BLA 13/180, BLA 16/180	7	0.2 – 1.5 solid: 0.2 – 2.5	0.5 – 1.4 solid: 0.5 – 1.8	0.4 – 0.5	3 × OD**
BL 3.5 (-)	Weidmüller BL 3.5/05/180 BL 3.5/09/180	6	0.2 – 1.5	0.5 – 1.4	0.2 – 0.25	3 × OD**
FLANGED (F)	Weidmüller BLA 2B/180, BLA 3B/180, BLA 4B/180, BLA 6B/180, BLA 8B/180, BLA 10B/180, BLA 12B/180, BLA 16B/180	7	0.2 – 1.5 solid: 0.2 – 2.5	0.5 – 1.4 solid: 0.5 – 1.8	0.4 – 0.5	3 × OD**
TOP-SCREW (T)	Weidmüller BLT 5.08HC/06/180F, BLT 5.08HC/08/180F, BLT 5.08HC/12/180F, BLT 5.08HC/16/180F	13	0.2 – 1.5 solid: 0.2 – 2.5	0.5 – 1.4 solid: 0.5 – 1.8	0.4 – 0.5	3 × OD**
TOP-SCREW (T)***	Weidmüller BLAT 2B, BLAT 3B	7	0.2 – 1.5 solid: 0.2 – 2.5	0.5 – 1.4 solid: 0.5 – 1.8	0.4 – 0.5	3 × OD**
RING-LUG (R)	TE Connectivity BC6-Q308-08	-	0.33 – 3.31	0.65 – 2.05	0.79	3 × OD**

* Bend radius is measured along the inside curve of the wire or wire bundles.

** OD is the outer diameter of the wire or cable, including insulation.

*** On power supply modules only (PS or PSTP)

CONNECTOR NAME (SHORT ID)	CONNECTOR TYPES	STRIP LENGTH [MM]	CONDUCTOR AREA [MM ²]	CONDUCTOR DIAMETER [MM]	TIGHTENING TORQUE [NM]	MINIMUM BEND RADIUS*
STVS (-)	Weidmüller STVS 6 SB, STVS 8 SB	9	0.5 – 4	0.8 – 2.3	0.5 – 0.6	3 × OD**
B2L 3.5	Weidmüller B2L 3.5	7	0.2 – 1	0.5 – 1.1	tension clamp connection	3 × OD**
ST/FC/LC	Bayonet/Screw/Snap Fiber Optic	-	-	-	-	30 mm
PE FASTON TERMINAL	TE Connectivity 6.3x0.8	7	min. 4	min. 2.3	-	3 × OD**

* Bend radius is measured along the inside curve of the wire or wire bundles.

** OD is the outer diameter of the wire or cable, including insulation.

The tightening torque of the screw for protective earth connection and the wall mounting must be approx. 5 Nm.
The tightening torque of the screw for fastening the STVS connector must be approx. 1 Nm.

The minimum distance between an EP+ device and its wire channel must be at least 3 cm.
The minimum distance between two EP+ devices must be at least 10 cm.

During the installation make sure that the shortest possible length for PE (Protective Earth) cable routing is applied.

MOUNTING METHODS

- Flush mounting
 - 84 HP single rack
 - 42 HP single rack
 - 42 HP double rack
 - 24 HP panel instrument case
 - Remote HMI
- Rack mounting
 - 84 HP single rack
 - 42 HP single rack
 - Remote HMI
- Semi-flush mounting
 - 84 HP single rack
 - 42 HP single rack
 - 24 HP panel instrument case
 - Remote HMI
- Wall mounting (with terminals)
 - 84 HP single rack
 - 42 HP single rack
- Din rail mounting
 - 24 HP panel instrument case
- IP54 rated mounting
 - 84 HP single rack
 - 42 HP single rack
 - 24 HP panel instrument case (original frame with additional gasket)
- Fold-down mounting (with optional terminals)
 - 84 HP single rack
 - 42 HP single rack
- No mounting
 - 84 HP single rack
 - 42 HP single rack

MOUNTING METHOD	84 HP SINGLE RACK	42 HP SINGLE RACK	42 HP DOUBLE RACK	24 HP PANEL INSTRUMENT CASE	REMOTE HMI
FLUSH MOUNTING	X	X	X	X	X
RACK MOUNTING	X	X			X
SEMI-FLUSH MOUNTING	X	X		X	X
WALL MOUNTING (WITH TERMINALS)	X	X			
DIN RAIL MOUNTING				X	
IP54 RATED MOUNTING	X	X		X*	
FOLD-DOWN MOUNTING	X	X			

*additional gasket inserted into the original front panel frame



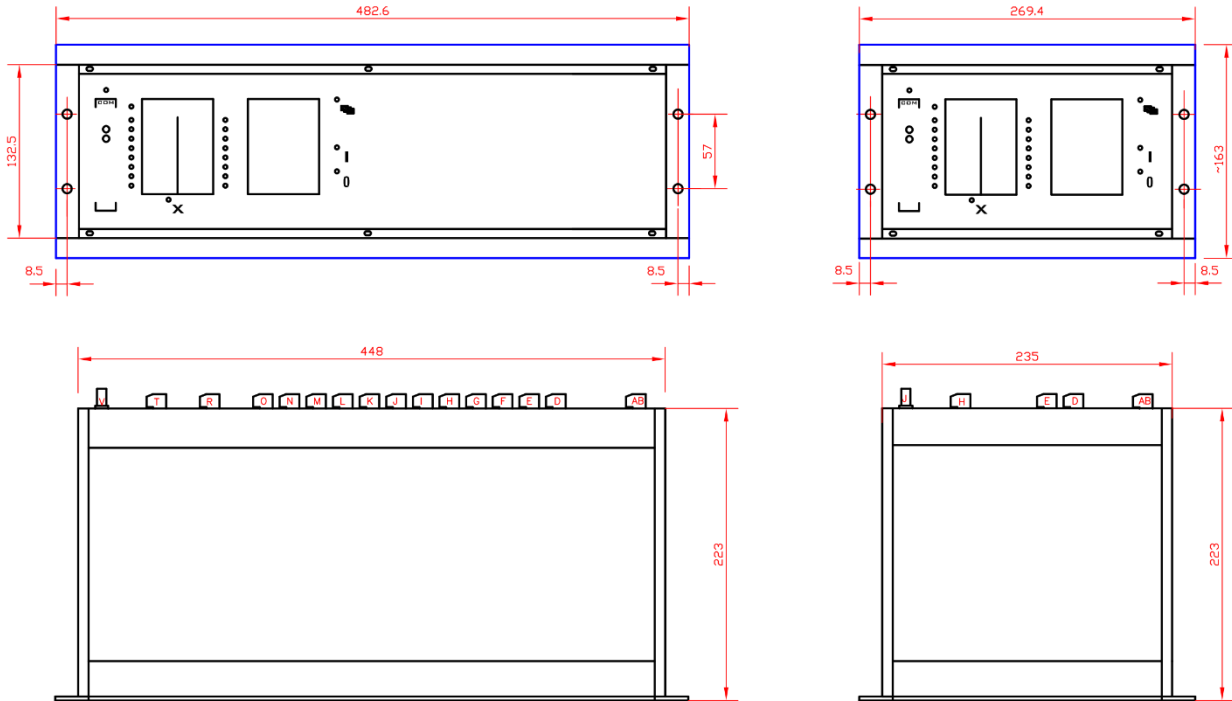
It is recommended to leave at least 80 mm free space for the wiring at the back of the IED in case of Flush mounting, Rack mounting, and Semi-flush mounting.

Flush mounting

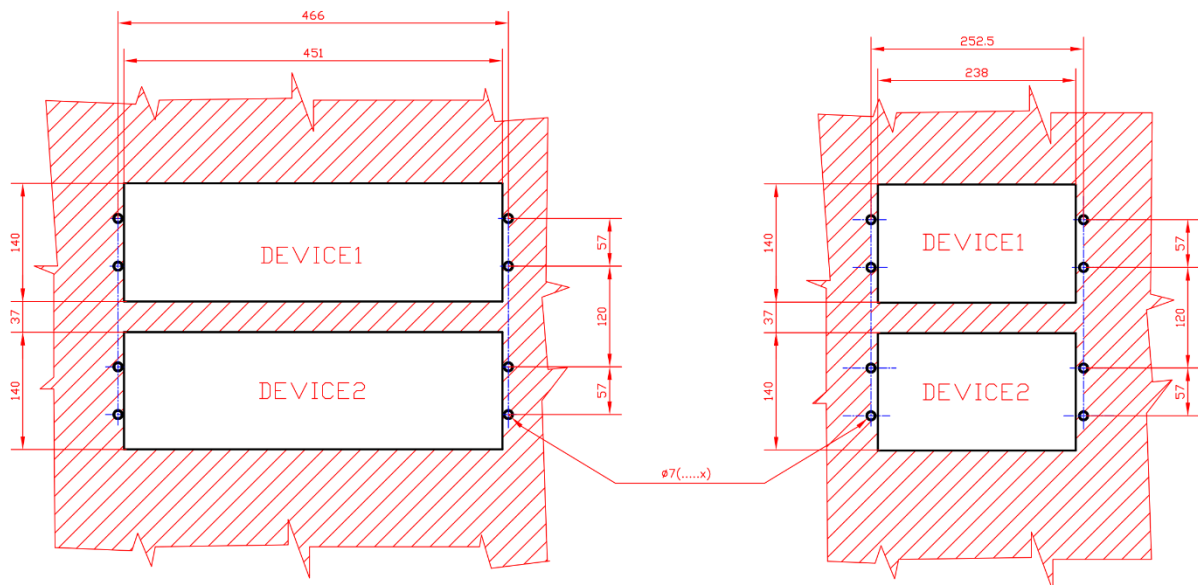
Flush mounting can be used for all size of racks (84 HP, 42 HP, double 42 HP) including the 24 HP panel instrument case and the remote HMI devices. When this type of mounting alternative is used the 84 HP, 42 HP, double 42 HP and remote HMI devices have got a cover profile fit on and the 24 HP devices have got a mounting frame fit on.

The dimensions of the cut-outs for the 84 HP and 42 HP devices are also applicable for the same sized remote HMI devices.

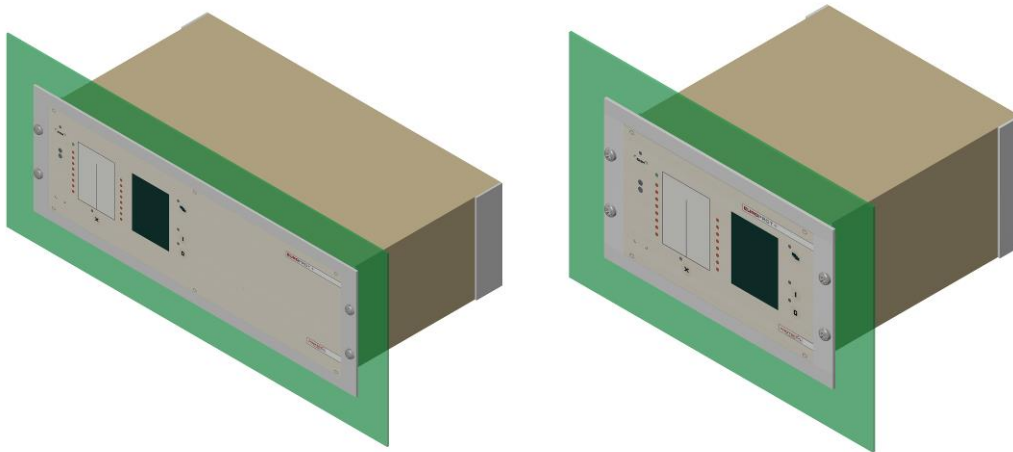
Flush mounting of 84 HP and 42 HP single rack



PANEL CUT-OUT

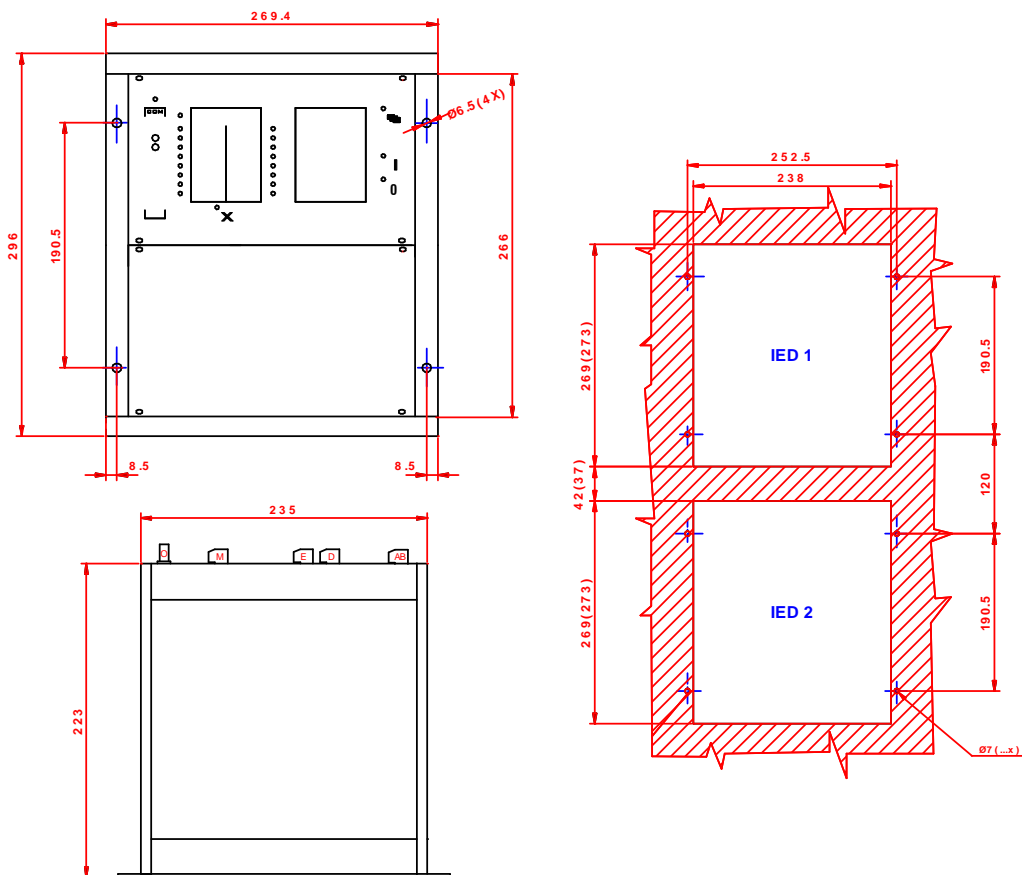


Dimensions for flush mounting of 84 HP and 42 HP single rack

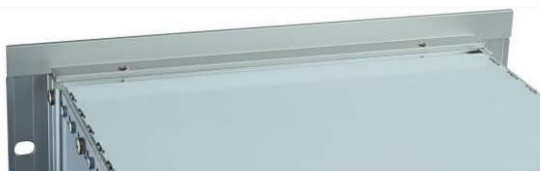


3D illustration for flush mounting of 84 HP and 42 HP devices

Flush mounting of 42 HP double rack

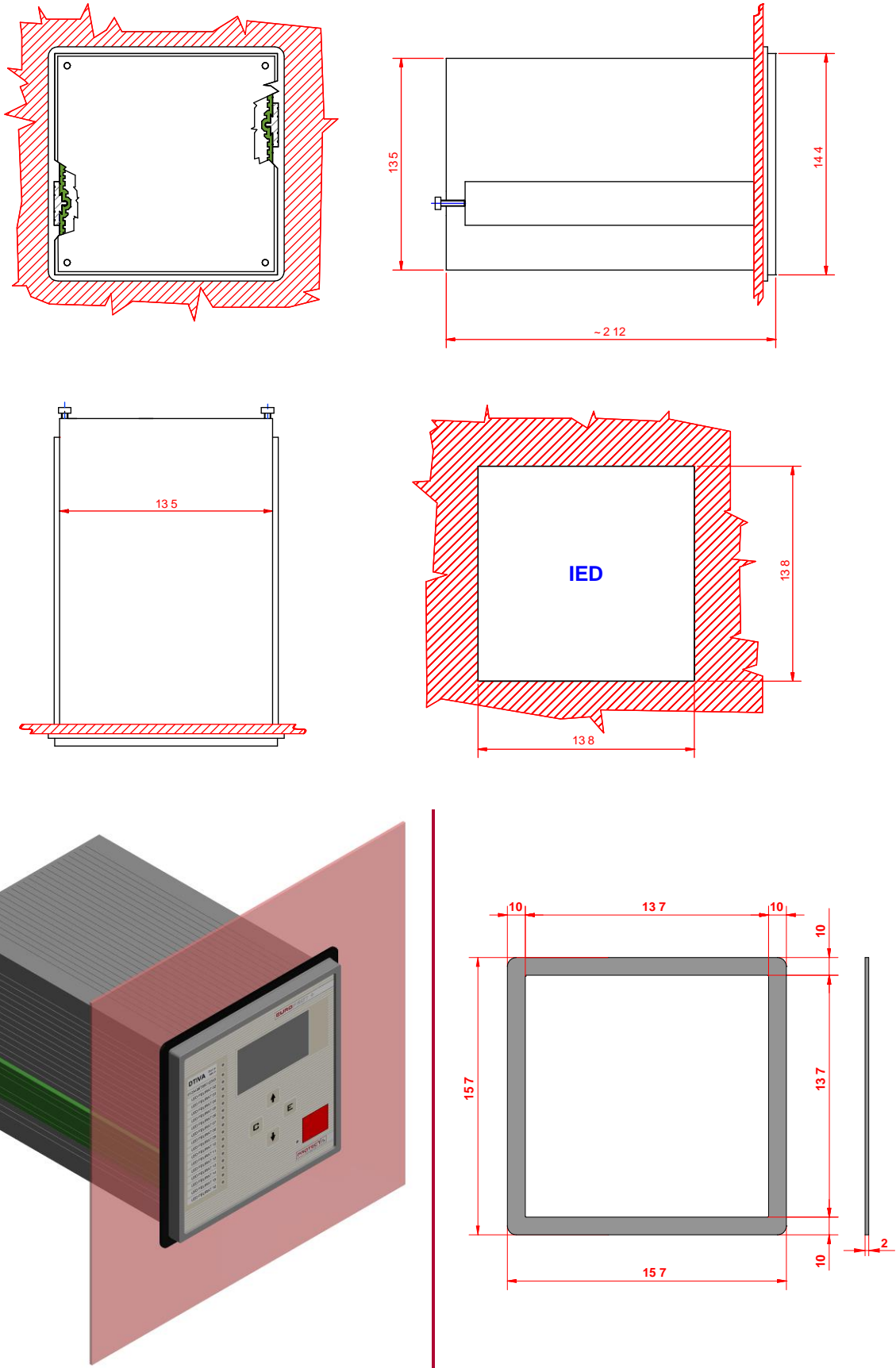


Dimensions for flush mounting of 42 HP double rack



42 HP wide cover profile

Flush mounting of 24 HP panel instrument case

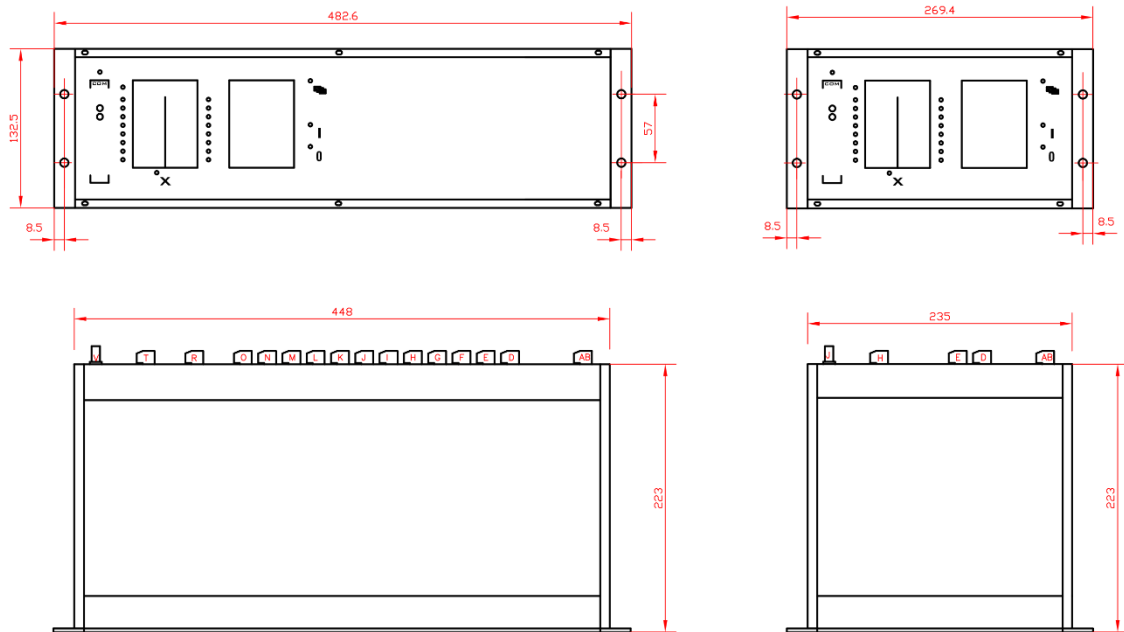


Dimensions for flush mounting of 24 HP panel instrument case with 3D illustration

Rack mounting

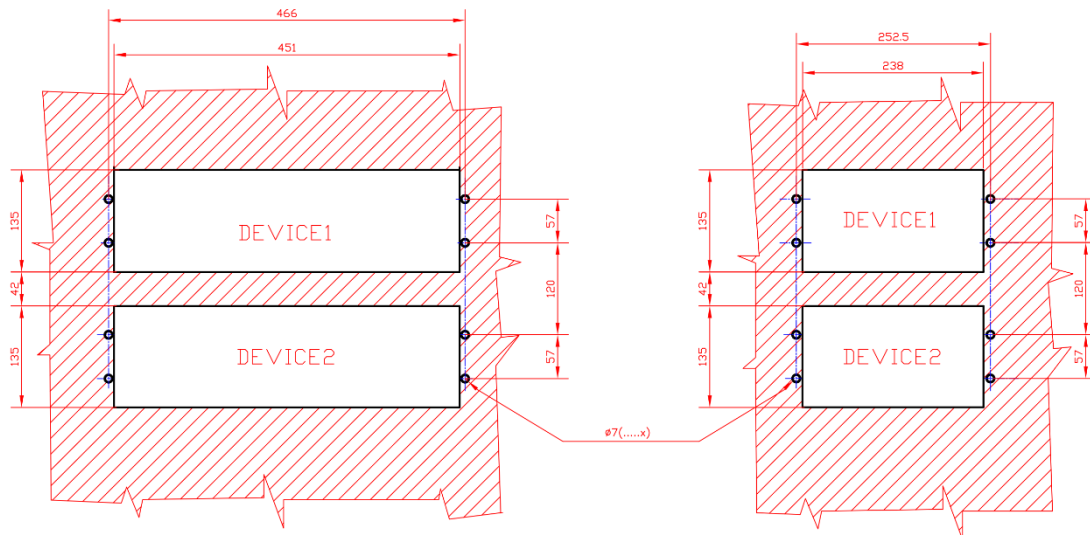
When rack mounting is used, the devices do not have a cover profile fit on, so it is possible to mount them in a 19" rack.

Rack mounting of 84 HP and 42 HP single rack

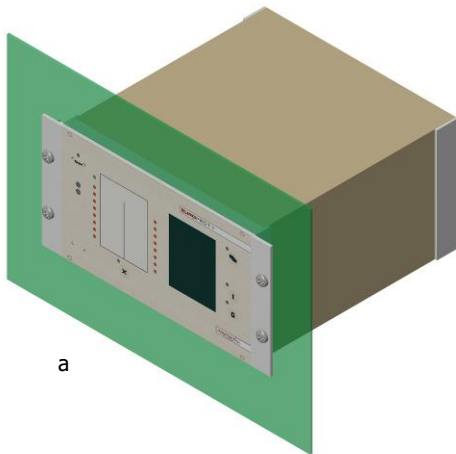


Dimensions for rack mounting of 84 HP and 42 HP single rack

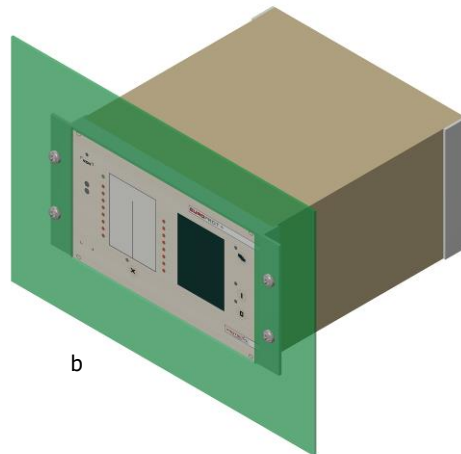
Note that rack mounting type devices can also be mounted in a cut-out (e.g. on a switchgear door). It is possible to mount them from the front or from the back of the cut-out. The dimensions for rack mounting cut-outs are in the figure below. Dimensions in brackets are applicable in case of mounting from the back.



Dimensions of rack mounting cut-outs

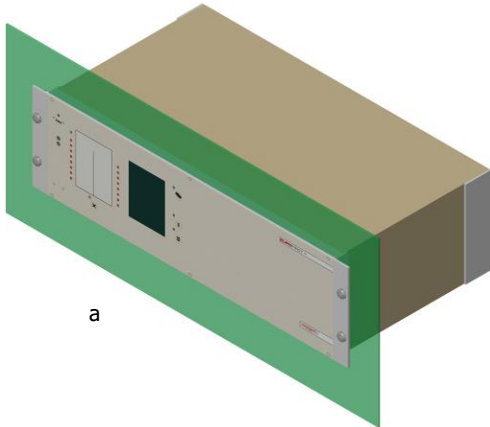


a

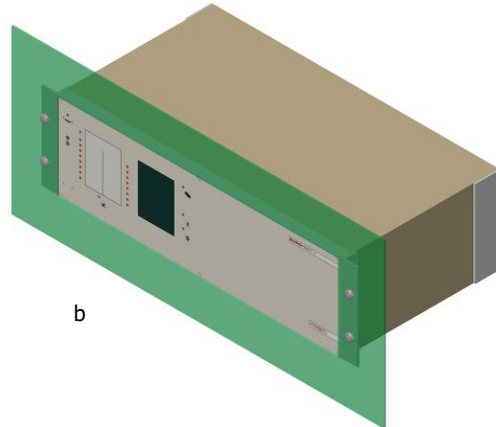


b

3D illustration for rack mounting of 42 HP device
(a - from the front; b - from the back)



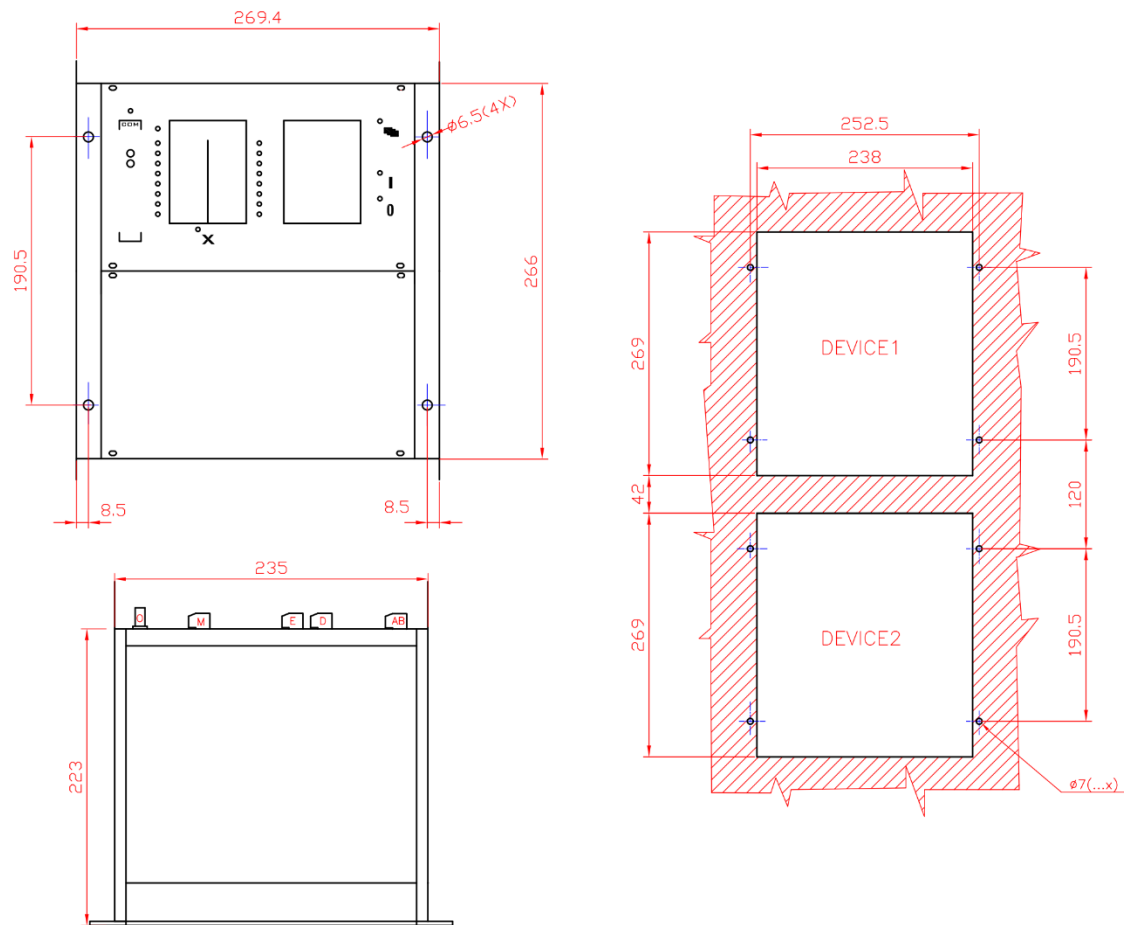
a



b

3D illustration for rack mounting of 84 HP device
(a - from the front; b - from the back)

Rack mounting of 42 HP double rack



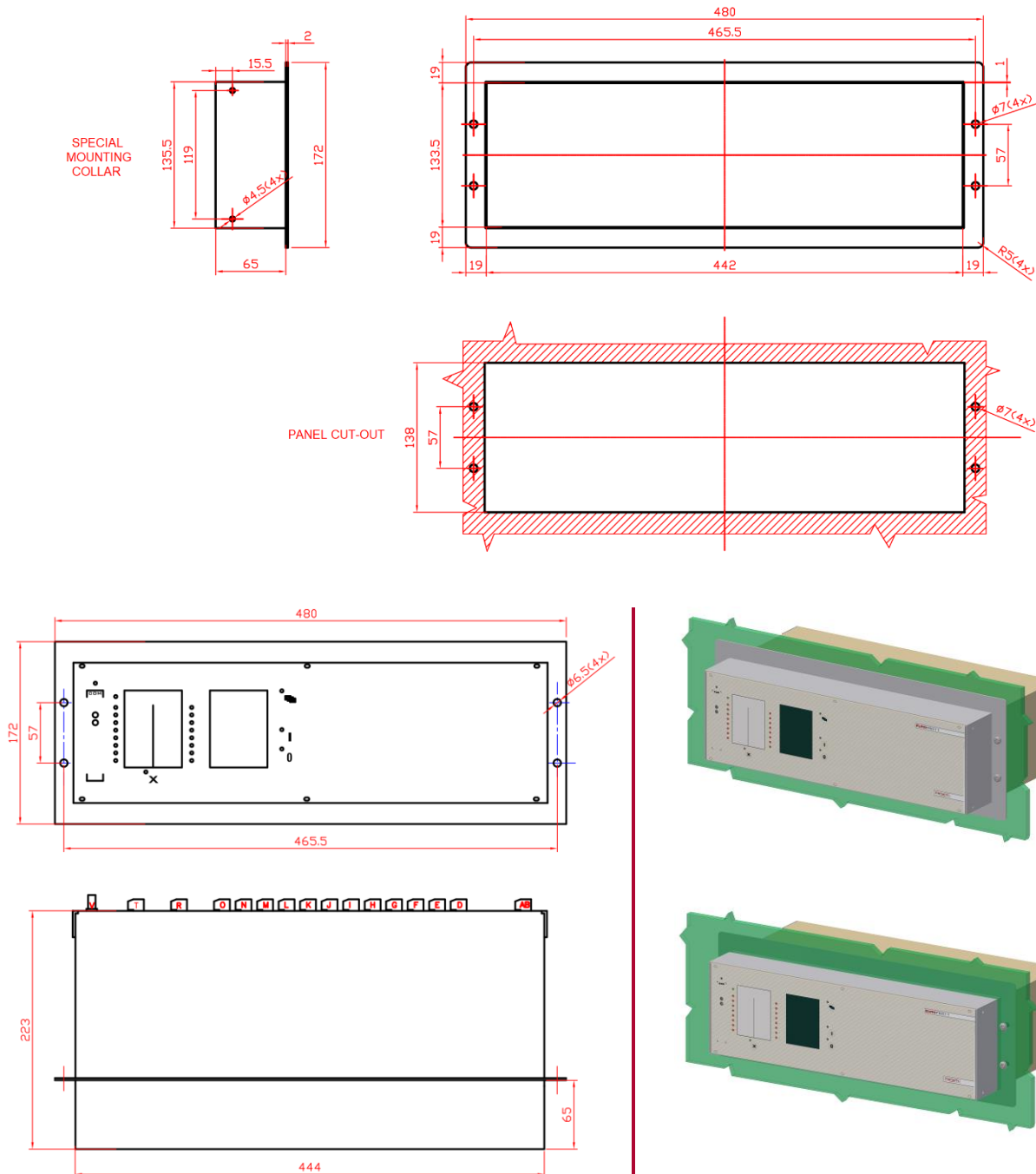
Dimensions for rack mounting of 42 HP double rack

Semi-flush mounting

Semi-flush mounting can be used for 84 HP and 42 HP single racks, for 24 HP panel instrument cases and for remote HMI devices. The purpose of this type of mounting alternative is to reduce the depth of the devices in the switchgear/rack if there is not enough space in that direction. To achieve this, a special mounting collar must be fit on the rack type devices. The default color of the mounting collar is grey (RAL 7035).

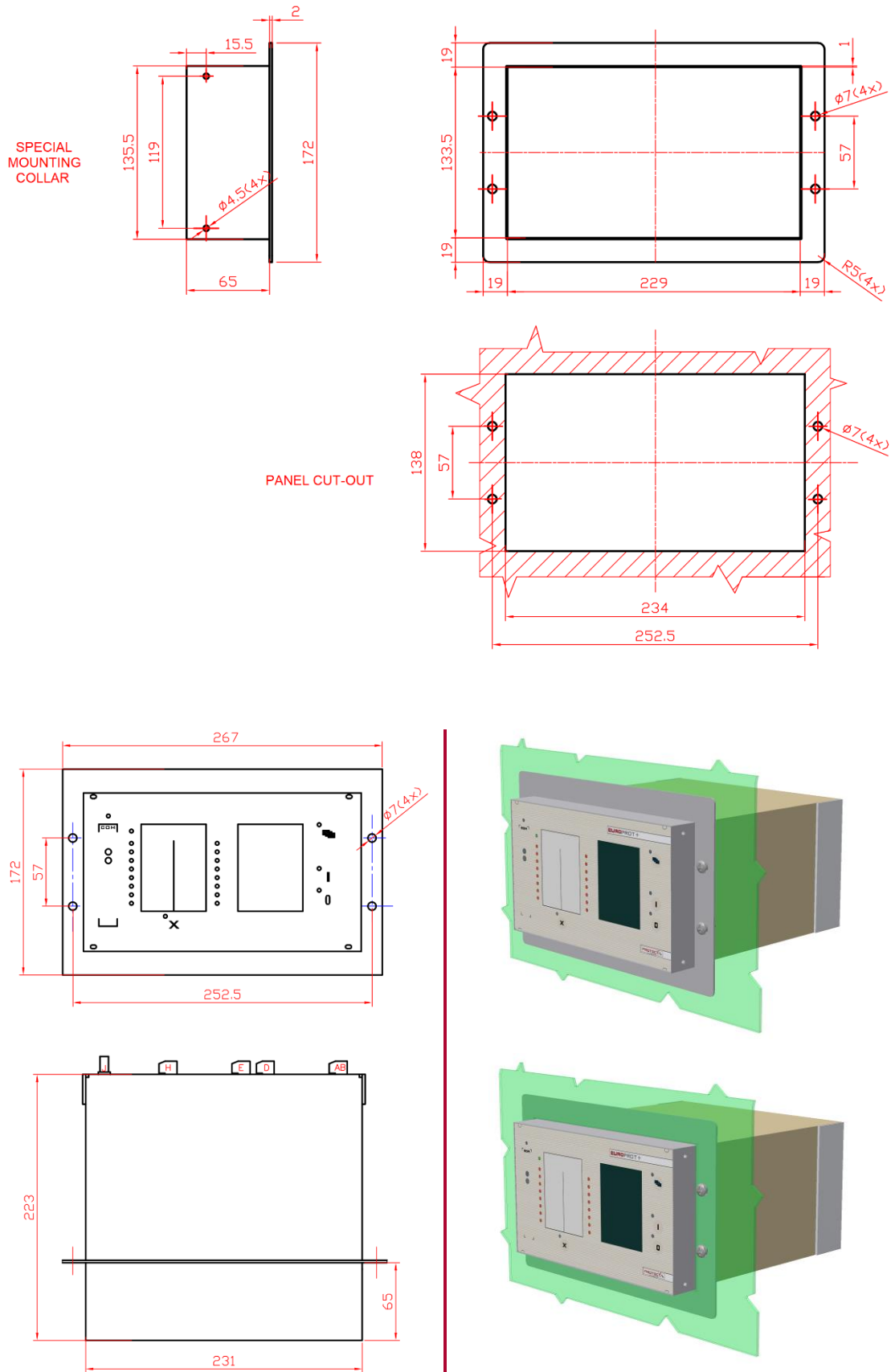
The dimensions of the special mounting collars and the cut-outs for the 84 HP and 42 HP devices are also applicable for the same sized remote HMI devices.

Semi-flush mounting of 84 HP single rack



Dimensions for semi-flush mounting of 84 HP single rack with 3D illustration

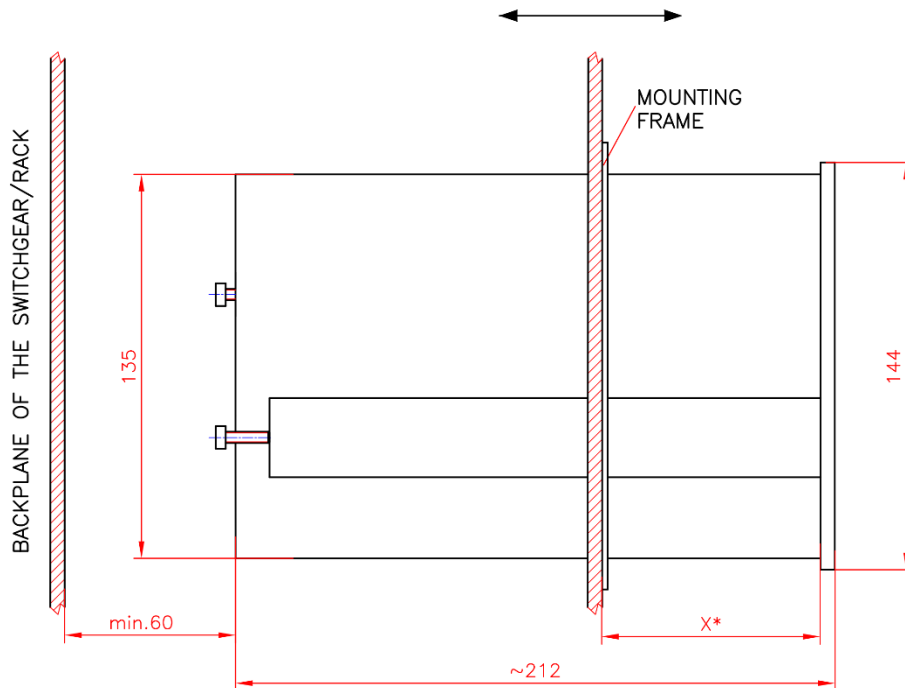
Semi-flush mounting of 42 HP single rack



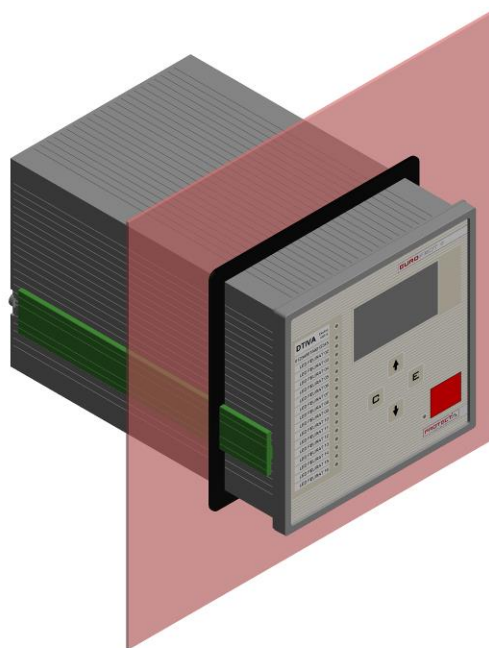
Semi-flush mounting of 24 HP panel instrument case

The dimensions of the panel cut-out for this type of mounting method are the same as in case of flush mounting (138 mm × 138 mm). For semi flush mounting, it is enough to cut in two the fixing elements (with green colour in the 3D illustration below) and to make the assembly as shown in the pictures below.

Note that the IP54 front panel option cannot be utilized with this type of mounting.



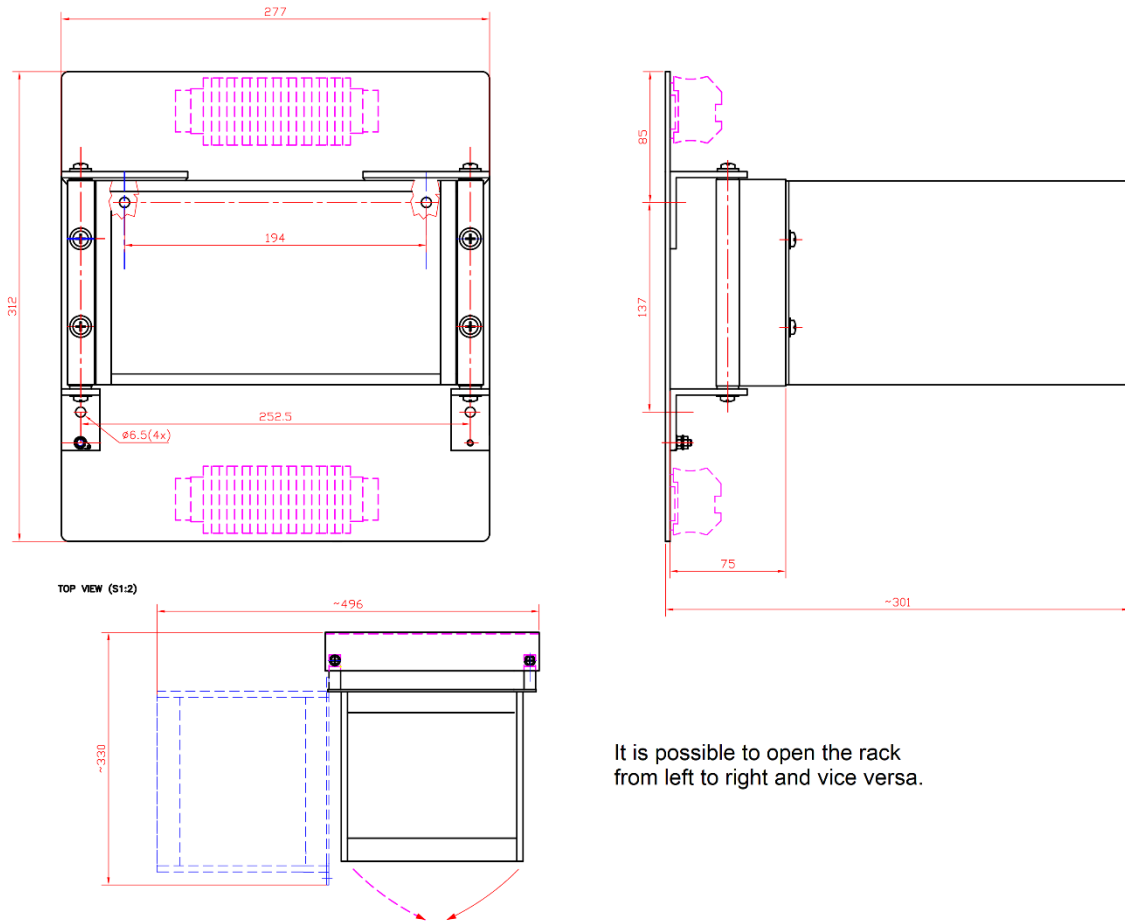
*X: depending on the position of the cutting, the frame can be placed freely



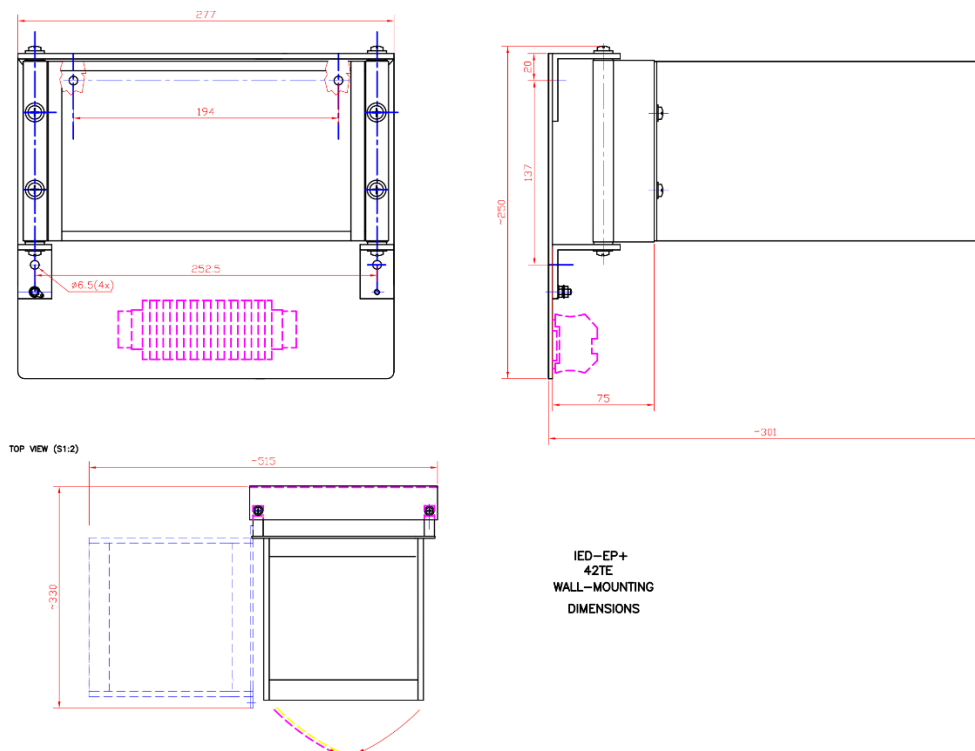
Dimensions for semi-flush mounting of 24 HP panel instrument case with 3D illustration

Wall mounting of 42 HP and 84 HP devices

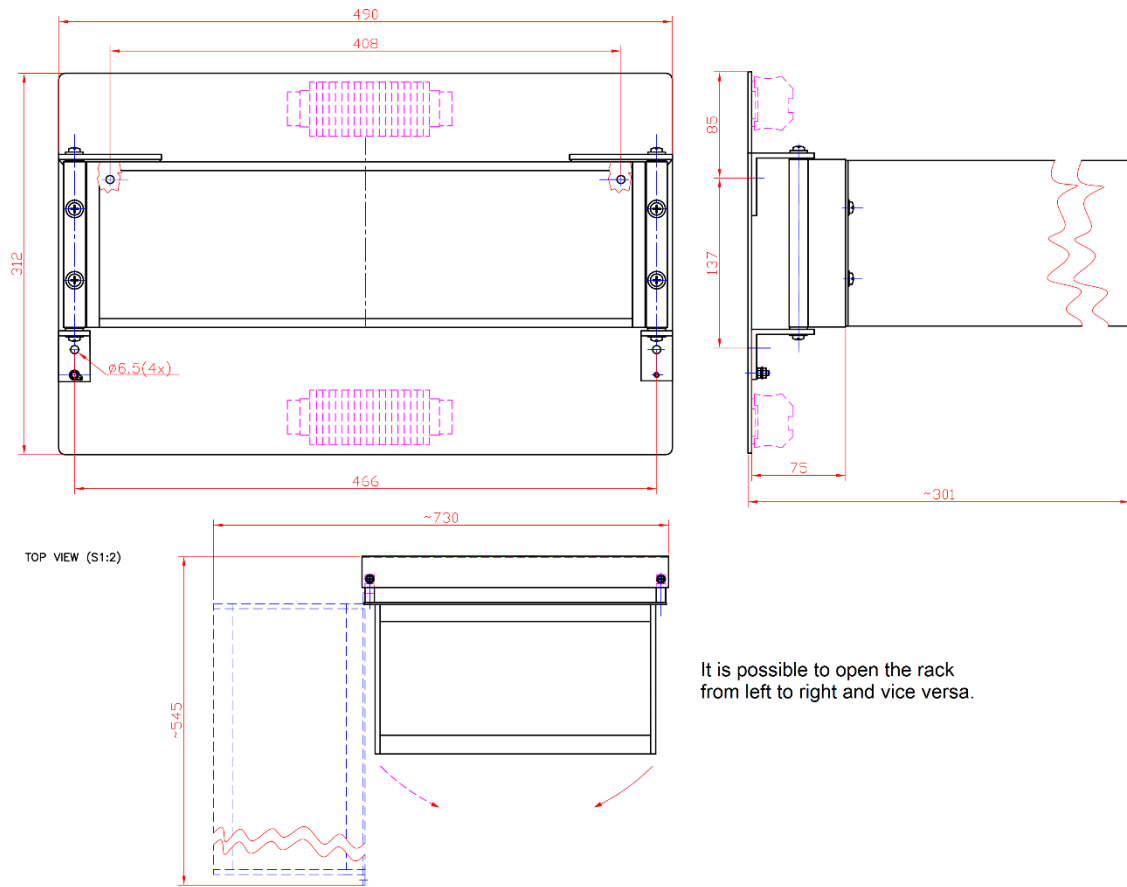
Depending on the amount of the terminal contacts, it is possible to use both upper and lower terminals.



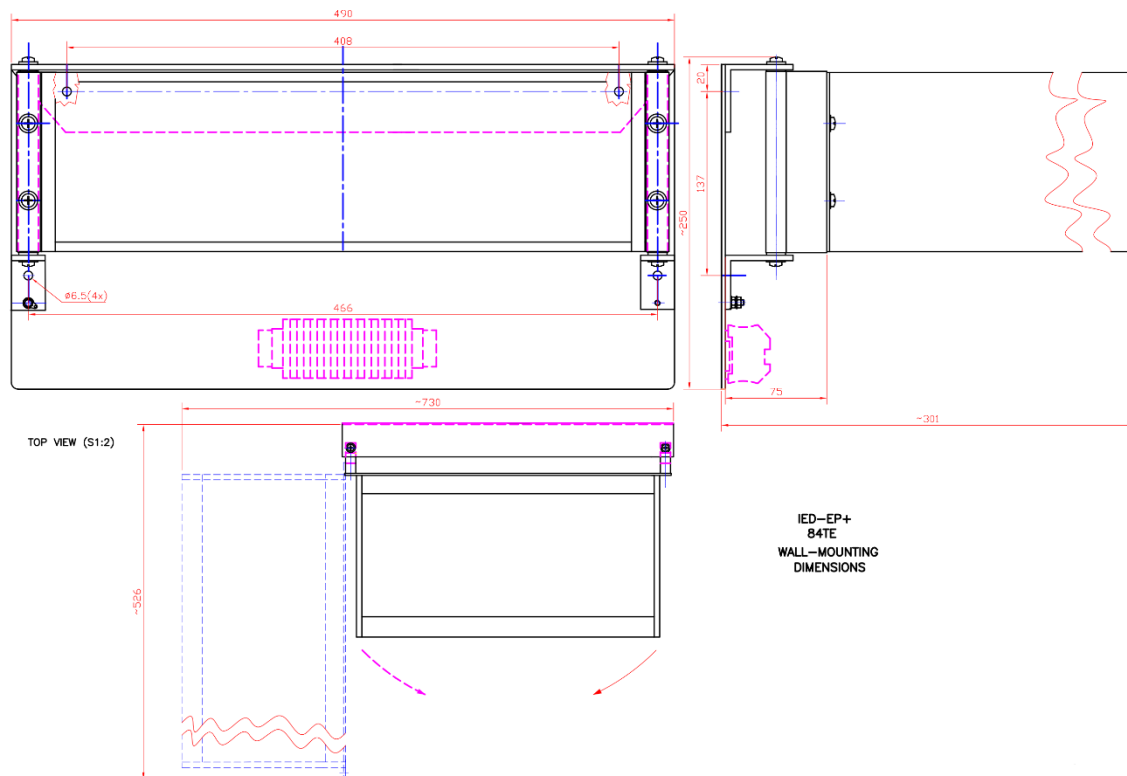
Dimensions for wall mounting of 42 HP devices (upper and lower terminals)



Dimensions for wall mounting of 42 HP devices (lower terminal only)



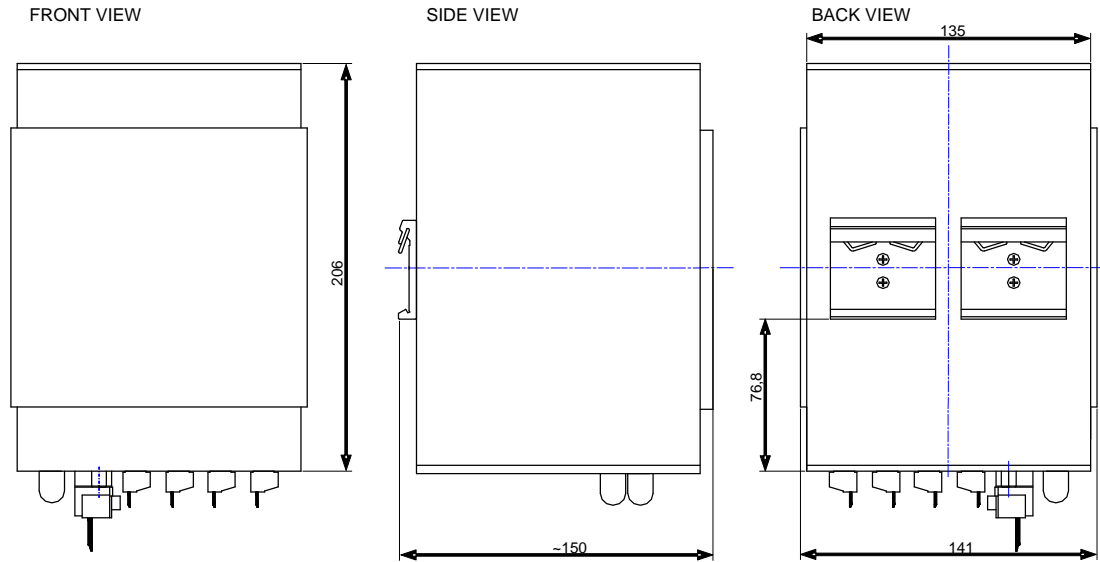
Dimensions for wall mounting of 84 HP devices (upper and lower terminals)



Dimensions for wall mounting of 84 HP devices (lower terminals only)

Din rail mounting of 24 HP panel instrument case

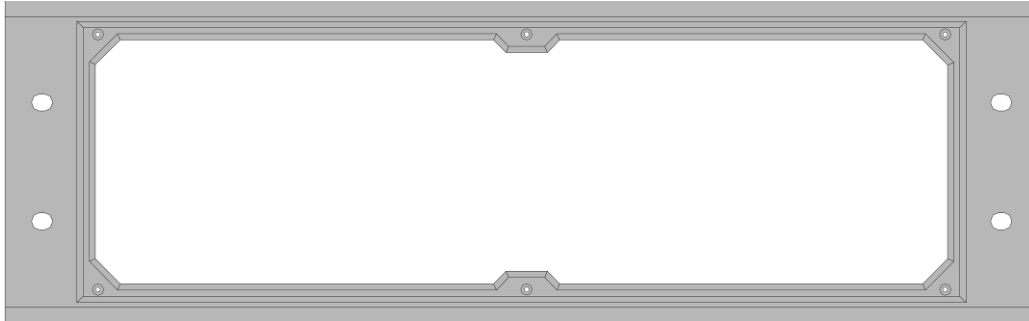
Note that the IP54 front panel option cannot be utilized with this type of mounting.



Dimensions for din rail mounting of 24 HP panel instrument case

IP54 rated mounting kit

The IP frame seen below provides IP54 protection from front side for 84HP and 42HP devices.



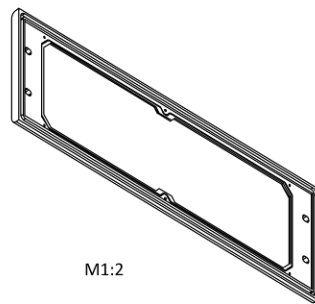
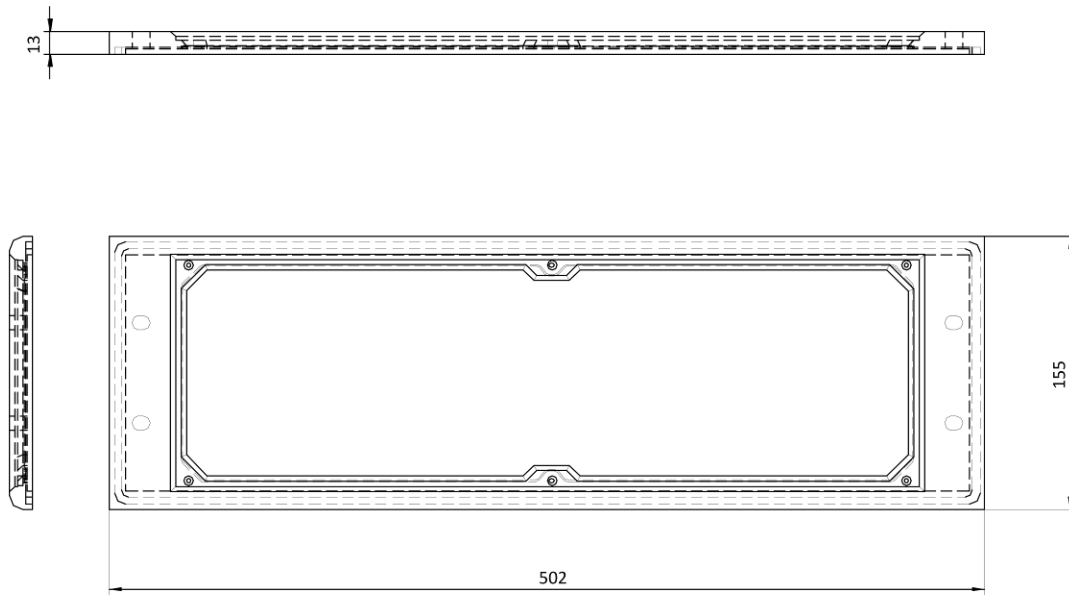
84 HP IP frame front view



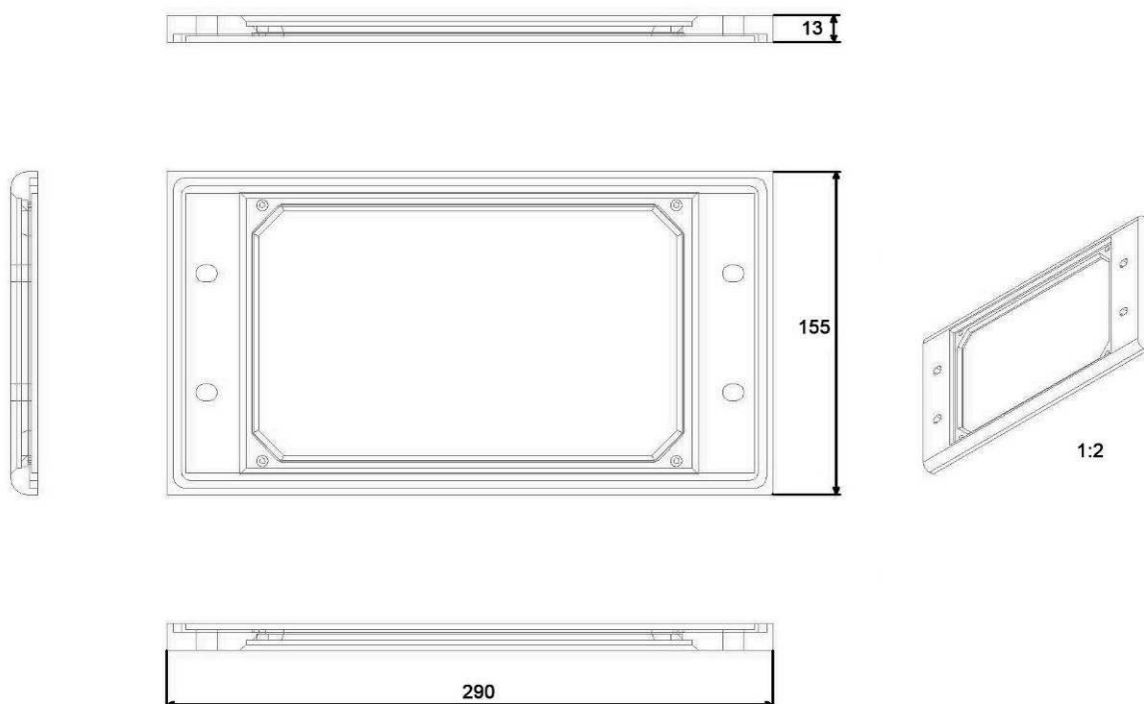
42 HP IP frame front view

S24 devices

The S24 devices' front panel *does not differ from the normal front panel on the outside*, as there is IP54 gasket applied within the frame itself. Devices ordered with this option must be mounted by *flush mounting*; with other types of mountings (e.g. semi-flush), the IP54 protection is not guaranteed!



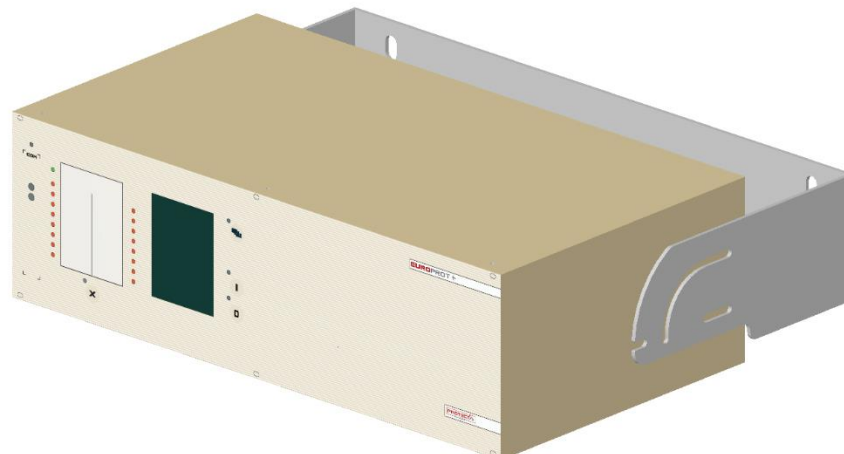
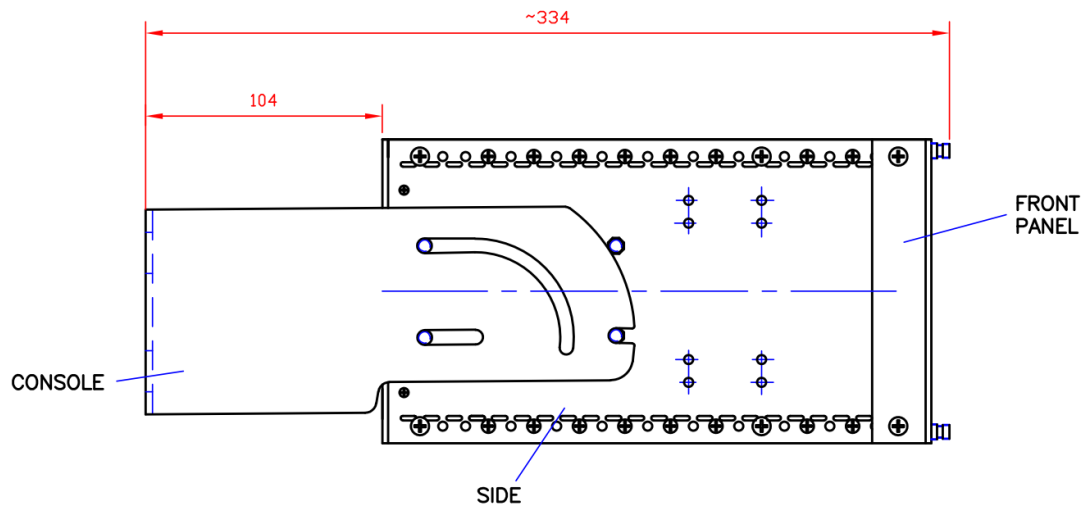
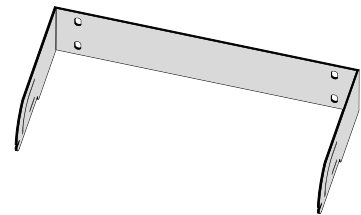
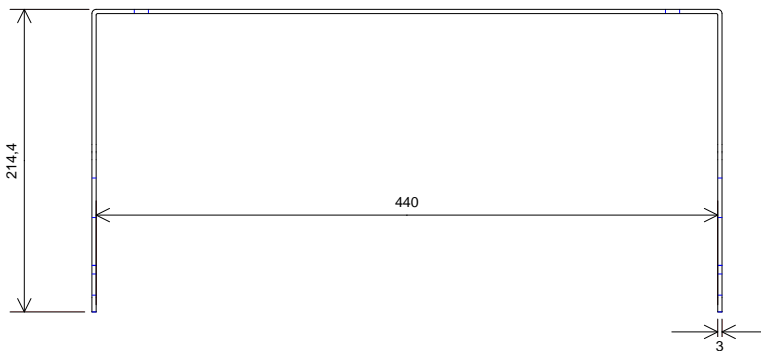
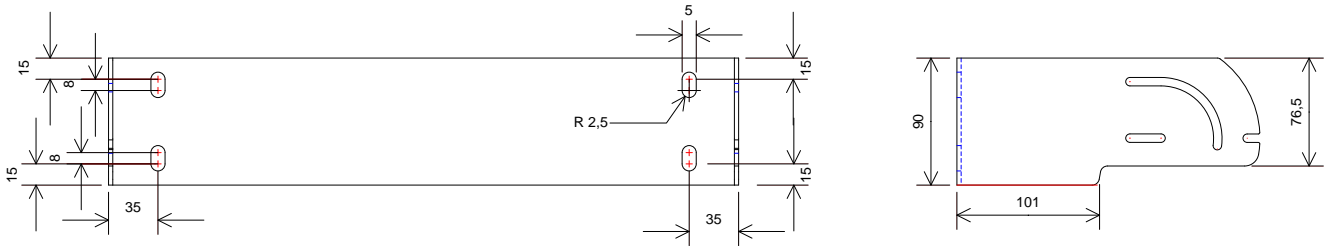
84 HP IP frame dimensions



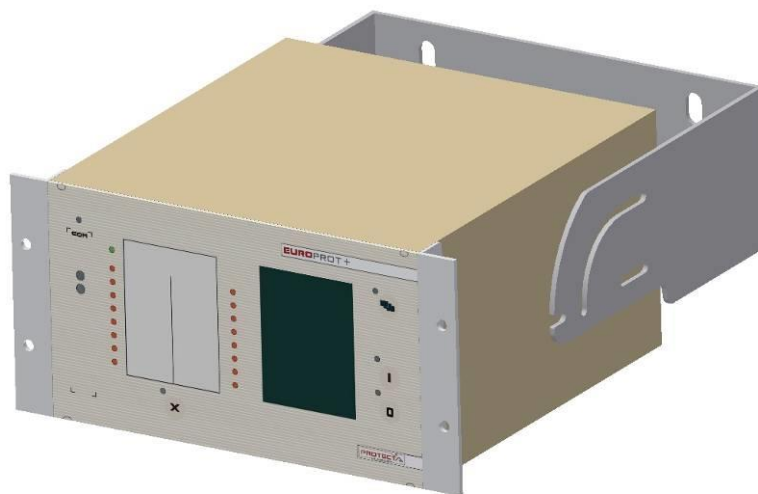
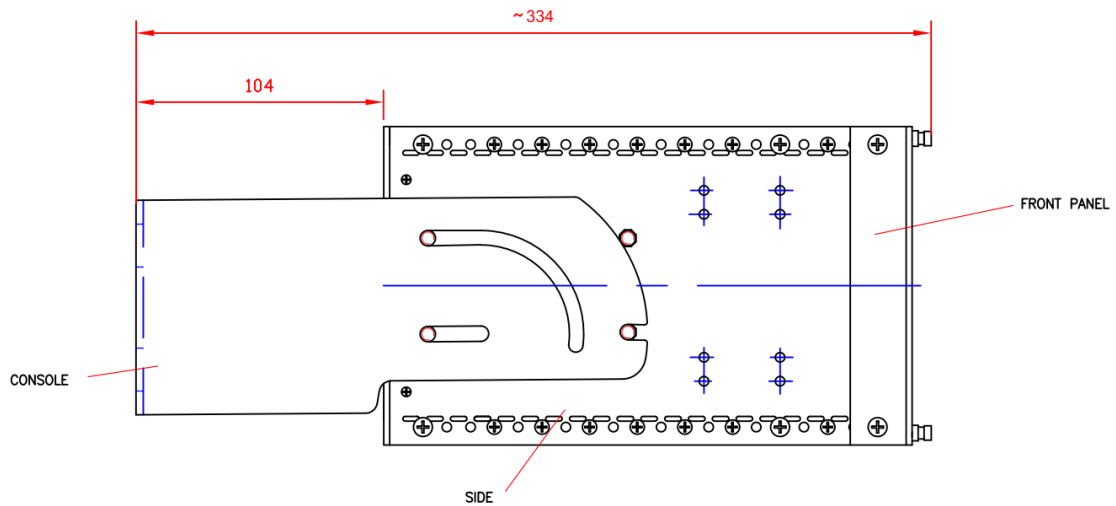
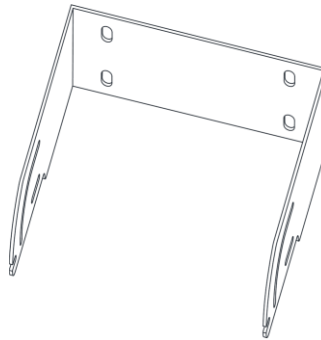
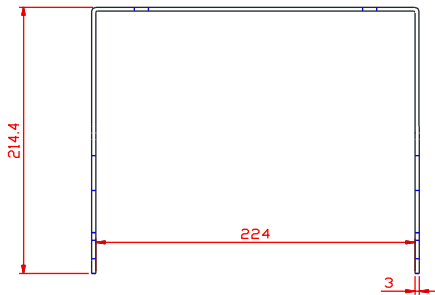
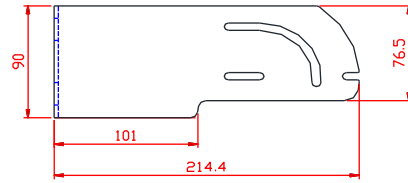
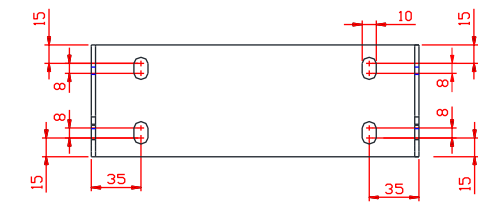
42 HP IP frame dimensions

Fold-down mounting

Fold-down mounting without terminals

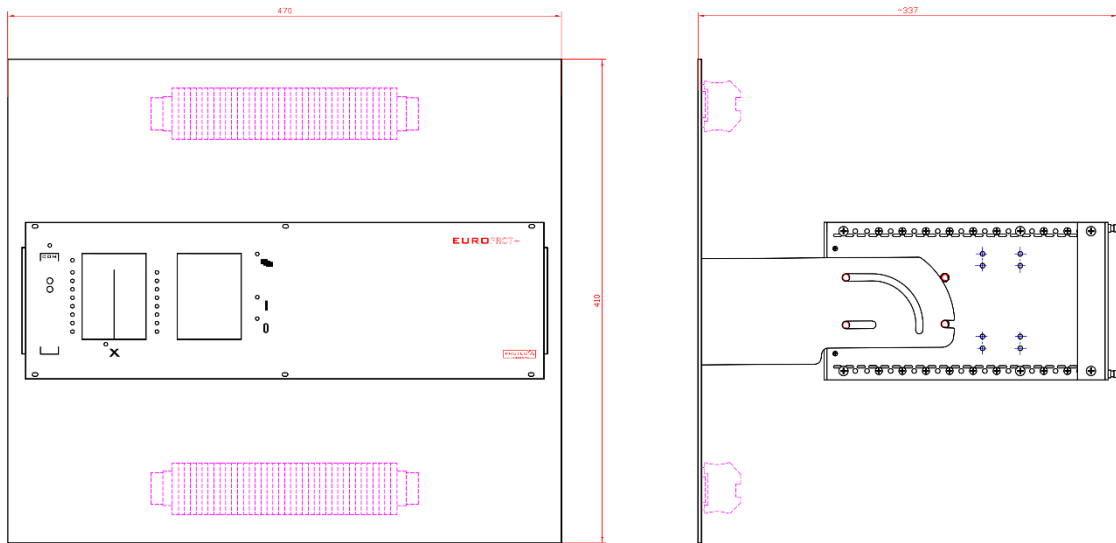


84 HP fold-down mounting



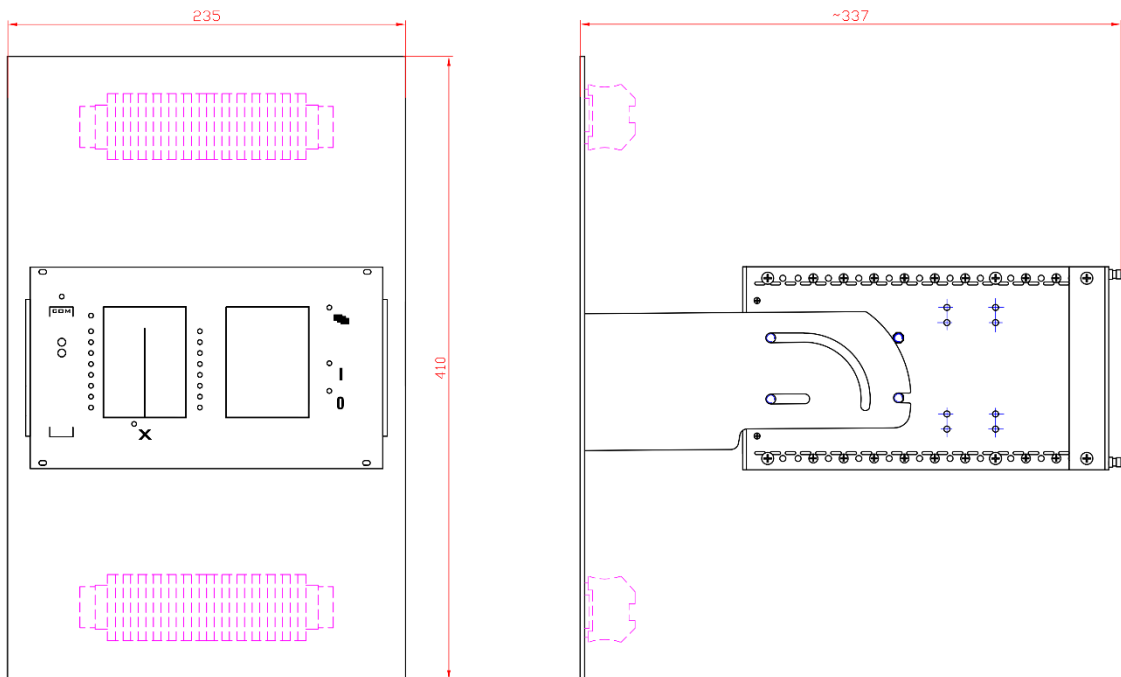
42 HP fold-down mounting

Fold-down mounting with terminals



Fold-down mounting with terminals for 84HP devices

*fastening points are customized



Fold-down mounting with terminals for 42HP devices

No mounting

"No mounting" means that the 84 HP and 42 HP devices do not have any mounting accessories on them.

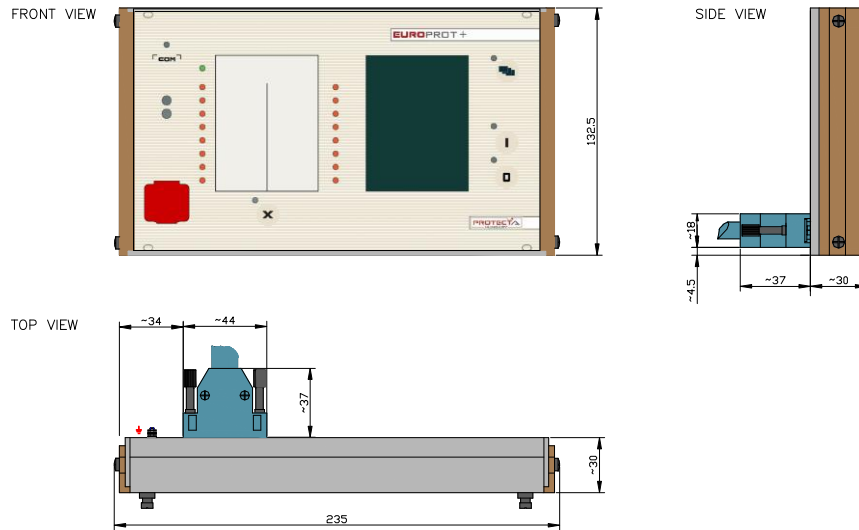
This mounting method is only applicable if the device is for demonstration application.

For more information about this topic please contact our Application Team. (<https://www.microener.com>)

Remote HMI devices

IMPORTANT

The dimensions of the cut-outs applicable for the remote HMI are depending on which previously mentioned mounting method is used (flush mounting, semi-flush mounting or rack mounting).



Dimensions for 42 HP wide remote HMI



Dimensions for 84 HP wide remote HMI

PRODUCT AVAILABILITY (SPECIAL AND OBSOLETE MODULES)

In this chapter you can read a list of the modules that have not regular availability for any reason (being obsolete or being used only in special configurations).

Special modules:

These modules can be ordered in case of special applications which are indicated for each module at its description in the previous chapters.

For more information about these devices please contact our Application Team. ((<https://www.microener.com>))

Optional connectors:

The optional connectors are indicated at each module's description in the previous chapters. If a module is to be shipped with an optional connector, the issue must be discussed during ordering.

MODULE TYPE	COMMENT	DATE
CPU+/0001	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1211	2013-06-12
CPU+/0002	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1111	2013-06-12
CPU+/0003	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1101	2013-06-12
CPU+/0004	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1201	2013-06-12
CPU+/0005	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1281	2013-06-12
CPU+/0006	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1381	2013-06-12
CT+/1155	Available only for special configurations.	2013-06-12
CT+/5152	Available only for OGYD bay unit configurations.	2013-06-12
VT+/2215	Available only for special configurations.	2013-06-12
O12+/2101	Available only for demonstration applications.	2013-06-12
O12+/4201	Available only for demonstration applications.	2013-06-12
R4S+/01	Available only for special configurations.	2013-06-12
R4S+/16	Available only for special configurations.	2013-06-12
TRIP+/1101	Obsolete module. Not recommended for new designs.	2013-06-12
PS+/1602	Available only for special configurations.	2013-06-12
HMI+/2401	Obsolete module. Not recommended for new designs.	2014-10-06
HMI+/2404	Smart Line S24 special selection modules.	2014-10-06
HMI+/2504	Smart Line S24 special selection modules.	2014-10-06
COM+/8882	Available only for special configurations.	2014-10-06
CT+/1111	Available only for special configurations.	2014-10-06

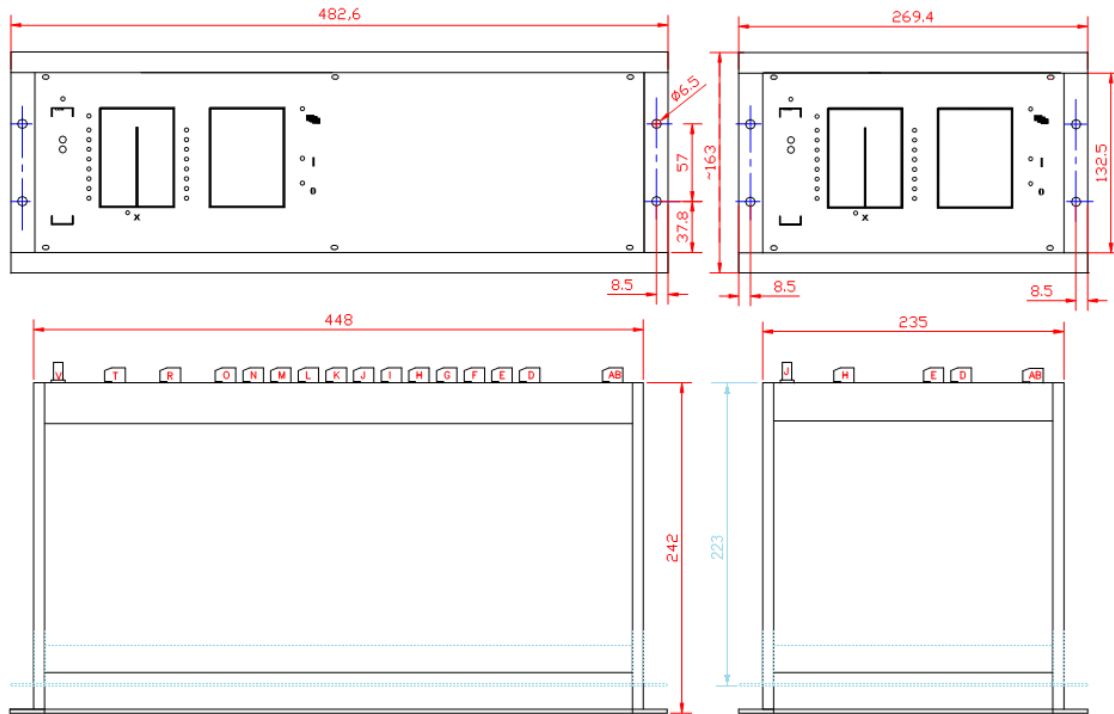
CT+/2500	Available only for special configurations.	2014-10-06
CT+/5153	Available only for special configurations.	2014-10-06
VT+/2212	Available only for special configurations.	2014-10-06
R8+/01	Available only for special configurations.	2014-10-06
R8+/A1	Available only for special configurations.	2014-10-06
R8+/C0	Available only for special configurations.	2014-10-06
R8+/FF	Available only for special configurations.	2014-10-06
R12+/4400	Available only for special configurations.	2014-10-06
R16+/0101	Available only for special configurations.	2014-10-06
R16+/0001	Available only for special configurations.	2014-10-06
R16+/A001	Available only for special configurations.	2014-10-06
PS+/4401	Available only for special configurations.	2014-10-06
CT+/2500	Obsolete module. Not recommended for new designs. Replacement: CT+1500.	2015-02-13
PSTP+/2102	Available only for special configurations.	2015-06-23
PSTP+/4202	Available only for special configurations.	2015-06-23
CT+/5111	Available only for special configurations.	2015-12-08
CT+/0101	Available only for special configurations. DEFL earth fault protection only.	2018-03-19
INJ+/0015	Available only for special configurations.	2018-03-19
CT+/5155	Available only for special configurations.	2018-03-26
VT+/2246	Available only for special configurations.	2018-03-26
AIC+/0201	Obsolete module. Not recommended for new designs.	2018-03-26
CT+/5111	Obsolete module. Not recommended for new designs.	2018-03-27
VS+/0031	Obsolete module. Not recommended for new designs.	2018-05-25
R1T+/0001	Available only for special configurations. DMD.	2018-10-05
CT+/5253	Available only for special configurations.	2018-10-05
42 HP housing	The length of the 42 HP box has been reduced from 242 mm to 223 mm. For more information about the previous size of the 42 HP box please see the Erreur ! Source du renvoi introuvable..	2018-12-18

AIC+/0200	Obsolete module. Not recommended for new designs.	2019-04-08
PS+/1030	Available only for special configurations.	2020-05-07
PS+/1060	Available only for special configurations.	2020-05-07
HMI+/5001	Obsolete module. Not recommended for new designs.	2020-06-04
HMI+/5002	Obsolete module. Not recommended for new designs.	2020-06-04
HMI+/3502 (for 42HP)	Obsolete module. Not recommended for new designs.	2020-06-04
CT+/1515	Available only for special configurations.	2020-06-04
CT+/5115	Available only for special configurations.	2020-06-04
CT+/5116	Available only for special configurations.	2020-06-04
CT+/5154	Available only for special configurations.	2020-06-04
PSF+/1001	Available only for special configurations.	2020-06-04
RTD+/0200	Available only for special configurations.	2020-06-04
RTD+/1200	Available only for special configurations.	2020-06-04
R4MC+/01	Available only for special configurations.	2020-06-04
PS+/4301	Obsolete module. Not recommended for new designs.	2020-06-04
84 HP housing	The depth of the 84 HP box has been reduced from 242 mm to 223 mm. For more information about the previous size of the 84 HP box, see the Erreur ! Source du renvoi introuvable..	2021-04-01
HMI+/3501	Obsolete module. Not recommended for new designs.	2021-04-20
HMI+/3502	Obsolete module. Not recommended for new designs.	2021-04-20
HMI+/5701	Obsolete module. Not recommended for new designs.	2021-04-20
HMI+/5702	Obsolete module. Not recommended for new designs.	2021-04-20
COM+/1202	Obsolete module. Not recommended for new designs.	2021-04-20
COM+/1324	Obsolete module. Not recommended for new designs.	2021-04-29
VT+/2212	Obsolete module. Not recommended for new designs.	2021-05-06
CT+/5154	Obsolete module. Not recommended for new designs.	2021-05-06

Previous 42HP and 84HP device housings

As of 2021. Q2, not only the 42HP, but the 84HP devices are shipped with shorter racks as well. Note that this is the only difference between the new and old housings. The new racks are shorter by 19 mm from the front, thus their depth is 223 mm instead of 242 mm.

The mounting methods described in Chapter 0 are valid for the previous racks as well, keeping in mind that the depth of the device is 19 mm bigger than that of the drawings. As an example, see the previous drawing of the flush mounting for 42HP and 84HP devices in **Erreur ! Source du renvoi introuvable.** As a comparison, the new, shorter rack is also drawn in **light blue**.



Dimensions for flush mounting of the previous 84HP and 42HP single rack, including the new (shorter) rack dimensions as well.

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