

HARDWARE GUIDES

EuroProt+ Hardware description



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PROTECTION, AUTOMATION AND
CONTROL FOR POWER INDUSTRY

VERSION INFORMATION

VERSION	DATE	MODIFICATION	COMPILED BY
Preliminary	2010-02-01	Preliminary version	Budenszki
Preliminary	2010-04-23	Corrected preliminary version	Budenszki
1.0	2010-11-11	First edition	Petri
1.1	2011-06-25	Module description updated, some technical data added	Budenszki
1.2	2011-09-07	Binary output module (R4) drawings corrected, new modules added	Budenszki
1.3 prelim.	2011-09-08	PS+2401 power supply added, some other corrections added	Budenszki
1.31	2012-04-17	New modules added	Budenszki
1.32	2012-04-26	Wall-mounting drawing update	Budenszki
1.34	2012-08-28	Minor corrections	Budenszki
1.35	2012-09-10 2012-10-09 2012-10-10 2012-10-15 2012-10-31 2012-11-07 2012-11-21	24HP IP54 feature added, power supply naming clarification, PS+4401, PS+2101 and PS+1602 added, O16+2401 and O16+4801 added 24 V DC PSTP+4201 and PS+4201 added Resolving Acronyms EMC/ESD conformance data updated RIO module added Device housing description updated O8+2401 module added VT+ and TRIP+ modules data updated HMI+ module types added Device weight data added ASIF-O transmitter and receiver data added TRIP+ wiring methods	Budenszki, Nagy
1.36	2013-06	CPU+9201 module type added COM+8882, COM+1112 module types added Long and short haul Ethernet transceiver types added ASIF-O POF, ASIF-O GLASS transmitter output optical power data updated, ASIF-O GLASS receiver data added Slot numbers updated in backplane table CT+ accuracy and power consumption data updated, recommended applications added VT+ selectable voltage range and power consumption data updated, recommended applications added Binary input modules data updated R4S+ modules data updated TRIP+ module wiring chapter updated RTD module data updated AI modules data updated PS+2101 input voltage interruption time updated O6R5 modules added Semi-flush mounting chapter updated Product availability chapter added Minor corrections	Budenszki, Nagy
1.37	2014-10	New modules added: CPU+0007, CPU+0291, CPU+1191, CPU+1391, CPU+1291, CPU+9291,	Budenszki, Nagy

		<p>COM+9901, COM+9902, COM+9992, COM+1324, HMI+2404, HMI+2504, CT+5152, CT+5153, CT+2500, VT+2212, R8+01, R8+A1, R8+C0, R8+FF, R12+4400, R16+0101, R16+0001, R16+A001, RTD+0200, AIC+0201</p> <p>CPU and COM module: CPU+ module description updated.</p> <p>Human-Machine Interface (HMI) module: Remote HMI product added.</p> <p>Voltage input module: Voltage measuring ranges updated.</p> <p>Binary input module: Thermal withstand voltages updated.</p> <p>Signaling module: Rated voltages updated. Main features updated.</p> <p>Tripping module: Thermal withstand voltages updated. TRIP+ module wiring description and figures updated.</p> <p>RTD input module: RTD module wiring figures updated.</p> <p>Analog input module: AIC+ module illustrations has been updated. AI wiring figures added.</p> <p>Power supply module: Input voltage interruption times updated. Input voltage ranges updated. Internal fuses added. Inrush current values added to main features.</p> <p>PSTP+ module: Input voltage interruption times updated, Input voltage ranges updated. Internal fuses added. Inrush current values added to main features</p> <p>O6R5+ module: Rated voltages updated, Relay output main features updated</p> <p>Binary input module with time synchronization: Module description updated, Withstand voltage for sync. input added</p> <p>General data chapter: Altitude, atmospheric pressure added</p> <p>Mounting methods chapter: Rack types vs. mounting methods table added, Illustrations updated for all methods, 42 HP and 84 HP remote HMI dimensions added</p> <p>Product availability chapter: Modules added</p>	
1.38	2015-02	<p>Minor corrections: SL/BL and SLA/BLA marking correction</p> <p>HMI module: LCD dot-defect handling policy chapter added</p> <p>Current input module: CT+2500 became obsolete, replacement: CT+1500</p> <p>Tripping module: TRIP+2101 restricted to 110 V DC application,</p>	Budenzski, Nagy

		<p>TRIP+2201 became available and recommended for new designs with rated voltage 220 V DC</p> <p>PSTP+ module: Card drawings updated, PE symbol added</p> <p>Minor corrections</p>	
1.39	2015-08	<p>New modules added: CPU+0281, CPU+0501, CPU+1401, CPU+1091 PSTP+2102, PSTP+4202 VS+0031</p> <p>Mechanical data: Notes on solid and perforated rack covers for 84 and 42 HP devices added.</p> <p>Mounting methods: Semi-flush mounting of 24 HP panel instrument case figure updated. Wall mounting method figures updated. IP54 rated mounting kit for 42 HP devices chapter updated. No mounting chapter added.</p> <p>Minor corrections</p>	Budenzski, Nagy
1.40	2018-10	<p>New modules added: ATO+0002, ATO+0004, CPU+A001, CPU+A011, COM+1801, CT+5111, CT+5154, CT+5155, CT+5253, R1T+0001, RTD+1200, CVS+0001, CVSR+0001, INJ+0005, INJ+0015, RAI+01, RAI+11, RINJ+21, PS3F+1001, PS+2303, PSR2+2101, RBOX+A201.</p> <p>Current input module: Thermal withstand data updated. Accuracy data removed. Max. measured current data updated.</p> <p>Voltage input module: Accuracy data removed. Max. measured current data updated.</p> <p>Signaling module: Main features updated. Unused modules have been removed.</p> <p>Tripping module: TRIP+1101 restricted to 110 V DC.</p> <p>RTD input module: RTD module wiring figures updated.</p> <p>Power supply module: PS+4401 nominal 60 V DC input voltage range added.</p> <p>PSTP+ module: PSTP+4201 nominal voltage and input voltage range updated.</p> <p>Special devices: TRCS has been added.</p> <p>Mounting methods: IP54 rated mounting kit for 84 HP devices</p> <p>Minor corrections</p>	Budenzski, Bidó

1.41	2020-06-18	<p>New modules added: HMI+/3505, HMI+/3506, HMI+/5706, HMIT+/3505, HMIT+/3506, HMIT+/5706, HMI+/2406, HMI+/2506 CPU+/0201T, CPU+/1201T, CPU+/1291T, CPU+/6001 COM+/1103, COM+/1111D, COM+/1202 CT+/1111, CT+/1515, CT+/5115, CT+/5116 VT+/2212 AIC+/0202 O9S+/4221F <i>Shorter default rack for 42HP devices</i></p> <p>New chapter about terminals/connectors: New connectors added under Chapter 20, module chapters updated with the available terminals wherever necessary (CPU, COM excluded!)</p> <p>CPU and COM module: EOB removed (obsolete) MM/LC connector indicated COM module introduction shortened Added recommendations for the cabling of the multimode connectors</p> <p>HMI module: HMI modules for reduced racks, remote HMI modules added to the table S24 HMI modules' table separated and extended with the DIN-rail mounted devices</p> <p>Current input module: CT Application Guide removed, as it became obsolete</p> <p>Binary input module: Notes added for thermal withstand voltage and for clamp voltages</p> <p>Signaling module: Notes and continuous carry data for modules with solid-state relays (SSR) updated</p> <p>Tripping module: Thermal withstand voltage updated. Tech data table of the TCS updated</p> <p>Analog input module: AI wiring figures for obsolete modules removed, the rest is updated</p> <p>Generator protection module: External boxes renamed, figures updated External boxes for middle-grounded rotors unified into one box Introduction added to the boxes</p> <p>Power supply module: PS+/1030 and PS+/1060 input voltage ranges and interruption times updated. Both modules are reintroduced for special configurations.</p> <p>Mixed function modules: PSTP+/4202 and PSTP+/2102 are shown separately in the table Tech. data of the TCS added</p> <p>Special devices: RIO figures have been added and updated TRCS figures have been added</p> <p>Mechanical data:</p>	Bidó, Erdős
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		<p>New sub-chapters (general mech. data, connectors/terminals) Existing terminal types listed here, introduction of new terminal types and naming (F, T, R) Mounting methods: <i>Shorter 42HP rack added</i> Console mounting replaced with Fold-down mounting. Figures have been added. Other corrections Nominal (rated) values now get the 'N' index. Minor corrections VT+/2245, INJ+/0005, O9S modules are no longer special modules</p>	
1.42	2021-06-02	<p>New chapters: Sampling synchronization module Previous 42HP and 84HP device housings</p> <p>Chapter deleted: Special devices (RIO, TRCS), these are moved into their own separate descriptions RBOX chapter</p> <p>New modules added: CPU+/0211, CPU+/6004, CPU+/6094, CPU+/6601, COM+/6603, COM+/6663, PS+/1303, TSYNC+/0071</p> <p>T connector option added: CPU+/0211, CPU+/0291, CPU+/1101, CPU+/6601, CPU+/A001, PS+/1060, PS+/2601, RAI+/11, RINJ+/21, O9S+/2111, O9S+/2121, TRIP+/21F1</p> <p>CPU and COM module: Modules with T connector option removed from the list, highlighted differently, notes added. COM chapter split up according to the application fields</p> <p>Backplane module: Chapter modified for device housing information only. Backplane module information is moved to Chapter 1 Device pictures updated</p> <p>HMI module: Introduction part updated Split into three subchapters (local HMI, remote HMI, S24 HMI) Tables revised, all modules referring to normal-depth housings marked as obsolete HMI pictures updated 84HP devices now get the rack with reduced depth All device housings with normal depth size are obsolete</p> <p>Voltage input module: Continuous voltage withstand value lowered to 200V for VT+/2211, VT+/2212 and VT+/2215</p>	Erdős

		<p>Current input module: Notes added to the CT+/5115 module, ring-lug option added CT+/5253 nominal values fixed</p> <p>General Data: Subchapter added for hardware type tests' list</p> <p>Mounting methods: Flush mounting data/figure updated for 84HP and double 42HP devices Rack mounting data/figure updated for 84HP devices Rack mounting figure added for double 42HP devices Semi-flush mounting data/figures updated for 84HP and 42HP devices Semi-flush mounting data/figures updated for S24 devices Wall mounting data/figure updated for 84HP and 42HP devices Wall mounting figures added for 84HP and 42HP devices with one terminal line only Fold-down mounting data/figure updated for 84HP devices Fold-down mounting with terminals data/figure updated for 84HP devices Fold-down mounting with terminals data/figure added for 42P devices</p>	
1.43	2021-09-22	<p>New modules added: CPU+/1004, CPU+/6093, CPU+/A004, CPU+/A094, COM+/1901</p> <p>T connector option added: CPU+/0501, COM+/1801, COM+/1901</p> <p>CPU and COM module: COM+/1801 application information updated</p> <p>Current input module: CT+/0101 rated current, max. measured current updated CT+/5153 T option added (only the handle changes)</p> <p>Mechanical data: Optional IP54 front panel listed here as well</p> <p>Mounting methods: IP54 front panel option added for S24 devices, notes added to the mounting methods</p>	Erdős
1.44	2022-03-31	<p>New modules added: O15+/1101T, O15+/4801T</p> <p>T connector option added: PS+/4401, O9S+/4221, CPU+/0281</p> <p>Minor corrections</p>	Erdős

2.00	2023-02-10	<p>New modules added: CPU+/1202, CPU+/1292, CPU+/9901 HMI+/2304, HMI+/2306, HMI+/2604, HMI+/2606, HMI+/2704, HMI+/2706, HMI+/3404, HMI+/3405, HMI+/3406, HMI+/5004, HMI+/5704 PS+/4261, PS+/4264, PS+/2161, PS+/2164</p> <p>CPU and COM module: Connector types info updated, table rearranged</p> <p>VT module: Short time overload data updated (DC removed, 2211 and 2246 raised to 10s)</p> <p>Signaling module: Drawings updated</p> <p>Power Supply module: Voltage dip withstand data updated according to IEC 60255-26</p> <p>Analog input module: Voltage input removed</p> <p>Connectors Top-screw BLAT removed</p>	Erdős
2.01	2024-05-08	<p>New module added: CPU+/A002</p>	Erdős
2.1	2024-09-17	<p>New modules added: CPU+/6201, CPU+/6501T, CPU+/6691, CPU+/1302, CPU+/1502, CPU+/2202, CPU+/2292, CPU+/22F2S, CPU+/6092S, CPU+/9202, CPU+/A092, CPU+/A202, CPU+/A212, CPU+/A292, CPU+/F202, CPU+/F292, CPU+/F2F2S, O12+/2102, O15+/2201T, O15+/2401T, R6+/0012, R8+/01, R8+/0002, R12+/0002, R12+/4400, TRIP+/2102, INJ+/ 0025, PS+/2162, PSTP+/2104T, PSTO+/2101</p> <p>VT module: VT+/2211 module - Power consumption of voltage input values doubled</p> <p>All module types: Connector types info updated</p> <p>PSTO+ chapter: Added a new chapter 18.3 PSTO+ module</p> <p>Connectors - F terminal types: Obsolete terminal type, not recommended for new designs, removed</p> <p>Minor corrections: Minor corrections in the text and on drawings</p>	Ádám
2.11	2024-10-11	<p>Minor corrections Rated voltage values: corrected for the new signaling modules</p>	Ádám

2.12	2024-11-06	<p>New module added: VT+/2221</p> <p>Binary input module: 125V DC rated voltage added wherever applicable</p> <p>Tripping module: 125V DC rated voltage added wherever applicable</p> <p>Power supply module: 125V DC rated voltage added wherever applicable</p> <p>PSTP+ module: 125V DC rated voltage added wherever applicable</p>	Erdős
2.2	2025-04-16	<p>New modules added: CPU+/6294, CPU+/0292, CPU+/1102, CPU+/1182, CPU+/15F2S, CPU+/22E2S, CPU+/2502, CPU+/6002, CPU+/6092, CPU+/6202S, CPU+/6302S, CPU+/6502S, CPU+/A0G2S, CPU+/A012, CPU+/A062, CPU+/A0F2, CPU+/A292S, CPU+/A2F2, CPU+/F0D2, CPU+/F2E2S HMI+/BRM01, HMI+/BRM03, HMI+/EPP01, HMI+/EPP02, HMI+/EPP03, HMI+/EPP07, HMI+/EPP08, HMI+/EPP09, HMI+/EPP10 VT+/2231T, O8+/2102, O8+/4202, O12+/4202, O15+/2102, O15+/4202, R15+/0002, R6S+/0012, TRIP+/4202, INJ+/0080T, INJTR+/0020, INJTR+/0080, TSYNC+/0071T, O6R5+/4202, O9S+/2112, O9S+/4222</p> <p>T connector option added: CPU+/1501T, CT+/1500T, PS+/1602T, PSTP+/4202T</p> <p>Secure boot option added (to basic modules): CPU+/1202S, CPU+/2202S, CPU+/A002S, CPU+/A0F2S, CPU+/A292S, CPU+/A2F2S,</p> <p>CPU module: Secure boot option added</p> <p>CT module: CT+/5155 module - Max. measured current and Thermal withstand values corrected</p> <p>TRIP module: Trip+/21F1 rated and withstand voltage values changed</p> <p>INJTR module chapter added</p> <p>New Connector type: New connector type 5CDG 7.62 added.</p> <p>Minor corrections Minor corrections in the text and on drawings</p>	Ádám

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1 System design

The EuroProt+ 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.

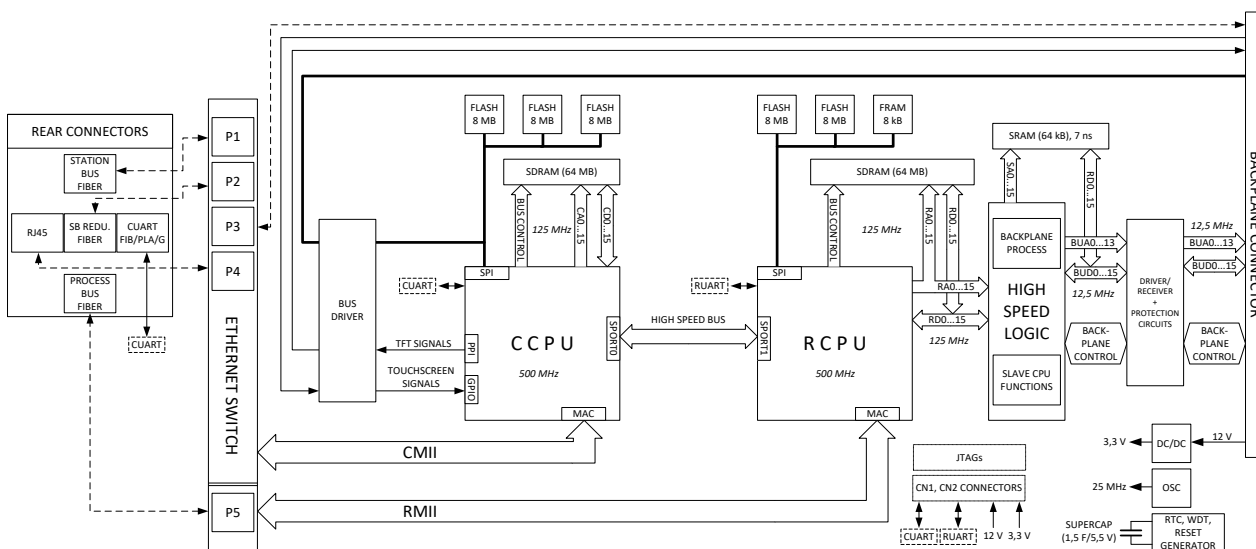


Figure 1-1 CPU block diagram

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.

2 CPU and COM module

2.1 CPU+ module

The CPU module contains all the protection, control and communication functions of the EuroProt+ 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 firmware is stored in a dedicated flash memory independent from the disturbance recorder and event storage.

The 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.

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.

2.1.1 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.

2.1.2 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 EuroProt+ 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)
- IEEE802.1w (RSTP, STP) standard supported by onboard Ethernet chipset (only on marked modules, see the table below).
- 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	PORT 1		PORT 2	PORT 3		SECURE BOOT CAPABILITY
	A	B		A	B	
CPU+/0007	-		-	-		-
CPU+/0091*	-		-	+ SM SH		-
CPU+/0201*	-		+ RJ45	-		-
CPU+/0211*	-		+ RJ45	+ MM		-
CPU+/0281*	-		+ RJ45	+ SM LH		-
CPU+/0291*	-		+ RJ45	+ 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		+ RJ45	-		-
CPU+/1211	+ MM		+ RJ45	+ MM		-
CPU+/1281*	+ MM		+ RJ45	+ SM LH		-
CPU+/1291*	+ MM		+ RJ45	+ 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 VERSION	PORT 1		PORT 2	PORT 3		SECURE BOOT CAPABILITY
	A	B		A	B	
CPU+/1511	+ MM		+ Galv. RS485/422**	+ MM		-
CPU+/1581*	+ MM		+ Galv. RS485/422**	+ SM LH		-
CPU+/1611	+ MM		+ Galvanic sync**	+ MM		-
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+/6201*	+ MM/LC		+ RJ45	-		-
CPU+/6294	+ MM/LC		+ RJ45	+ SM SH		-
CPU+/6501T	+ MM/LC		+ Galv. RS485/422**	-		-
CPU+/6601*	+ MM/LC		+ MM/LC	-		-
CPU+/6691	+ MM/LC		+ MM/LC	+ SM SH		-
CPU+/9201*	+ SM SH		+ RJ45	-		-
CPU+/9291	+ SM SH		+ RJ45	+ SM SH		-
CPU+/9501	+ SM SH		+ Galv. RS485/422**	-		-
CPU+/9901	+ SM SH		+ SM SH	-		-
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		-

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 20.2). In these cases, a "T" letter appears on the label of the module (e.g. **CPU+/1201T), but all other properties remain the same.*

***Legacy port/protocol*

The CPU+/xxx4 cards are for special use.

CPU VERSION	PORT 1		PORT 2	PORT 3		SECURE BOOT CAPABILITY
	A	B		A	B	
CPU+/0202	-		+ RJ45	-		-
CPU+/0292	-		+ RJ45	+ SM SH		-
CPU+/1102	+ MM		+ MM	-		-
CPU+/1182	+ MM		+ MM	+ SM LH		-
CPU+/1202	+ MM		+ RJ45	-		+
CPU+/1292	+ MM		+ RJ45	+ SM SH		-
CPU+/1302	+ MM		+ POF**	-		-
CPU+/1502	+ MM		+ Galv. RS485/422**	-		-
CPU+/15F2S	+ MM		+ Galv. RS485/422**	SFP		+
CPU+/2202	+ RJ45		+ RJ45	-		+
CPU+/2292	+ RJ45		+ RJ45	+ SM SH		-
CPU+/22E2S	+ RJ45		+ RJ45	SFP****		+
CPU+/22F2S	+ RJ45		+ RJ45	SFP		+
CPU+/2502	+ RJ45		+ Galv. RS485/422**	-		-
CPU+/6002	+ MM/LC		-	-		+
CPU+/6092	+ MM/LC		-	+ SM SH		+
CPU+/6202S	+ MM/LC		+ RJ45	-		+
CPU+/6302S	+ MM/LC		+ POF**	-		+
CPU+/6502S	+ MM/LC		+ Galv. RS485/422**	-		+
CPU+/9202	+ SM SH		+ RJ45	-		-
CPU+/A0G2S	+ MM/LC PRP/HSR		-	+ MM/LC***		+
CPU+/A002*	+ MM/LC PRP/HSR		-	-		+
CPU+/A012	+ MM/LC PRP/HSR		-	+ MM		-
CPU+/A062	+ MM/LC PRP/HSR		-	+ MM/LC		-
CPU+/A092	+ MM/LC PRP/HSR		-	+ SM SH		-
CPU+/A0F2	+ MM/LC PRP/HSR		-	+ double SFP		+
CPU+/A202	+ MM/LC PRP/HSR		+ RJ45	-		-
CPU+/A212	+ MM/LC PRP/HSR		+ RJ45	+ MM		-
CPU+/A292	+ MM/LC PRP/HSR		+ RJ45	+ SM SH		+

CPU VERSION	PORT 1		PORT 2	PORT 3		SECURE BOOT CAPABILITY
	A	B		A	B	
CPU+/A2F2	+ MM/LC PRP/HSR		+ RJ45	+ double SFP		+
CPU+/F0D2	+ double SFP		-	SFP***		-
CPU+/F202	+ double SFP		+ RJ45	-		-
CPU+/F292	+ double SFP		+ RJ45	+ SM SH		-
CPU+/F2E2S	+ double SFP		+ RJ45	SFP(1X)****		+
CPU+/F2F2S	+ double SFP		+ RJ45	SFP (2X)		+

*IEEE802.1w (**RSTP, STP**) standard supported by onboard Ethernet chipset

**Legacy port/protocol

***Connected to the station bus, instead of the process bus

****Double SFP, but only one of them is in use

The last column shows which CPU modules have secure boot capability (+). Out of these the CPU versions ending with the letter S are only available with secure boot capability (e.g. CPU+/F2E2S). The others without the S marking are obtainable with or without a secure boot capability (e.g. CPU+/F2F2 and CPU+/F2F2S).

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

PRP/HSR option: A and F types can be ordered with PRP/HSR communication as software option.

Legend for CPU version table:

MM: Multimode with ST connector	GS: Glass with ST connector
MM/LC: Multimode with LC connector	SFP: Small Form-factor Pluggable connector
SM: Single mode with FC/PC connector	SB: Station Bus
LH: Long Haul with FC/PC connector	SBW: Station Bus Working
SH: Short Haul with FC/PC connector	SBR: Station Bus Redundant
POF: Plastic Optical Fiber with 1 mm fiber connector	PB: Proprietary Process Bus

CPU+ 0007	CPU+ 0091	CPU+ 0201	CPU+ 0211	CPU+ 0281	CPU+ 0291	CPU+ 0301	CPU+ 0401	CPU+ 0501	CPU+ 1001	CPU+ 1004
		RJ-45	RJ-45	RJ-45	RJ-45	PDF Tx Rx	GS/ST Tx ASIF Rx	Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5	MM/ST Tx SB Rx	MM/ST Tx SB Rx
	SM SH FCPC Tx PB Rx		MM/ST Tx PB Rx	SM LH FCPC Tx PB Rx	SM SH FCPC Tx PB Rx					
CPU+ 1011	CPU+ 1091	CPU+ 1101	CPU+ 1111	CPU+ 1181	CPU+ 1191	CPU+ 1201	CPU+ 1211	CPU+ 1281	CPU+ 1291	CPU+ 1301
MM/ST Tx SB Rx	MM/ST Tx SB Rx	MM/ST Tx SBW Rx MM/ST Tx SBR Rx	MM/ST Tx SBW Rx MM/ST Tx SBR Rx	MM/ST Tx SBW Rx MM/ST Tx SBR Rx	MM/ST Tx SBW Rx MM/ST Tx SBR Rx	MM/ST Tx SB Rx RJ-45	MM/ST Tx SB Rx RJ-45	MM/ST Tx SB Rx RJ-45	MM/ST Tx SB Rx RJ-45	MM/ST Tx SB Rx PDF Tx Rx
MM/ST Tx PB Rx	SM SH FCPC Tx PB Rx		MM/ST Tx PB Rx	SM LH FCPC Tx PB Rx	SM SH FCPC Tx PB Rx		MM/ST Tx PB Rx	SM LH FCPC Tx PB Rx	SM SH FCPC Tx PB Rx	
CPU+ 1311	CPU+ 1331	CPU+ 1381	CPU+ 1391	CPU+ 1401	CPU+ 1411	CPU+ 1481	CPU+ 1491	CPU+ 1501	CPU+ 1511	CPU+ 1581
MM/ST Tx SB Rx PDF Tx Rx	MM/ST Tx SB Rx PDF1 Tx Rx PDF2 Tx Rx	MM/ST Tx SB Rx PDF Tx Rx	MM/ST Tx SB Rx PDF Tx Rx	MM/ST Tx SB Rx GS/ST Tx ASIF Rx	MM/ST Tx SB Rx GS/ST Tx ASIF Rx	MM/ST Tx SB Rx GS/ST Tx ASIF Rx	MM/ST Tx SB Rx GS/ST Tx ASIF Rx	MM/ST Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5	MM/ST Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5	MM/ST Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5 SM LH FCPC Tx PB Rx
MM/ST Tx PB Rx		SM LH FCPC Tx PB Rx	SM SH FCPC Tx PB Rx		MM/ST Tx PB Rx	SM LH FCPC Tx PB Rx	SM SH FCPC Tx PB Rx		MM/ST Tx PB Rx	

CPU+ 1611	CPU+ 1681	CPU+ 6001	CPU+ 6004	CPU+ 6093	CPU+ 6094	CPU+ 6201	CPU+ 6294	CPU+ 6501T	CPU+ 6601	CPU+ 6691
MM/ST Tx SB Rx - 1 - 2 GND 3 Sy- 4 Sy+ 5 MM/ST Tx PB Rx	MM/ST Tx SB Rx - 1 - 2 GND 3 Sy- 4 Sy+ 5 SM LH FCPC Tx PB Rx	MM/LC Rx Tx LAN - 1 - 2 GND 3 Sy- 4 Sy+ 5 Tx+ Tx- GND 3 Rx- 4 Rx+ 5 MM/LC Rx Tx LAN SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN RJ-45 SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN RJ-45 SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5 SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN MM/LC Rx Tx LAN SM SH FCPC Tx PB Rx	MM/LC Rx Tx LAN MM/LC Rx Tx LAN SM SH FCPC Tx PB Rx
CPU+ 9201	CPU+ 9291	CPU+ 9501	CPU+ 9901	CPU+ A001	CPU+ A004	CPU+ A011	CPU+ A081	CPU+ A091	CPU+ A094	CPU+ 0202
SM SH FCPC Tx SB Rx RJ-45	SM SH FCPC Tx SB Rx RJ-45 SM SH FCPC Tx PB Rx	SM SH FCPC Tx SB Rx Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5 SM SH FCPC Tx PB Rx	SM SH FCPC Tx PB Rx SM SH FCPC Tx PB Rx	PRP/HSR MM/LC Rx Tx LAN A LAN B Rx Tx LAN A LAN B A B I LINK/ACT SM SH FCPC Tx PB Rx	PRP/HSR MM/LC Rx Tx LAN A LAN B Rx Tx LAN A LAN B A B I LINK/ACT SM SH FCPC Tx PB Rx	PRP/HSR MM/LC Rx Tx LAN A LAN B Rx Tx LAN A LAN B A B I LINK/ACT MM/ST Tx PB Rx	PRP/HSR MM/LC Rx Tx LAN A LAN B Rx Tx LAN A LAN B A B I LINK/ACT SM LH FCPC Tx PB Rx	PRP/HSR MM/LC Rx Tx LAN A LAN B Rx Tx LAN A LAN B A B I LINK/ACT SM SH FCPC Tx PB Rx	PRP/HSR MM/LC Rx Tx LAN A LAN B Rx Tx LAN A LAN B A B I LINK/ACT SM SH FCPC Tx PB Rx	RJ-45
CPU+ 0292	CPU+ 1102	CPU+ 1182	CPU+ 1202	CPU+ 1292	CPU+ 1302	CPU+ 1502	CPU+ 15F2S	CPU+ 2202	CPU+ 2292	CPU+ 22E2S
RJ-45 SM SH FCPC Tx PB Rx	MM/ST Tx SBW Rx MM/ST Tx SBR Rx	MM/ST Tx SBW Rx MM/ST Tx SBR Rx SM LH FCPC Tx PB Rx	MM/ST Tx SBW Rx RJ-45	MM/ST Tx SBW Rx RJ-45 SM SH FCPC Tx PB Rx	MM/ST Tx SB Rx PDF Tx Rx	MM/ST Tx SB Rx Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5 SM SH FCPC Tx PB Rx	MM/ST Tx SB Rx Tx+ 1 Tx- 2 GND 3 Rx- 4 Rx+ 5 LDC-BB SFP LAN A LAN B	RJ-45 RJ-45	RJ-45 RJ-45 SM SH FCPC Tx PB Rx	RJ-45 RJ-45 LDC-BB SFP LAN A

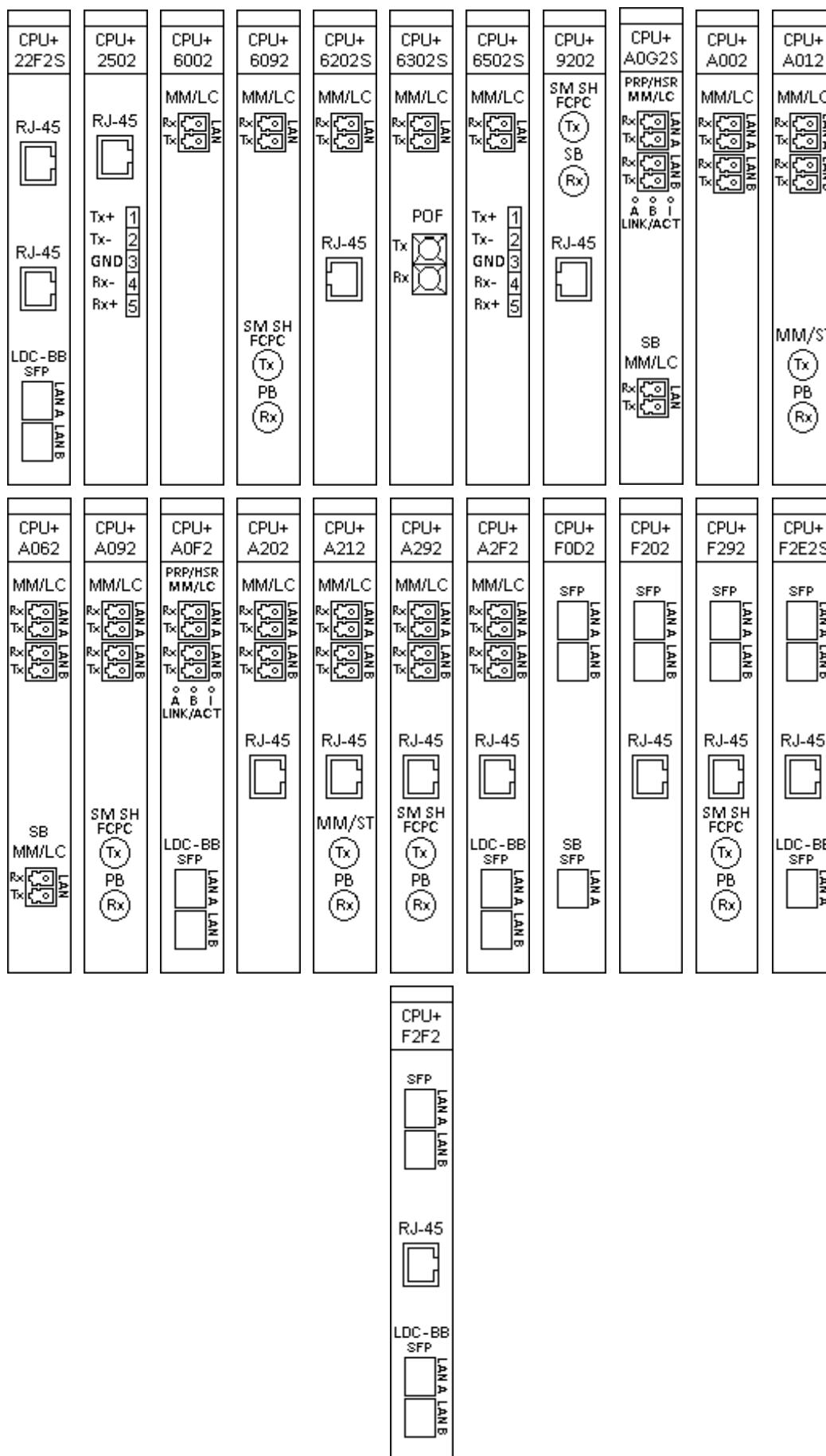


Figure 2-1 CPU versions

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
 - SFP
 - MM/LC 1300nm
 - RAD E1 (G703, 2 Mbit/s)
 - SM/LC 1550nm, -12dBm to -6dBm, short haul use
 - SM/LC 1550nm, -5dBm to 0dBm, long haul use
 - RJ45
- 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)

2.2 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

2.2.1 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 20.2). In these cases, a "T" letter appears on the label of the module (e.g. **COM+/1801T**), but all other properties remain the same.

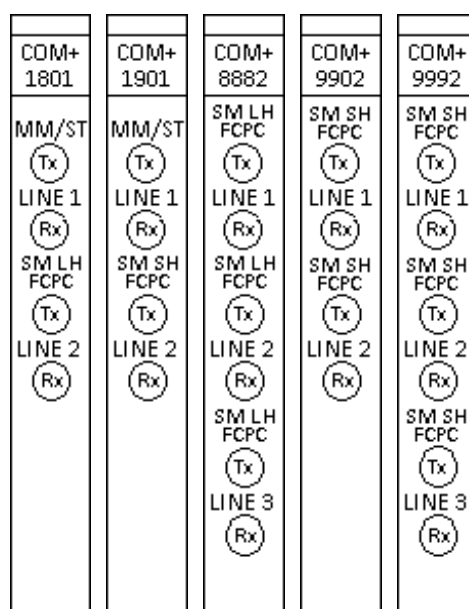


Figure 2-2 COM modules for binary signal transmission

2.2.2 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 20.2). In these cases, a "T" letter appears on the label of the module (e.g. **COM+/1801T**), but all other properties remain the same.

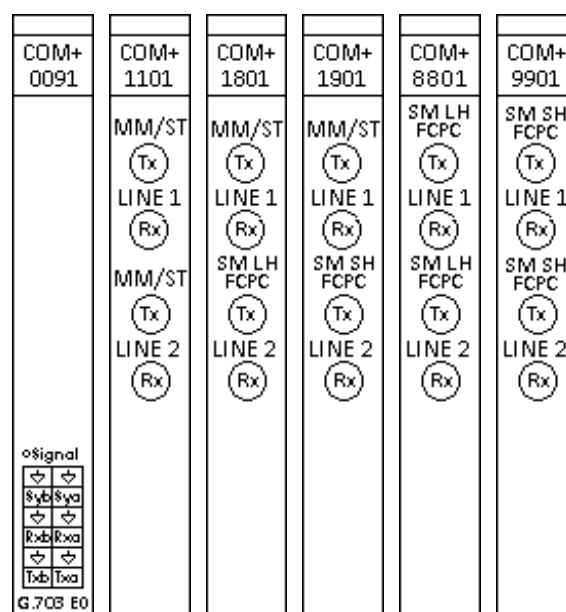


Figure 2-3 COM modules for line differential applications

2.2.3 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

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 20.2). In these cases, a "T" letter appears on the label of the module (e.g. **COM+/1801T), but all other properties remain the same.*

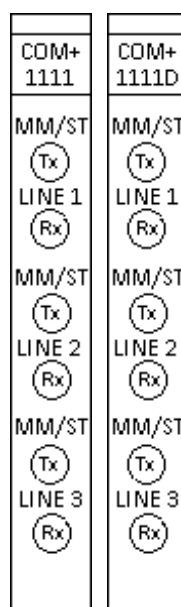


Figure 2-4 COM modules for busbar differential protections

2.2.4 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

*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 20.2). In these cases, a "T" letter appears on the label of the module (e.g. **COM+/1801T**), but all other properties remain the same.

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

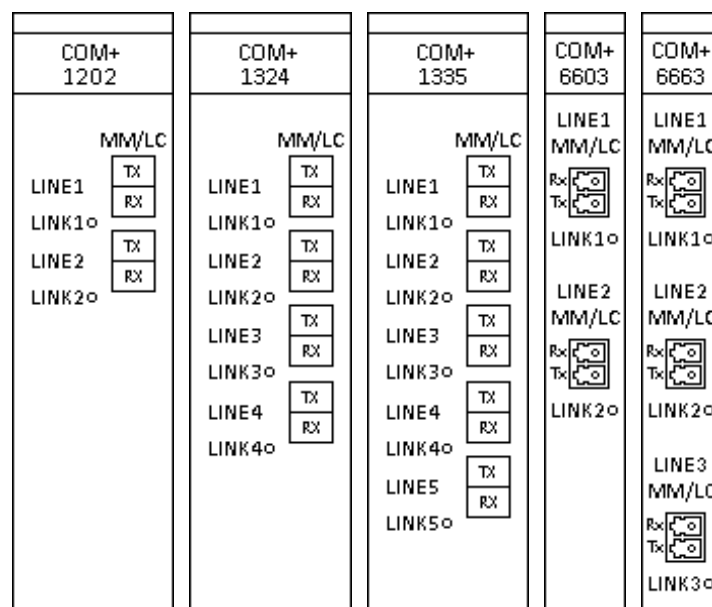


Figure 2-5 COM modules for RIO servers

2.3 Communication interface characteristics

2.3.1 Ethernet multi-mode transmitter and receiver

2.3.1.1 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	$P_D + 1.5$ dB	-	-33	dBm avg.
SIGNAL DETECT - DEASSERTED	P_D	-45	-	-	dBm avg.
SIGNAL DETECT - HYSTERESIS	$P_A - P_D$	1.5	-	-	dB
INPUT OPTICAL POWER MAXIMUM	$P_{IN\ Max}$	-14	-	-	dBm avg.
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

2.3.1.2 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	$P_D + 1.5$ 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

2.3.2 Ethernet single mode transmitter and receiver

2.3.2.1 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 EXTINGUCTION 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

2.3.2.2 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 EXTINGUISH 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

2.3.3 Small Form-factor Pluggable connector (SFP)

2.3.3.1 MM/LC connector

Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL OUTPUT POWER 62.5/125 μm , NA = 0.275 FIBER	P_O	-20.0	-17.0	-14.0	dBm avg.
OPTICAL OUTPUT POWER 50/125 μm , NA = 0.20 FIBER	P_O	-23.5	-20.0	-14.0	dBm avg.
OPTICAL EXTINCTION RATIO	ER	10	-	-	dB
CENTER WAVELENGTH	λ_C	1270	1308	1380	nm

Receiver

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL INPUT POWER	P_{IN}	-31.0	-	-14.0	dBm
OPERATING WAVELENGTH	λ_R	1270	-	1380	nm
SIGNAL DETECT - ASSERTED	P_A	-45	-	-	dBm avg.
SIGNAL DETECT - DE-ASSERTED	P_D	-	-	-32.0	dBm avg.
SIGNAL DETECT - HYSTERESIS	$P_A - P_D$	0.5	1.8	-	dB

2.3.3.2 RAD E1 (G703, 2 Mbit/s)

PARAMETER	VALUE
FRAME FORMAT	E1 G.732N CRC
COMPLIANCE	G.704, G.775, G.823
DATA RATE	2.048 Mbps
LINE CODE	HDB3
FRAMING	Framed, Unframed (HDLC, cHDLC)
LINE IMPEDANCE	120Ω, balanced
TRANSMIT CLOCK	Receive clock
CONNECTOR	RJ-45
CABLE LENGTH (MAX)	Up to 2500 m (8202 ft) for the AWG 22 cable
E1 RJ45 CONNECTOR PINOUT	The E1/T1 interface terminates in an 8-pin RJ-45 connector, wired as shown in the following table.

E1/T1 Connector Pinout

PIN	FUNCTION
1	Rx Ring
2	Rx Tip
3, 6, 7, 8	-
4	Tx Ring
5	Tx Tip
S=CONN. BODY	FGND/GND

2.3.3.3 Long haul, single mode transceiver - SM/LC

Up to approximately 104 km, with max. 29 dB link attenuation.

Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL OUTPUT POWER 9/125 μm , NA = 0.275 FIBER	P_O	-5	-	0	dBm avg.
OPTICAL EXTINCTION RATIO	ER	10	-	-	dB
CENTER WAVELENGTH	λ_C	1530	1550	1570	nm

Receiver

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL INPUT SENSITIVITY 9/125 μm , NA = 0.275 FIBER	P_{IN}	-	-38	-34	dBm avg.
SATURATION	P_{SAT}	-3	0	-	dBm
CENTER WAVELENGTH	λ	1100	-	1600	nm
SIGNAL DETECT - ASSERTED	P_A	-	-	-34	dBm avg.
SIGNAL DETECT - DEASSERTED	P_D	-48	-	-	dBm avg.
HYSTERESIS	P_{HYS}	-	2	-	dB

2.3.3.4 Short haul, single mode transceiver – SM/LC

Up to approximately 50 km, with max. 28 dB link attenuation.

Transmitter

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL OUTPUT POWER 9/125 μm , NA = 0.275 FIBER	P_O	-12	-	-6	dBm avg.
OPTICAL EXTINCTION RATIO	ER	10	-	-	dB
CENTER WAVELENGTH	λ_C	1530	1550	1570	nm

Receiver

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPTICAL INPUT SENSITIVITY 9/125 μm , NA = 0.275 FIBER	P_{IN}	-	-38	-34	dBm avg.
SATURATION	P_{SAT}	-3	-	-	dBm
CENTER WAVELENGTH	λ_C	1100	-	1600	nm
SIGNAL DETECT - ASSERTED	P_A	-	-	-34	dBm avg.
SIGNAL DETECT - DEASSERTED	P_D	-48	-	-	dBm avg.
HYSTERESIS	P_{HYS}	-	2	-	dB

2.3.3.5 GE-FB-P2RT - RJ45 Small Form-factor Pluggable connector

+3.3V Volt Electrical Power interface

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
SUPPLY CURRENT	I_s	-	320	375	mA
INPUT VOLTAGE	V_{CC}	3.13	3.3	3.47	V
MAXIMUM VOLTAGE	V_{max}	-	-	3.6	V

Low-speed signals, electronic characteristics

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
SFP OUTPUT LOW (MEASURED AT HOST SIDE OF THE CONNECTOR)	VOL	0	0.5	V
SFP OUTPUT HIGH (MEASURED AT HOST SIDE OF THE CONNECTOR)	VOH	host_ V_{CC} - 0.5	Host_ V_{CC} + 0.3	V
SFP INPUT LOW (MEASURED AT SFP SIDE OF THE CONNECTOR)	VIL	0	0.8	V
SFP INPUT HIGH (MEASURED AT SFP SIDE OF THE CONNECTOR)	VIH	2	$V_{CC} + 0.3$	V

High-speed electrical interface, transmission line-SFP

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
LINE FREQUENCY	fL	-	125	-	MHz
TX OUTPUT IMPEDANCE	$Z_{out, TX}$	-	100	-	Ohm
RX INPUT IMPEDANCE	$Z_{in, RX}$	-	100	-	Ohm

High-speed electrical interface, host-SFP

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
SINGLE ENDED DATA INPUT SWING	V_{insing}	250	-	1200	mV
SINGLE ENDED DATA OUTPUT SWING	$V_{outsing}$	350	-	800	mV
RISE/FALL TIME (20% - 80%)	T_r, T_f	-	175	-	psec
TX INPUT IMPEDANCE	Z_{in}	-	50	-	Ohm
RX OUTPUT IMPEDANCE	Z_{out}	-	50	-	Ohm

2.3.3.6 FLD-S155-T - RJ45 Small Form-factor Pluggable connector

+3.3V Volt Electrical Power Interface

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
SUPPLY CURRENT	I_s	-	320	375	mA
INPUT VOLTAGE	V_{CC}	3.13	3.3	3.47	V
MAXIMUM VOLTAGE	V_{max}	-	-	4	V
SURGE CURRENT	I_{surge}	-	-	30	mA

Low-Speed Signals

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
SFP OUTPUT LOW (MEASURED AT HOST SIDE OF THE CONNECTOR)	VOL	0	0.5	V
SFP OUTPUT HIGH (MEASURED AT HOST SIDE OF THE CONNECTOR)	VOH	host_ V_{CC} - 0.5	Host_ V_{CC} + 0.3	V
SFP INPUT LOW (MEASURED AT SFP SIDE OF THE CONNECTOR)	VIL	0	0.8	V
SFP INPUT HIGH (MEASURED AT SFP SIDE OF THE CONNECTOR)	VIH	2	$V_{CC} + 0.3$	V

High-Speed Electrical Interface

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
LINE FREQUENCY	fL	-	125	-	MHz
TX OUTPUT IMPEDANCE	$Z_{out, TX}$	-	100	--	Ohm
RX INPUT IMPEDANCE	$Z_{in, RX}$	-	100	-	Ohm

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
SINGLE ENDED DATA INPUT SWING	V_{insing}	250	-	1200	mV
SINGLE ENDED DATA OUTPUT SWING	$V_{outsing}$	350	-	800	mV
RISE/FALL TIME	T_r, T_f	-	175	-	psec
TX INPUT IMPEDANCE	Z_{in}	-	50	-	Ohm
RX OUTPUT IMPEDANCE	Z_{out}	-	50	-	Ohm

2.3.4 ASIF-O transmitter and receiver

2.3.4.1 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.

2.3.4.2 ASIF-O GLASS

Transmitter (Output measured out of 1 meter of cable)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	JUMPER SETTINGS
TRANSMITTER OUTPUT OPTICAL POWER 50/125 μm FIBER CABLE NA = 0.2	P_O	-19.4	-16.4	-14.4	dBm peak	JP1 2-3
		-28.9	-25.9	-23.9		JP1 1-2
TRANSMITTER OUTPUT OPTICAL POWER 62.5/125 μm FIBER CABLE NA = 0.275	P_O	-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 ($\lambda_P = 820 \text{ nm}$)	P_{RH}	-25.4	-	-9.2	dBm peak
PEAK OPTICAL INPUT POWER LOGIC LEVEL LOW	P_{RL}	-	-	-40	dBm peak

2.3.5 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.

Transmitter

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

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

The EuroProt+ 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

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

Transmitter

PARAMETER	VALUE
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

2.3.7 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.

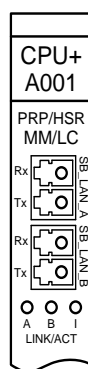


Figure 2-6 PRP/HSR connectors on a CPU+A001 module

2.3.7.1 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.

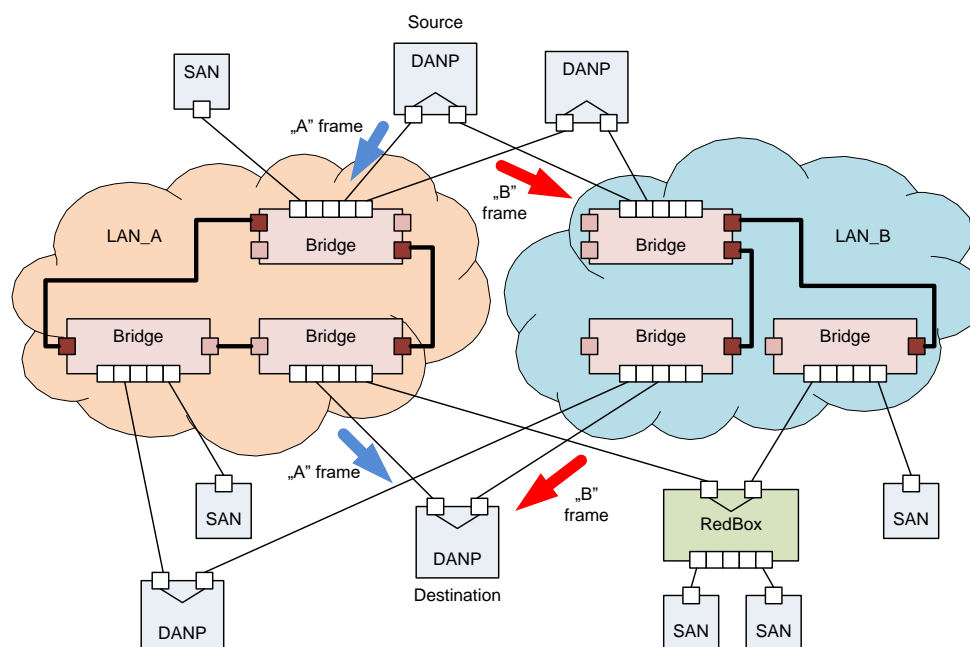


Figure 2-7 Example of a PRP redundant network

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.

2.3.7.2 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 copies of a frame to both directions 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.

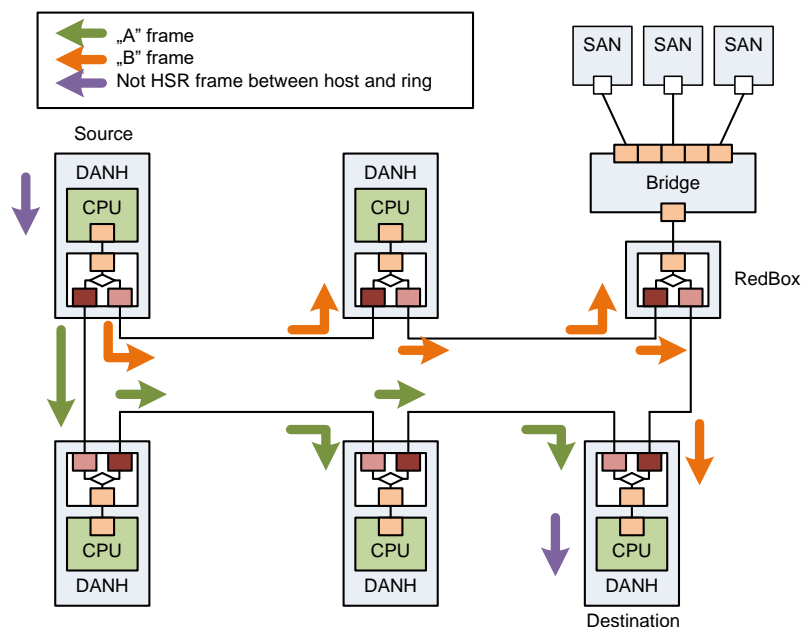


Figure 2-8 Example of an HSR redundant network

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.

3 Device housing

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 housing does not have this feature, as the S24 system is less flexible, their range of the optional modules is 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 was 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 4.






<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>	

Figure 3-1 Rack configuration illustrations

4 Human-Machine Interface (HMI) module

The EuroProt+ device HMI consists of the following two main parts:







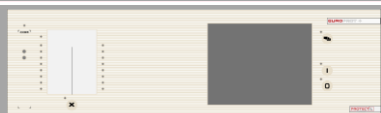
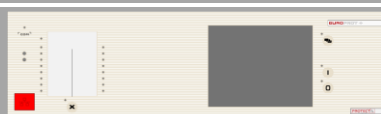


- Hardware: the HMI module, which is the front panel of the device, this is described here
- Software: the embedded web server and the menu system that is accessible through the HMI module. The web server is accessible via station bus, EOB interface or RJ-45 Ethernet connector. This is described in detail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


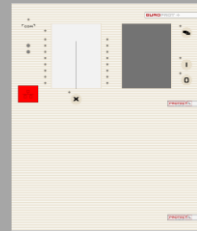


4.1 Local HMI modules

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	RACK DEPTH	ILLUSTRATION
HMI+/EPP03	3,5" TFT	RJ-45	42 HP	Reduced	
HMI+/EPP01	3,5" TFT	RJ-45	84 HP	Reduced	
HMI+/5005	5,7" TFT	EOB	42 HP	Reduced	
HMI+/5006 HMI+/5004*	5,7" TFT	RJ-45	42 HP	Reduced	
			Double 42 HP		n/a
HMI+/EPP02	5,7" TFT	RJ-45	84 HP	Reduced	
HMI+/BRM01	3,5" TFT	RJ-45	84 HP	Reduced	
HMI+/BRM03	3,5" TFT	RJ-45	42 HP	Reduced	

*New display hardware requires CDSP firmware version 1560-H5 or higher!

The following modules were made for the previous (now obsolete) racks (see Chapter 0), 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	
HMI+/3505 HMI+/3405*	3,5" TFT	EOB	42 HP	Reduced	
			84 HP		

HMI+/3506 HMI+/3406* HMI+/3404*	3,5" TFT	RJ-45	42 HP	Reduced	
			Double 42HP		
			84 HP		
HMI+/5706 HMI+/5704*	5,7" TFT	RJ-45	84 HP	Reduced	

4.2 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 the 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.



Figure 4-1 42 HP Remote HMI




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



Figure 4-2 Remote HMI module with its host device



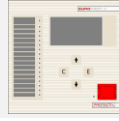

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	RACK DEPTH	ILLUSTRATION
HMIT+/3505	3,5" TFT	EOB	42 HP	Reduced	
			84 HP		
HMIT+/3506	3,5" TFT	RJ-45	42 HP	Reduced	
			84 HP		
HMIT+/5706	5,7" TFT	RJ-45	84 HP	Reduced	

The following modules were made for the previous (now obsolete) racks (see Chapter 0), so they can be found in numerous devices. These became obsolete as well, **they are not recommended for new designs!**



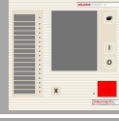


MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	RACK DEPTH	ILLUSTRATION
HMIT+/3501	3,5" TFT	EOB	42 HP	Normal	
			84 HP		
HMIT+/3502	3,5" TFT	RJ-45	42 HP	Normal	
			84 HP		
HMIT+/5702	5,7" TFT	RJ-45	84 HP	Normal	

4.3 S24 HMI

The S24 Smart Line devices have a different HMI family:

MODULE TYPE	DISPLAY	SERVICE PORT	RACK SIZE	MOUNTING	ILLUSTRATION
HMI+/EPP07	3,5" TFT	RJ-45	24 HP	Flush	
HMI+/EPP08	3,5" TFT	RJ-45	24 HP	DIN-rail	
HMI+/EPP09	B&W LCD 128x64	RJ-45	24 HP	Flush	
HMI+/EPP10	B&W LCD 128x64	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	
HMI+/2604* HMI+/2404 HMI+/2304**	3,5" TFT	RJ-45	24 HP	Normal	
HMI+/2606* HMI+/2406 HMI+/2306**	3,5" TFT	RJ-45	24 HP	DIN-rail	
HMI+/2704* HMI+/2504	B&W LCD	RJ-45	24 HP	Normal	
HMI+/2706* HMI+/2506	B&W LCD	RJ-45	24 HP	DIN-rail	

*For newer, modular-type S24 devices.

**New display hardware requires CDSP firmware version 1560-H5 or higher!

4.4 Parts of the HMI modules

The EuroProt+ 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
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.)

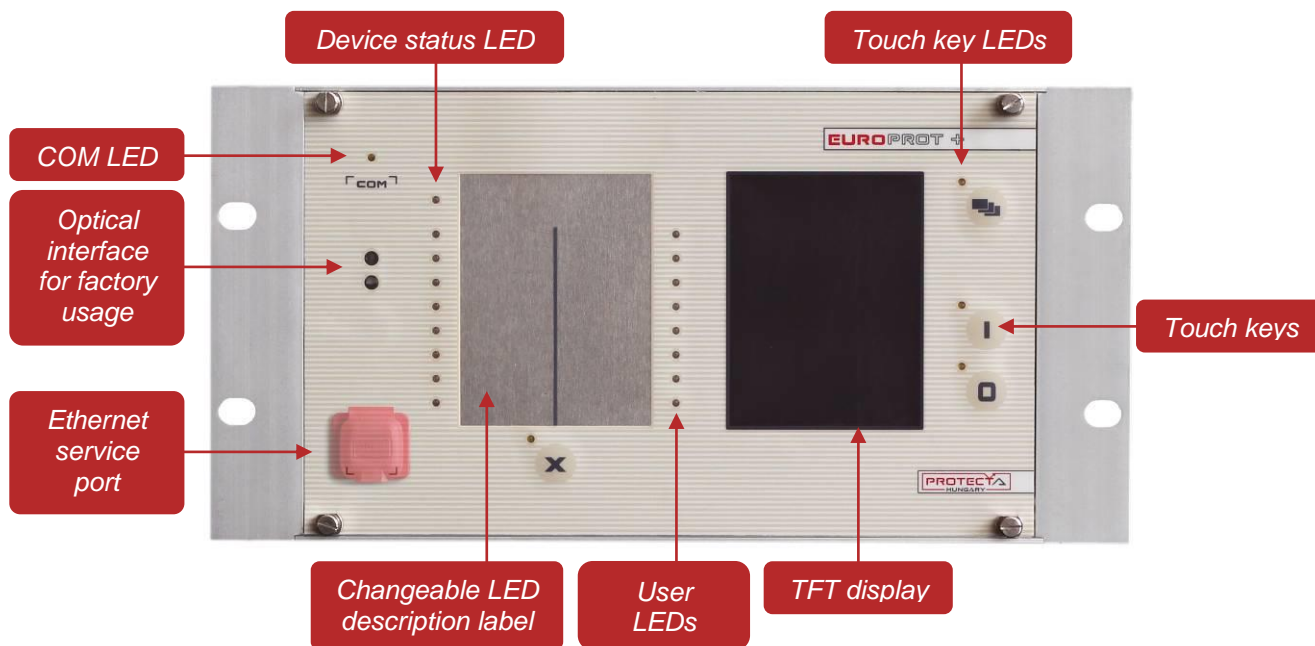


Figure 4–3 HMI signals and controls

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)	n/a
IN TOTAL		6	10	

For further information please contact our Application Team. (application@protecta.hu)

5 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 20.2 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	<u>Default:</u> STVS <u>Options:</u> T		<u>Default:</u> STVS <u>Options:</u> -		<u>Default:</u> STVS <u>Options:</u> -		<u>Default:</u> STVS <u>Options:</u> R, T	
RECOMMENDED APPLICATION	DEFL earth fault protection		Special disturbance recorder application in wider frequency range		Special protection applications where the overcurrent in the secondary circuit cannot 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			
SELECTABLE RATED CURRENT, I_N [A]	1	5	1	5	1	5	0.2	1
MAX. MEASURED CURRENT ($\pm 10\%$)	$2 \times I_N$		$2 \times I_N$		$50 \times I_N$		$12.5 \times I_N$	
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	<u>Default:</u> STVS <u>Options:</u> -		<u>Default:</u> STVS <u>Options:</u> -		<u>Default:</u> STVS <u>Options:</u> -			
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+/5110				CT+/5111*			
CHANNEL NUMBER	1 – 3		4		1 – 3		4		1 – 3		4	
SELECTABLE RATED CURRENT, I_N [A]	1	5	0.2	1	1	5	0.2	1	1	5	0.001	0.005
MAX. MEASURED CURRENT ($\pm 10\%$)	$50 \times I_N$				$50 \times I_N$				$50 \times I_N$			
POWER CONSUMPTION AT RATED CURRENT [VA]	0.01	0.25	0.001	0.01	0.06	1.3	0.004	0.6	0.01	0.25	0.005	0.1
THERMAL WITHSTAND [A]												
CONTINUOUSLY	20		20		20		7		20		7	
10 s	175		120		175		50		175		50	
1 s	500		380		500		150		500		150	
10 ms	1200		850		1200		330		1200		330	
CONNECTOR TYPE	<u>Default:</u> STVS <u>Options:</u> -				<u>Default:</u> STVS <u>Options:</u> R				<u>Default:</u> STVS <u>Options:</u> R			
RECOMMENDED APPLICATION	Sensitive earth-fault applications				High impedance earth-fault protection				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, T		Default: STVS Options: R		Default: STVS Options: R, T		Default: STVS Options: R	
RECOMMENDED APPLICATION	<ul style="list-style-type: none"> General protection application* 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 ($\pm 10\%$)	$50 \times I_N$			$10 \times I_N$		$50 \times I_N$		$10 \times I_N$		
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	0.01	0.05	0.25
M MAX. MEASURED CURRENT ($\pm 10\%$)	$50 \times I_N$			$8 \times I_N$		$50 \times I_N$		$10 \times I_N$		
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		1			20		7		
10 s	175		5			175		50		
1 s	500		10			500		150		
10 ms	1200		25			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*

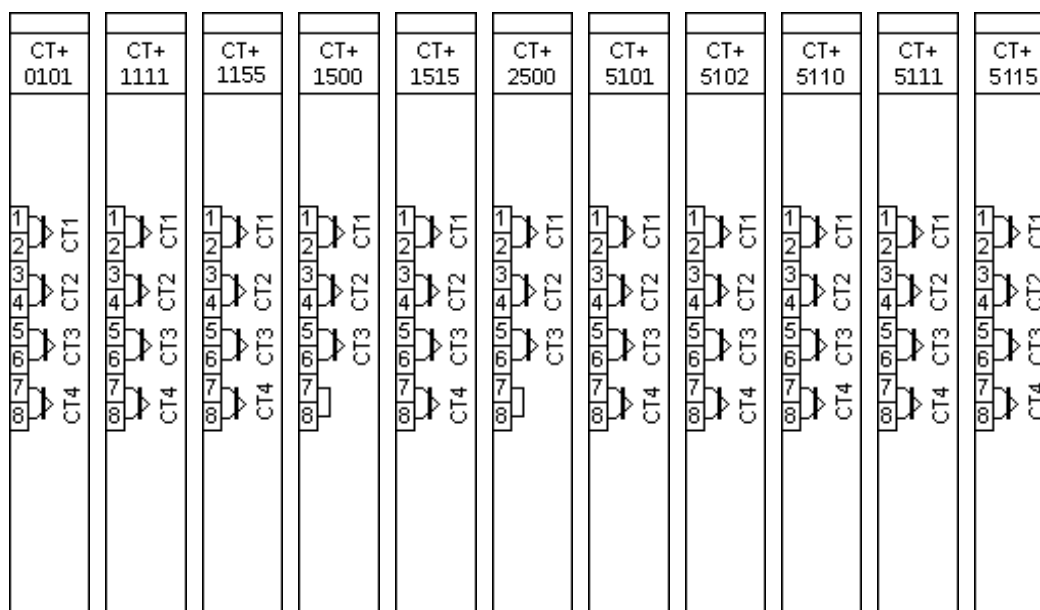




Figure 5-1 CT modules

6 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 20.2 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 (10s)	275 V	275 V
VOLTAGE MEASURING RANGE ($\pm 10\%$)	$0.05 U_N - 1.3 U_N$	$0.05 U_N - 1.3 U_N$	$0.05 U_N - 1.3 U_N$
POWER CONSUMPTION OF VOLTAGE INPUT	1.22 VA at 200 V 0.4 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
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T, R	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> -
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+/2221*	VT+/2231T
CHANNEL NUMBER	4	4
SELECTABLE VOLTAGE RANGE	Type 100: $\frac{100}{\sqrt{3}}$, 100 V	Type 100: $\frac{100}{\sqrt{3}}$, 100 V Type 200: $\frac{200}{\sqrt{3}}$, 200 V
CONTINUOUS VOLTAGE WITHSTAND	240 V	200 V
SHORT TIME OVERLOAD (1 s)	275 V (10s)	275 V (10s)
VOLTAGE MEASURING RANGE ($\pm 10\%$)	0.05 U _N – 1.3 U _N	0.05 U _N – 1.3 U _N 0.00625 U _N – 0.1625 U _N
POWER CONSUMPTION OF VOLTAGE INPUT	0.4 VA at 100 V	1.22 VA at 200 V 0.4 VA at 100 V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T, R	BLT
RECOMMENDED APPLICATION	Special applications with 115-120 V AC secondary voltage	Special applications for Petersen-coil controller

*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	420 V (10 s)
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	
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -
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

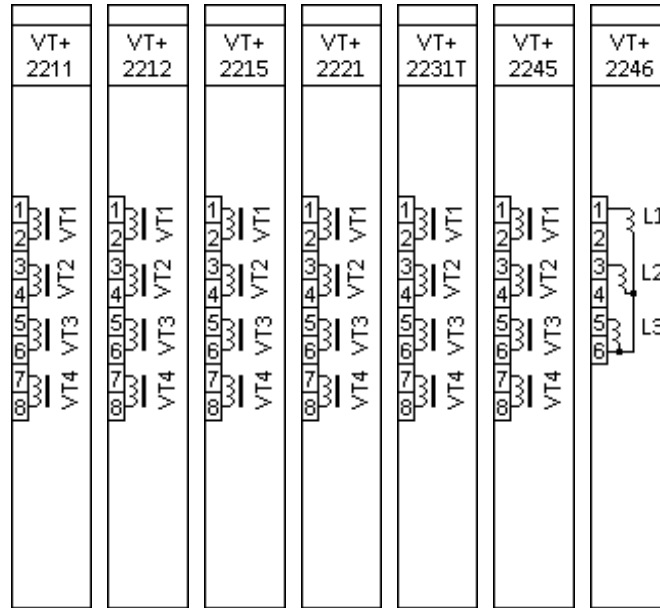


Figure 6-1 VT modules

7 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 20.2 for details about each type.

Notes for the following tables:

- **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+/1101	O8+/2102	O8+/2201	O8+/2401
CHANNEL NUMBER	8	8	8	8
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP
RATED VOLTAGE	110 (125) V*	110 V DC / 220 V DC	220 V	24 V
WITHSTAND VOLTAGE	250 V	264 V	320 V	72 V
CLAMP VOLTAGE	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$	falling $0.64 U_N$ rising $0.8 U_N$
COMMON GROUPS	independent	independent	independent	independent
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	BLT	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T

*The clamp voltage values refer to 110 V.

MODULE TYPE	O8+/4202	O8+/4801	O12+/1101	O12+/2201
CHANNEL NUMBER	8	8	12	12
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP
RATED VOLTAGE	24 V DC / 48 (60) V DC**	48 V	110 (125) V*	220 V
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 $0.8 U_N$
COMMON GROUPS	independent	independent	4 × 3 common	4 × 3 common
CONNECTOR TYPE	BLT	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T

*The clamp voltage values refer to 110 V.

** The clamp voltage values refer to 24/48 V

MODULE TYPE	O12+/2401	O12+/4801	O12+/2101**	O12+/2102
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 (125) V DC / 220 V DC user selectable on channel basis by jumpers*	110 (125) V DC / 220 V DC*
WITHSTAND VOLTAGE	72 V	72 V	320 V	264 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
COMMON GROUPS	4 × 3 common	4 × 3 common	4 × 3 common	4 × 3 common
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	BLT

*The clamp voltage values refer to 110 V

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

MODULE TYPE	O12+/4201***	O12+/4202	O15+/1101T	O15+/2102
CHANNEL NUMBER	12	12	15	15
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP
RATED VOLTAGE	24 V DC / 48 V DC user selectable on channel basis by jumpers	24 V DC / 48 (60) V DC**	110 (125) V*	110 V DC / 220 V DC
WITHSTAND VOLTAGE	72 V	72 V	250 V	264 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
COMMON GROUPS	4 × 3 common	4 × 3 common	1 × 15 common	1 × 15 common
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> -	BLT	BLT	BLT

*The clamp voltage values refer to 110 V.

** The clamp voltage values refer to 24/48 V.

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

MODULE TYPE	O15+/2201T	O15+/2401T	O15+/4202	O15+/4801T
CHANNEL NUMBER	15	15	15	15
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP
RATED VOLTAGE	220 V	24 V	24 V DC / 48 (60) V DC*	48 V
WITHSTAND VOLTAGE	250 V	100 V	72 V	100 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
COMMON GROUPS	1 × 15 common	1 × 15 common	1 × 15 common	1 × 15 common
CONNECTOR TYPE	BLT	BLT	BLT	BLT

*The clamp voltage values refer to 24/48 V.

MODULE TYPE	O16+/1101*	O16+/2201*	O16+/2401*	O16+/4801*
CHANNEL NUMBER	16	16	16	16
TIME SYNCHRONIZATION	-	-	-	-
RATED VOLTAGE	110 (125) V**	220 V	24 V	48 V
WITHSTAND VOLTAGE	250 V	320 V	72 V	100 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
COMMON GROUPS	2 × 8 common	2 × 8 common	2 × 8 common	2 × 8 common
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> -

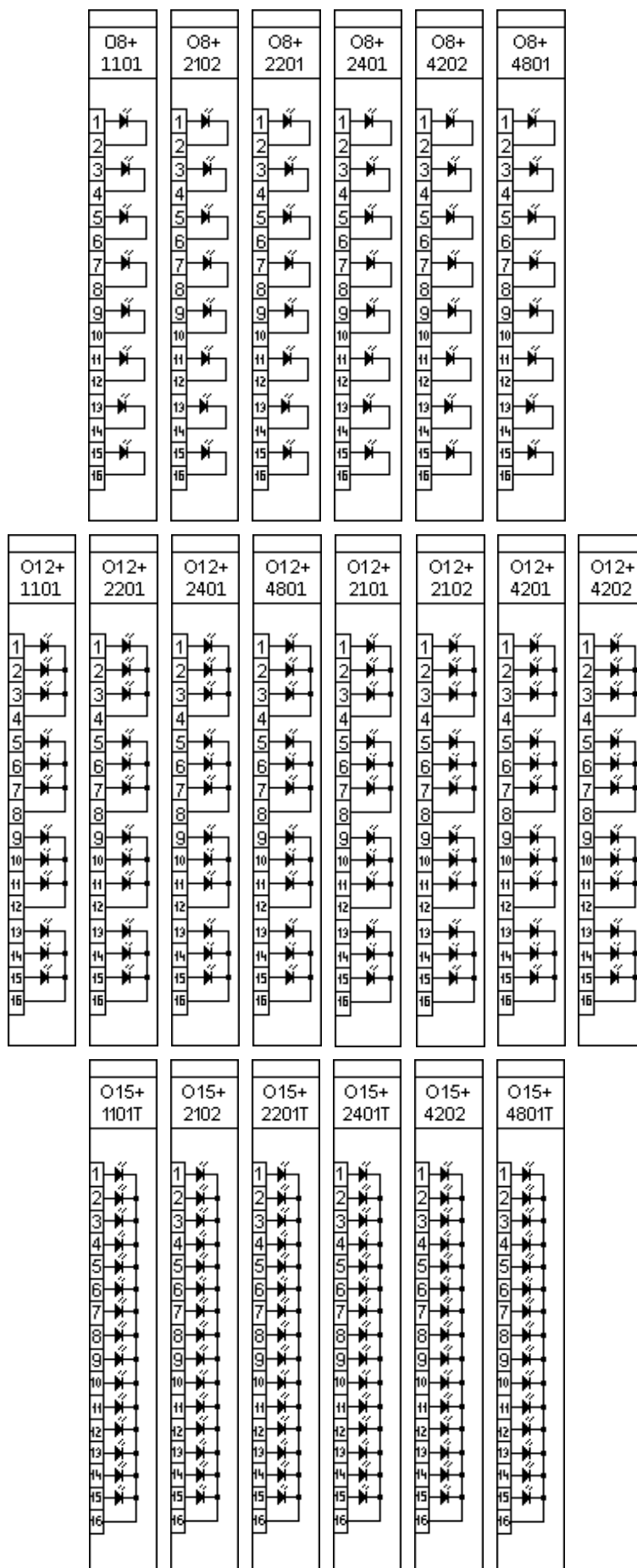
***Obsolete module. These modules are not recommended for new designs! O15+ modules are recommended instead (see above).**

**The clamp voltage values refer to 110 V.

Though the states of the inputs are refreshed with 2 kHz frequency, there is a 1 ms built-in analog filtering in them. Additional digital filtering is set in the EuroCAP tool (default: 4 ms).

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.



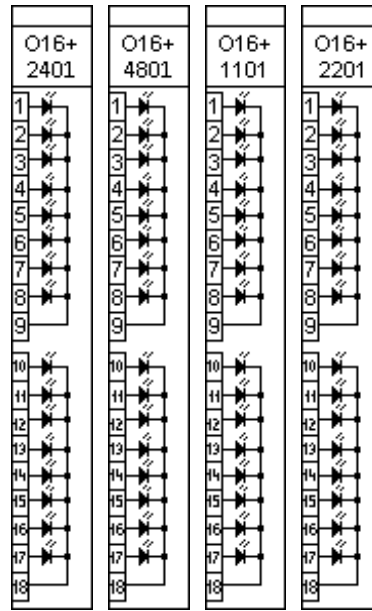
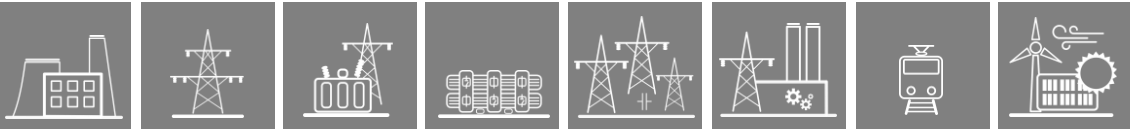


Figure 7-1 Binary input modules

8 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 20.2 for details about each type.

MODULE TYPE	R4+/01	R6+/0012	R8+/00	R8+/01*
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	CH5 and CH6 NO others CO	8 NO	CH1 NC others NO
GROUP ISOLATION	4 independent	6	8 independent	8 independent
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	BLT	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -

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

MODULE TYPE	R8+/80	R8+/0002	R8+/C0	R8+/FF
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	CH8 NC others NO	8 NO	CH7 and CH8 NC others NO	8 NC
GROUP ISOLATION	8 independent	8 independent	8 independent	8 independent
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	BLT	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T

MODULE TYPE	R12+/0000	R12+/4000	R12+/4400	R15+/0002
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	12 NO	CH12 NC others NO	CH9 and CH12 NC others NO	15 NO
GROUP ISOLATION	4 × 3 common	4 × 3 common	4 × 3 common	15 common
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	BLT

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> BL 3.5 <u>Options:</u> -	<u>Default:</u> BL 3.5 <u>Options:</u> -	<u>Default:</u> BL 3.5 <u>Options:</u> -

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

MODULE TYPE	R4S+/01*	R4S+/16*	R6S+/0012	R1T+/0001***
RATED VOLTAGE	250 V AC/DC	250 V AC/DC	250 V AC/DC	320 V AC/DC
CONTINUOUS CARRY	8 A 120 mA**	120 mA	8 A	32 A
CONTACT VERSIONS	4 CO (1 SSR, 3 normal)	4 CO (4 SSR)	4 CO + 2 SSR	1 NO
GROUP ISOLATION	4 independent	4 independent	6 independent	1 independent
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -	BLT	STVS

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 %)
- 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*

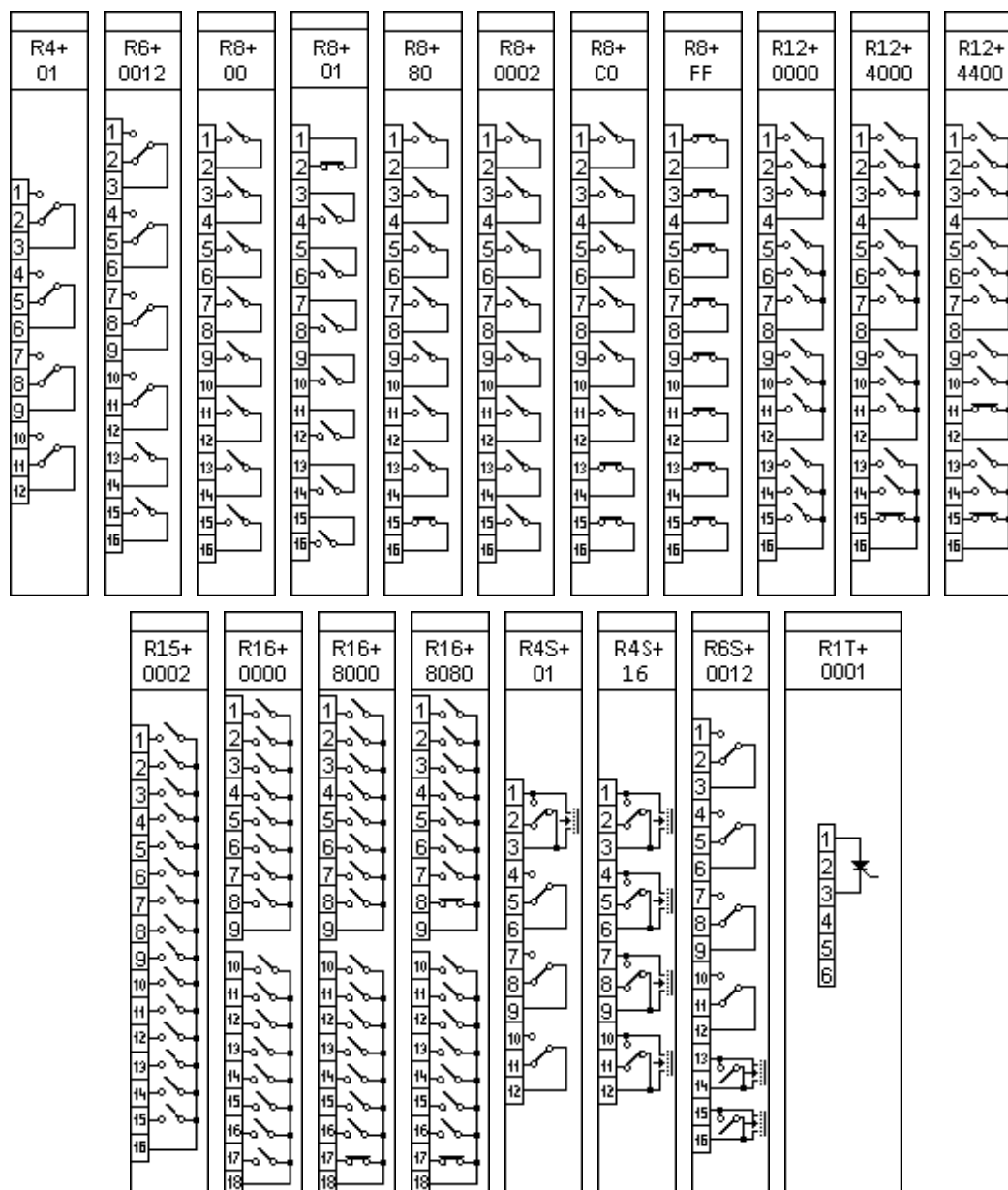


Figure 8-1 Signaling modules

9 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 20.2 for details about each type.

MODULE TYPE	TRIP+/4201	TRIP+/4202	TRIP+1101*	TRIP+/2101
CHANNEL NUMBER	4	4	4	4
RATED VOLTAGE	24 V DC and 48 V DC	24 V DC and 48/60 V DC	110 (125) V DC	110 (125) V DC
WITHSTAND VOLTAGE	72 V DC	72 V DC	242 V DC	150 V DC
CONTINUOUS CARRY	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
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
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	BLT	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> T

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

MODULE TYPE	TRIP+/2102	TRIP+/21F1*	TRIP+/2201	TRIP+/2201/C
CHANNEL NUMBER	4	4	4	4
RATED VOLTAGE	110 (125) V DC / 220 V DC	110 V DC / 220 V DC	220 V DC	220 V
WITHSTAND VOLTAGE	264 V DC	242 V DC	242 V DC	242 V DC
CONTINUOUS CARRY	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
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
CONNECTOR TYPE	BLT	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -

**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

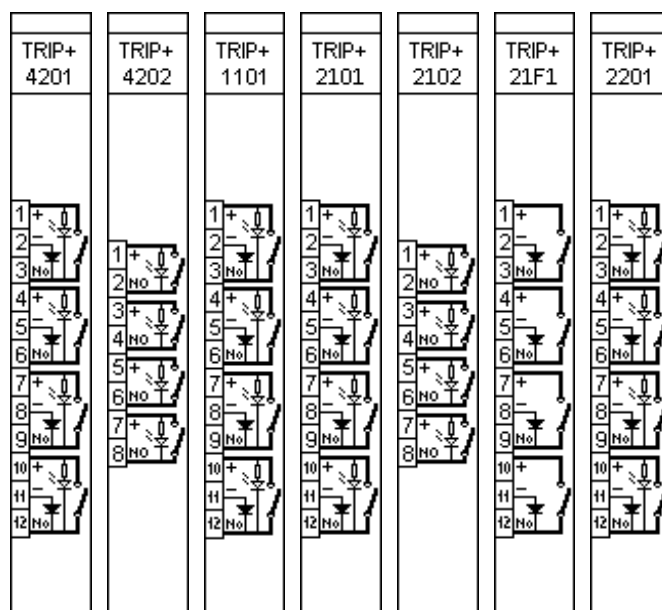


Figure 9-1 Tripping modules

9.1 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 damage internal circuits. Improper wiring might cause improper operation!**

9.1.1 3-wire TRIP+ wiring methods

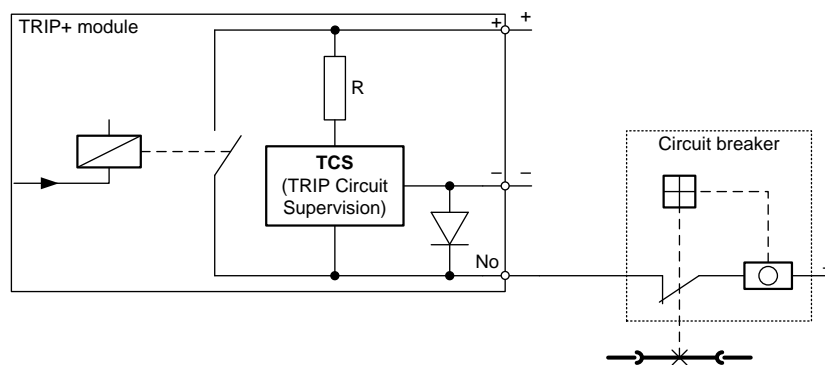


Figure 9-2 3-wire TRIP+ wiring

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

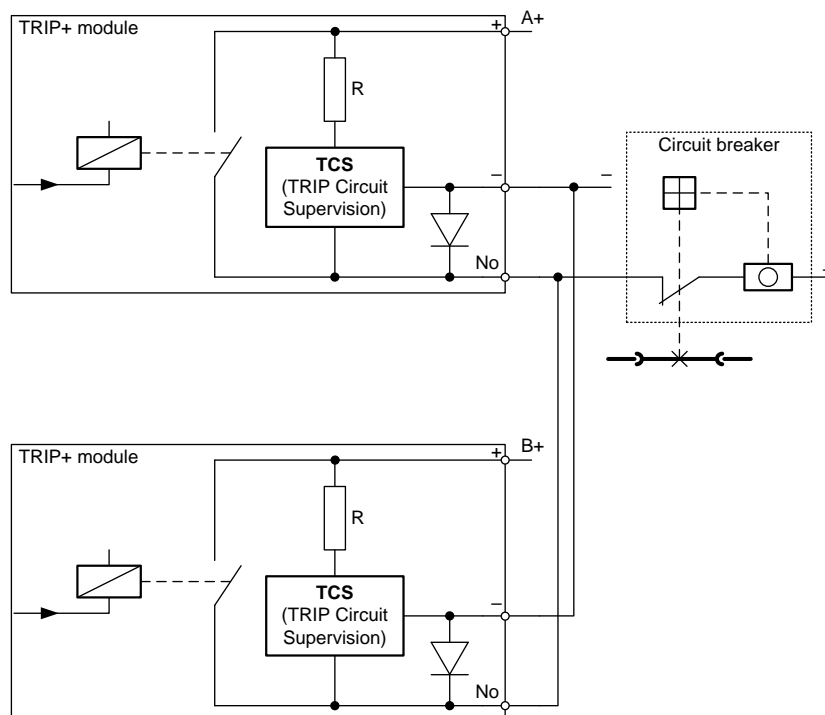


Figure 9-3 3-wire TRIP+ wiring using parallel connected TRIP+ modules

9.1.2 2-wire TRIP+ wiring methods

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

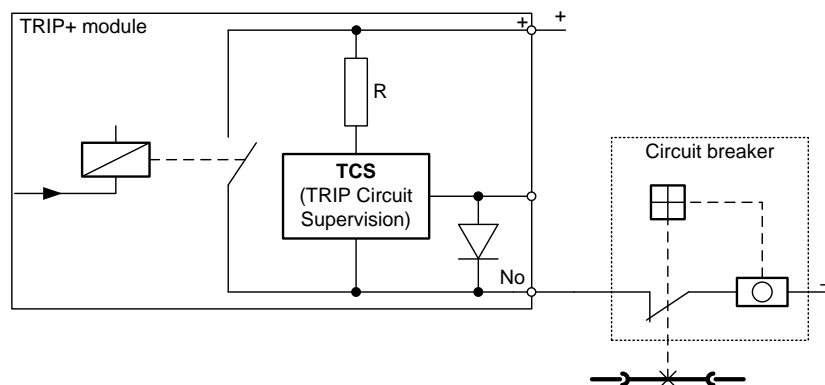


Figure 9-4 2-wire TRIP+ wiring

It is possible to use parallel connected TRIP+ modules.

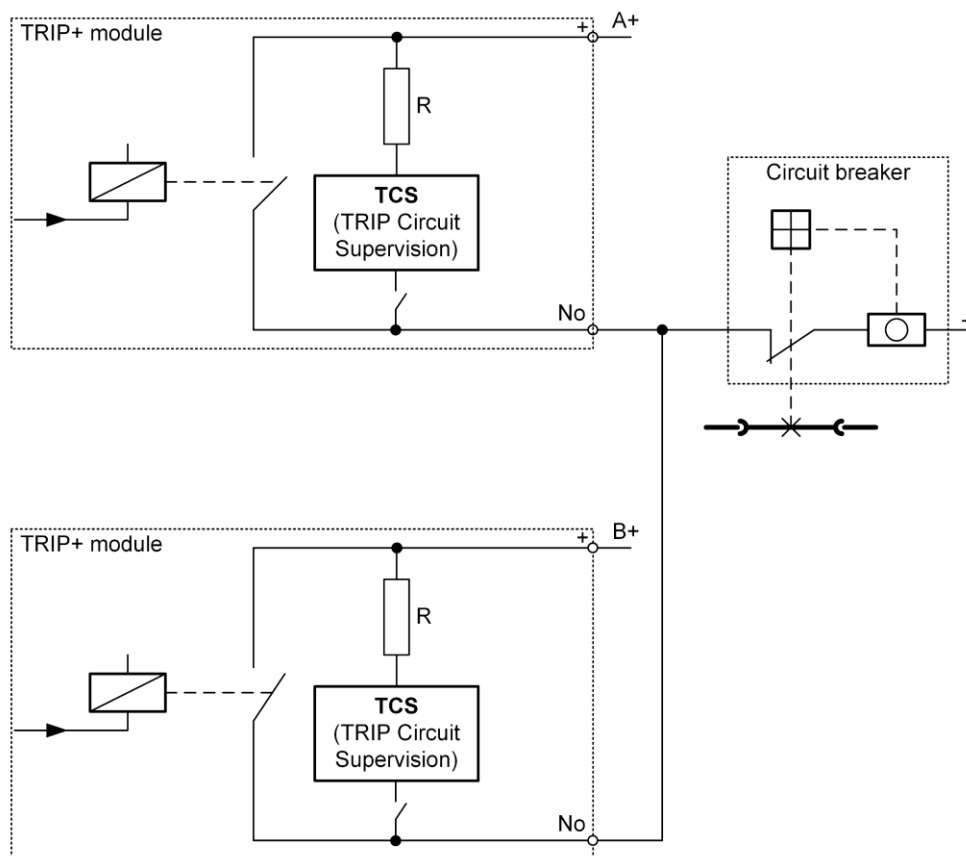


Figure 9-5 2-wire TRIP+ wiring using parallel connected TRIP+ modules

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

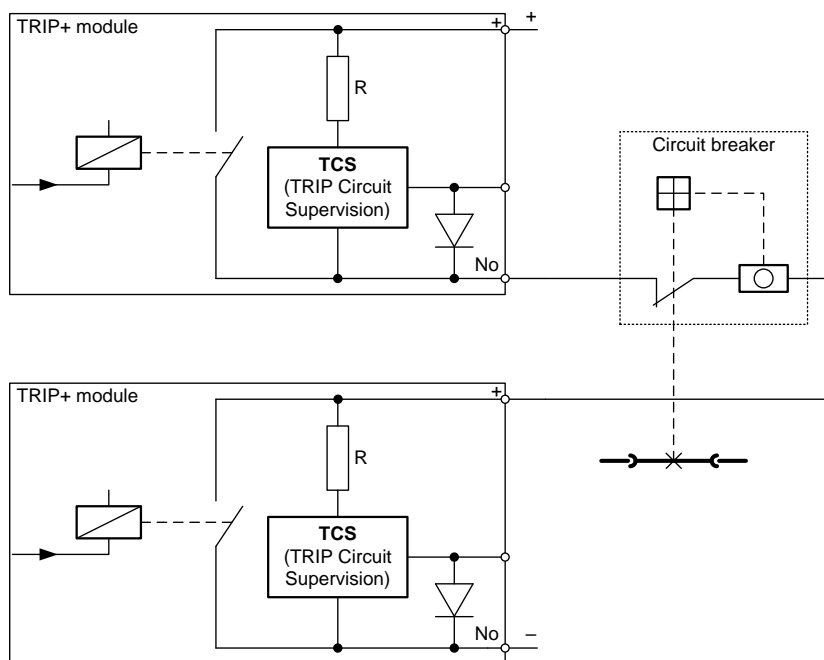


Figure 9-6 2-wire TRIP+ wiring using series connected TRIP+ modules

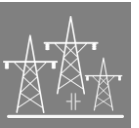
9.2 Trip Circuit Supervision (TCS)

Apart from the TRIP+/21F1, all TRIP modules have TCS. The feature is described in detail (tech. data, instructions, etc.) in a separate document:

https://www.protecta.hu/downloads/tcs_en

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



	MODULE TYPE	TRIP+/4202	TRIP+/2102
MAXIMUM RESISTANCE OF THE TRIP COIL	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

10 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 20.2 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
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	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T
RECOMMENDED APPLICATION	Arc suppression coil controller	General resistance-based temperature measurement	Arc suppression coil controller

*Special module

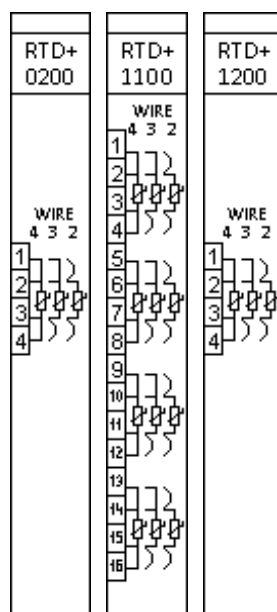


Figure 10-1 RTD input modules

10.1 RTD module wiring

If 2-wire wiring is used, you have to make sure that the value of RA and RD resistors are set correctly in the “parameters” menu of the web server.

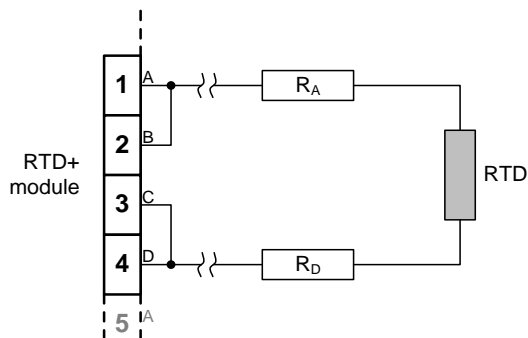


Figure 10-2 2-wire RTD wiring

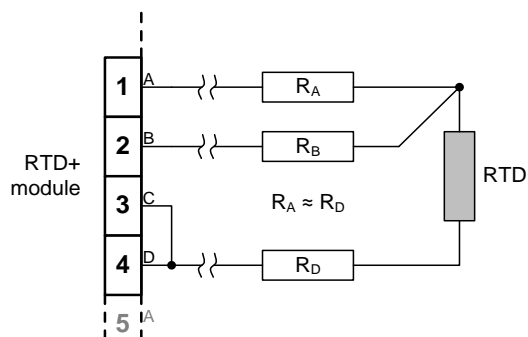


Figure 10-3 3-wire RTD wiring

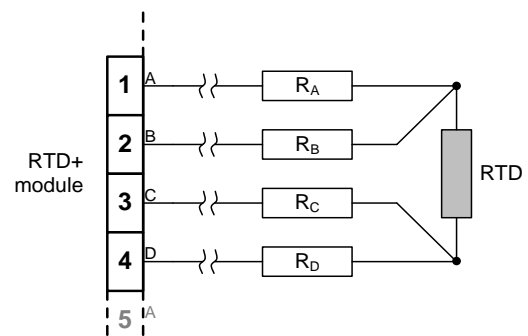


Figure 10-4 4-wire RTD wiring

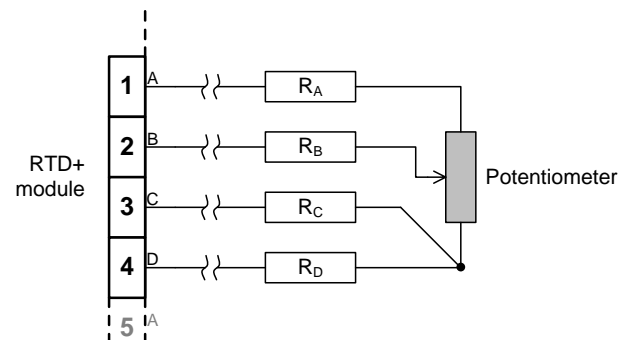


Figure 10-5 4-wire RTD wiring of potentiometer

11 Analog input module (AI)

The analog input module accepts transducers' current 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 20.2 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 DC power supply	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	± 20 mA (typical 0-20, 4-20 mA) $R_{LOAD} = 56 \Omega$	± 20 mA (typical 0-20, 4-20 mA) $R_{LOAD} = 56 \Omega$	± 20 mA (typical 0-20, 4-20 mA) $R_{LOAD} = 56 \Omega$
CONNECTOR TYPE	Default: BLA Options: -	Default: BLA Options: -	Default: BLA Options: T

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

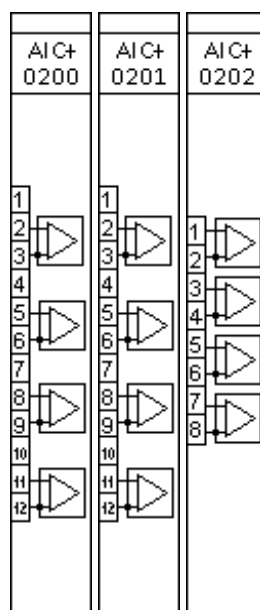


Figure 11-1 Analog input modules

11.1 AI module wiring

The following wiring method can be applied.

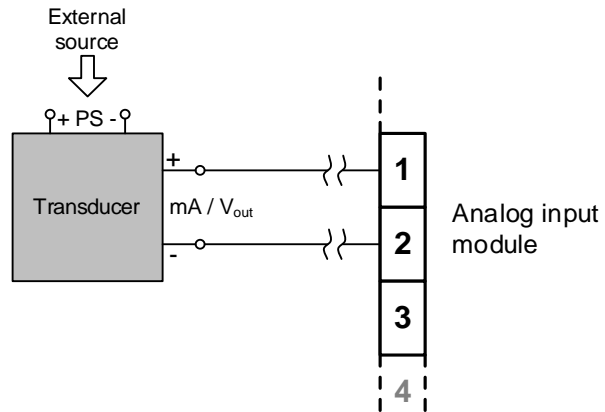


Figure 11-2 AI wiring

12 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 20.2 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: T

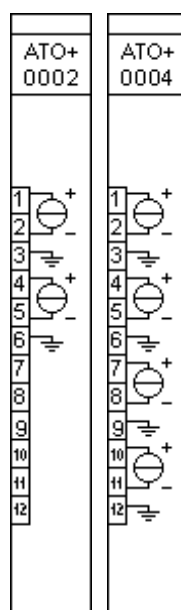


Figure 12-1 Analog output modules

12.1 ATO module wiring

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

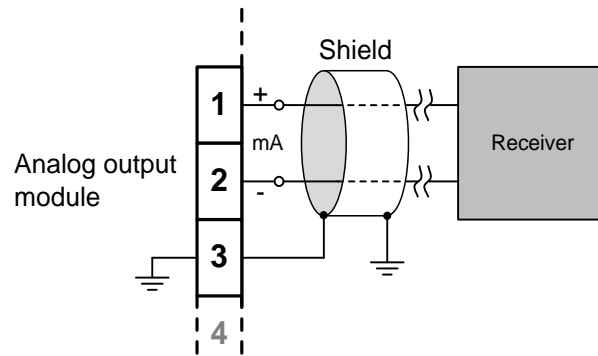


Figure 12-2 Analog output module wiring diagram

13 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 20.2 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 VALUE ($\pm 10\%$)	1.8 U _N	50 I _N	2.1 U _N	50 I _N	1.6 U _N
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 <u>Options:</u> T		RJ45 – 8 pole, shielded connector, grounded shielding <u>Options:</u> T		M8 3-pin connector <u>Receptacle:</u> Hirschmann ELST 3308 RV FM 8 05 <u>Plug:</u> 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.
(application@protecta.hu)

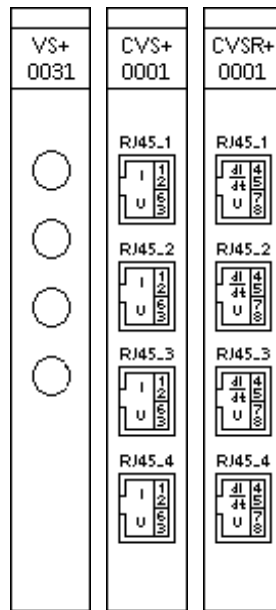


Figure 13-1 Voltage sensor modules

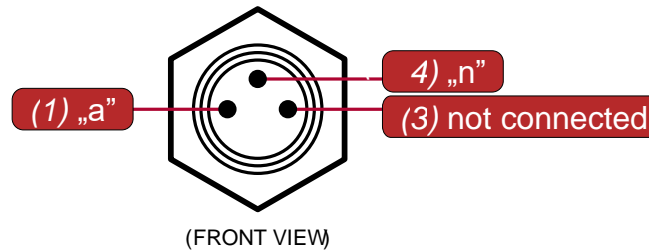
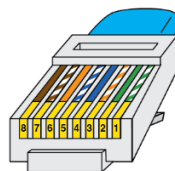
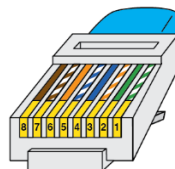


Figure 13-2 M8 connector pinout



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

Figure 13-3 CVS module connector pinout



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

Figure 13-4 CVSR module connector pinout

14 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 20.2 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	<u>Default:</u> STVS6, BLA10 <u>Options:</u> T	<u>Default:</u> STVS6, BLA10 <u>Options:</u> -
RECOMMENDED APPLICATION	Arc suppression coil controller	Network compensation level measurement on resonant grounded networks

*Special module

MODULE TYPE	INJ+/0025	INJ+/0080T*
INJECTED CURRENT	2 A	8 A
ENABLING INPUT CLAMP VOLTAGE	18 V AC	Not available function
BLOCKING INPUT CLAMP VOLTAGE	200 V AC	200 V AC
ADDITIONAL RESISTANCE FOR VOLTAGE INPUT	Not available function	Not available function
CONNECTOR TYPE	<u>Default:</u> STVS6, BLA10 <u>Options:</u> T	BLT
RECOMMENDED APPLICATION	Arc suppression coil controller	Arc suppression coil controller

*Not applicable by itself, only in combination with one of the INJTR modules.

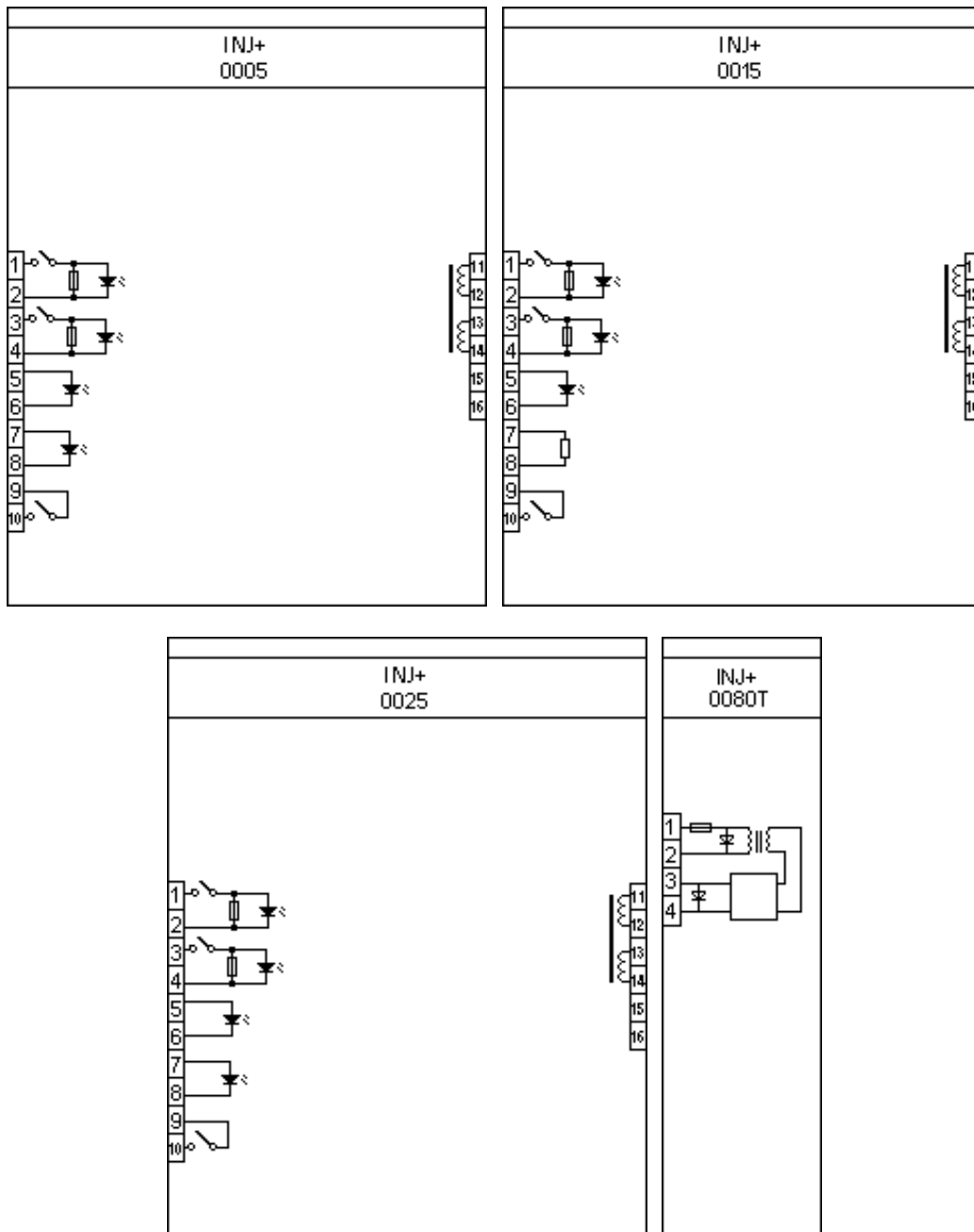


Figure 14-1 INJ modules

14.1 INJTR module

The injector transformer modules were developed for the INJ+/0080T injector module. According to user requirements the injector module can be paired with the 2 or the 8 A transformer. By itself, neither module can be applied.

MODULE TYPE	INJTR+/0020	INJTR+/0080
RATIO	1/2	1/2
RATED SECONDER CURRENT	2 A	8 A

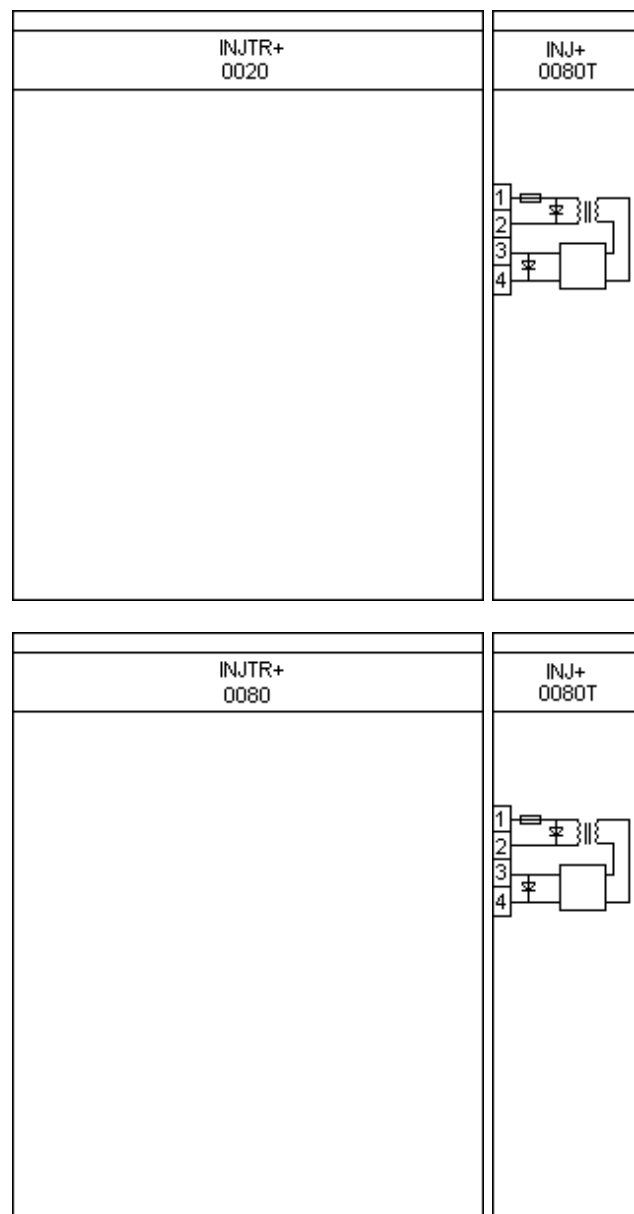


Figure 14-2 INJ+/0080T and INJTR module pairs

15 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 20.2 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	Default: STVS8 Options: T	Default: STVS8 Options: T*	Default: STVS8 Options: 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.

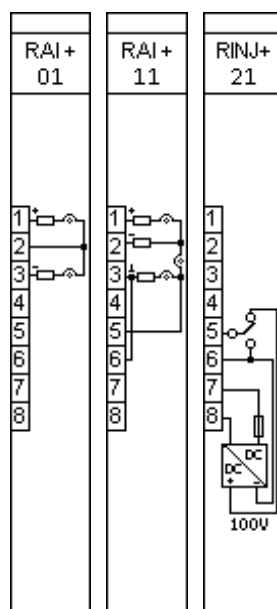


Figure 15-1 Generator protection modules

15.1 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.

15.1.1 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.

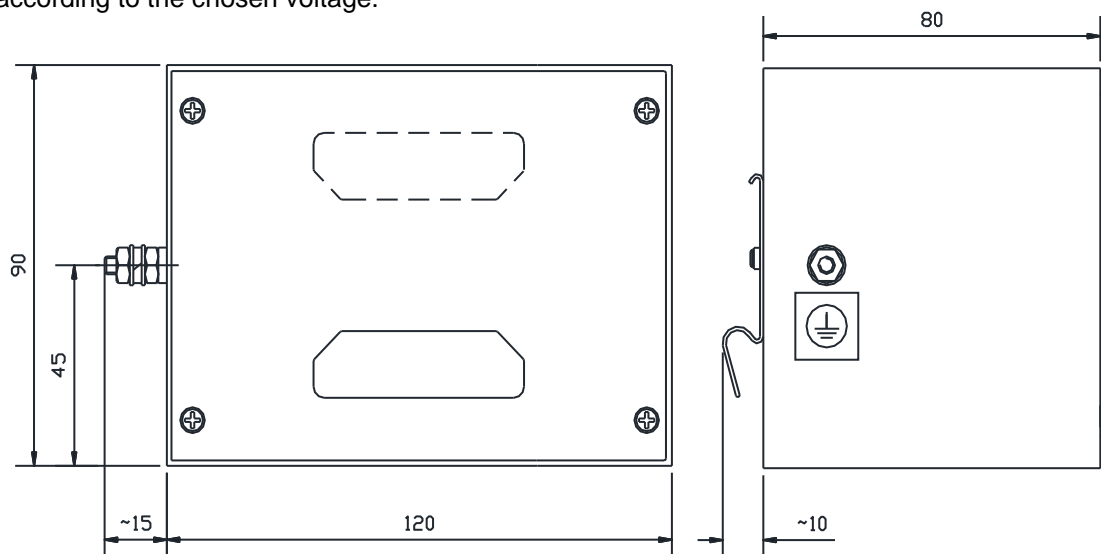


Figure 15-2 Size of the auxiliary boxes

15.2 Wiring of the rotor earth fault protection modules

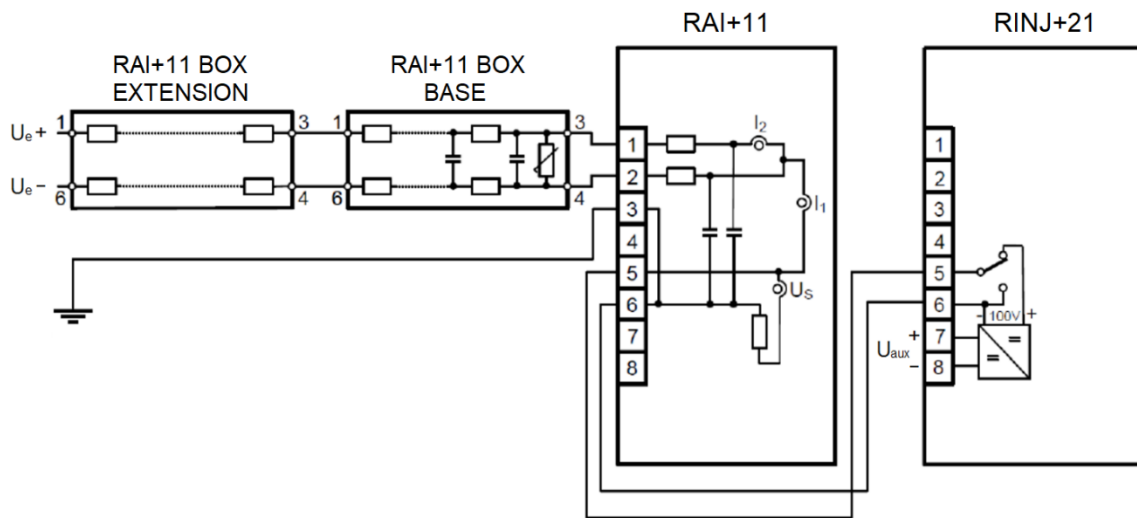


Figure 15-3 Wiring for ungrounded (isolated) rotors

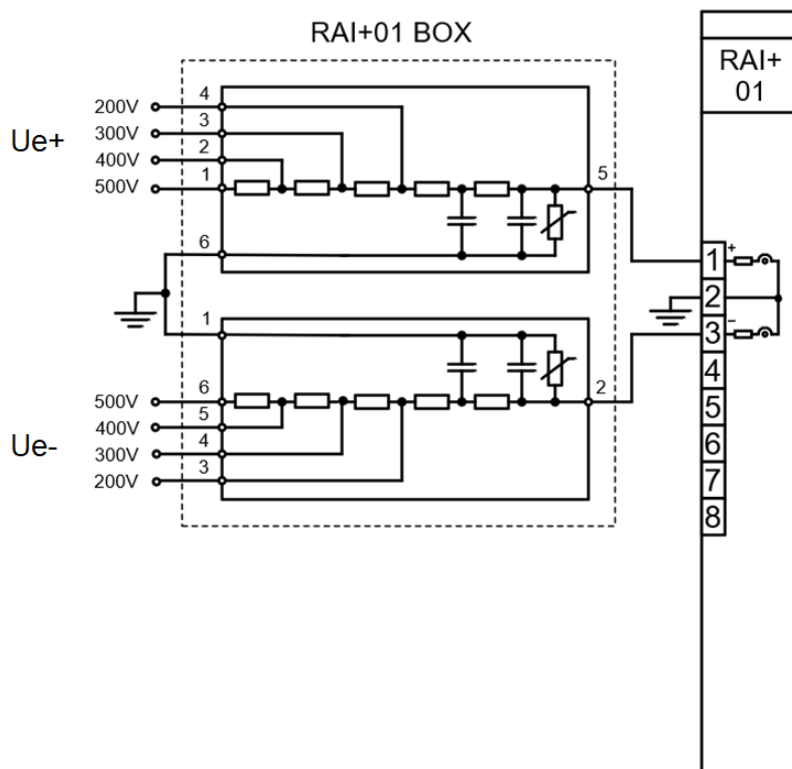


Figure 15-4 Wiring for middle-grounded rotors

16 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 20 W, a 4 HP wide PS+ module shall be installed.

Connector types:

- *The default and optionally available connector types are indicated for each module in the tables below. See Chapter 20.2 for details about each type.*

MODULE TYPE	PS+/4201 (4 HP wide)	PS+/2101 (4 HP wide)
RATED VOLTAGE	24 V DC / 48 V DC / 60 V DC	110 (125) V DC / 220 V DC
INPUT VOLTAGE OPERATIVE RANGE	19.2 - 72 V DC	88 - 264 V DC 80 - 253 V AC
NOMINAL POWER	20 W	20 W
VOLTAGE DIP WITHSTAND AT 80% UN → 0% INPUT VOLTAGE CHANGE (IEC 60255-26)	50 ms on the rated input voltage, minimum 40 ms on the specified input voltage operative range	100 ms on the specified input voltage operative range
INTERNAL FUSE	3.15A/250V	3.15A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T

IMPORTANT

Devices with 20W or higher power consumption shall be equipped with an 8 HP wide PS module.

MODULE TYPE	PS+/1301	PS+/1303**	PS+/2301	PS+/2303**
RATED VOLTAGE	110 V DC	110 V DC	220 V DC	220 V DC
INPUT VOLTAGE OPERATIVE RANGE	88 - 132 V DC 80 - 130 V AC	88 - 132 V DC 80 - 130 V AC	176 - 264 V DC 160 - 253 V AC	176 - 264 V DC 160 - 253 V AC
MAX. CONTINUOUS POWER OUTPUT	30 W	30 W	30 W	30 W
VOLTAGE DIP WITHSTAND AT 80% UN → 0% INPUT VOLTAGE CHANGE (IEC 60255-26)	50 ms 100 ms at 100%Un → 0%	50 ms 100 ms at 100%Un → 0%	50 ms 100 ms at 100%Un → 0%	50 ms 100 ms at 100%Un → 0%
INTERNAL FUSE	2.5A/250V	2.5A/250V	2.5A/250V	2.5A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -

**Can be connected in parallel.*

MODULE TYPE	PS+/1030*	PS+/1060**	PS+/1601	PS+/1602**
RATED VOLTAGE	110 (125) V DC / 220 V DC	110 (125) V DC / 220 V DC	110 V DC	110 V DC
INPUT VOLTAGE OPERATIVE RANGE	88 - 264 V DC 80 - 264 V AC	88 - 264 V DC	88 - 132 V DC 95 - 130 V AC	88 - 132 V DC 95 - 130 V AC
MAX. CONTINUOUS POWER OUTPUT	25 W	60 W	60 W	60 W
VOLTAGE DIP WITHSTAND AT 80% UN → 0% INPUT VOLTAGE CHANGE (IEC 60255-26)	20 ms 100 ms at 100%Un → 0%	20 ms 100 ms at 100%Un → 0%	50 ms 100 ms at 100%Un → 0%	50 ms 100 ms at 100%Un → 0%
INTERNAL FUSE	2.5A/250V	3.15A/250V	2.5A/250V	2.5A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T

**Special module, available only in custom configurations.*

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

MODULE TYPE	PS+/2601	PS+/4301*	PS+/2161	PS+/2162**
RATED VOLTAGE	220 V DC	48 V DC	110 (125) V DC / 220 V DC/ 230 V AC	110 (125) V DC / 220 V DC/ 230 V AC
INPUT VOLTAGE OPERATIVE RANGE	176 - 264 V DC 160 - 253 V AC	38.4 - 57.6 V DC	88 - 264 V DC 184 - 253 V AC	88 - 264 V DC 184 - 253 V AC
MAX. CONTINUOUS POWER OUTPUT	60 W	25 W	60 W	60 W
VOLTAGE DIP WITHSTAND AT 80% UN → 0% INPUT VOLTAGE CHANGE (IEC 60255-26)	50 ms 100 ms at 100%Un → 0%	20 ms 30 ms at 100%Un → 0%	50 ms	50 ms
INTERNAL FUSE	2.5A/250V	3.15A/250V	3.15A/250V	3.15A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLT <u>Options:</u> -	<u>Default:</u> BLT <u>Options:</u> -

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

***Supports auxiliary voltage measurement.*

MODULE TYPE	PS+/2164*	PS+/4261	PS+/4264*	PS+/4401**
RATED VOLTAGE	110 (125) V DC / 220 V DC/ 230 V AC	24 V DC / 48 V DC / 60 V DC	24 V DC / 48 V DC / 60 V DC	48 V DC / 60 V DC
INPUT VOLTAGE OPERATIVE RANGE	88 - 264 V DC 184 - 253 V AC	19.2 - 72 V DC	19.2 - 72 V DC	38.4 - 72 V DC
MAX. CONTINUOUS POWER OUTPUT	60 W	60 W	60 W	30 W
VOLTAGE DIP WITHSTAND AT 80% UN → 0% INPUT VOLTAGE CHANGE (IEC 60255-26)	40 ms	40 ms	40 ms	40 ms
INTERNAL FUSE	3.15A/250V	8A/250V	8A/250V	3.15A/250V
CONNECTOR TYPE	<u>Default:</u> BLT <u>Options:</u> -	<u>Default:</u> BLT <u>Options:</u> -	<u>Default:</u> BLT <u>Options:</u> -	<u>Default:</u> BLA <u>Options:</u> T

**Can be connected in parallel and supports auxiliary voltage measurement.*

***Can be connected in parallel.*

MODULE TYPE	PS3F+/1001*
RATED VOLTAGE	3x100 V AC (line voltage)
INPUT VOLTAGE OPERATIVE RANGE	80 - 120 V AC
MAX. CONTINUOUS POWER OUTPUT	20 W
VOLTAGE DIP WITHSTAND AT 80% UN → 0% INPUT VOLTAGE CHANGE (IEC 60255-26)	50 ms 100 ms at 100%Un → 0%
INTERNAL FUSE	2.5A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> -

***Special module.** At least 2 healthy phase voltages are needed for the operation of the PS3F+1001 module. LEDs on the front of the module indicate 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").

Main features:

- Fault relay contacts (NC and NO): device fault contact and also assignable to user functions. All 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.)



Figure 16-1 Power supply modules

17 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
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T

*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.

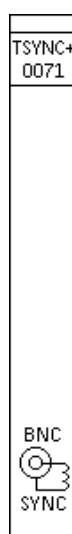


Figure 17-1 Sampling synchronization module

18 Mixed function modules

18.1 PSTP+ module

IMPORTANT

PSTP+ modules can be used only if the power consumption of the device does not reach 20 W and a maximum of 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+ (Chapter 16) and TRIP+ (Chapter 9) modules must be used.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 20.2 for details about each type.

Note for the following tables:

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

MODULE TYPE	PSTP+/2101	PSTP+/2102*	PSTP+/2104T
	POWER SUPPLY CHARACTERISTICS		
RATED VOLTAGE	110 (125) V / 220 V	110 (125) V / 220 V	110 (125) V DC / 220 V DC / 230 V AC
INPUT VOLTAGE OPERATIVE 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
MAXIMUM CONTINUOUS POWER OUTPUT	20 W	20 W	20 W
VOLTAGE DIP DURATION AT 0% RESIDUAL VOLTAGE (IEC 60255-26)	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	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLT <u>Options:</u> -
	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
WITHSTAND VOLTAGE	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	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> -	<u>Default:</u> BLT <u>Options:</u> -

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

MODULE TYPE	PSTP+/2131**	PSTP+/4201	PSTP+/4202*
	POWER SUPPLY CHARACTERISTICS		
RATED VOLTAGE	110 V / 220 V	24 V / 48 V / 60 V	24 V / 48 V / 60 V
INPUT VOLTAGE OPERATIVE RANGE	88 - 264 V DC 80 - 250 V AC	19.2 - 72 V DC	19.2 - 72 V DC
MAXIMUM CONTINUOUS POWER OUTPUT	20 W	20 W	20 W
VOLTAGE DIP DURATION AT 0% RESIDUAL VOLTAGE (IEC 60255-26)	min. 100 ms in the specified input voltage range	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	3.15A/250V
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T
	TRIPPING CHARACTERISTICS		
CHANNEL NUMBER	2	2	2
RATED VOLTAGE	110 V DC and 220 V DC or dry contacts	24 V DC and 48 V DC or dry contacts	24 V DC and 48 V DC or dry contacts
WITHSTAND VOLTAGE	242 V DC	72 V DC	72 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	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T	<u>Default:</u> BLA <u>Options:</u> T

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

****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
- 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.)

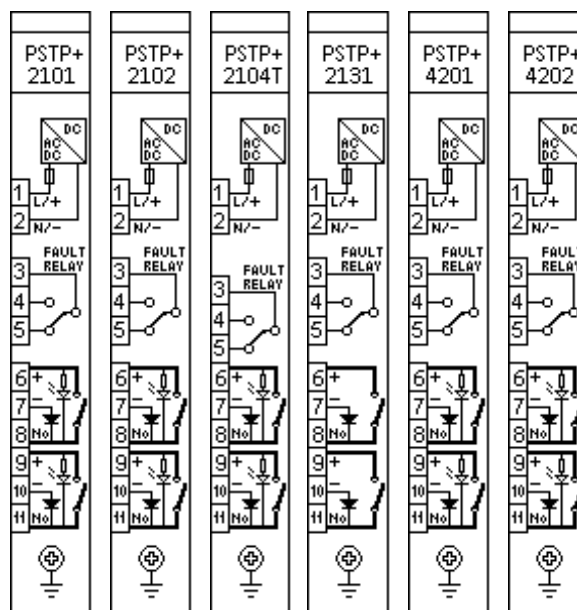


Figure 18-1 Power supply with 2 Ch. TRIP modules

18.1.1 Trip Circuit Supervision (TCS) in PSTP modules

Apart from the PSTP+/2131, all PSTP modules have TCS. The feature is described in detail (tech. data, instructions, etc.) in a separate document:

https://www.protecta.hu/downloads/tcs_en

The technical data of the TCS in PSTP modules:

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

18.2 PSR2+ module

IMPORTANT

PSR2+ modules can be used only if the power consumption of the device does not reach 20 W and a maximum of 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+ (Chapter 16) and Signaling (Chapter 8) modules must be used.

Connector types:

- The default and optionally available connector types are indicated for each module in the table below. See Chapter 20.2 for details about each type.

MODULE TYPE	PSR2+/2101
	POWER SUPPLY CHARACTERISTICS
RATED VOLTAGE	110 V / 220 V
INPUT VOLTAGE OPERATIVE RANGE	88 - 264 V DC 80 - 250 V AC
MAXIMUM CONTINUOUS POWER OUTPUT	20 W
VOLTAGE DIP DURATION AT 0% RESIDUAL VOLTAGE (IEC 60255-26)	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 %)
- 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

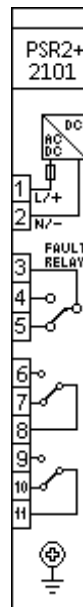


Figure 18-2 Power supply with 2 Ch. signaling modules

18.3 PSTO+ module

IMPORTANT

PSTO+ modules can be used only if the power consumption of the device does not reach 20 W and a maximum of 1 TRIP contact is 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+ (Chapter 16) and TRIP+ (Chapter 9) modules must be used.

Connector types:

- The default and optionally available connector types are indicated for each module in the tables below. See Chapter 20.2 for details about each type.

Note for the following tables:

- **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	PSTO+/2101
	POWER SUPPLY CHARACTERISTICS
RATED VOLTAGE	110 V / 220 V
INPUT VOLTAGE OPERATIVE RANGE	88 - 264 V DC 80 - 250 V AC
MAXIMUM CONTINUOUS POWER OUTPUT	20 W
VOLTAGE DIP DURATION AT 0% RESIDUAL VOLTAGE (IEC 60255-26)	min. 100 ms in the specified input voltage range
INTERNAL FUSE	3.15A/250V
CONNECTOR TYPE	<u>Default:</u> BLT <u>Options:</u> -
	TRIPPING CHARACTERISTICS
CHANNEL NUMBER	1
RATED VOLTAGE	110 V DC and 220 V DC or dry contacts
WITHSTAND VOLTAGE	242 V DC
CONTINUOUS CARRY	8 A
MAKING CAPACITY	0.5 s, 30 A
BREAKING CAPACITY	L/R = 40 ms: 4 A DC
CONNECTOR TYPE	<u>Default:</u> BLT <u>Options:</u> -

MODULE TYPE	PSTO+/2101
	BINARY INPUT CHARACTERISTICS
CHANNEL NUMBER	3
RATED VOLTAGE	110 V / 220 V user selectable on channel basis by jumpers
TIME SYNCHRONIZATION	configured by EuroCAP
WITHSTAND VOLTAGE	320 V
CLAMP VOLTAGE	falling $0.64 U_N$ rising $0.8 U_N$
COMMON GROUPS	1 × 3 common
CONNECTOR TYPE	<u>Default:</u> BLT <u>Options:</u> -

Main features:

- High-speed operation: with pre-trip 0.5 ms, without pre-trip typically 10 ms, maximally 22 ms.
- Trip circuit supervision
- 1 unit wide (4 HP) module
- 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.)
- 3x binary inputs

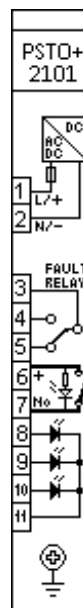


Figure 18-3 Power supply with 1 Ch. Trip module and 3 Ch. Binary Input module

18.4 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 20.2 for details about each type.

Notes for the following table:

- **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	O6R5+/4202
	BINARY INPUT CHARACTERISTICS		
CHANNEL NUMBER	6	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	24 V / 48/60 V user selectable on channel basis by jumpers
TIME SYNCHRONIZATION	configured by EuroCAP	configured by EuroCAP	configured by EuroCAP
WITHSTAND VOLTAGE	320 V	72 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	falling 0.64 U_N rising 0.8 U_N
COMMON GROUPS	1 × 6 common	1 × 6 common	1 × 6 common
	RELAY OUTPUT CHARACTERISTICS		
RATED VOLTAGE	250 V AC/DC	250 V AC/DC	390 V AC
CONTINUOUS CARRY	8 A	8 A	8 A
CONTACT VERSIONS	4 NO, 1 CO	4 NO, 1 CO	4 NO, 1 CO
GROUP ISOLATION	2 × 2 common, 1 independent	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	BLT

Though the states of the inputs are refreshed with 2 kHz frequency, there is a 1 ms built-in analog filtering in them. Additional digital filtering is set in the EuroCAP tool (default: 4 ms).

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 V_{RMS}
- 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

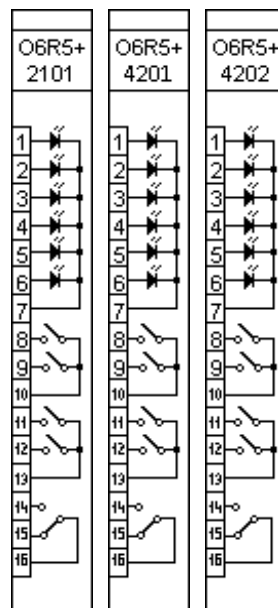


Figure 18-4 Binary input/output modules

18.5 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 20.2 for details about each type.*

Notes for the following table:

- **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	O9S+/2111	O9S+/2112	O9S+/2121
CHANNEL NUMBER	9	9	9
SYNCRON CHANNEL TYPE AND NUMBER	1 isolated BNC connector	1 isolated BNC 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	110 V DC / 220 V DC user selectable by jumpers
WITHSTAND VOLTAGE	320 V	264 V	320 V
WITHSTAND VOLTAGE FOR SYNC. INPUT	35 V _{PEAK}	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 $0.8 U_N$
COMMON GROUPS	9 (3 × 3 common)	9 (3 × 3 common)	9 (3 × 3 common)
CONNECTOR TYPE	<u>Default:</u> BLA <u>Options:</u> T	BLT	<u>Default:</u> BLA <u>Options:</u> T

MODULE TYPE	O9S+/4221T	O9S+/4222
CHANNEL NUMBER	9	9
SYNCRON CHANNEL TYPE AND NUMBER	1 850 nm multimode fiber with ST connector	1 850 nm multimode fiber with ST connector
RATED VOLTAGE	24 V DC / 48 V DC user selectable by jumpers	24 V DC / 48/60 V DC user selectable by jumpers
WITHSTAND VOLTAGE	72 V	72 V
WITHSTAND VOLTAGE FOR SYNC. INPUT	35 V _{PEAK}	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
COMMON GROUPS	9 (3 × 3 common)	9 (3 × 3 common)
CONNECTOR TYPE	<u>Default:</u> BLT <u>Options:</u> -	BLT

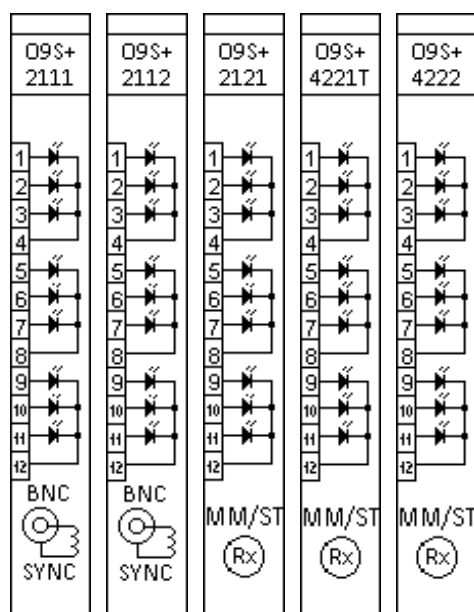


Figure 18-5 Binary input modules with time synchronization

18.6 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 20.2 for details about each type.

MODULE TYPE	R4MC+01*
CHANNEL NUMBER	2
RATED VOLTAGE	110 V DC
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	<u>Default:</u> BLA <u>Options:</u> F

*Special module

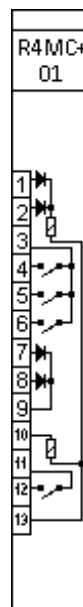


Figure 18-6 Externally driven TRIP modul

19 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

19.1 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, Level 4
 - 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, Level 3
 - 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

20 Mechanical data

20.1 General mechanical data

- Construction: chromate aluminum surface with built-in EMC accessories

- If the power consumption of an 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
 - 1½ 19" (42 HP), 3 U, single rack
 - 1½ 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

20.2 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 6), 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/02/180F, BLT 5.08HC/03/180F, 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**
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.

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**
5CDG 7.62	DEGSON 5CDG-7.62-08P	10	0.2 – 4.0	0.3 – 2.5	0.5	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.

21 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.



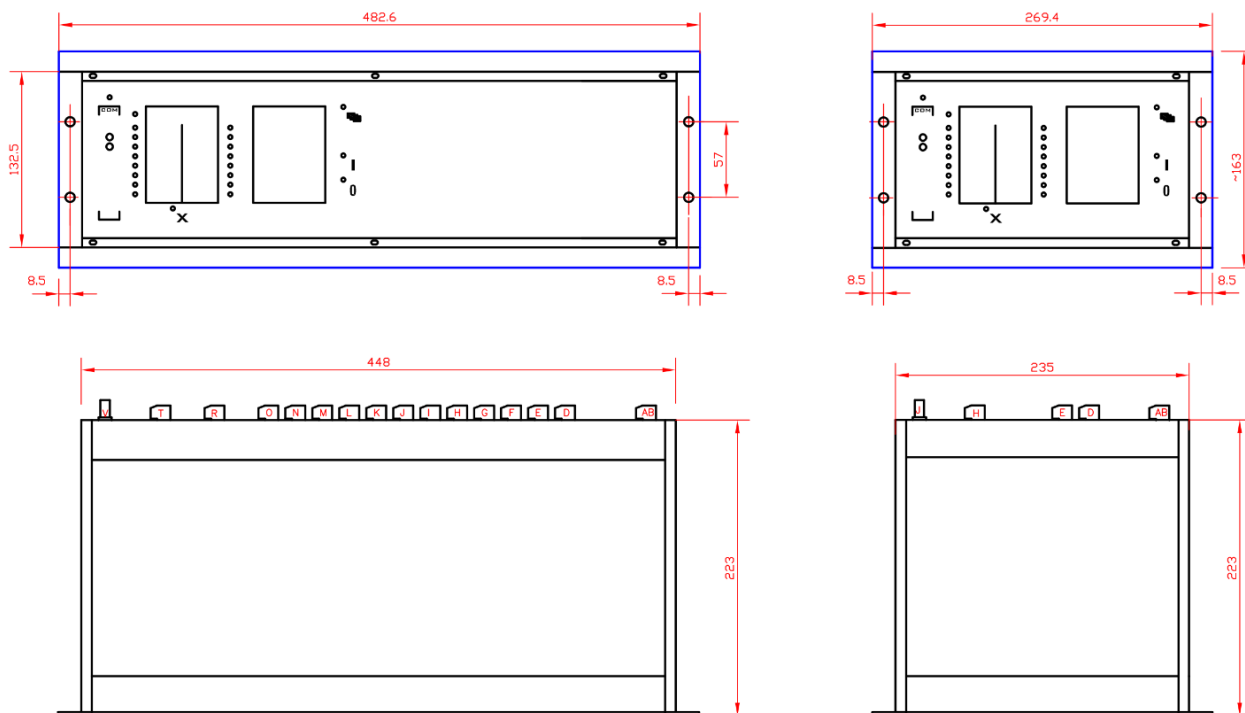
It is recommended to leave at least 80 mm free space for the wiring at the back of the IED in case of Flush mounting, Rack mounting, and Semi-flush mounting.

21.1 Flush mounting

Flush mounting can be used for all sizes 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.

21.1.1 Flush mounting of 84 HP and 42 HP single rack



PANEL CUT-OUT

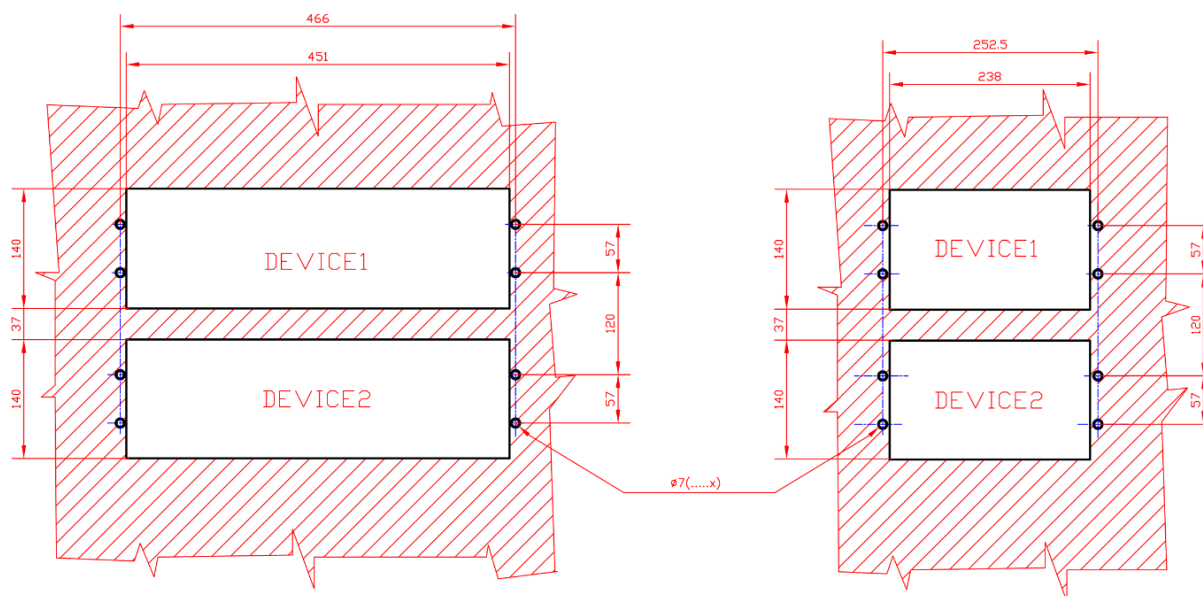


Figure 21-1 Dimensions for flush mounting of 84 HP and 42 HP single rack

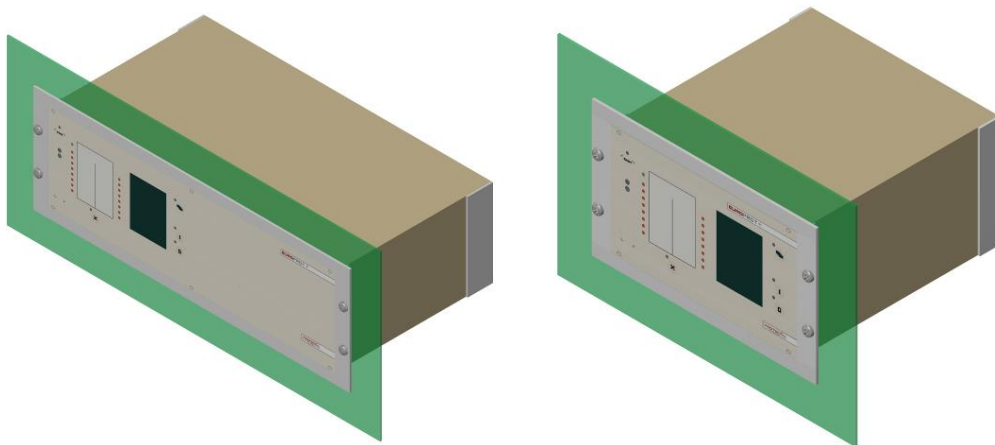
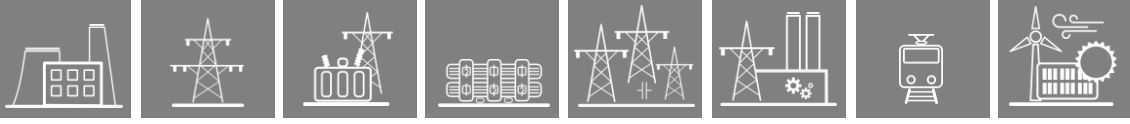


Figure 21-2 3D illustration for flush mounting of 84 HP and 42 HP devices



21.1.2 Flush mounting of 42 HP double rack

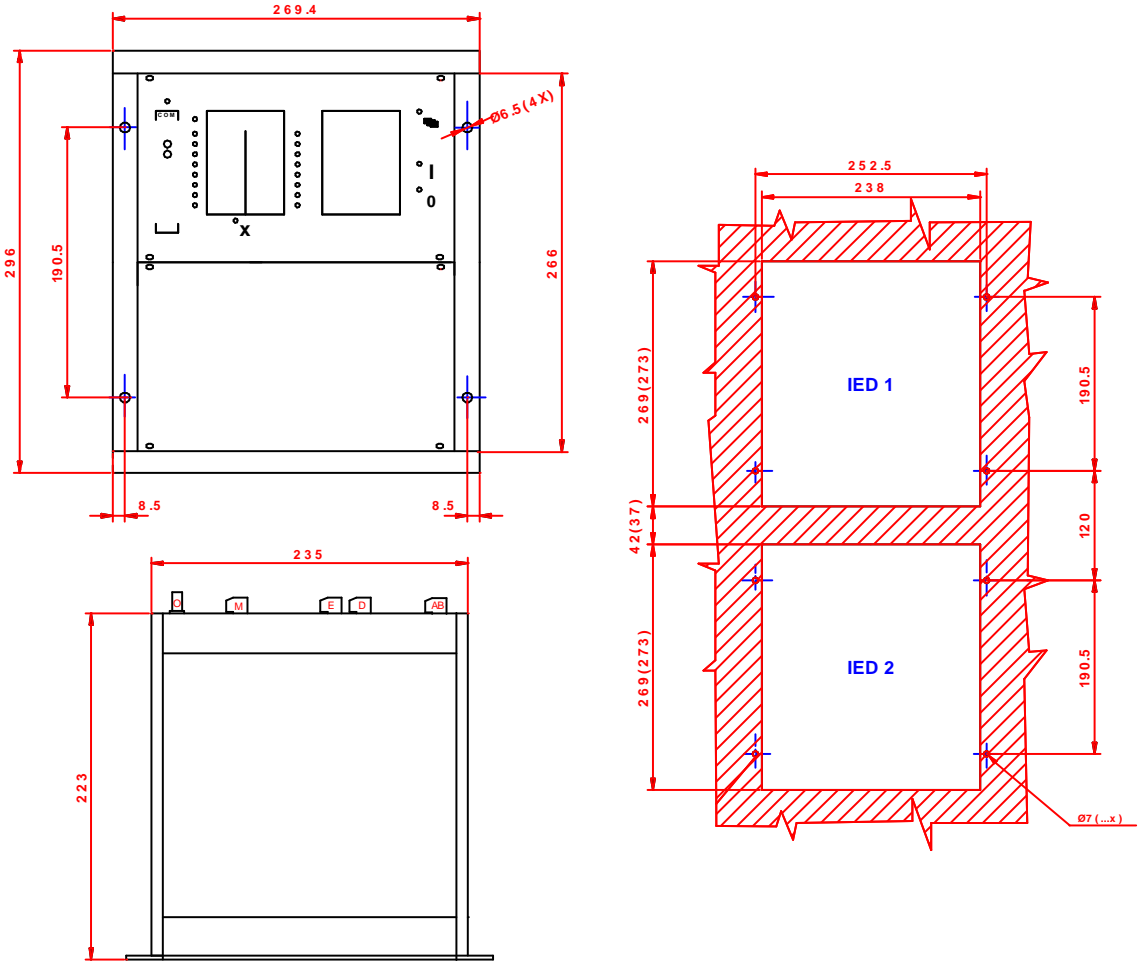


Figure 21-3 Dimensions for flush mounting of 42 HP double rack



Figure 21-4 42 HP wide cover profile

21.1.3 Flush mounting of 24 HP panel instrument case

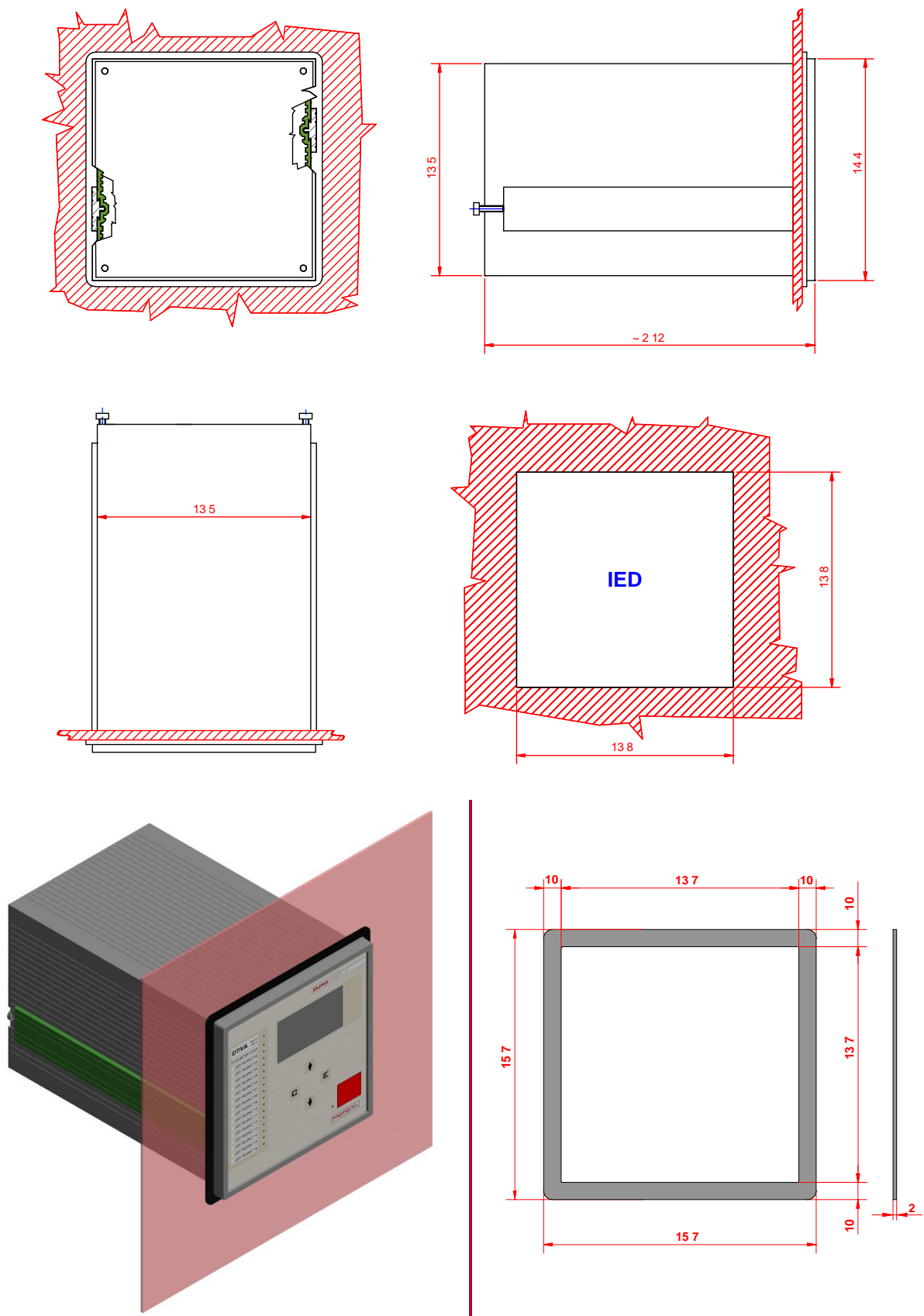


Figure 21-5 Dimensions for flush mounting of 24 HP panel instrument case with 3D illustration

21.2 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.

21.2.1 Rack mounting of 84 HP and 42 HP single rack

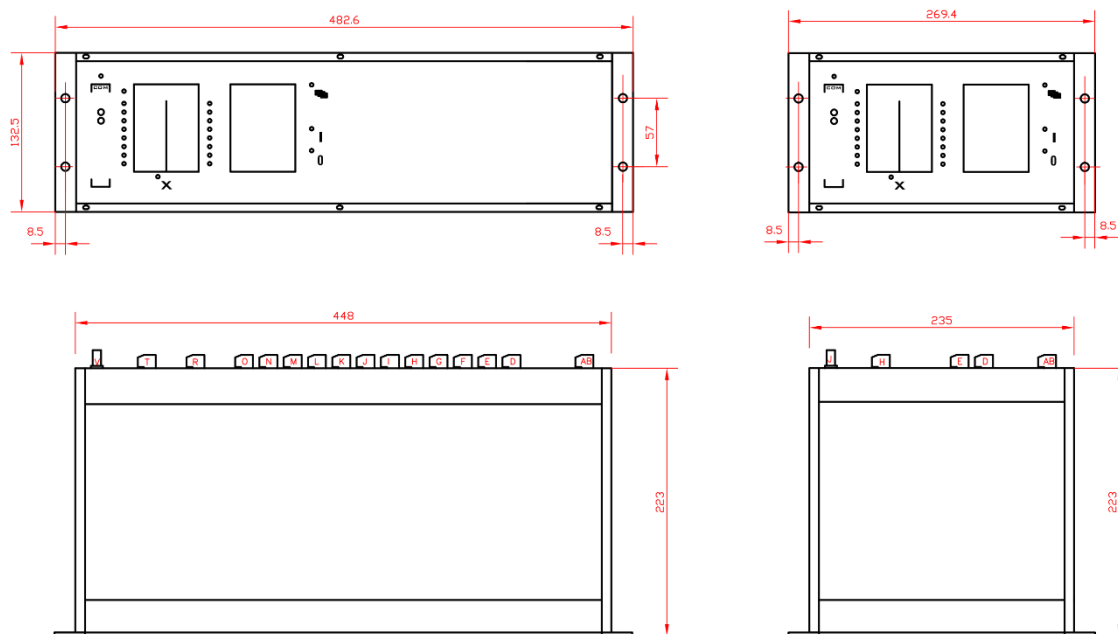


Figure 21-6 Dimensions for rack mounting of 84 HP and 42 HP single rack

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.

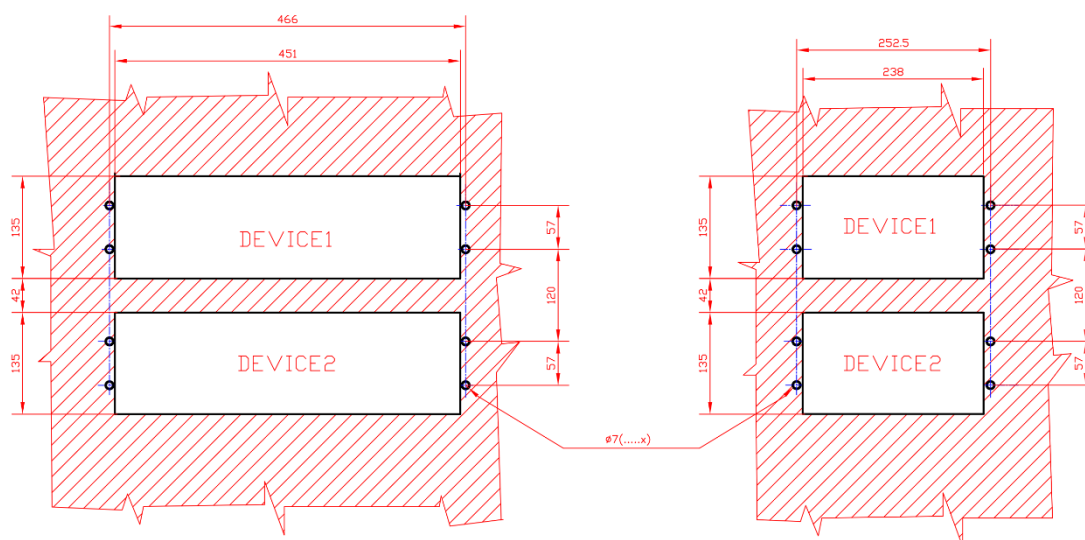


Figure 21-7 Dimensions of rack mounting cut-outs

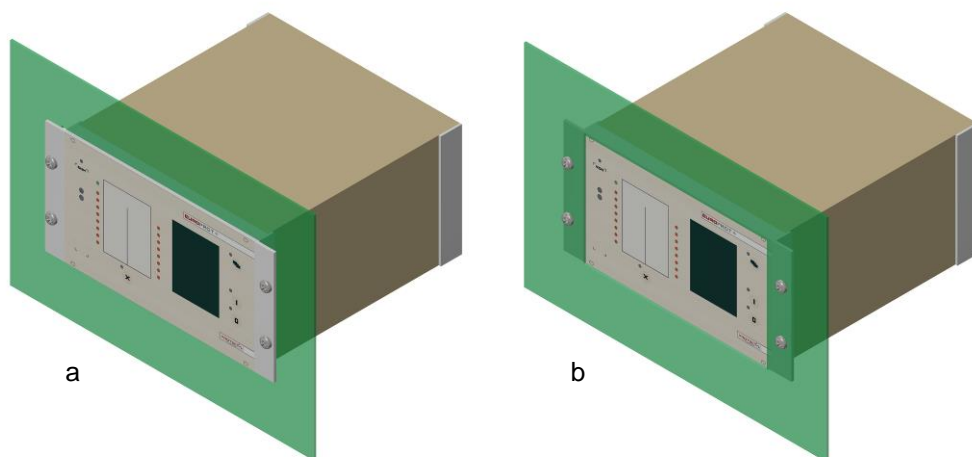


Figure 21-8 3D illustration for rack mounting of 42 HP device (a - from the front; b - from the back)

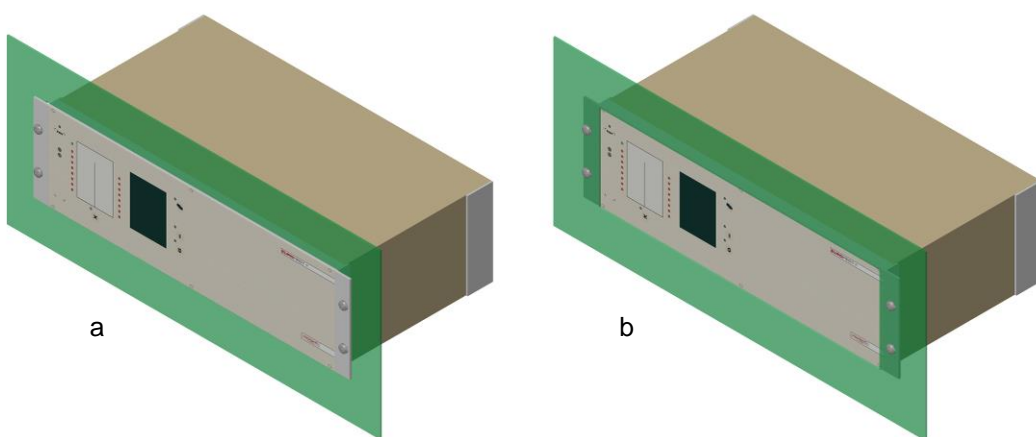


Figure 21-9 3D illustration for rack mounting of 84 HP device (a - from the front; b - from the back)

21.2.2 Rack mounting of 42 HP double rack

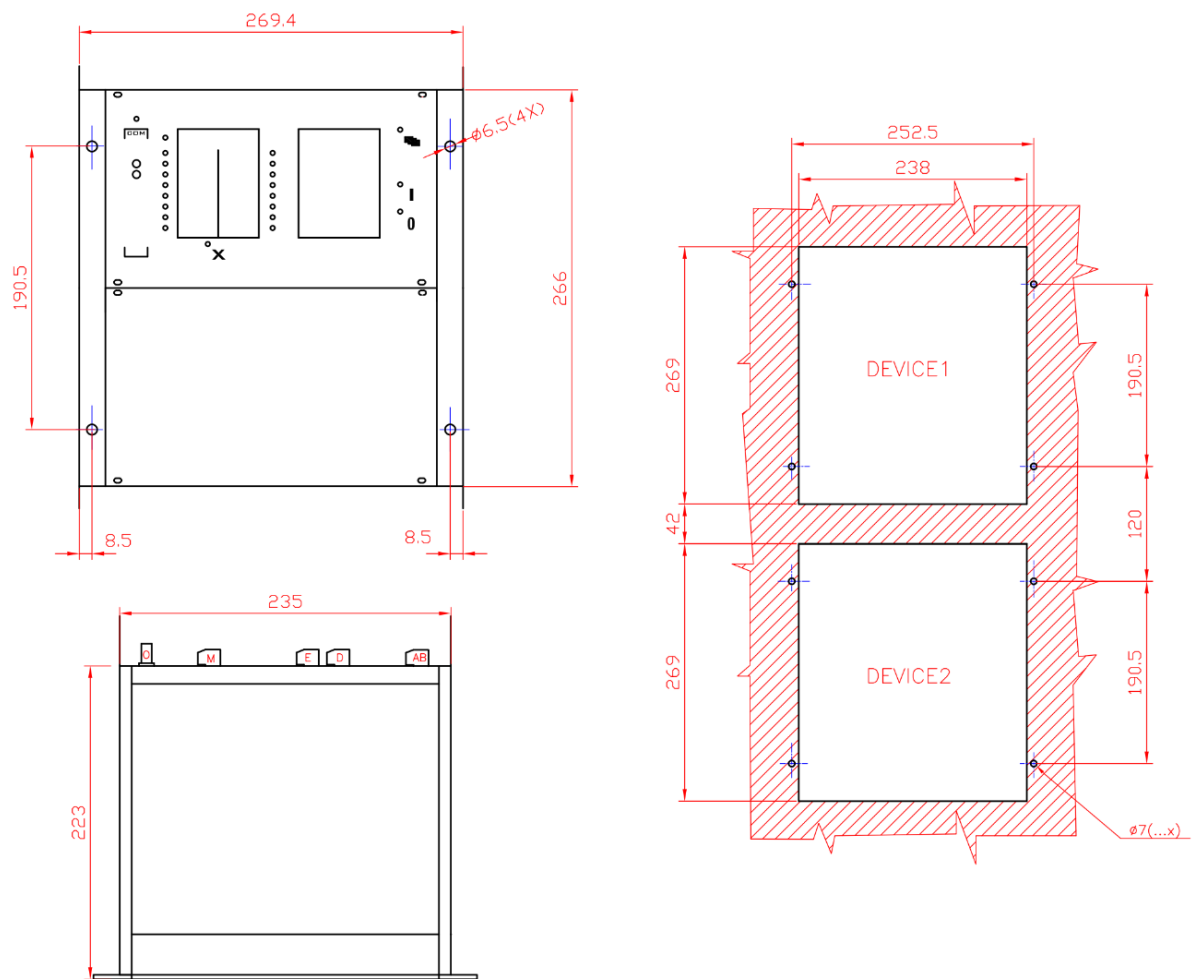


Figure 21-10 Dimensions for rack mounting of 42 HP double rack

21.3 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.

21.3.1 Semi-flush mounting of 84 HP single rack

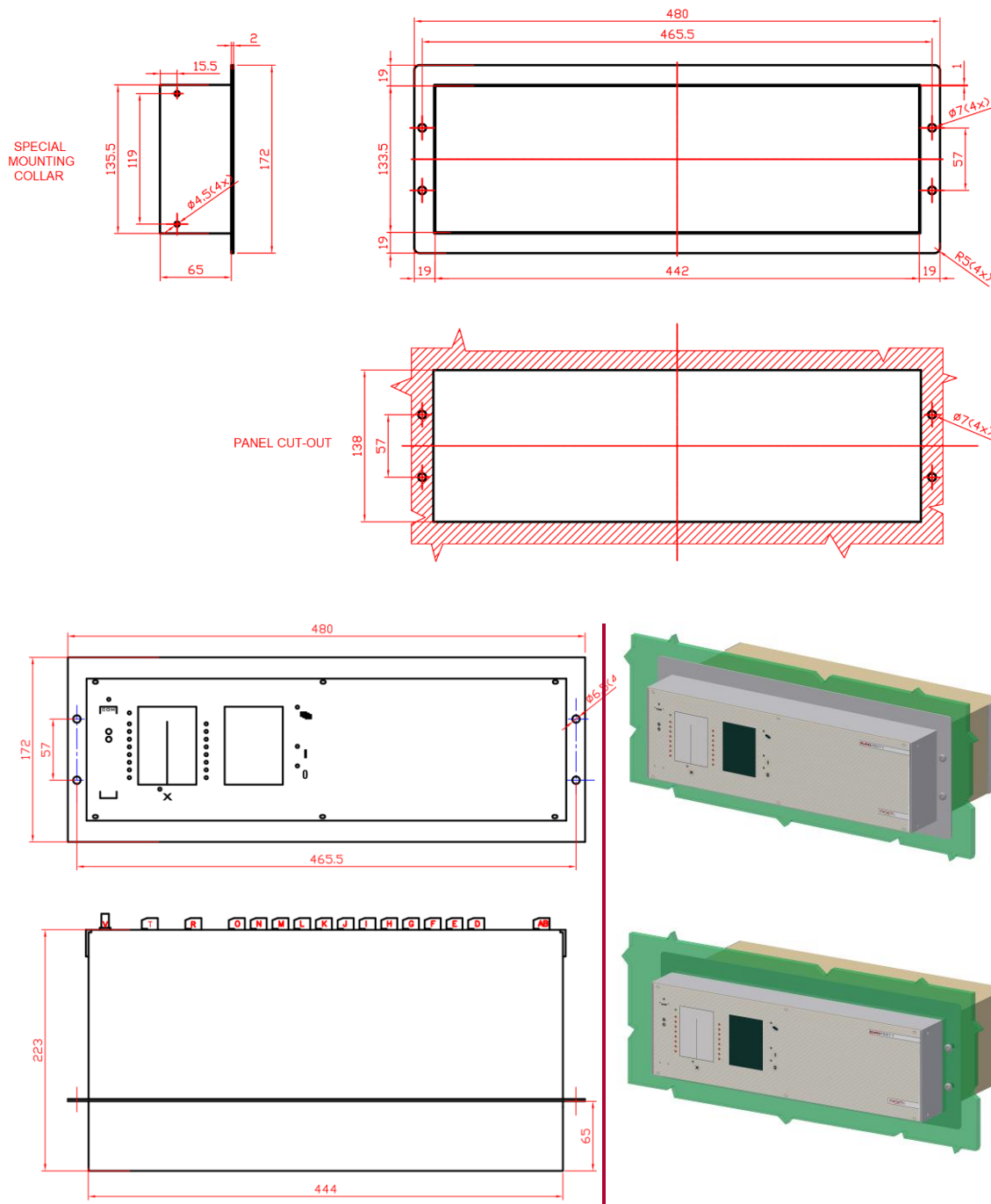


Figure 21-11 Dimensions for semi-flush mounting of 84 HP single rack with 3D illustration

21.3.2 Semi-flush mounting of 42 HP single rack

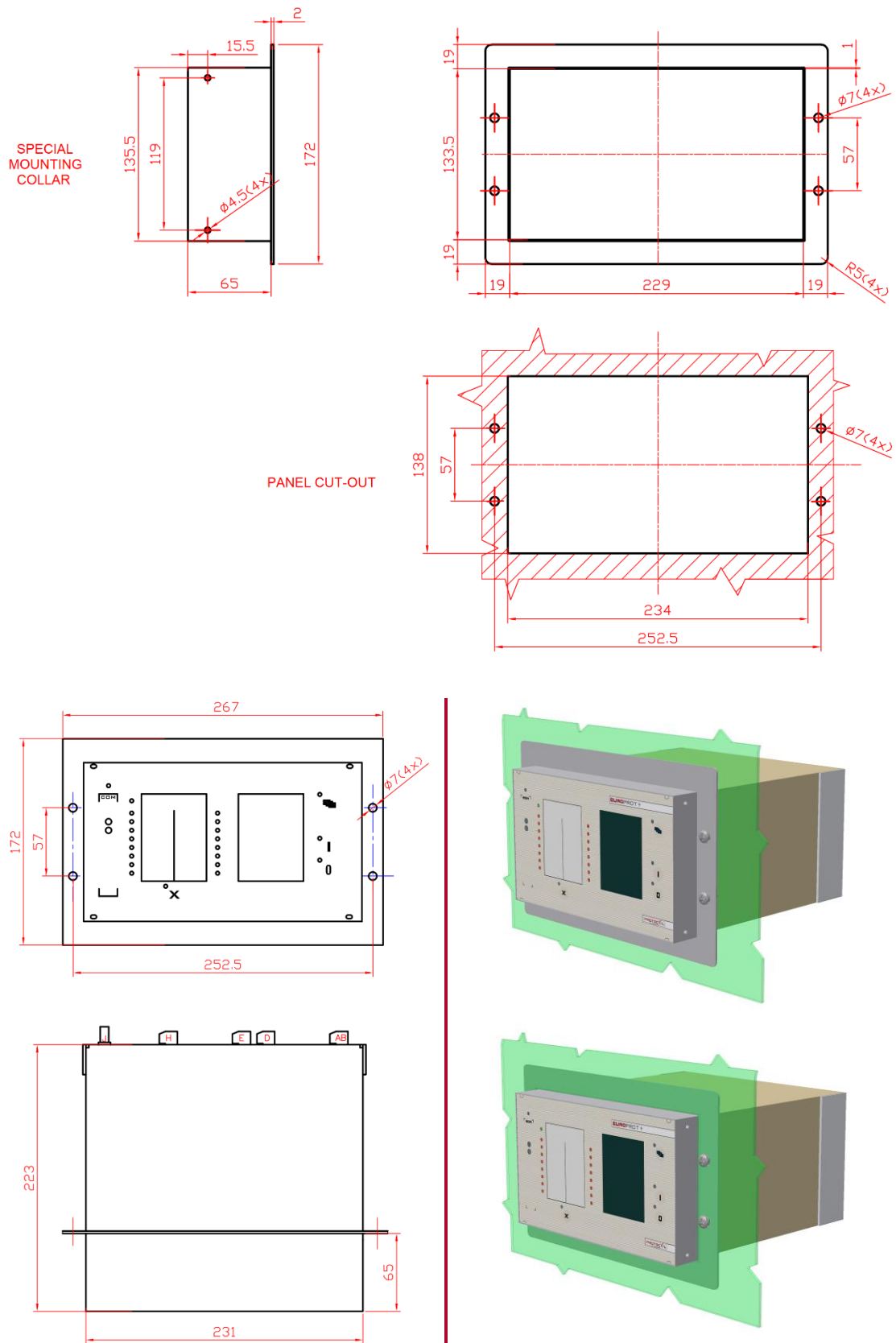
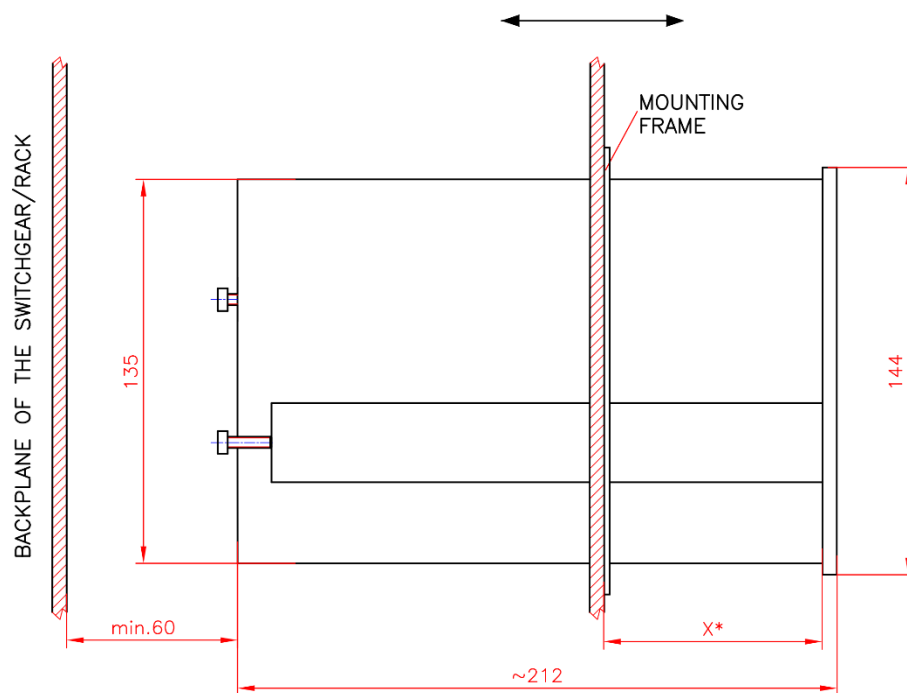


Figure 21-12 Dimensions for semi-flush mounting of 42 HP single rack with 3D illustration

21.3.3 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 color 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

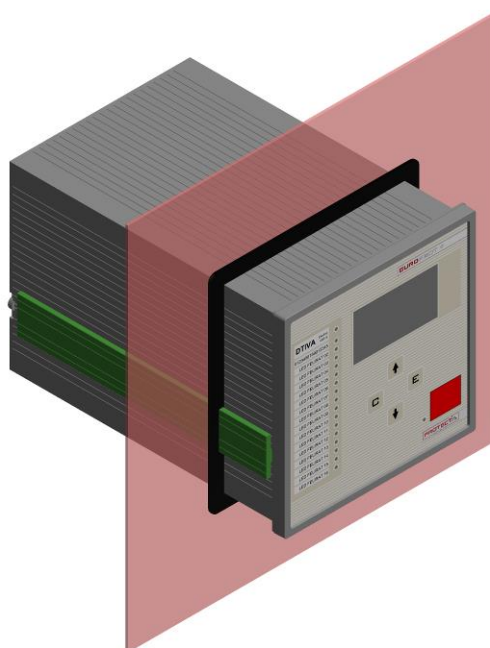


Figure 21-13 Dimensions for semi-flush mounting of 24 HP panel instrument case with 3D illustration

21.4 Wall mounting of 42 HP and 84 HP devices

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

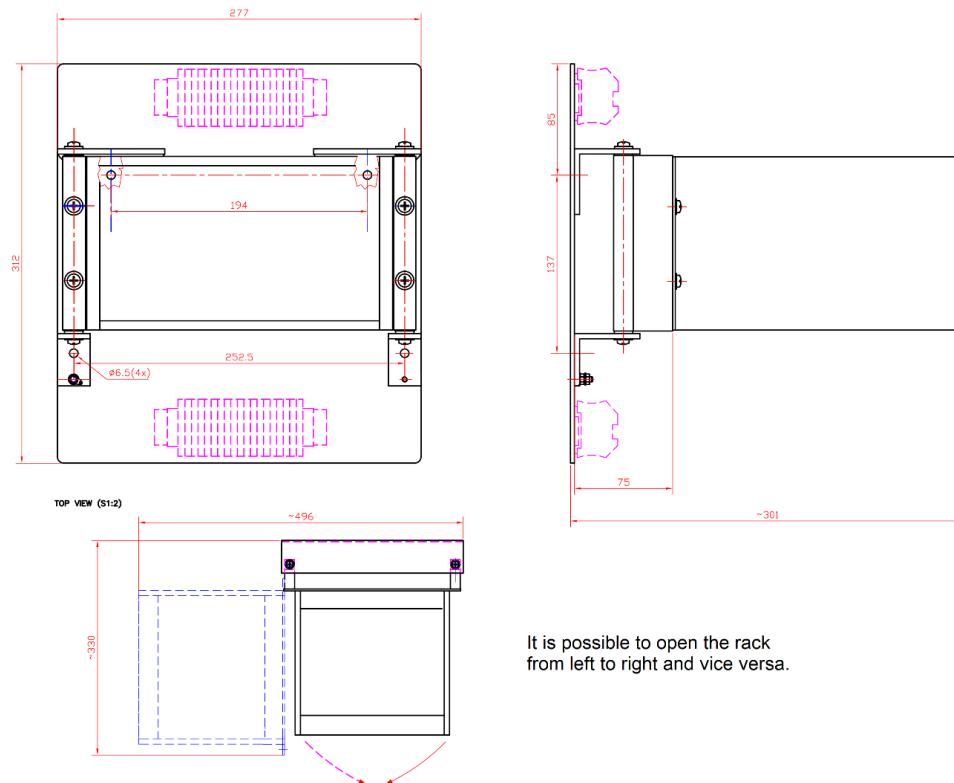


Figure 21-14 Dimensions for wall mounting of 42 HP devices (upper and lower terminals)

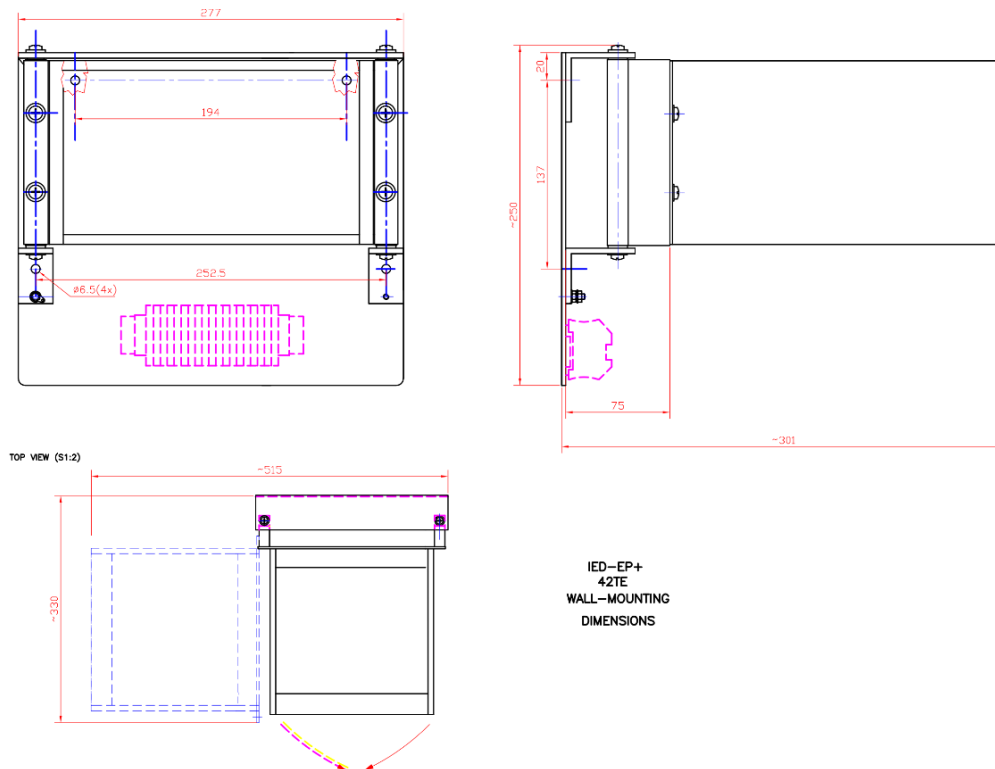


Figure 21-15 Dimensions for wall mounting of 42 HP devices (lower terminal only)

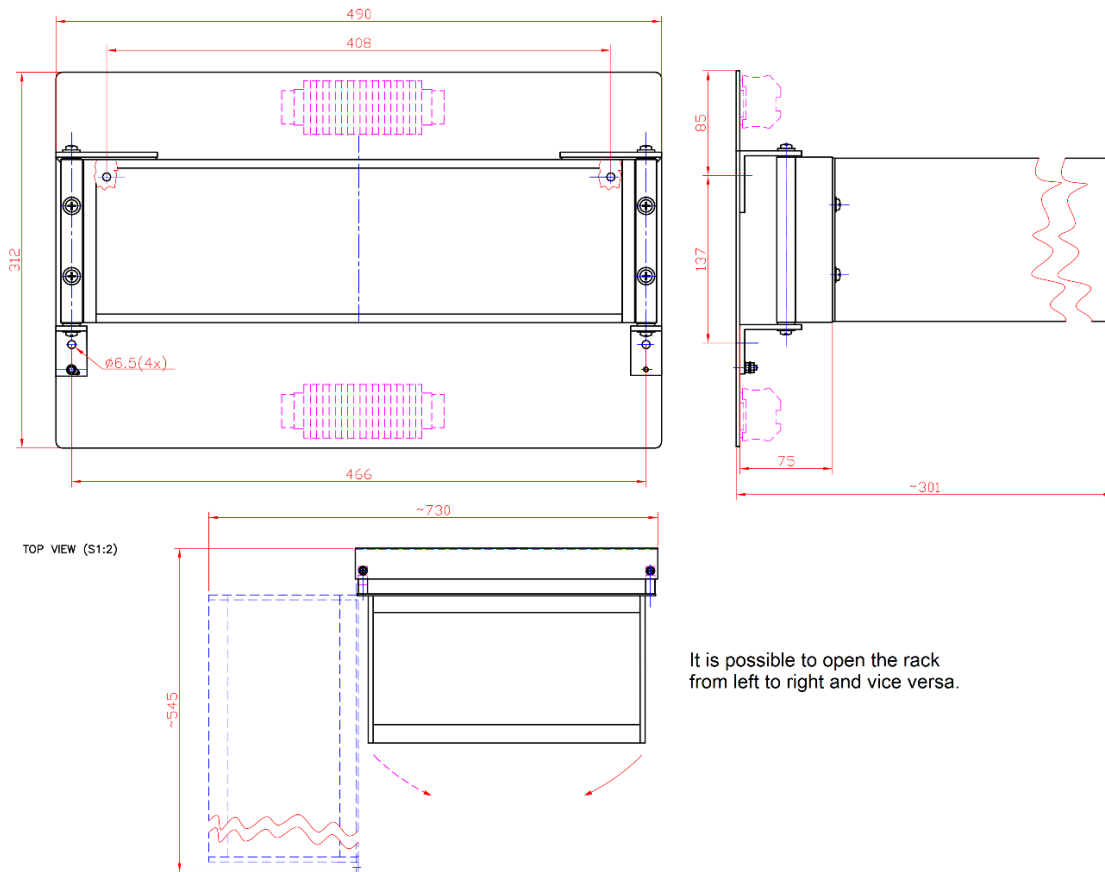


Figure 21-16 Dimensions for wall mounting of 84 HP devices (upper and lower terminals)

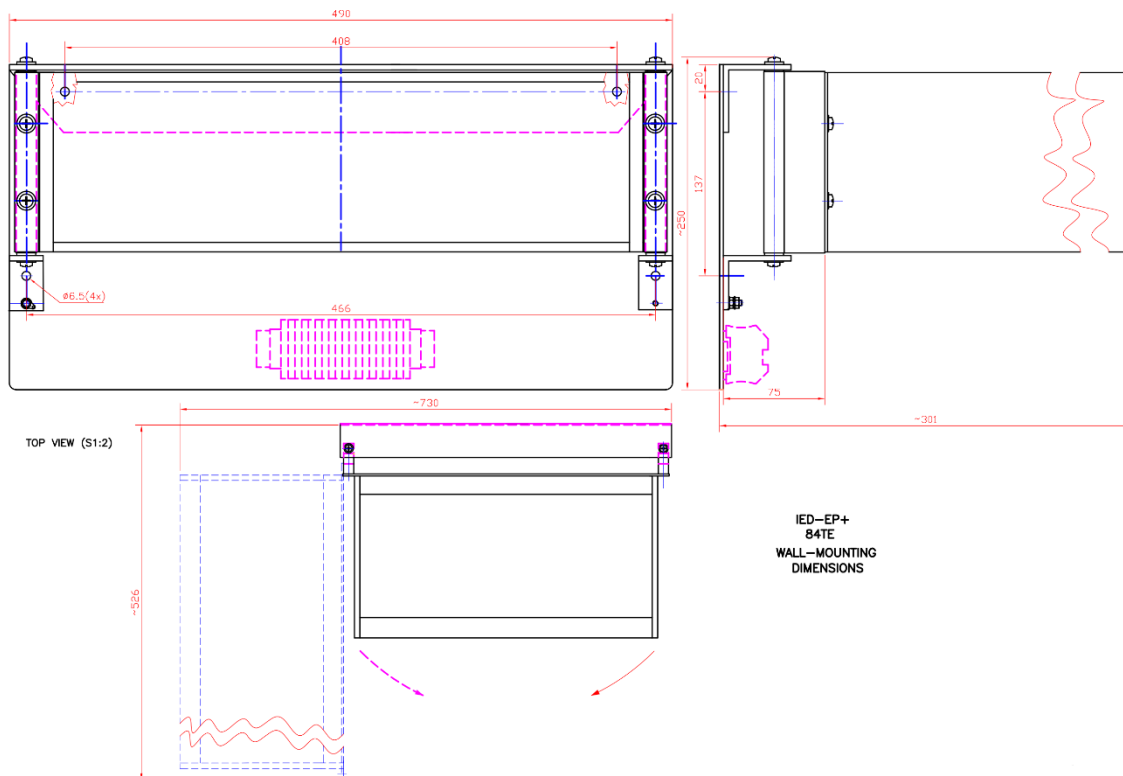


Figure 21-17 Dimensions for wall mounting of 84 HP devices (lower terminals only)

21.5 Din rail mounting of 24 HP panel instrument case

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

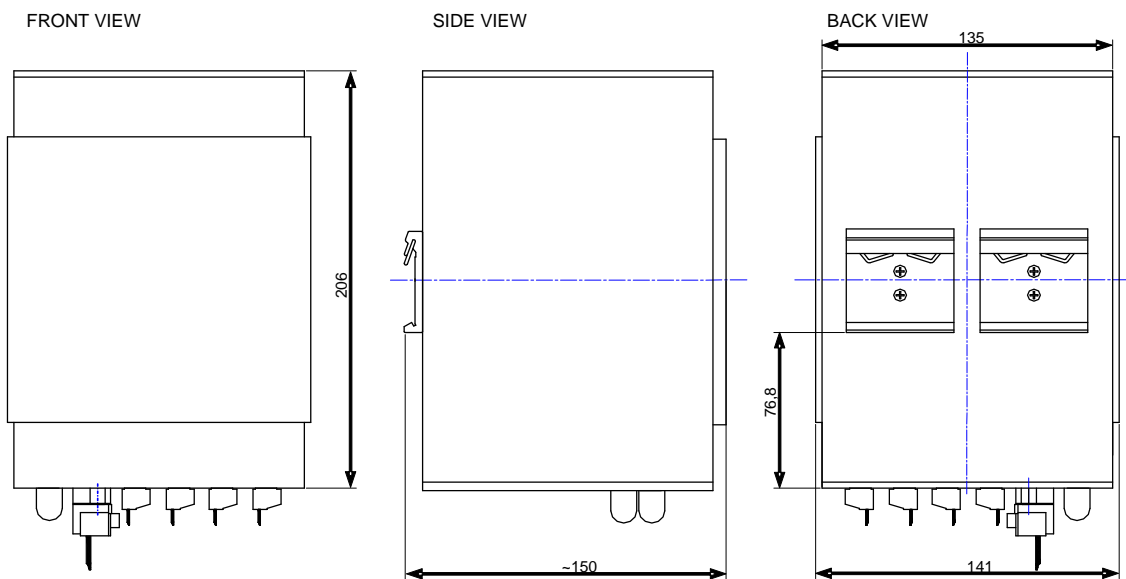


Figure 21-18 Dimensions for din rail mounting of 24 HP panel instrument case

21.6 IP54 rated mounting kit

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

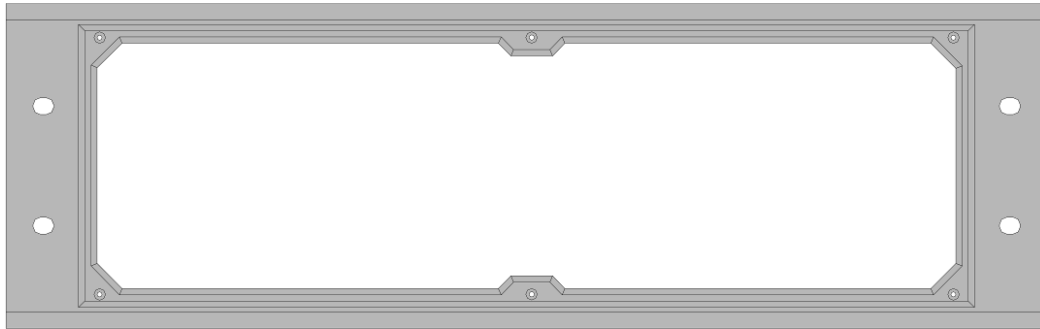


Figure 21-19 84 HP IP frame front view



Figure 21-20 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!

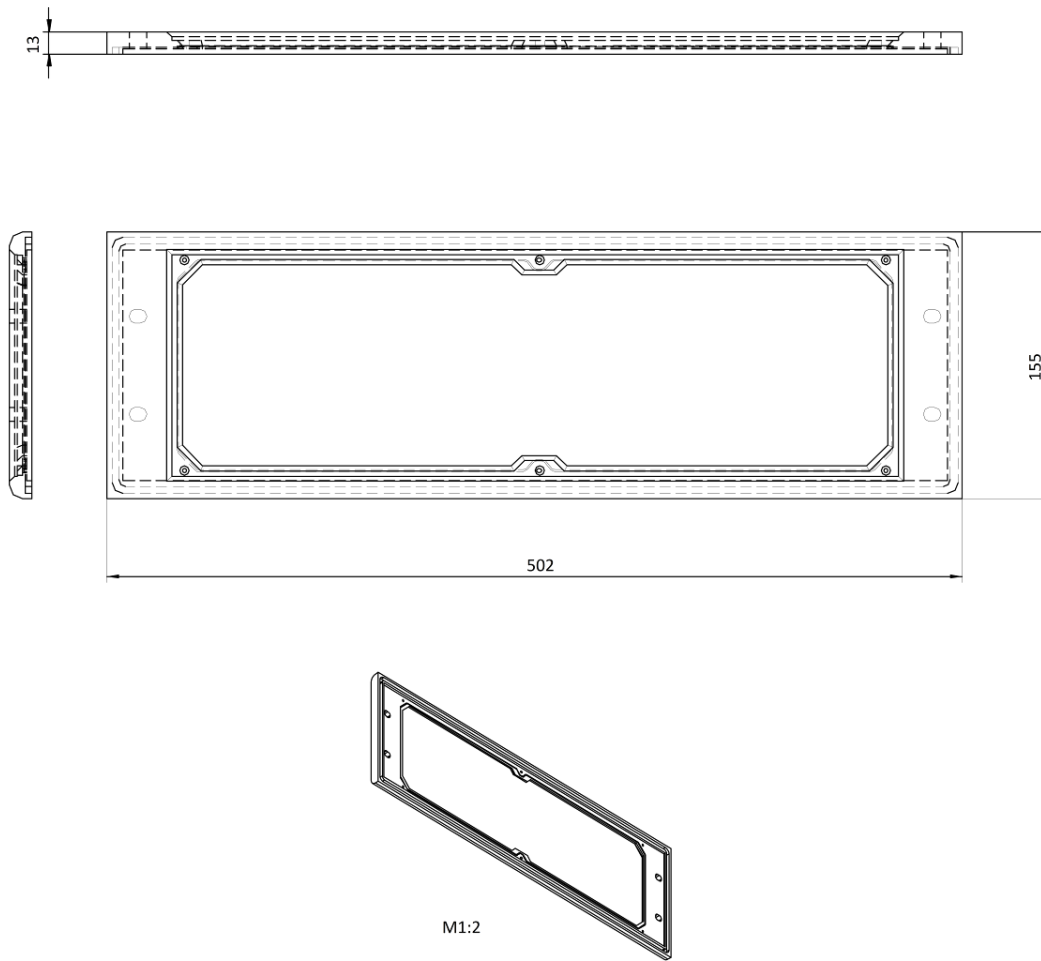


Figure 21-21: 84 HP IP frame dimensions

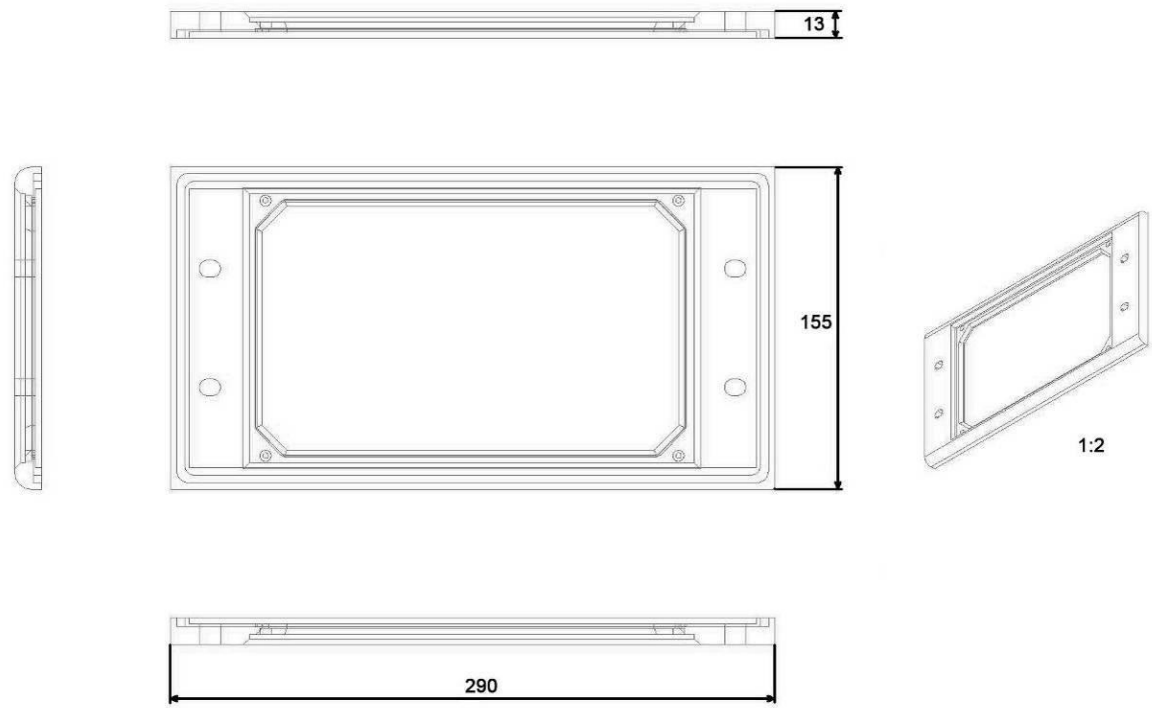


Figure 21-22 42 HP IP frame dimensions

21.7 Fold-down mounting

21.7.1 Fold-down mounting without terminals

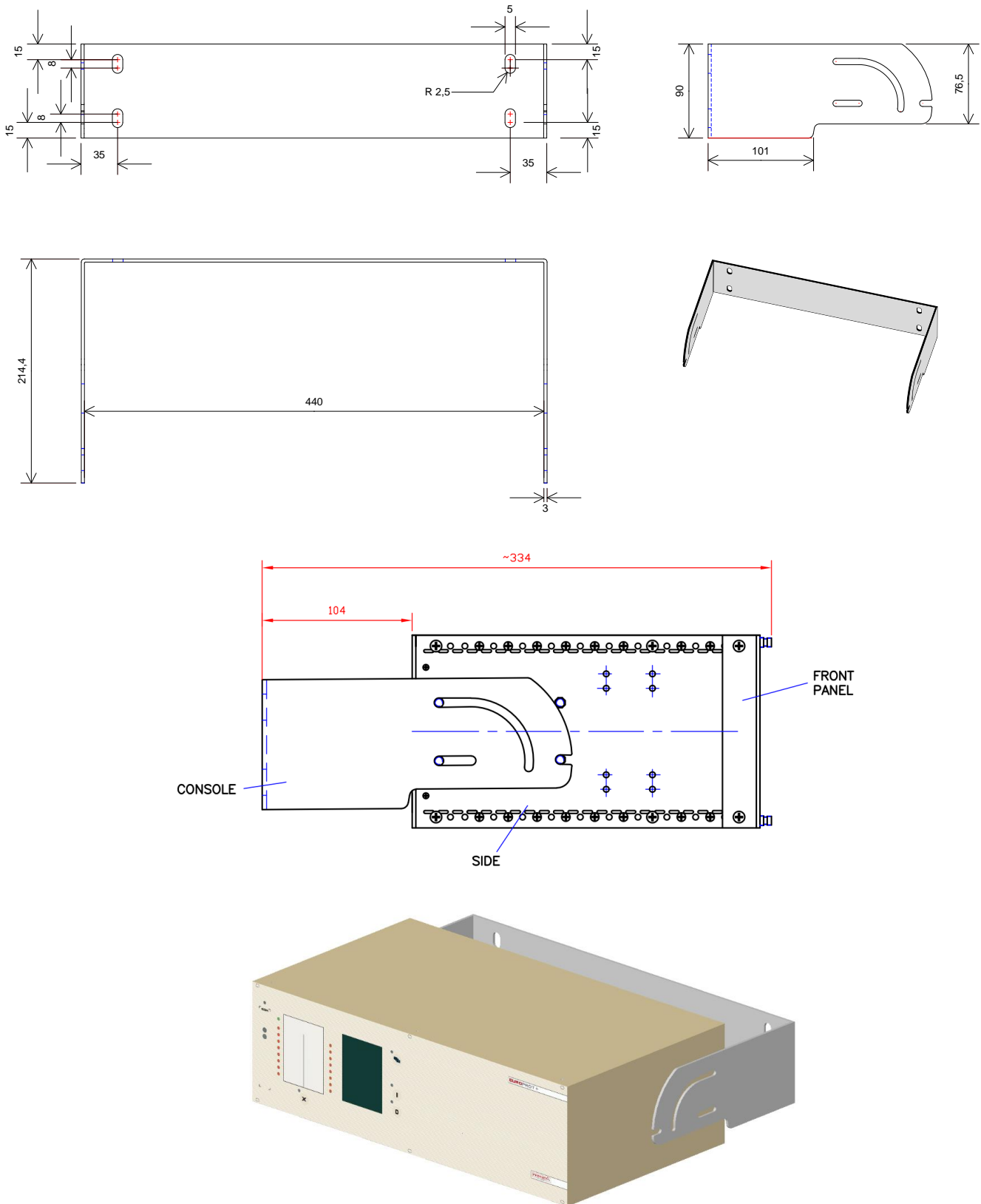


Figure 21-23 84 HP fold-down mounting

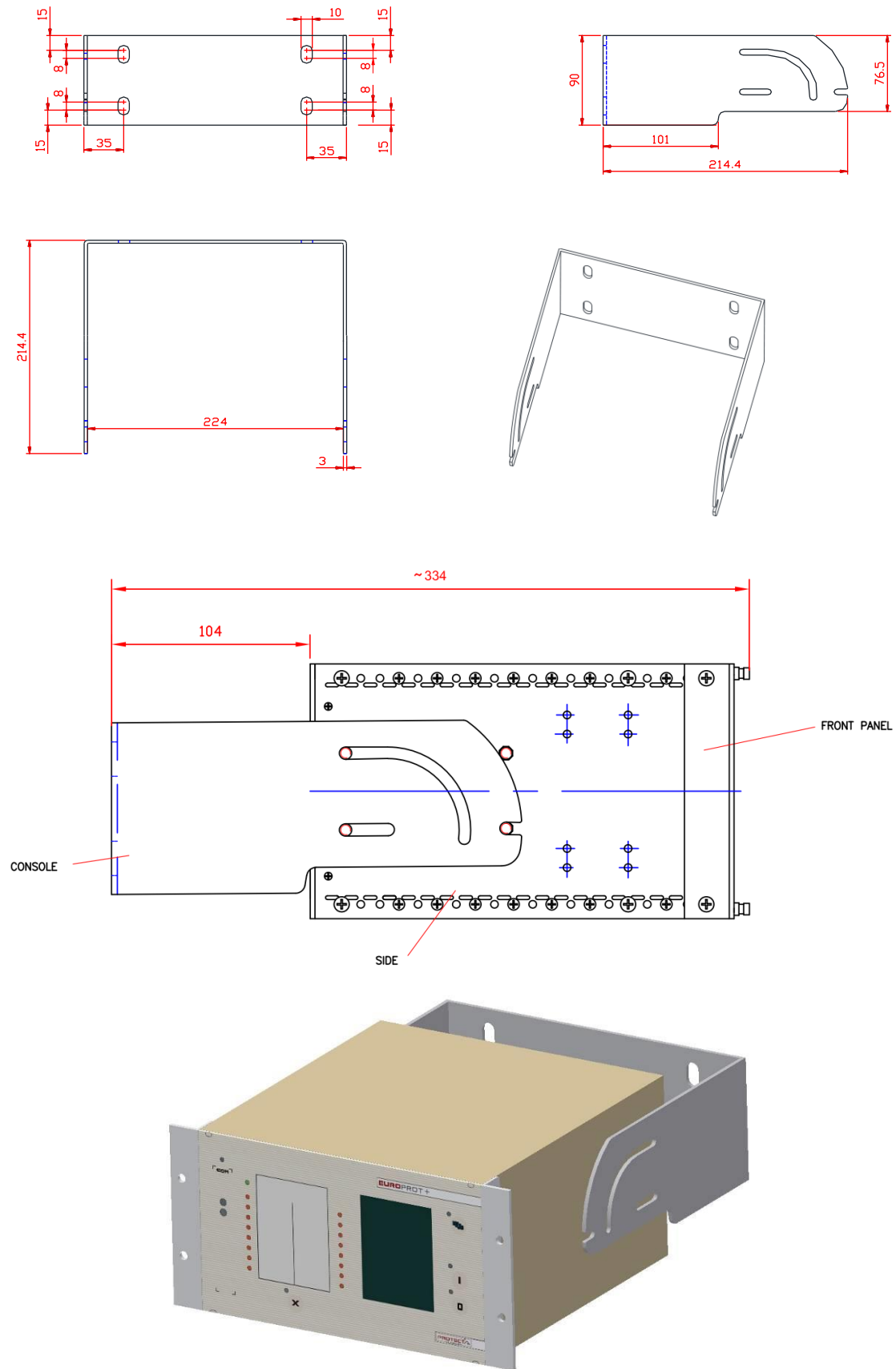


Figure 21-24 42 HP fold-down mounting

21.7.2 Fold-down mounting with terminals

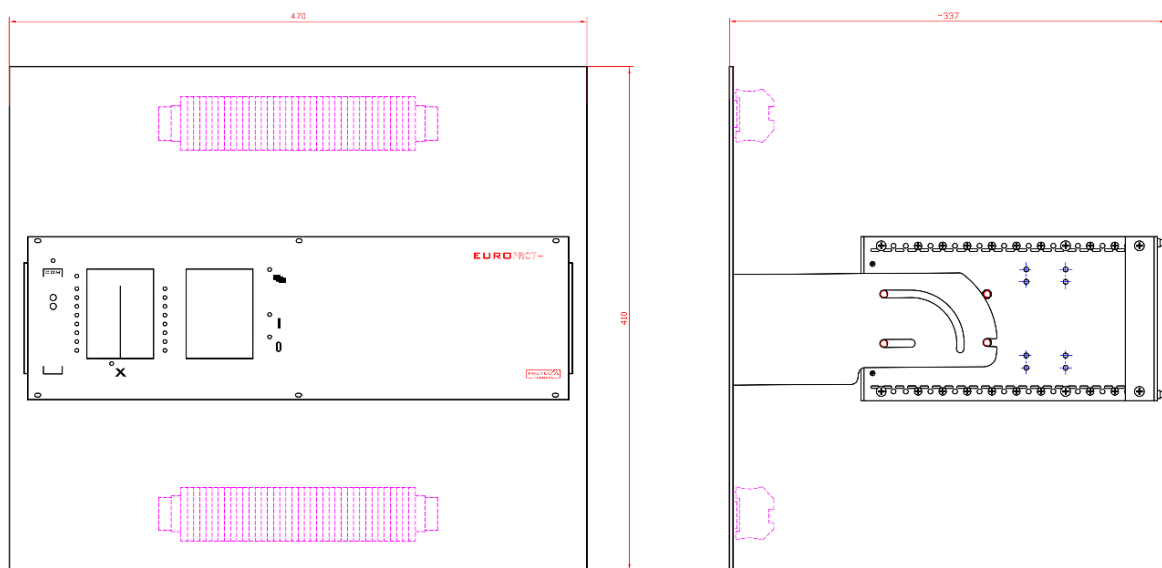


Figure 21-25 Fold-down mounting with terminals for 84HP devices

*Fastening points are customized.

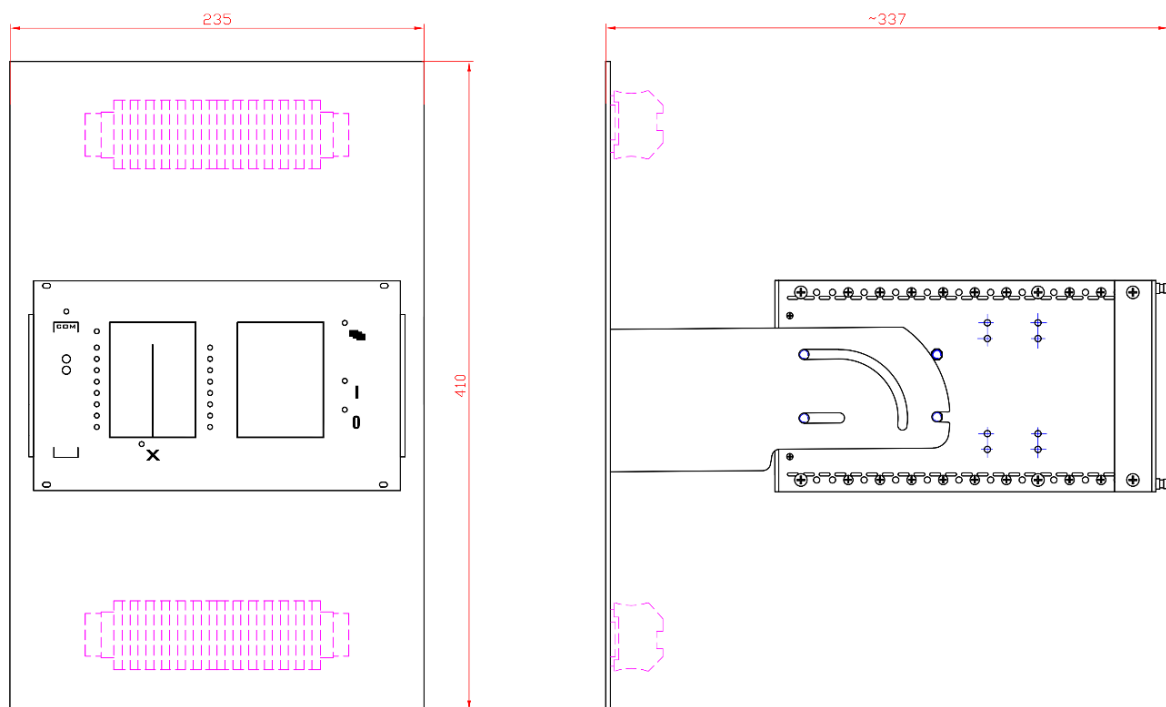


Figure 21-26 Fold-down mounting with terminals for 42HP devices

21.8 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.
(application@protecta.hu)

21.9 Remote HMI devices

IMPORTANT

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

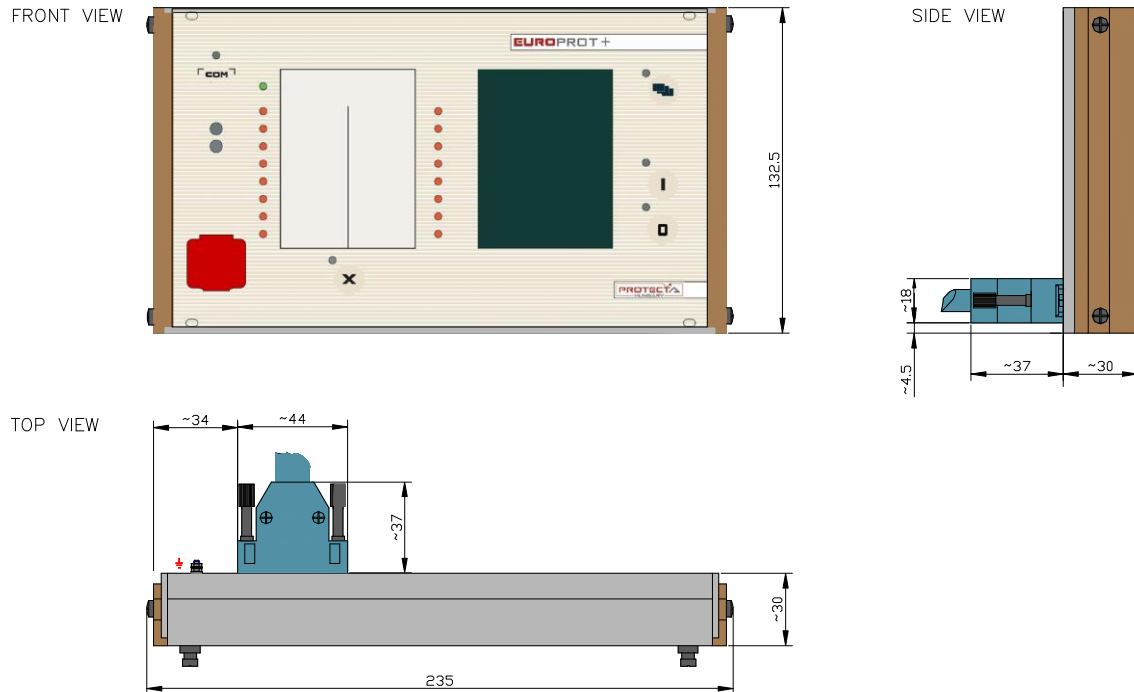


Figure 21-27 Dimensions for 42 HP wide remote HMI



Figure 21-28 Dimensions for 84 HP wide remote HMI

22 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:

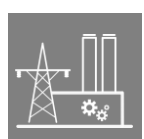
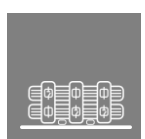
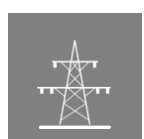
These modules can be ordered in case of special applications which are indicated for each module in its description in the previous chapters.

For more information about these devices please contact our Application Team. (application@protecta.hu)

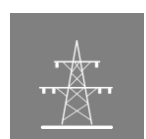
Optional connectors:

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.

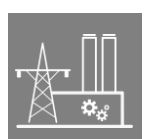
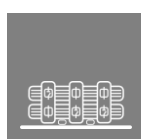
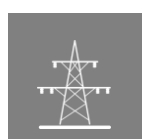
MODULE TYPE	COMMENT	DATE
CPU+/0001	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1211	2013-06-12
CPU+/0002	Legacy CPU card, not recommended for new configurations. Replacement: CPU+1111	2013-06-12
CPU+/0003	Legacy CPU card, not recommended for new configurations. Replacement: 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 Figure 22-1.	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
PS3F+/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 Figure 22-1.	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
O16+/2401	Obsolete module. Not recommended for new designs.	2022-03-22
O16+/4801	Obsolete module. Not recommended for new designs.	2022-03-22



O16+/1101	Obsolete module. Not recommended for new designs.	2022-03-22
O16+/2201	Obsolete module. Not recommended for new designs.	2022-03-22
F terminal type	Obsolete terminal type. Not recommended for new designs.	2024-05-27
CT+/5101	Obsolete module. Not recommended for new designs.	2024-05-30
CT+/5152	Obsolete module. Not recommended for new designs.	2024-05-30
R8+/01	Obsolete module. Not recommended for new designs.	2024-05-30
R16+/0000	Obsolete module. Not recommended for new designs.	2024-05-30
R16+/8000	Obsolete module. Not recommended for new designs.	2024-05-30
R16+/8080	Obsolete module. Not recommended for new designs.	2024-05-30
CT+/5102	Obsolete module. Not recommended for new designs.	2024-06-03
HMI+/3505	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/3405	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/3506	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/3406	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/3404	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/5706	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/5704	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2604	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2404	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2304	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2606	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2406	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2306	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2704	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2504	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2706	Obsolete module. Not recommended for new designs.	2024-11-22
HMI+/2506	Obsolete module. Not recommended for new designs.	2024-11-22

22.1 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 21 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 Figure 22-1. As a comparison, the new, shorter rack is also drawn in **light blue**.

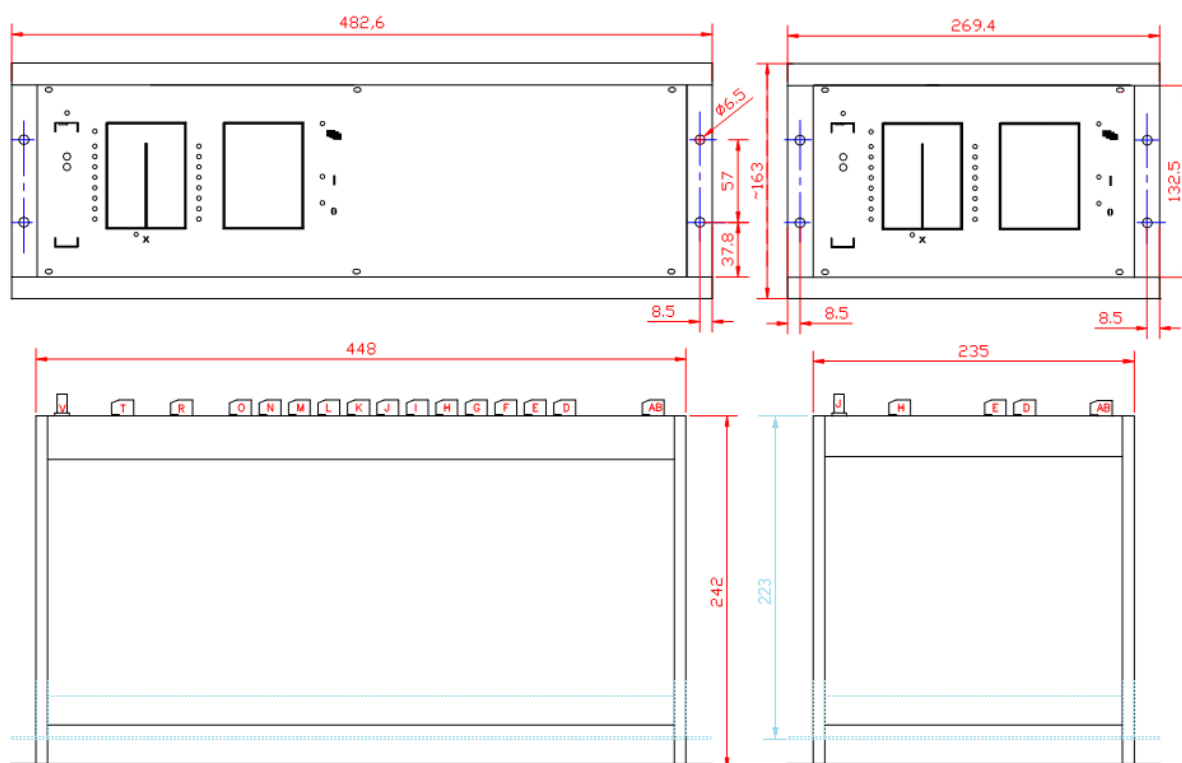


Figure 22-1 Dimensions for flush mounting of the previous 84HP and 42HP single rack, including the new (shorter) rack dimensions as well.