PowerManager CS Installation Manual

Data Logger for Photovoltaic Power Plants

Integrated PV Utility Control and Grid Stability Management System

Ethernet-enabled I/O Gateway

Version 23

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This product conforms with the low-voltage directive EN 62368-1:2014 + AC:2015 and the EMC directives BS EN IEC 61000-6:2019 and BS EN IEC 6100-6-4:2019. The certificates can be obtained from the manufacturer Stem Inc.

Stem GmbH
Franz-Ehrlich-Strasse 9
D-12489 Berlin

Phone:+49 (0) 30 338 430-100
Email: service@stem.com

Stem Japan K.K
617 MG Meguro Ekimae
2-15-19, Kamiosaki, Shinagawa-ku
Tokyo 141-0021, Japan

Phone: +81 3 4530 9502
Email: service@stem.com

Stem India
11th Floor, Building 10 B, DLF Cybercity,
Sector 24 Gurgaon 122002 Haryana India

Phone: +91-7506247799
Email: service@stem.com

Stem Inc
5400 Airport Blvd. Ste. 100
Boulder, CO 80301

Phone: +1 866 303 5668
Email: service@stem.com

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1. INSTRUCTIONS FOR THE USE OF THE MANUAL

1.1 Target Group

This installation manual is intended for qualified technical personnel such as technicians, installation, and planning personnel in charge of the installation and setup of the unit.

1.2 Icons

Warnings and notes are provided with icons as follows:

	**Warning - danger to life by high electrical current**
	**Warning - danger to life by high electrical voltage**
⚠	Follow the hints and instructions given in the manual.
	Recommends actions to improve situations and enhance operation safety. If you do not act as stated, however, safety is not jeopardized nor does this lead to any malfunction or destruction.

Stem is used in the text instead of the full company name Stem Inc.

1.3 Contents

The installation manual provides information about the safe and proper installation of the equipment to ensure efficient operation and use. Please read the manual carefully prior to installing the equipment and putting it into service. Make sure that you keep the manual in the dedicated place in the cabinet door.

The contents of this manual do not, however, replace any technical knowledge. Such expertise is subject to the user's training or further education. Acquiring special knowledge is solely subject to the user of the equipment.

Stem is not liable for damage due to installation and use of the equipment not in compliance with the law.

2. STORAGE AND TRANSPORTATION

Make sure not to expose the unit to direct sunlight or to rainwater. Transport and store the unit in its original packaging in dry and dust-free conditions on a pallet. This will protect the external connectors from damage, dust, and dirt.

⚠ Make sure not to bend the fibre-optic cables as they will irreparably break.

3. SAFETY

Risk of death! The device is powered by AC voltage.
Before installation, maintenance, cleaning or repair work, switch off the power supply and secure it against being switched on again.

The device must be opened, installed, and maintained only by qualified personnel (see Target Group). Make sure to follow the prevailing accident protection regulations when working on conducting systems.

Impermissible modifications and the use of spare parts and components other than those recommended by Stem may cause injury to persons and damage to technical equipment. Unauthorized personnel must not have any access to the equipment.

Make sure to remove interferences and rectify conditions that may jeopardize safety.

4. SCOPE OF DELIVERY

The scope of delivery is comprised of:

- 1 device cabinet
- 1 set of wall mounting brackets
- 2 batteries (optional)
- this installation manual

To start with, check the original packaging and the unit for damages. Then, check the contents of the package with the items on the delivery slip. In case of damage or questions regarding the scope of delivery, do not hesitate to contact Stem (see Manufacturer's Service).

5. SETUP

The device can be installed and safely operated both indoors and outdoors.

When you select the installation location, observe the following:

- ATTENTION: All cables should be laid in a way that the data communication is not interfered with electromagnetic radiation. The appropriate standards for information technology cabling installation (Part 2: EN 50174-2 Installation planning and practices inside buildings and Part 3: EN 50174-3 Installation planning and practices outside buildings) should be taken into account. Stem recommends a minimum distance of 1.0 m between data communication cables and power cables.
- Avoid direct sunlight. The shadow of the modules is a preferred location for installation.
- Make sure that no rainwater is able to run from the modules over the cabinet.
- Keep the cables to the device as short as possible in order to minimize cable loss.
- Keep extra cable length to connect the device.
- Mount the device cabinet vertically with the cable glands at the bottom.
- Use the mounting brackets to mount the device at a sufficiently stable wall or rack.

Make sure to follow the prevailing safety regulations when working with the device. Non-compliance may endanger persons and technical equipment.

⚠ Ensure the protection class IP 66 as defined in the standard EN 60529.

Avoid installing the device in high humidity conditions or during rainfall, as humidity might be enclosed in the housing and interfere later during operation or damage the equipment.

By means of the supplied material, mount the cabinet as shown in Figure 1.

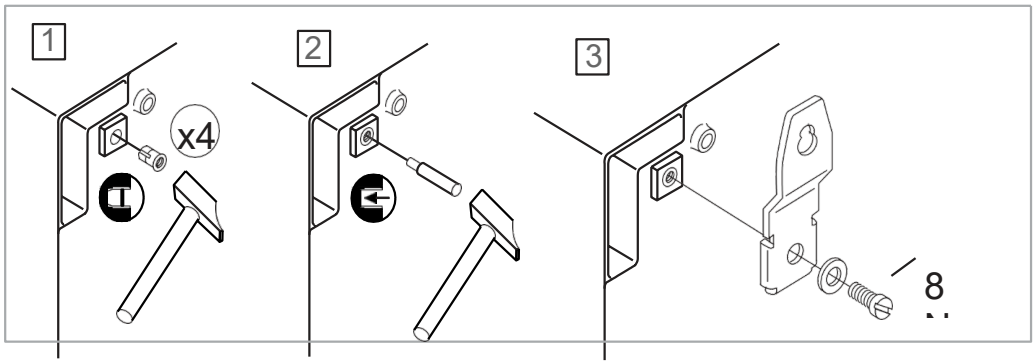
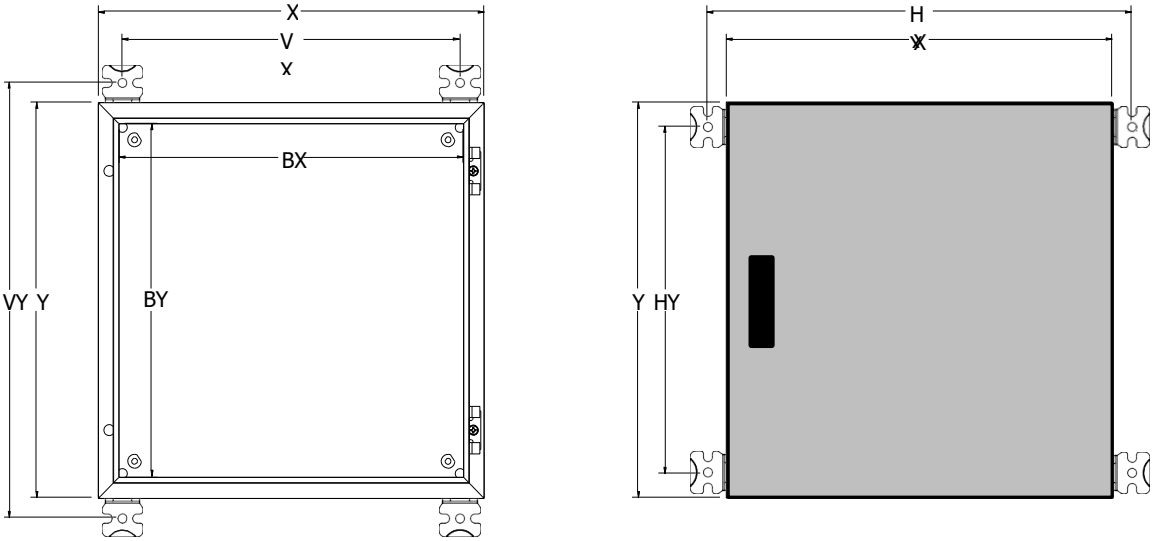


Figure 1: Wall mounting device cabinet with delivered mounting brackets



Enclosure Dimensions (mm)									
Part No.	**External Dimensions**			**Backplate**		**Vertical Bracket Orientation Spacing**		**Horizontal Bracket Orientation Spacing**	
Item	X	Y	Z	BX	BY	VX	VY	HX	HY
PMCS-GX	636	847	300	750	550	530	889	664	755
PMCS-GL	436	647	250	350	550	330	689	464	555

Figure 2: Dimensions of cabinet and mounting hardware, details

6. PRODUCT DESCRIPTION

The device is sectioned in the following three modules:

- (A) Power supply module (optional)
- (B) Monitoring & Network module / heating and cooling optional
- (C) Connection module

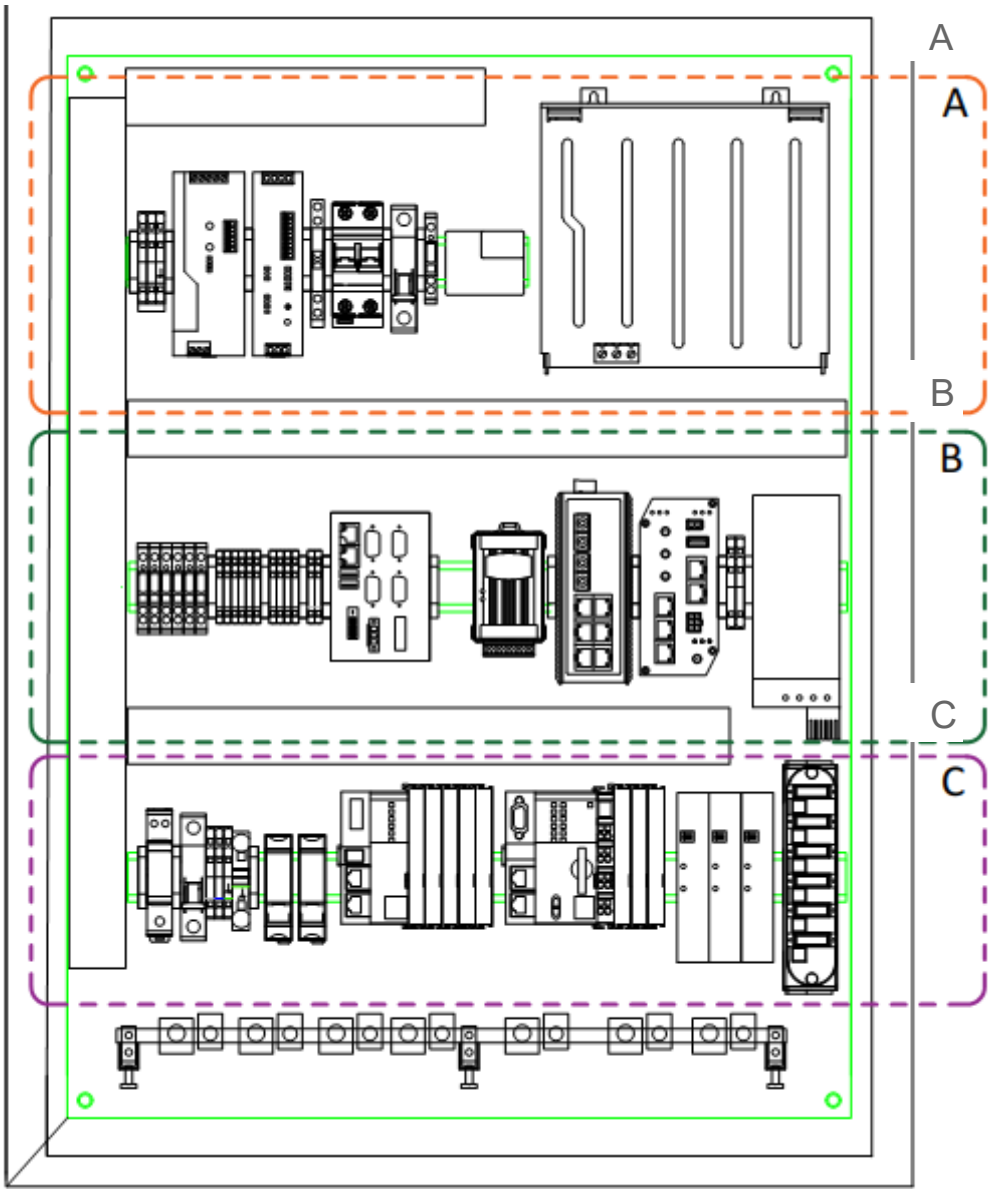
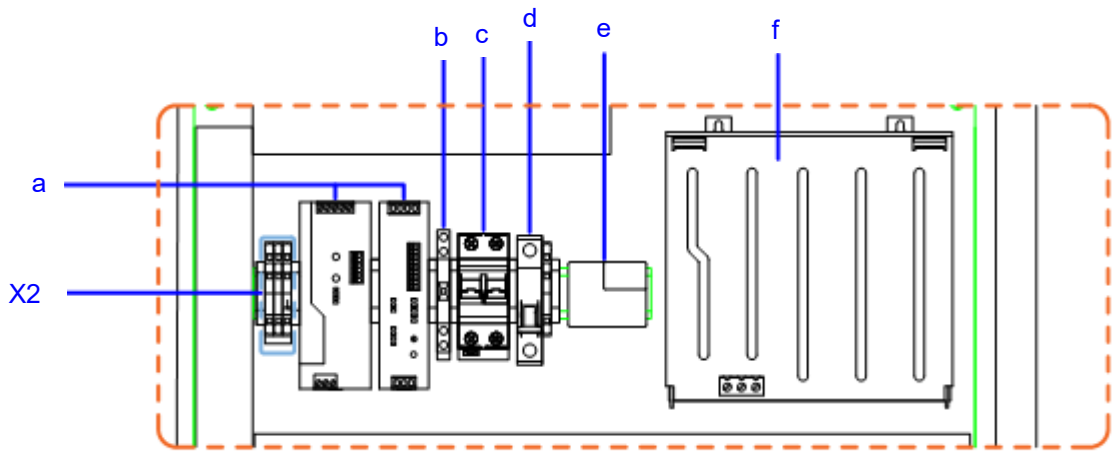


Figure 3: Product overview

7. DESIGN

> The following pictures refer to a fully developed PowerManager CS.
> Not all components must be included in your customized product.

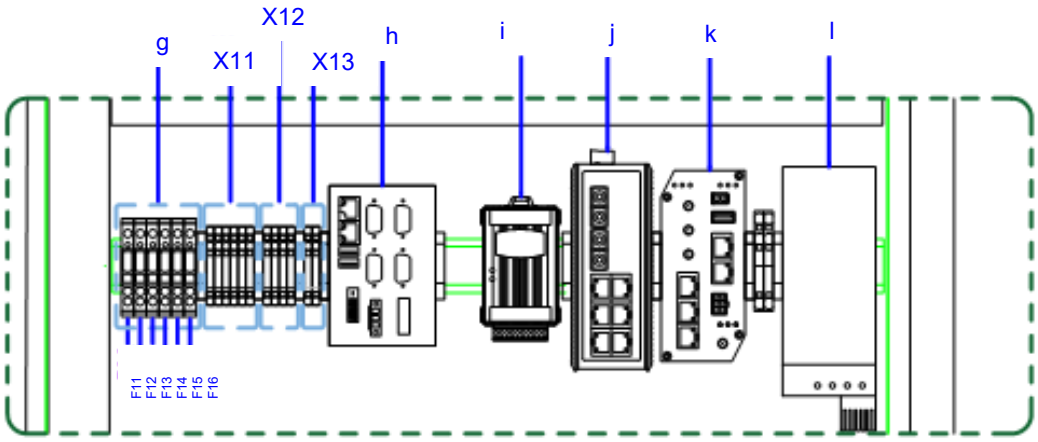
7.1 Power Supply Module (optional)



X2	AC terminal
a	24 V DC-UPS
b	Push button to start the device in battery mode
c	Circuit breaker of the battery
d	AC circuit breaker for heater
e	Accessory box
f	24 V DC batteries 12Ah

Figure 4: Power supply module, details

7.2 Monitoring & Network Module



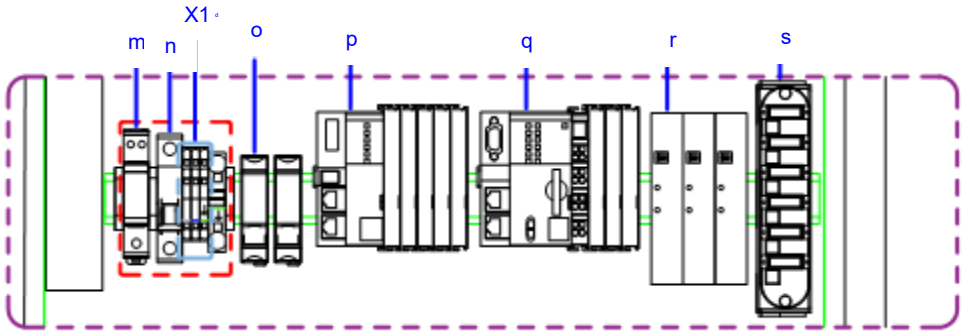
g	DC fuses
X11	24 V DC buffered
X12	24 V DC unbuffered for sensor heater supply
X13	24 V DC buffered for PC and PLC
h	Industrial PC(s)
i	Modbus RTU/TCP converter(s)
j	Ethernet switch(es) (optional)
k	Router (optional)
l	Heater

Fuse assignment	
F11	Ethernet Switch
F12	Router or Ethernet Switch
F13	24 VDC buffered
F14	IPC1/PLC1
F15	IPC2/PLC2
F16	24 VDC unbuffered

Figure 5: Monitoring & network module, details

7.3 Connection Module

Danger to life! The area marked red in Figure 6 is energized.



X1	AC line connection terminal and earth connection PE
m	AC line overvoltage arrester
n	AC line circuit breaker
o	Ethernet overvoltage protection device(s)
p	PLC1
q	PLC2
r	RS485 bus and 24 VDC output overvoltage protection device(s)
s	Splice box(es)

Figure 6: Connection module, details

PE	**Ext. Bat.**	**Ethernet**	**Ethernet**	**PLC**	**PLC**	**RS485 HD**	**RS485 HD**	**RS485 HD**
AC/DC	**Bat. Temp**	**Ethernet**	**PLC**	**PLC**	**PLC**	**RS485 HD**	**RS485 HD**	**RS485 HD**

Figure 7 Connectors on the bottom side

8. CONNECTION OF DATA COMMUNICATION

Make sure to turn off all fuses and the AC main supply prior to working on the electrical connections of the device.

Make sure to mark all cables prior to disconnecting them

8.1 Connecting the Ethernet Cable

1. Lead the Ethernet cable(s) through the cable gland(s) marked ETHERNET (Figure 7) into the cabinet.
2. Connect the cable(s) ether to the overvoltage arrester(s) (q in Figure 6) or to the Ethernet switch (k in Figure 5).

8.2 Connecting Digital Inputs

Refer to Figure 8 and Table 1 and follow the steps below to connect the digital inputs.

1. Lead the cables through the applicable cable glands (Figure 7) into the housing.
2. Tighten the cable gland.
3. Connect the cable shields to the shielding clamps (see Connecting the Cable Shield).
4. Connect the cables to the connection terminal for digital inputs (Figure 8). Refer to Table 1 below for the correct wire assignment.

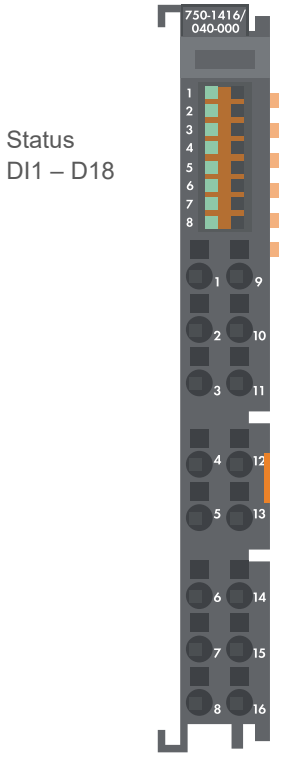


Figure 8: 8-channel digital input module, 750-1416

Terminal	Description	Terminal	Description
1	Digital Input 1	**9**	24V DC [1]
2	Digital Input 2	**10**	24V DC [2]
3	Digital Input 3	**11**	24V DC [3]
4	Digital Input 4	**12**	24V DC [4]
5	Digital Input 5	**13**	24V DC [5]
6	Digital Input 6	**14**	24V DC [6]
7	Digital Input 7	**15**	24V DC [7]
8	Digital Input 8	**16**	24V DC [8]

Table 1: Wire assignment digital input channels

Cross section, solid wire	0.08mm^2 to 1.5mm^2 / AWG 28 to 16
Cross section, fine-stranded wire	0.25mm^2 to 1.5 mm^2 / AWG 22 to 16

8.3 Connecting Temperature Sensors

Four-wire sensors can be connected to the RTD module which is based on a three-wire technology.

Refer to Figure 9 and Table 2 and follow the steps below to connect the temp. sensors.

1. Lead the cables through the applicable cable glands (Figure 7) into the housing.
2. Tighten the cable gland.
3. Connect the cable shields to the shielding clamps (see Connecting the Cable Shield).
4. Connect the connection cables to the connection terminal for temperature sensors (Figure 9). Refer to Table 2 for the correct wire assignment.

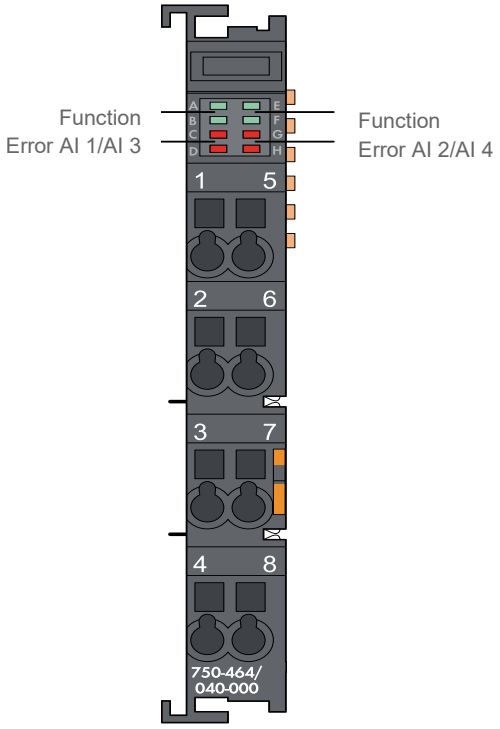


Figure 9: 2-channel analog input module (RTD), 750-464

Terminal	Description	Wire Color
1	Supply 1 (+)	White

2	Sense 1 (+)	Red
3	--	--
4	Supply 1 (-) / Sense 1 (-)	Brown / Blue
5	Supply 2 (+)	White
6	Sense 2 (+)	Red
7	--	--
8	Supply 2 (-) / Sense 2 (-)	Brown / Blue

Table 2: Wire assignment analog input channels

Cross section, solid wire	0.08mm^2 to 1.5mm^2 / AWG 28 to 16
Cross section, fine-stranded wire	0.25mm^2 to 1.5 mm^2 / AWG 22 to 16

8.4 Connecting Digital Outputs

Refer to Figure 10 and Table 3 and follow the steps below to connect the digital outputs.

1. Lead the cables through the applicable cable glands (Figure 7) into the housing.
2. Tighten the cable gland.
3. Connect the cable shields to the shielding clamps (see Connecting the Cable Shield).
4. Connect the connection cables to the connection terminal for digital outputs (Figure 10 below). Refer to Table 3 below for the correct wire assignment.

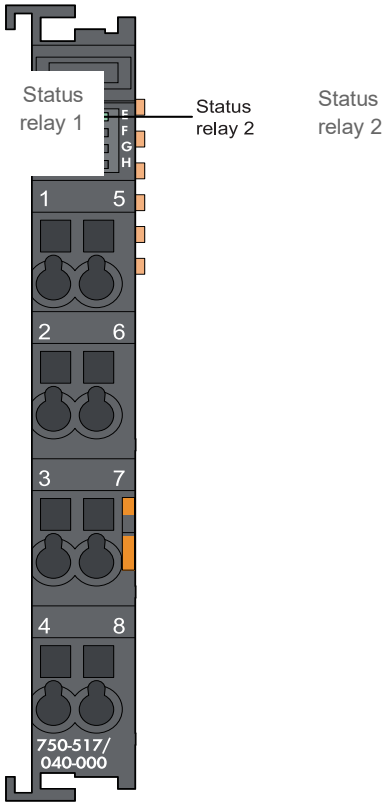


Figure 10: 2-channel digital output module (relay), 750-517

Terminal	Description
1	Digital Output 1 (NO)
2	Digital Output 1 (COM)
3	Digital Output 1 (NC)
4	--
5	Digital Output 2 (NO)
6	Digital Output 2 (COM)
7	Digital Output 2 (NC)
8	--

Table 3: Wire assignment digital output channels

Wire cross section | 0.08 mm^2 to 2.5 mm^2 / AWG 28 to 14

8.5 Connecting Analog Inputs

Refer to Figure 11and Table 4 and follow the steps below to connect the analog inputs.

1. Lead the cables through the applicable cable glands (Figure 7) into the housing.
2. Tighten the cable gland.
3. Connect the cable shields to the shielding clamps (see Connecting the Cable Shield).
4. Connect the connection cables to the connection terminal for analog inputs (Figure 11 below). Refer to Table 4 below for the correct wire assignment.

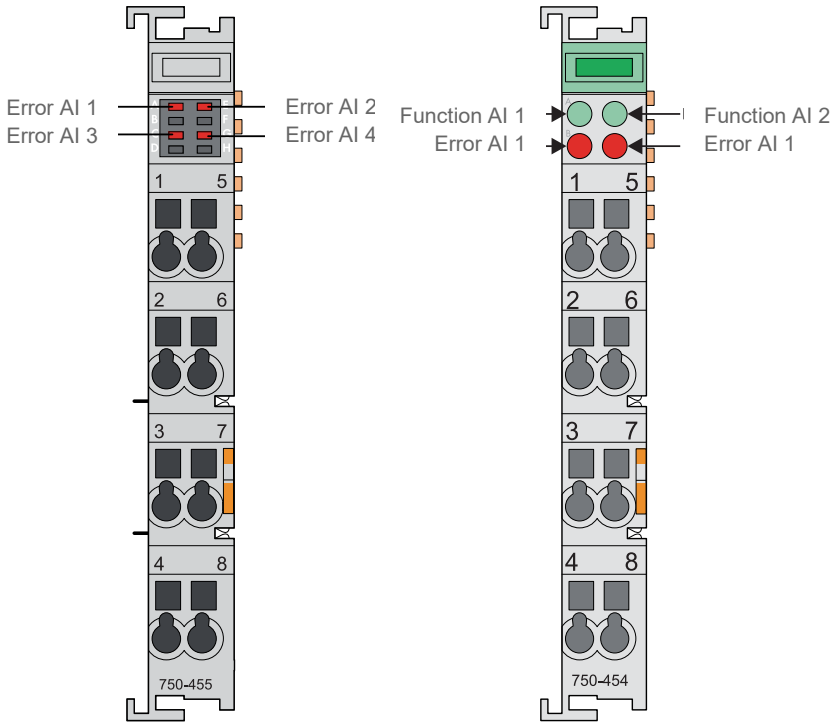


Figure 11: Left: 4-channel analog input module, Right: 2-channel analog input module

4-channel analog input (750-455)		2-channel analog input (750-454 / 750-466)	
Terminal	**Description**	**Terminal**	**Description**
1	Analog Input 1 (0/4-20 mA)	**1**	Analog Input 1 (0/4-20 mA)
2	GND (common)	**2**	24 VDC (common)
3	Analog Input 3 (0/4-20 mA)	**3**	GND (common)
4	GND (common)	**4**	shield
5	Analog Input 2 (0/4-20 mA)	**5**	Analog Input 2 (0/4-20 mA)
6	GND (common)	**6**	24 VDC (common)
7	Analog Input 4 (0/4-20 mA)	**7**	GND (common)
8	GND (common)	**8**	shield

Table 4: Wire assignment analog input channels

Wire cross section | 0.08 mm^2 to 2.5 mm^2 / AWG 28 to 14

8.6 Connecting Analog Outputs

1. Lead the cables through the applicable cable glands (Figure 7) into the housing.
2. Tighten the cable gland.
3. Connect the cable shields to the shielding clamps (see Connecting the Cable Shield).
4. Connect the connection cables to the connection terminal for analog outputs (Table 5 and Figure 12 below).

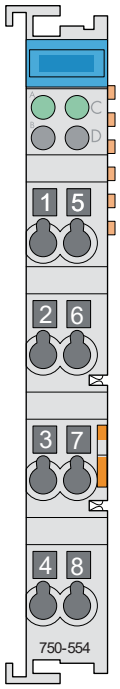


Figure 12: 2-channel analog output module

Terminal	Description

1	Analog Output 1 (0 or 4-20 mA)
2	24V DC (common)
3	GND (common)
4	Cable shield
5	Analog Output 2 (0 or 4-20 mA)
6	24V DC (common)
7	GND (common)
8	Cable shield

Table 5: Wire assignment analog output channels

Wire cross section | 0.08 mm^2 to 2.5 mm^2 / AWG 28 to 14

8.7 Connecting S0-Interface (counter)

1. Lead the connection cables through the applicable cable gland (Figure 7) into the housing.
2. Tighten the cable gland.
3. Connect the cable shields to the shielding clamps (see Connecting the Cable Shield).
4. Connect the connection cables to the connection terminal for S0 interface (Figure 13 below). Refer to Table 6 below for the correct wire assignment.

Make sure that terminal 3 is connected to terminal 4, and terminal 7 is connected to terminal 8.

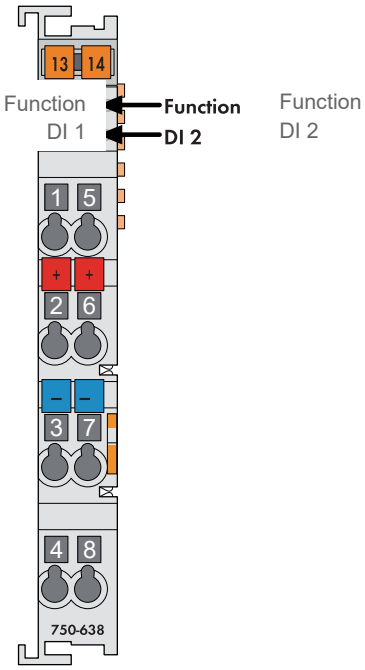


Figure 13: 2-channel counter module, 750-638

Terminal	Description
1	Channel 1 (-)
2	Channel 1 (+)
3	--
4	--
5	Channel 2 (-)
6	Channel 2 (+)
7	--
8	-

Table 6: Wire assignment 2 channel counter interface

Wire cross section | 0.08 mm^2 to 2.5 mm^2 / AWG 28 to 14

8.8 Connecting RS485 Bus Devices

Stem recommends that you use cable type Li2YCYv (TP) 4 x 2 x 0.5.

1. Lead the connection cables through the cable gland marked RS485 HD (Figure 7) into the housing.
2. Tighten the cable gland.
3. Connect the cable shields to the shielding clamps (see Connecting the Cable Shield).
4. Unplug X4 and X5 from the fieldbus overvoltage protection device.
5. Connect the connection cables to the plugs of the fieldbus overvoltage protection device (Figure 14 below). Refer to Table 7 below for the correct wire assignment.
6. Plug the connectors X4 and X5 to the fieldbus overvoltage protection device.

Figure 14: Preparing connectors X4 and X5

If included with pyranometer shipment, the Hukseflux "Pyranometer Insulation Disc" should be installed per manufacturer's provided recommendations.

Figure 15: Fieldbus overvoltage protection device

A: Metal foot catch, pull to remove

		4.1	4.2	4.3	4.4				
	Terminal	5.1	5.2	5.3	5.4	6.1	6.2	6.3	6.4

	Description	D- (B)	GND	COM	D+ (A)	GND	24V	GND	24V
Li2YCYv(TP4x2x0.5	Wire Color	Yellow	bridge		Green	Brown	White	Blue/Grey	Red/Rose
S0Z-03D		Blue	bridge		White	Black	Brown	-	-
Lufft Met Station		Yellow	bridge		Green	White	Brown	Blue/Grey	Red
SR05		Grey	-	Blue	White	Black	Brown	-	-
SR30-M2-D1*		Grey	-	Blue	White	Black	Brown	-	-
RT1		Grey	-	Green	Yellow	Blue	Red	-	-
IMT		Orange	bridge		Brown	Black	Red	-	-

**Applies only to SR30-M2-D1 model. Consult manufacturer documentation for all other models.*

Table 7 Wire assignment RS485 bus devices

Assignment of the serial overvoltage protection modules

The Fieldbus overvoltage protection devices are assigned as follows:

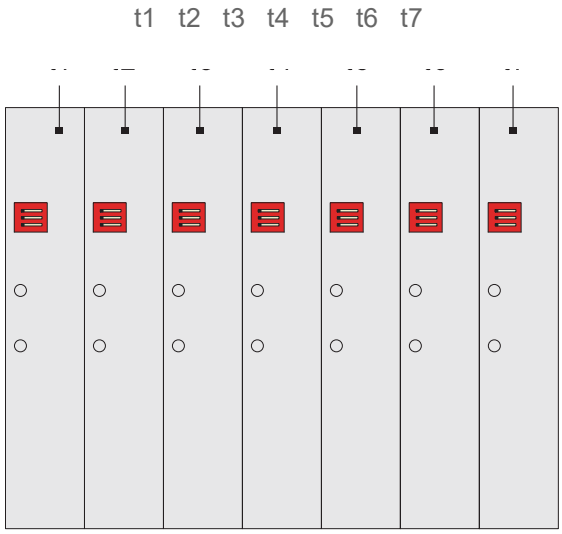


Figure 16: Serial overvoltage protection assignment

Device	DC Power Supply	Target Devices
t1	Unbuffered 24 V DC	Lufft weather station (heated) or inverters
t2 to t7	Buffered 24 V DC	Sensors without heating or inverters

8.9 Terminating the RS485 Bus

If the device is the last participant in the RS485 Bus line, make sure that the dip switch 1 on the Fieldbus overvoltage protection device is in *ON* position (see Figure 17 below).
If necessary, put the dip switches 2 and 3 in *ON* position to enable the BIAS.

DIP		
1	2	3
RS485 Term.	RS485 BIAS	RS485 BIAS

Figure 17: Terminating RS485 bus

8.10 Commissioning the LTE Router

⚠ Make sure the router is de-energized before you insert the SIM card.

ⓘ Make sure to mark all cables prior to disconnecting them.

1. Disconnect all cables from the router.
2. Carefully remove the router from the DIN rail (refer to Figure 18 below).
3. Insert the SIM card into the SIM card slot (refer to Figure 19 below).
4. Put the Router at an angle of approx. 45° with the bottom part of the mounting rail on the DIN rail (refer to Figure 18 below).
5. Carefully press the top side of the mounting rail on the DIN rail until the bracket clicks.

6. Reconnect all cables to the router.
7. Connect the antenna to the antenna socket of the router. If it is necessary to position the antenna outside the cabinet, lead the antenna cable through an applicable cable gland into the cabinet and connect it to router and antenna.
8. Connect the plug of the antenna cable to the socket marked ANT (yellow frame in Figure 20 below) on the router.
9. If necessary, attach the antenna cable at an appropriate position inside the cabinet.

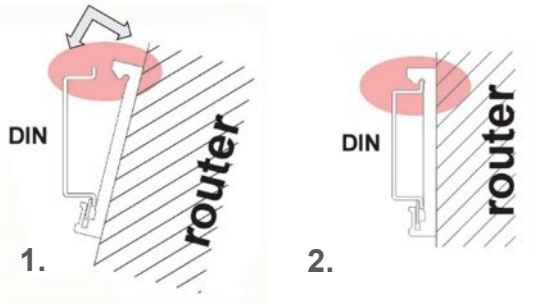


Figure 18: Router mounting

Figure 19: SIM card slots on the router's back side

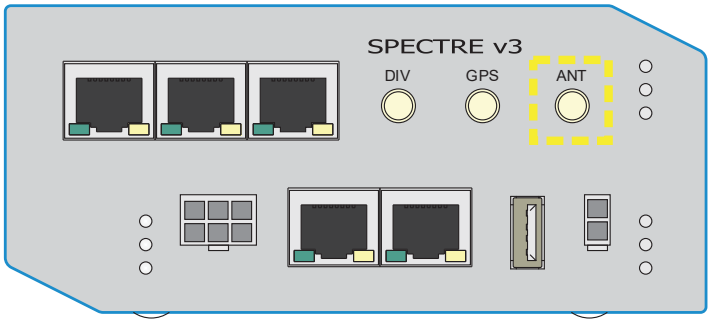


Figure 20: Antenna socket (marked yellow) on the router's front side

8.11 Commissioning the VPN-Router

The network connection can be established for the following two use cases:

A: Stem devices (2) and customers router (1) in the same network (refer to Figure 21 below).

B: Stem devices (2) and customers router (1) in two different networks (refer to Figure 22 below).

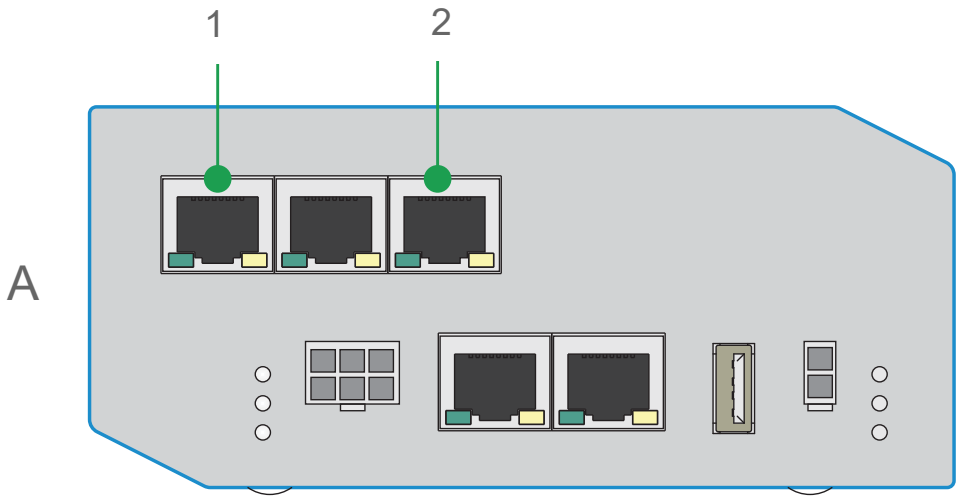


Figure 21: Connecting the VPN-router, case A

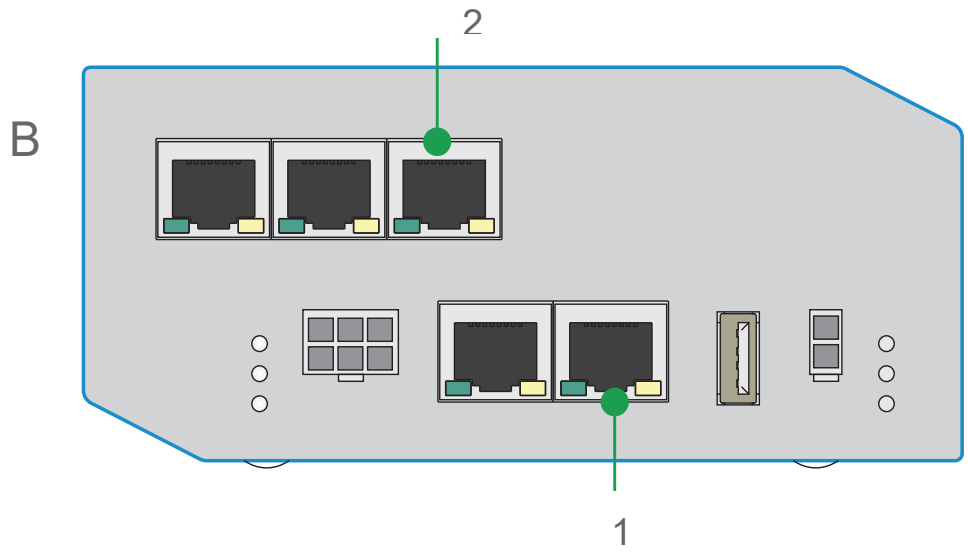


Figure 22: Connecting the VPN-router, case B

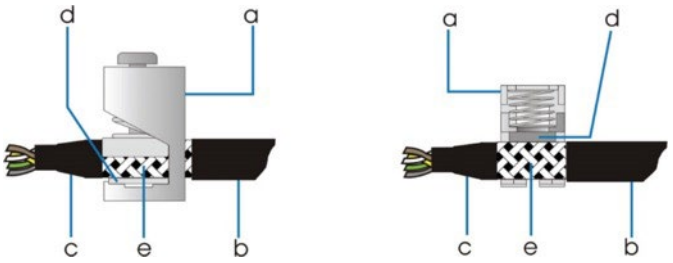
8.12 Connecting the Cable Shield

When you connect the cable shield, follow the steps below:

1. Unspool a sufficient length of the cable.
2. Pull the shielding over the cable.
3. Lead the cable through the applicable shielding clamp.

4. Attach the cable using the shield securing clip (left in Figure 23 below) or using the spring-type terminal (right in Figure 23 below).

⚠ Fasten the shield securing clip by hand, do not use a screwdriver or forceps (left in Figure 24 below).



a	Shielding clamp
b	Cable
c	Shrink hose
d	Neutral terminal busbar
e	Shield

Figure 23: Left: Shield over cable, hand-fasten shield securing clip, Right: Shield over cable, spring-type terminal

8.13 Splice Box - Removal and Installation

⚠ Make sure not to bend the fibre-optic cables as this may cause irreparable damage.

Follow the steps below to remove the splice box:

1. Push the disconnect tab.
2. Lift the splice box a little and pull it upwards to remove it from the DIN rail.

Figure 24: Splice box

3. After splicing the fibre optic cables, install the splice box in reverse order.

Fibre-Optic PowerManager CS Network

Figure 25 below shows an example of how to link several devices in a fibre-optic network; as a line or as a ring.

We recommend the ring structure which is redundant. If one station would be out of order all other stations could still communicate.

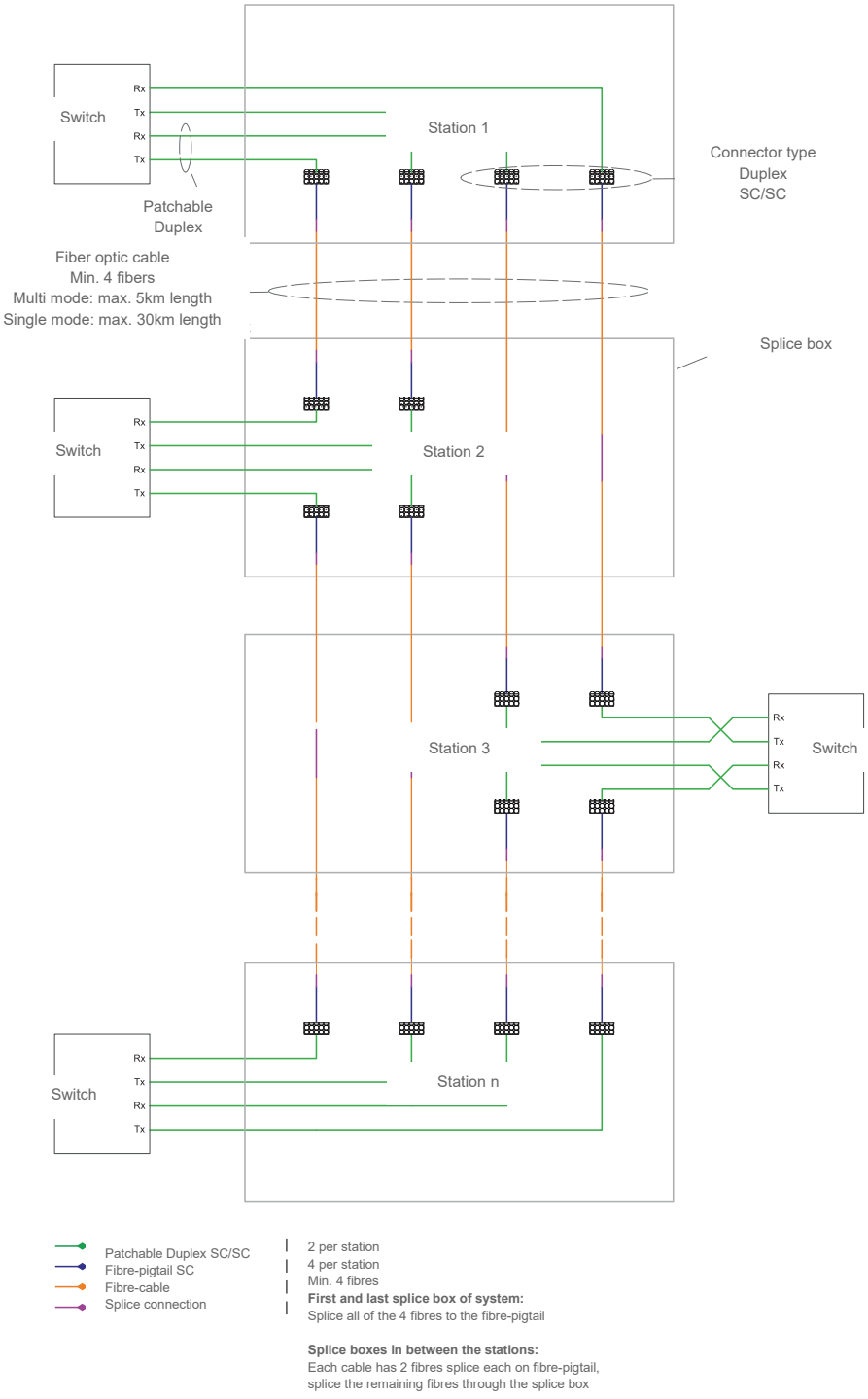


Figure 25: Fibre-optic network topology

9. CONNECTING POWER SUPPLY

Danger! Make sure to turn off all fuses and the AC main supply prior to working on the electrical connections.

9.1 Installing and Connecting the Batteries

When installing the batteries, ensure the correct polarity and observe the safety instructions on the batteries.

12Ah batteries are mounted to the enclosure and wired by Stem, no additional wiring is required.

9.2 Connecting the Earthing Cable

Lead the earthing cable through the cable gland marked *PE* and connect it to the earthing connector above the cable gland. Figure 26 and Table 8, below, show how to connect this cable as well as its wire cross-section.

9.3 Connecting the AC Main Cable

Lead the AC main cable through the cable gland marked *AC*. Figure 26 and Table 8 below show how to connect this cable as well as its wire cross-section.

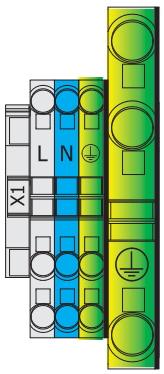


Figure 26: AC terminal block X1

Terminal X1	Wire colour	Description
L	Black	Phase, H07V-K 2.5mm^2
N	Blue	Neutral, H07V-K 2.5mm^2
PE	Green / yellow	PE, H07V-K 2.5mm^2
PE	Green / yellow	Earthing cable, H07V-K 16mm^2

Table 8: Terminal X1 assignment

10. ENERGIZE / DE-ENERGIZE

The areas marked red in Figure 4 and Figure 6 are energized with AC voltage.

To energize the device, make sure to

- put the AC line circuit breaker (n in Figure 6) in on position
- put the circuit breaker of the battery block (c in Figure 4) in on position
- put all DC fuses (g in Figure 5) in on position

To de-energize the device, make sure to

- put the AC line circuit breaker (n in Figure 6) in off position
- put the circuit breaker of the battery block (c in Figure 4) in off position

11. CONNECTING EXTERNAL BATTERY BOX

To increase the back-up time, it is possible to connect a battery box with two 38 Ah batteries.

⚠ No internal batteries must be connected when using the external battery cabinet.

If not already installed, install the self-adhesive rain protection as described in Setup.

To connect the battery box follow the steps below:

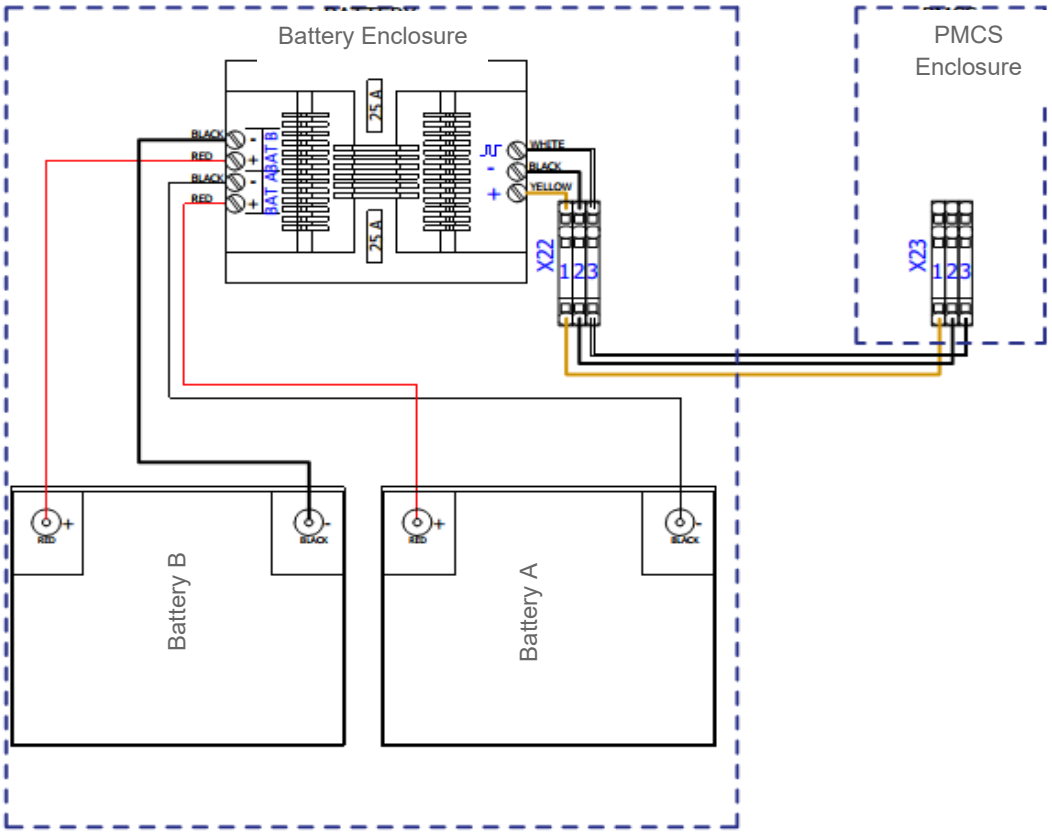


Figure 27: External battery box

1. Bring the circuit breaker of the battery block into the off position.
2. Connect one red cable to the positive pole of each battery. Use the alternative longer cables included if more length is needed.
3. Connect one black cable to the negative pole of each battery. Use the alternative longer cables included if more length is needed.

⚠ Apply a torque of 5 Nm / 3.68 lb ft.

4. Attach the pole protecting covers.
5. Lead the delivered connection cable through the applicable cable gland into the housing.
6. Connect the wires to the X23 bus in the PMCS enclosure.
7. Lead the other end of the connection cable into the battery box and connect to the X22 bus as shown.
8. Insert the 25A fuses into the battery fuse module and bring the circuit breaker of the battery block into the on position when ready to energize.

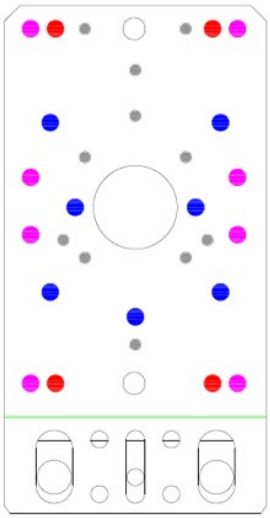
12. MOUNTING PYRANOMETERS/ REFERENCE CELLS

12.1 Sensor Mounting Plate

Stem's mounting plate is also shipped with every pyrometer purchased. This design accommodates several different sensors and can be mounted in vertical or horizontal orientations. The below directions will walk you through typical installation.

Figure 28: Mounted tangential to pole

Figure 29: Mounted parallel to pole



IMT Reference Cell
Ø6.5mm

NES SOZ-03
Ø6.5mm

Hukseflux – All Models
Kipp & Zonen – CMPxx & SMPxx
Ø6.5mm

AL-100 leveling plate
Licor – All Models
Kipp & Zonen – SP Lite 2
#8-32

Figure 30: Mounted holes for select pyrometers and sensors

12.2 Mounting the Sensor Mounting Plate

The Sensor Mounting Plate will be horizontal to whatever it is mounted to - be that an upright pole or a pole that is oriented to the plane or array. Mounting directions are as follows.

If not mounted yet, mount the pyranometer on the mounting plate (Mounting a Pyranometer).

⚠ Make sure that the installed sensors are not shaded by solar modules, support constructions or other installations.

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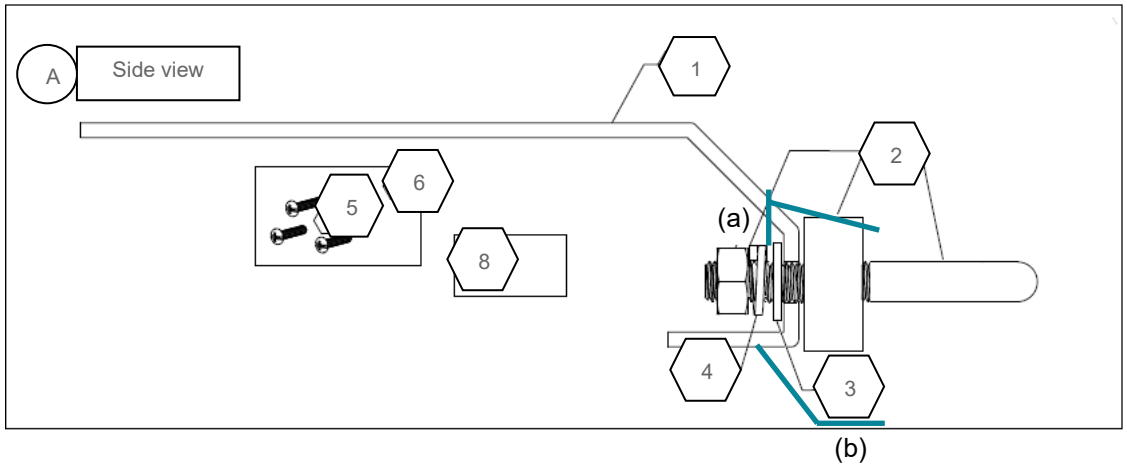
1. Choose the desired orientation, using surface (a) or (b)
2. Put the sensor mounting plate [1] and plastic saddle [2] (if applicable) in position.
3. Lead the U-bolt [2] through the corresponding drilled holes.
4. Place the two washers [3], two split lock washers [4] and two nuts [2] onto the screws.
5. Three pan head screws are provided for sensor mounting if needed.
6. Attach and level the sensor per provided directions below and the sensor manufacturer's directions.



Bill of Materials		
Ref.	**Qty**	**Description**
1	1	Fabricated 12GA plated steel bracket
2	1	Zinc-plated steel clamping U-bolt, M10 thread size, 2-1/16” ID with plastic saddle https://www.mcmaster.com/3066T34 or equivalent
3	2	18-8 stainless steel washer for M10 screw size, 10.7mm ID, 20mm OD, https://www.mcmaster.com/93475A280 or equivalent
4	2	18-8 stainless steel split lock washer for M10 screw size, standard, 10.7mm ID, 18.1mm OD, https://www.mcmaster.com/92148A210 or equivalent
5	3	Pan head combination Phillips / slotted screws, 18-8 stainless steel 8-32 thread size, 3/4” long, https://www.mcmaster.com/90604A197 or equivalent
6	1	Bag for (3) screws (P/N TBD)
7	1	Bag for assembly with label – overall size 262mm x 100mm x 59mm (L x W x H) (P/N TBD)
8	1	White label with text “Stem WS-BR-PY4A” (can be two-line text) (P/N TBD)

Figure 31: Sensor Mounting Plate side view with bill of materials

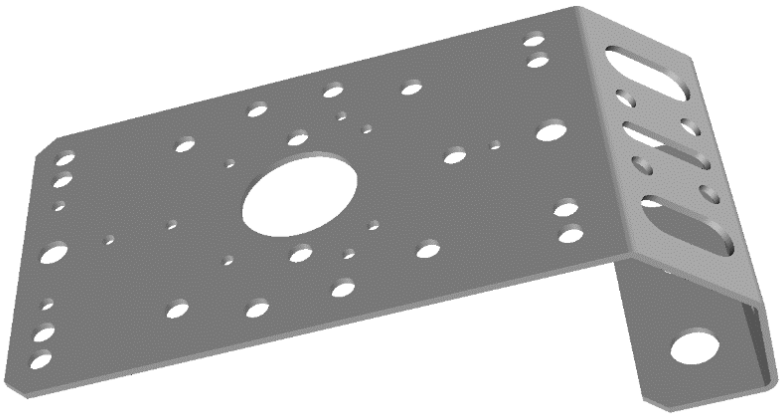


Figure 32: Sensor Mounting Plate

12.3 Mounting a Pyranometer

To mount a pyranometer, refer to Figure 33 and follow the steps below:

Please also consider the manufacturer‘s manual when you mount the reference cell.

⚠ Make sure to connect no other pyranometer than the unit determined by the PowerManager CS® configuration. Refer to the calibration sheet attached for the allocation.

1. If necessary, loosen the four screws (f in Figure 33).
2. Remove the sun shield from the pyranometer.
3. Place the pyranometer (c in Figure 33) in position on the mounting plate, either horizontally or in the plane of the array.
4. Put the two screws (b) that will attach the pyranometer to the mounting plate through the holes of the mounting plate and the pyranometer.
5. Tighten the screws to the specified torque.
6. Carefully press the sun shield onto the pyranometer until it clicks into place.
7. If necessary, re-fasten the four screws (f).
8. Make a cable loop for strain relief of the connection cable and lead the cable from the mounting device to a fixed component such as the array mounting frame.
9. Fasten the cable there. This way, the cable cannot vibrate.
10. Connect the pyranometer cable.

a	Sun screen
b	Screws
c	Pyranometer
d	Washers (optional)
e	Nuts (optional)
f	Screws (optional)

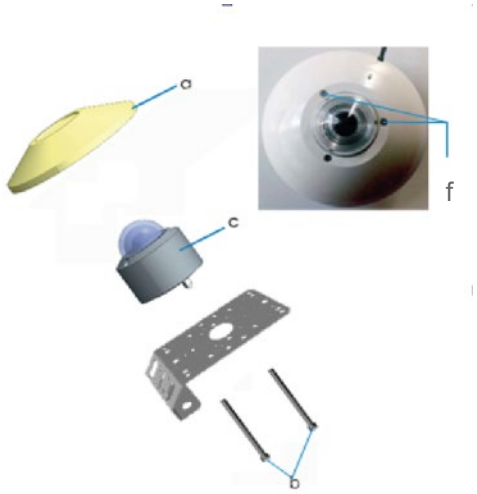


Figure 33: Pyranometer on mounting device with screws, b, inserted from below

12.4 Mounting a Reference Cell

To mount the silicon reference cell, refer to Figure 34 and follow the steps below:

Please also consider the manufacturer's manual when you mount the reference cell.

⚠ Make sure to connect no other reference cell than the unit determined by the PowerManager CS® configuration.

1. Remove the screws (c in Figure 34) from the sensor cap (b).
2. Carefully remove the sensor cap from the housing (a).
3. Put the housing in position on the mounting device (in the module plane or horizontal)
4. Lead the four screws through the housing and the mounting device.
5. Screw the nuts onto the four screws and tighten the nuts.
6. Put the sensor cap (b) in position on the housing and install the screws (c).
7. Make a cable loop for strain relief of the connection cable and lead the cable from the mounting device to the surrounding fixed construction.

a	Housing
b	Sensor cap
c	Screws

8. Fasten the cable there. This way, the cable cannot vibrate.
9. Connect the reference cell.

Figure 34: Reference cell on mounting device

13. STARTING UP

13.1 Checking the Connections

1. Make sure to check all plug and screw connections for firm attachment.
2. Measure the earthing resistance to ensure proper earthing.
3. Check if the AC supply is connected.
4. Check if all circuit breakers are closed.
5. Check if the power supply (batteries) is properly connected.

13.2 Starting the Data Communication

The data communication is set up by personnel from Stem or by personnel trained by Stem.

13.3 Starting the Device in Battery Mode

You can start the device in battery mode if there is no AC power supply available. To do so, press the push-button marked *b* in Figure 4.

To switch off the device, put the circuit breaker of the battery block (*c* in Figure 4) in *off* position.

14. MAINTENANCE

14.1 User Maintenance

The device and its components must not be maintained and repaired by anyone other than personnel of the manufacturer Stem or personnel trained and authorized by Stem using original parts.

14.2 Manufacturer's Service

Contact Stem for information and requests at **service@Stem.com.**

15. LIABILITY

Stem is not liable for damages resulting from unintended use of the technical equipment or from non-compliance to the regulations. Intended use applies to the following conditions:

- The safety regulations laid down in this installation manual are followed.
- Installation and maintenance work is carried out only by qualified and authorized personnel.
- The general prevailing accident protection regulations are followed.

- Attention is paid to the technical data of the equipment.
- The safety regulations given by the manufacturer of the inverter are followed.
- The general, locally prevailing installation regulations are followed.

⚠ Any liability and warranty claims will become invalid if the installation regulations have not been followed and observed!

⚠ When you open the equipment and/or perform any repairs or changes on your own, Stem is not responsible for specified performance and operational safety. All provisions of the guarantee and duties of Stem are forfeited.

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16. TECHNICAL DATA

Components (exact part usage may vary based on available parts)

Hardware	
1 DC UPS	24V DC
2 Batteries (optional)	Option 1: One 24V, 12Ah battery (no external box req'd) Option 2: One 24V, 38Ah (min) battery, external battery box req'd Option 3: Two 24V, 38Ah (min) batteries, external battery box req'd
Up to 2 Industry PCs	Compact Flash up to 2GB, battery-backed clock
Up to 2 Ethernet switches	Fibre-optic network
1 Router	LTE or VPN
Up to 2 fieldbus coupler/controller	Fieldbus coupler to connect several I/O modules Programmable fieldbus controller to connect several I/O modules
Software	
System software	Linux
Access	Internet Browser, Java V1.6

Data Transmission

Interfaces	
RS485 bus	up to 6, overvoltage protected
FOC	10/100BaseT, multimode or single mode
I/O modules (depending on device configuration)	Resistor temperature device (RTD), Pt100, Pt1000
	Digital inputs
	Analog inputs
	Relay channels (NO+NC)
	S0
Ethernet	up to 3, overvoltage protected
Data Logger	
Protocol	IP Ethernet, Stem-specific communication
Data rate	10/100 MBit/s
Cable recommended	multimode: HITRONIC® HQN outdoor cable 4G50/125 with SC connector single mode: HITRONIC® HQN outdoor cable 4E9/125 with SC connector

Electrical Data

Power supply	100V AC to 240V AC / 2.5A AC to 1.2A AC / 50Hz to 60Hz mains
Power consumption	max. 240W AC; 390W AC incl. heating
RS485 bus supply	up to four 24V DC through DC-UPS (buffered DC) one 24V DC through AC/DC power supply unit (unbuffered DC)
Backup system	24V DC, 2 batteries AGM 12Ah
Overvoltage protection	230V AC, 24V DC, RS485 bus, Ethernet
Standards	EN 60950-1, EN 61000-6, UL 62368-1:2014 Ed.2, CSA C22.2#62368-1:2014 Ed.2

Mechanical Data

	Cabinet	Battery Cabinet
Degree of protection	IP 66	IP 66
Dimensions h x w x d in mm	847 x 636 x 300	647 x 436 x 250
Weight	Approx. 32 kg; dependent on options	Approx. 14 kg; without batteries
Material	UV-resistant, glass-reinforced polyester	UV-resistant, glass-reinforced polyester

Ambient Conditions

	Cabinet
Operating temperature	-20°C to +50°C /-4°F to +122°F
Storage temperature	-20°C to +70°C / -4°F to +158°F
Relative air humidity	up to 95% non-condensing

Battery Data

	AGM Default	Extended Battery Option(s)
Nominal voltage	24V	24V
Nominal capacity	≥12Ah	≥38Ah or ≥76Ah
Dimensions h x w x d in mm	202 x 202 x 110 (battery dimensions, mounted inside cabinet)	647 x 436 x 250 (separate battery enclosure)
Weight	10 kg	44 kg or 76 kg
Operating temperature	0°C to +40°C /°F to 104°F	0°C to +40°C /°F to 10°F
Storage temperature	-20°C to +50°C / -4°F to 122°F	-20°C to +50°C / -4°F to 122°F