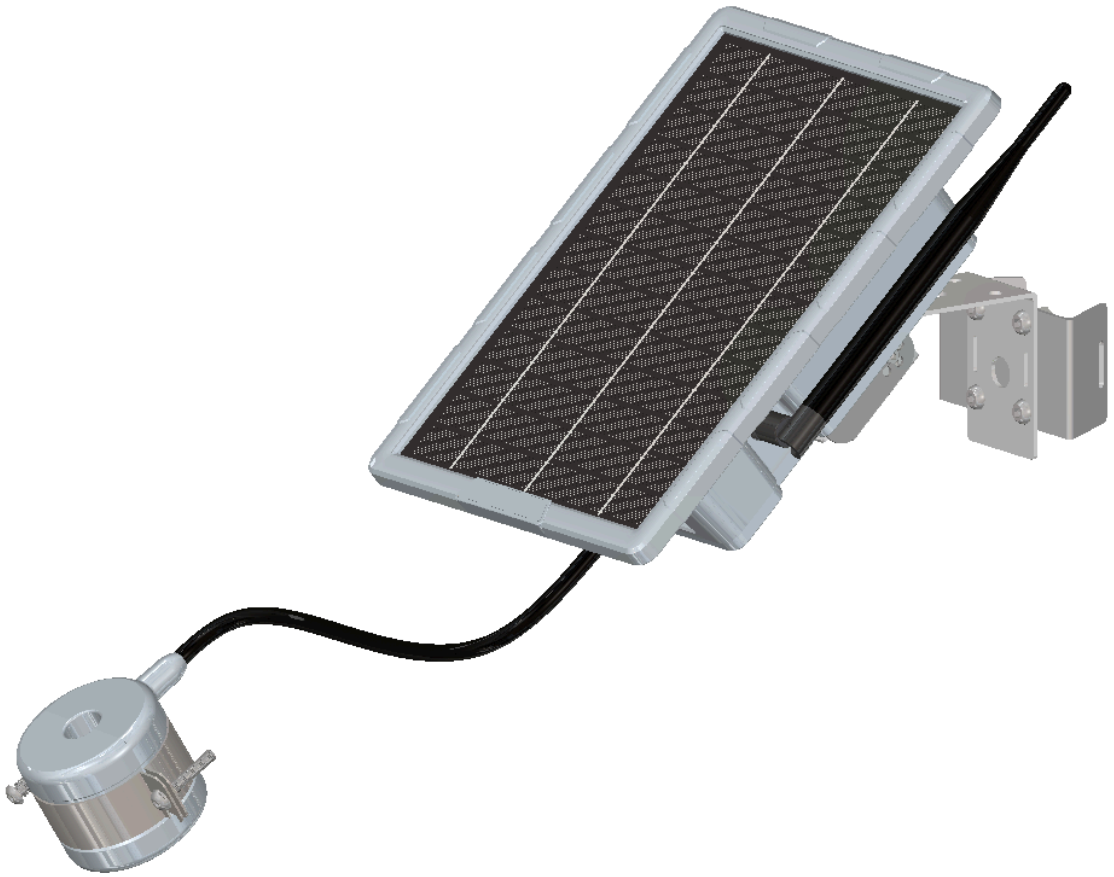
USER MANUAL SCA50L

Surge Counter
Autonomous LoRaWan



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1. Abbreviations and synonyms

Abbreviations	Definition
MOA	Metal Oxide Arresters
LLPD	Line Lightning Protection Devices
SLMD	Surge and Lightning Monitoring Devices
HV	High Voltage
SCA50L	Present device model
PMT	Pole Mounted Transformer
TLA	Transmission Line Arresters

Word	Synonym
Ground Lead	Ground Wire / Down Conductor / Earth lead / Earthing cable
Indication Unit	Deported Unit / Counter display

2. General safety instructions

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described.

Only competent technicians who are familiar with this equipment should install, operate, and service it.

A competent technician has these qualifications:

• Is thoroughly familiar with these instructions.

• Is trained in industry-accepted high and low-voltage safe operating practices and procedures.

• Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.

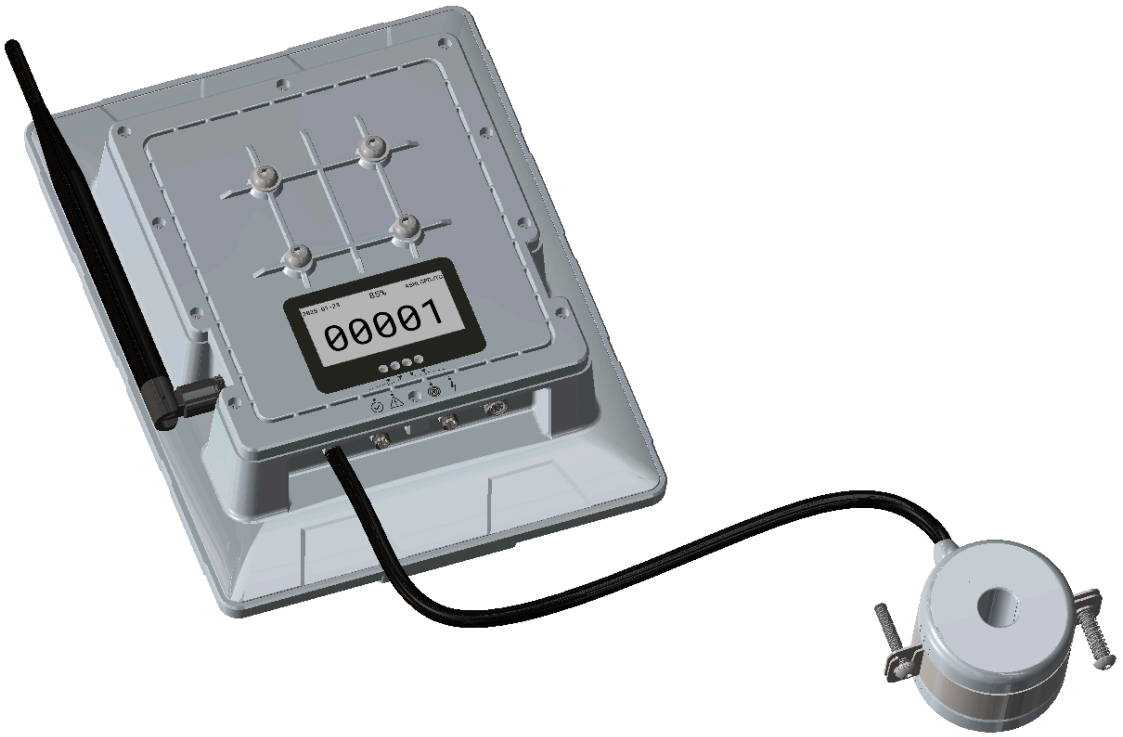
• Is trained in the care and use of protective equipment such as arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

This manual may contain four types of hazard statements:

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Or indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.

3. Introduction

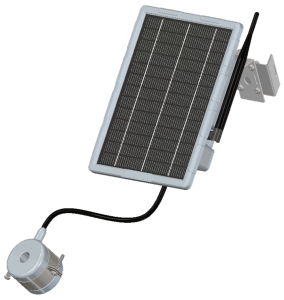
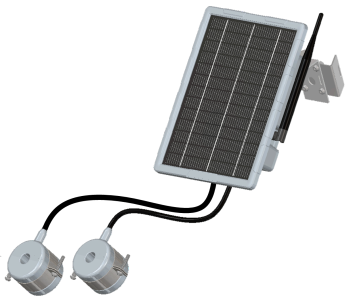
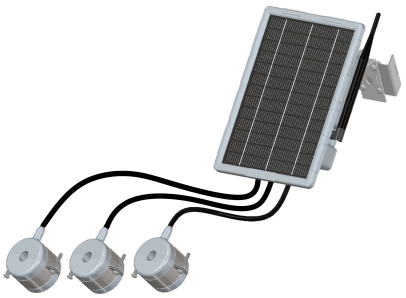
The SCA50L is a surge counter designed for monitoring low or high voltage surge arresters as well as lightning rods for buildings, infrastructures (as airports, oil tanks farms…), poles, and substations. It is available in single, double or three-phase configurations and provides fully autonomous and long range lightning event counts.The device records lightning events, as well as all subsequent lightning impulse components.



4. SLMD range & features

Characteristics		FEATURES SELECTION	SC250	SC25d	SMA	SC050L	SLC	SMC
Lightning	L1	Event counter : #	■	■	■	■	■	■
	L2	Detection range	250A	250A Outdoor / 300A Indoor	100A	50A to 100kA	120A to 40kA**	120A to 40kA**
	L3	Waveform record : 100us					■	■
	L4	Impulse record : peak (kA), duration (us), polarity					■	■
	L5	Charge (Coulomb) & Let-through (I2t) record					■	■
	L6	Classification : lightning, switching, fault					■	■
	L7	5% measurement accuracy					■	■
Leakage	N1	Instant total leakage current			■			■
	N2	Instant and record of leakage current						■
	N3	Waveform record : 1 cycle (16/20ms)						■
	N4	Instant and record of resistive & H3 leakage current						■
	N5	Instantenous comparison of 3 phases						■
	N6	Temperature measurement					■	■
	N7	Automatic temperature compensation						work in progress
	N8	10% accuracy on total and resistive						■
Ground fault	G1	fault record : peak (kA), duration (us)					■	■
Energy	E1	Total and per event energy: I2t					■	■
	E2	Remaining life span estimation					■	■
Power supply	P1	12VDC					■	■
	P2	Self supplied	via surge	via surge	via surge	via solar panels	via solar panels	via solar panels
	P3	Autonomy in blackout	no limit	no limit	no limit	3 months	3 days	3 days
Mechanical	M1	IP	68	42	65	65	67	67
	M2	Available in 1 or 3 phases	■			■	■	■
	M3	External split or closed core current transformers	■	■		■	■	
	M4	Internal current transformers			■			■
Communication & Software	C1	NFC					■	■
	C2	RS485 MODBUS				■	■	■
	C3	LoRa 2.5km range				■	work in progress	work in progress
	C4	Wifi 70m range					■	■
	C5	Fiber optic					■	■
	C6	IEC 61850 gateway / IEC 60870-5-104 / DNP3					■	■
	C7	Digital output					■	■
	C8	Cloud software						work in progress
	C9	Local software / PC software					■	■
Alarm Alert Indication	A1	End of life					■	■
	A2	Remaining life span estimation basic - embedded					■	■
	A3	Remaining life span advanced - through concentrator					■	■
	A4	Alarm on moisture ingress and external pollution					work in progress	work in progress
3rd party Type Tests	T1	Minimum detection 8/20 Class II | IEC 62561-6:2018	■		■		■	■
	T2	100kA 4/10us | IEC 62561-6:2018	■		■		■	■
	T3	100kA 10/350us | IEC 62561-6:2018	■				■	■
	T4	Leakage current measurement			■			■
GPS	G1	Localisation and accurate timestamp				■	■	■
Memory	S1	Lightning records					900	900
	S2	Leakage records					900	900

5. SCA50L family

SCA50L1	SCA50L2	SCA50L3
1 phase	2 phases	3 phases
For lightning rod, early streamer… SPD, TLA, NGLA, EGLA	SPD, TLA, NGLA, EGLA	SPD, TLA, NGLA, EGLA
		
High current range options: 50 to 100kA		
Serial Modbus, NFC, GPS.		

6. Technical characteristics

SCA50L			
DESIGNATION		Surge Counter LoRa 50A minimum detection	
REFERENCE RKA		SCPRL-050-3	
REFERENCE MANUFACTURER		RK.100.611.2111	
COUNTRY OF ORIGIN		THAILAND	
LIGHTNING CURRENT TRANSFORMER			
HOLE DIAMETER RANGE	mm2	4 to 16 (3 to 50mm2)	
CONDUCTOR LENGTH | FROM MAIN BODY TO CURRENT TRANSFORMER	m	3	
NUMBER MAX OF CURRENT TRANSFORMER		up to 3	
CONNECTOR OF CURRENT TRANSFORMER CABLE		M8	
SURGE EVENT COUNTER			
MINIMUM DISCHARGE PEAK CURRENT DETECTED - 8/20 us waveform - IEC 62561-6	A	50	
MAXIMUM DISCHARGE PEAK CURRENT DETECTED - 10/350 us waveform - IEC 62561-6	kA	100	
RESPONSE TIME	µs	1.3	
MINIMUM TIME BETWEEN 2 STROKE FOR REGISTRATION, RESPONSE TIME	µs	10	
LONG DURATION CURRENT WITHSTAND CAPABILITY		2500 A for 4 ms	
HIGH CURRENT WITHSTAND CAPABILITY	kA	100	
ENVIRONMENTAL CONSTRAINTS			
TEMPERATURE - oC		Class C2: -40 to +70°C	
PROTECTION CLASS		IP65, NEMA 4X	
TEMPERATURE CHANGE RATE - oC/min		Class C2: 1,0	
RELATIVE HUMIDITY - %		Class C2: 10 to 100	
MAX ABSOLUTE HUMIDITY - g/m3		Class C2: 35	
MAX ALTITUDE - m		2000	
ATMOSPHERIC PRESSURE - kPa		70 to 106	
NORMS			
TYPE OF SURGE COUNTER as per IEC 62561-6:2018		Type 1 and Type 2; outdoor	
RECORDS			
NUMBER OF EVENTS	10 000 Events for each phase		
LOGS (WARNING,COMMUNICATION...)	400 records		
GPS	Time stamp and location		
GPS TIME RECORD ACCURACY	< 0.5µs		
COUNTERS	lightning for each phases		
DISPLAY			
TYPE		E-Paper	
BATTERY LESS RETAINER		3 months	
SIZE OF CHARACTERS		6mm	
SIZE		60 x 30mm	
POWER SUPPLY			

TYPE		7W solar panels and LiFePo 18650-2Ah batteries 3x	
USB PORT | COMMUNICATION & POWER SUPPLY TERMINAL | requires a converter		M8	
BATTERY CAPACITY IN THE DARK		3 days	
BATTERY CYCLING		>3000 cycles	
TEMPERATURE RANGE		0°C to 55°C	
WIRELESS COMMUNICATION			
LONG RANGE		LoRa	
FREQUENCY	MHz	921	
MAX COMMUNICATION RANGE	km	0.3	
Tx POWER		20 dBm (921MHz)	
CONNECTOR		SMA RP Female	
MODE		OTAA Class C	
COMMUNICATION FREQUENCY		Every 3 mins	
WIRED COMMUNICATION			
WIRED COMMUNICATION		USB	
CONNECTOR MODBUS		M8 with converter, please ask us	
HARDWARE			
LABEL INCLUDES		Hardware version number, serial number, manufacturing batch	
UV STABILIZED HOUSING		YES	
ENCLOSURE MATERIAL		ABS & HDPE	
HOLDER & COVER		STAINLESS STEEL	
DIMENSIONS & WEIGHT			
WIDTH	mm	195	
HEIGHT	mm	240	
DEPTH	mm	75	
WEIGHT	kg	2	
ACCESSORIES			
BRACKET FOR SOLAR ADJUSTEMENTS		included	
BRACKET FOR ANTENNA HOLDING		included	
BRACKET FOR POLE STRAPING		included	
BRACKET FOR MOA HOLDER		included	
EVENT COMPONENTS RECORD EXAMPLE			
EVENT COMPONENTS RECORDS LIGHTNING / SWITCHING / FAULT CURRENT		**Unit**	**Example of value**
Date		Date	2021-05-06
Time		Time	14:30:05Z

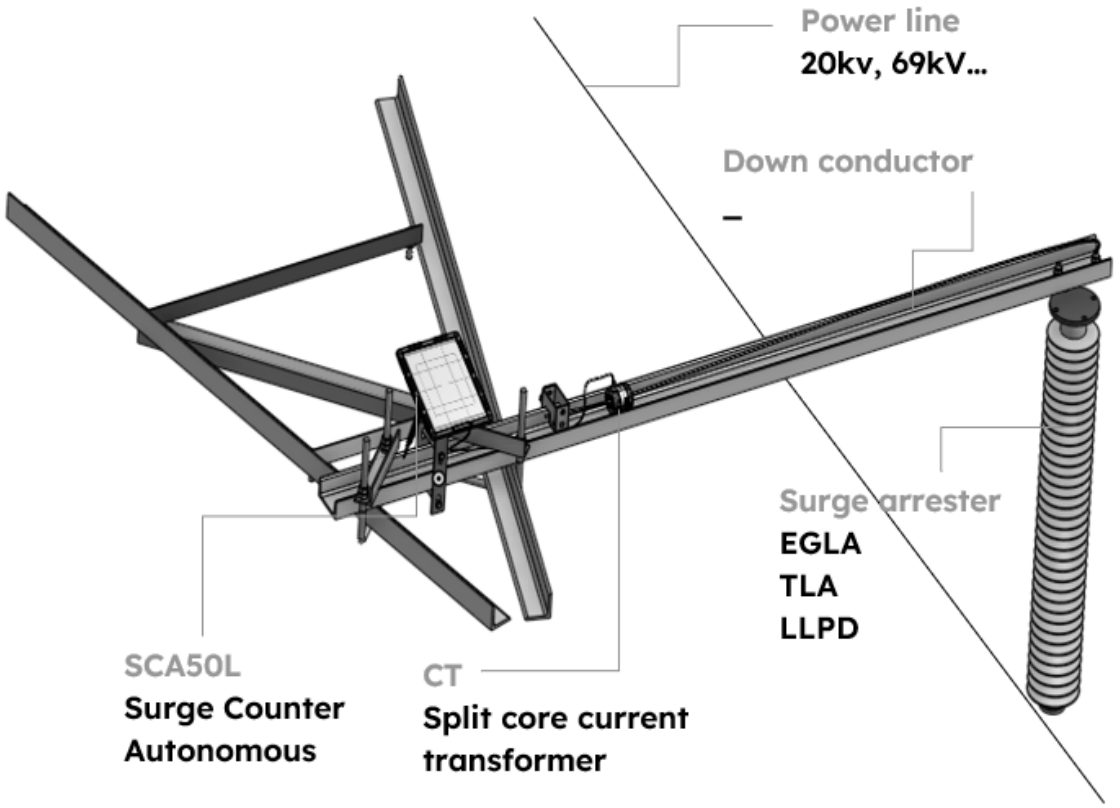
7. Installation

The SCA50L is meant to be installed in parallel to the ground wire of the protection device, whether on a lightning rod, or a surge arrester for over head line (i.e. EGLA, TLA, LLPD, CLAH…).

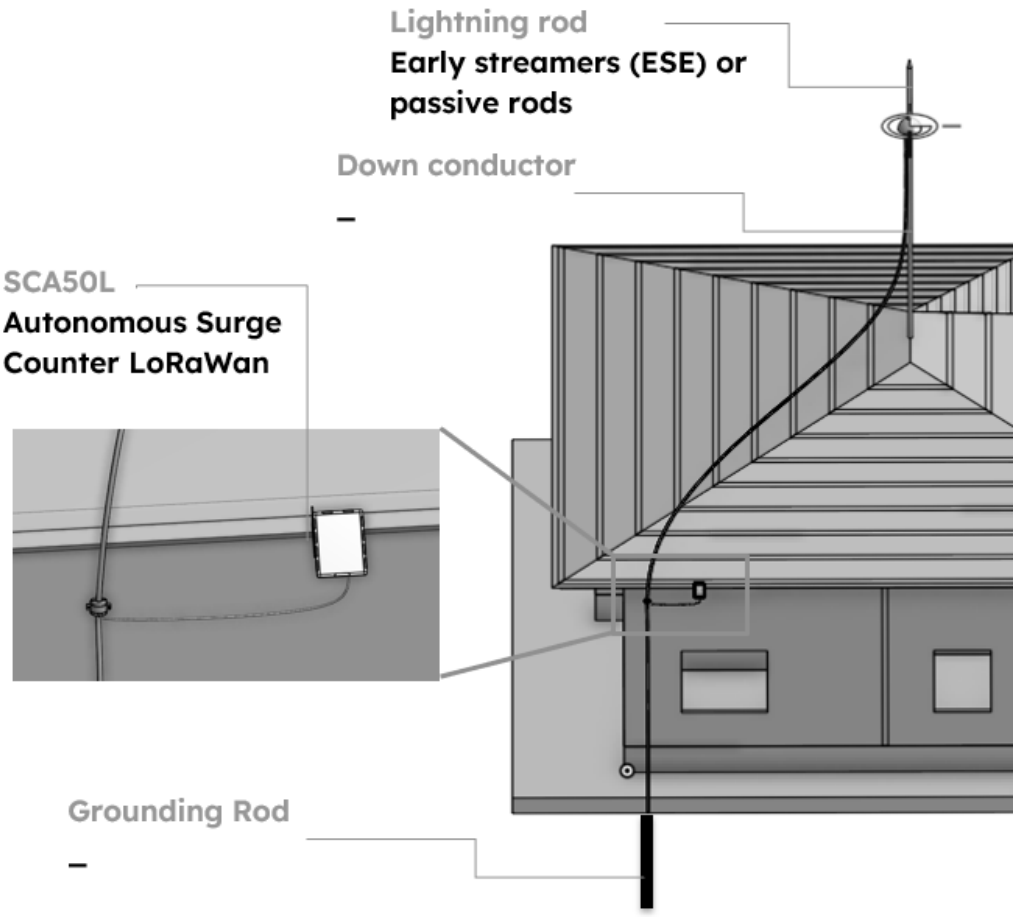
The SCA50L comes fully fitted with multiple brackets allowing the user to install the device in various conditions: round poles, wooden poles, lattice towers, concrete wall. A bracket allows the user to perfectly install the LoRa antenna while another allows the installation with the right latitude angle to capture the best out of the sun radiations.

Please select the most suitable installation method for your application in the following pages.

- On EGLA on lattice tower



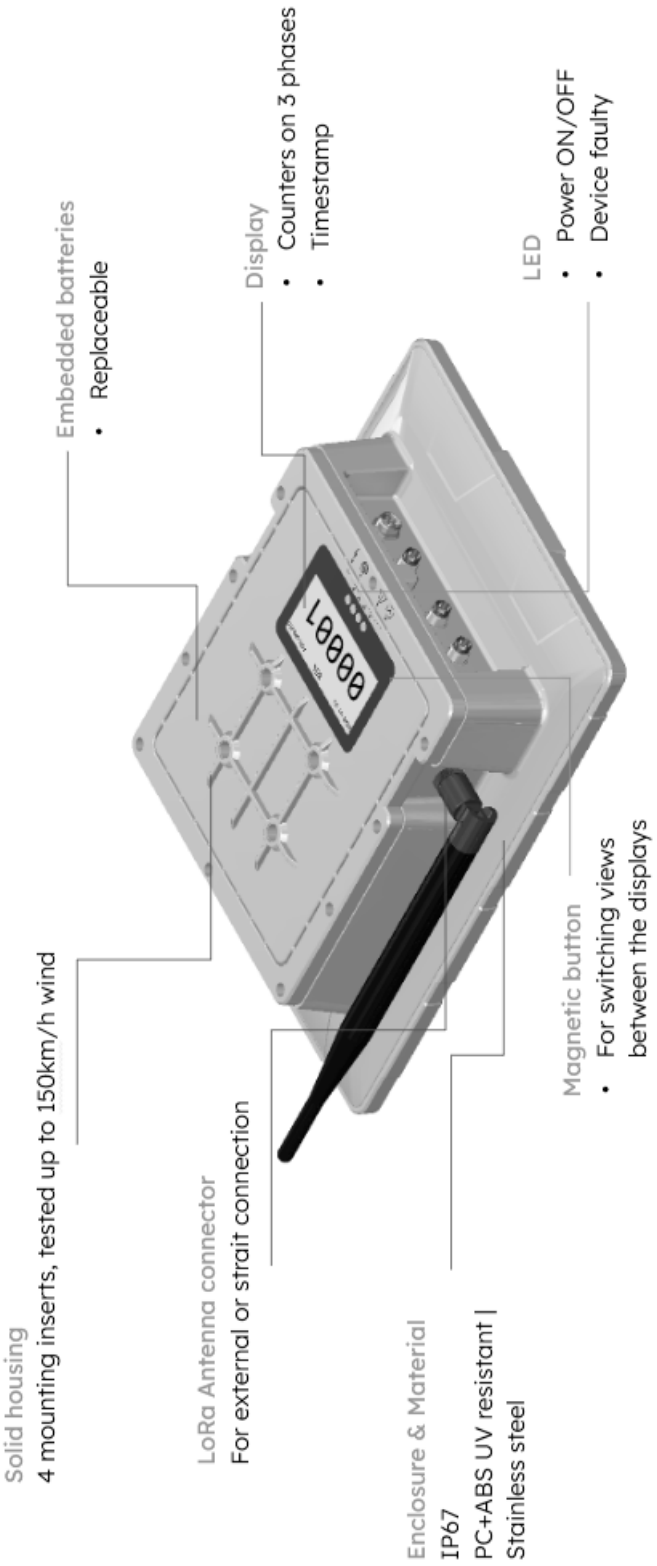
- On infrastructure ground lead

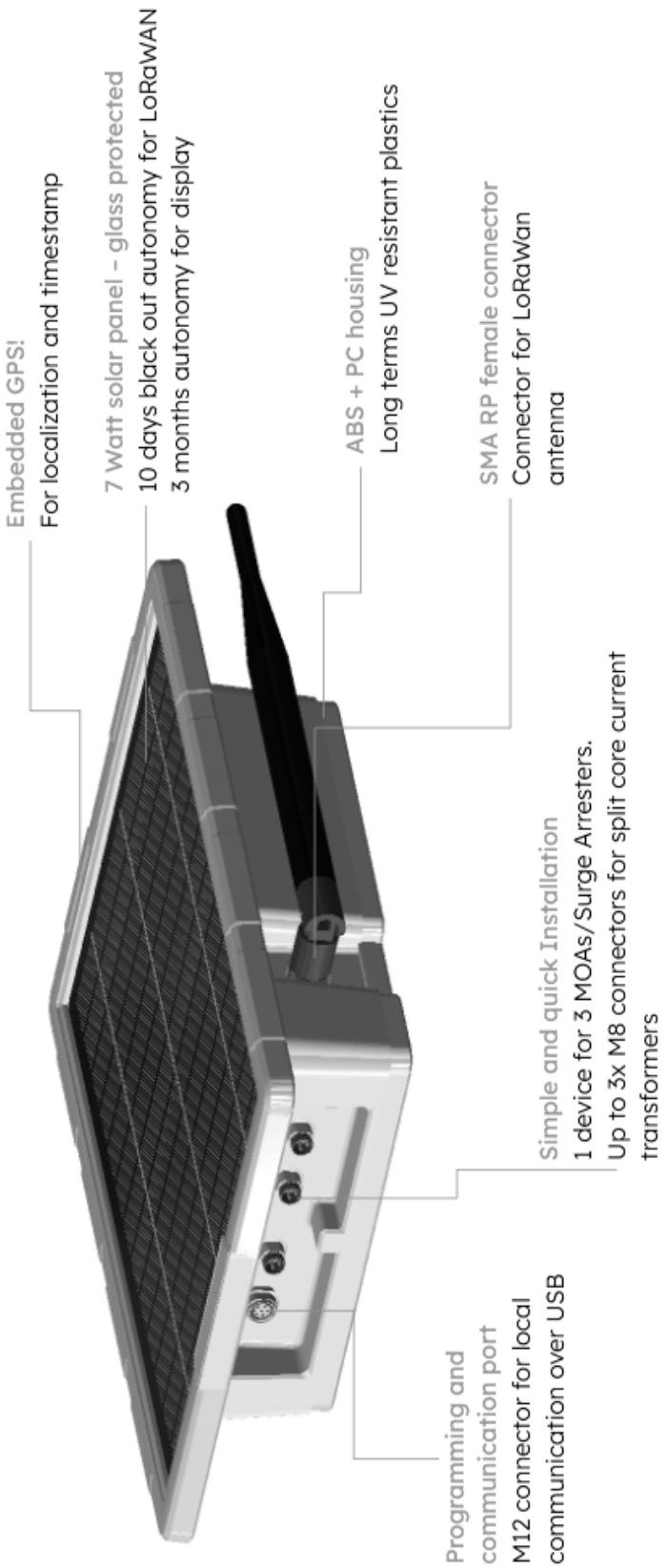


7.1. Safety rules

DANGER	Isolate and ground lines prior to installation De-energize parts Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high and low-voltage lines and equipment.
WARNING	Wear personal protective equipment!
CAUTION	Check all fittings after installation Check the correct earth connection with a continuity tester!

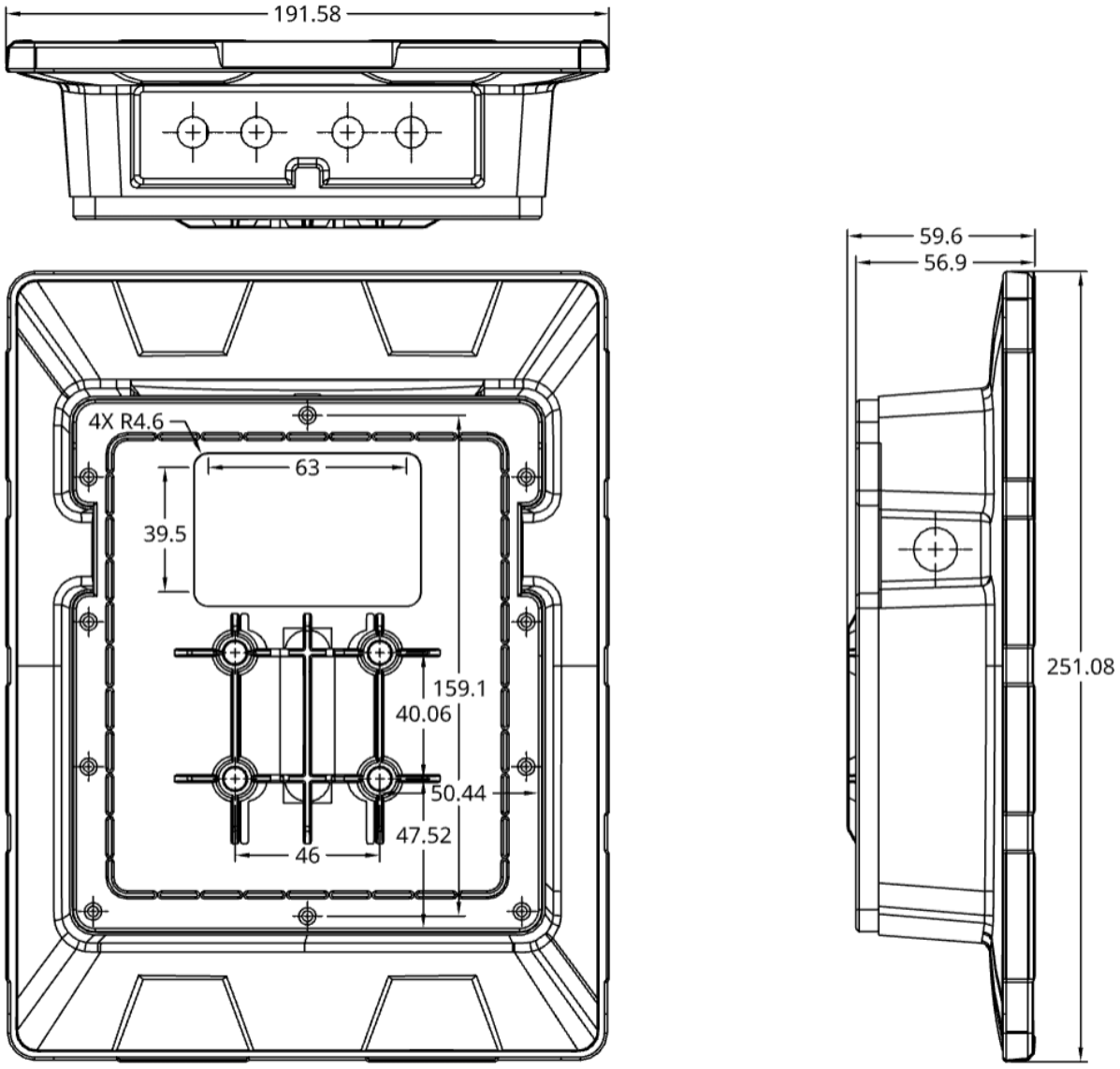
7.2. Product Description



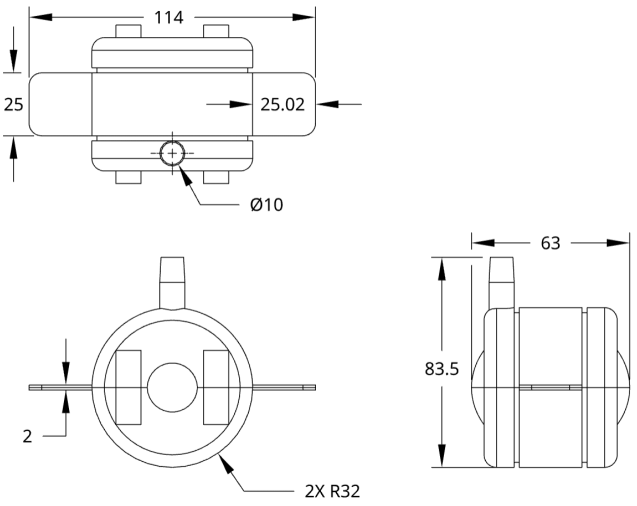

Embedded GPS!
For localization and timestamp
7 Watt solar panel – glass protected
10 days black out autonomy for LoRaWAN
3 months autonomy for display
ABS + PC housing
Long terms UV resistant plastics
SMA RP female connector
Connector for LoRaWan
antenna
Simple and quick Installation
1 device for 3 MOAs/Surge Arresters.
Up to 3x M8 connectors for split core current
transformers
Programming and
communication port
M12 connector for local
communication over USB

7.3. Product Dimensions

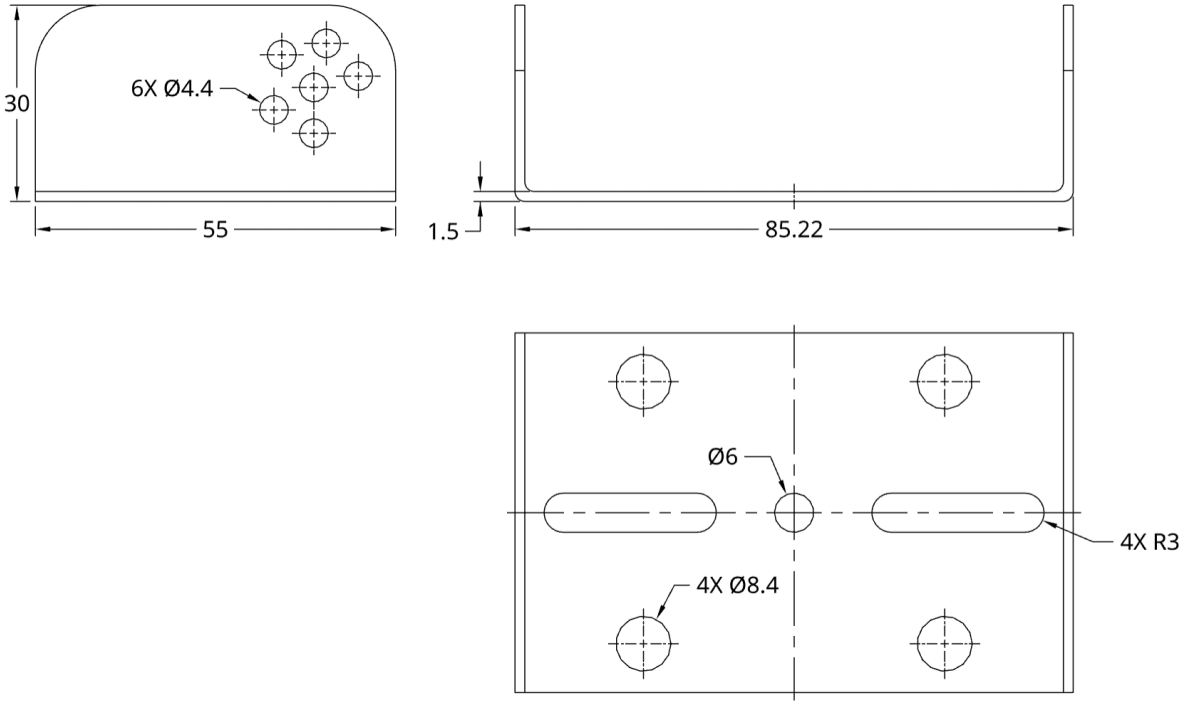
7.3.1. SCA50L1M

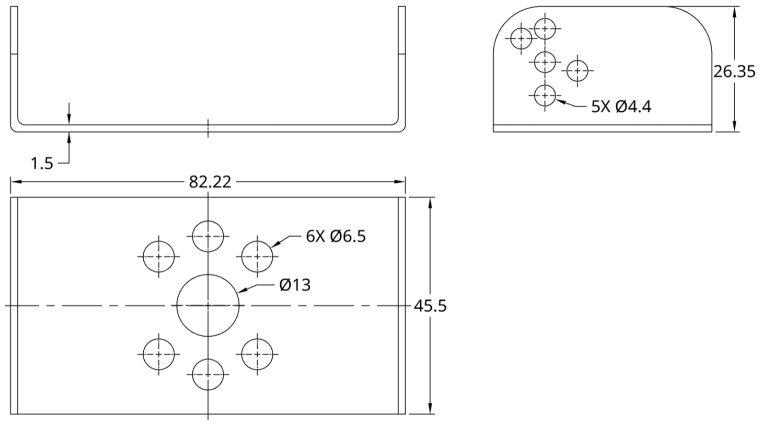


7.3.2. Current transformer dimensions

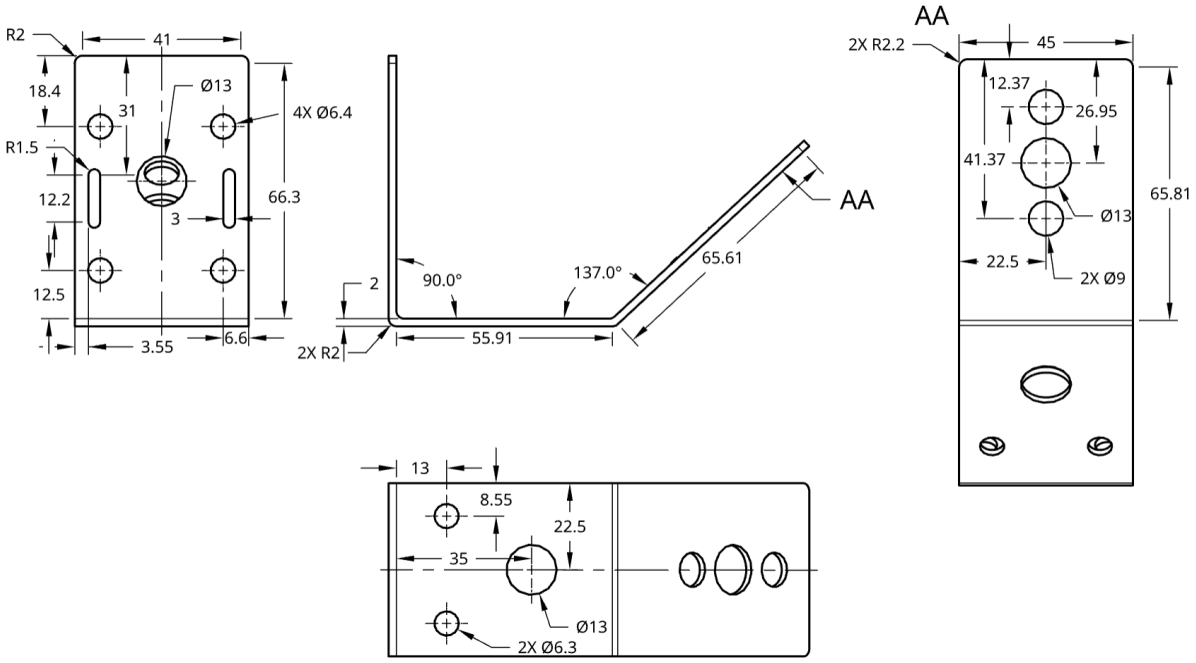


7.3.3. Rotating bracket dimensions

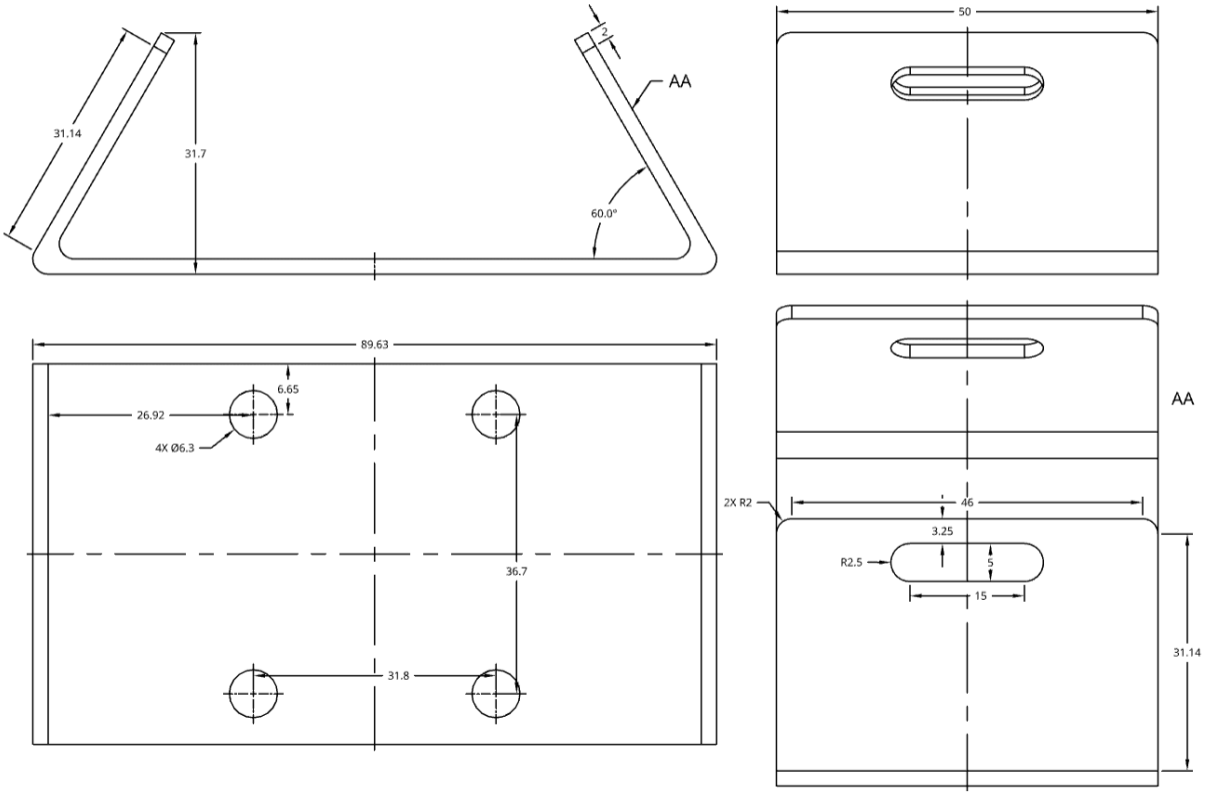




7.3.4. Extension plates dimensions



7.3.5. Pole strapping plate dimensions



7.4. Installation

7.4.1. Location, orientation and height considerations

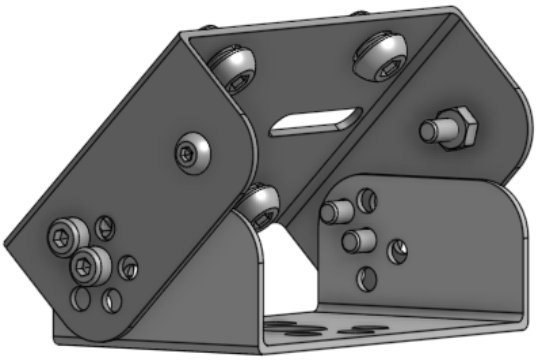
The following consideration shall be taken into account when mounting the product:

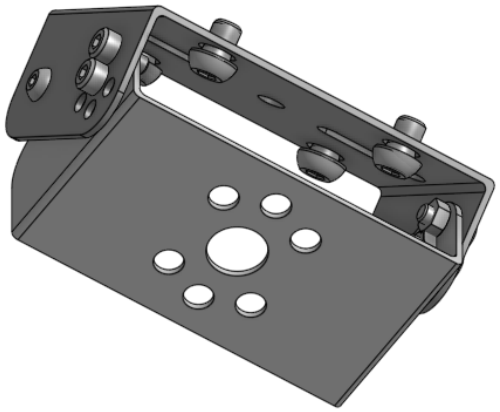
- Inclination of the solar panel,
- Orientation of the solar panel,
- Optimization strategies for LoRaWan antenna and product placement,
- Optimization strategies for GPS Antenna,
- Choice of the right brackets.

Inclination of the solar panel

Optimal solar panel inclination generally matches the location's latitude, with panels facing true south in the Northern Hemisphere and true north in the Southern Hemisphere. Common rules include setting tilt to 30 to 40* in higher latitudes (e.g., UK), or 10 to 20* in warmer regions.

In order to set the right inclination a rotating bracket is supplied along with the product.





Orientation of the solar panel

Solar panel orientation is fundamental to maximizing energy production, with the ideal direction depending on the hemisphere in which the system is installed. The general rule is to face panels toward the equator to capture the most direct sunlight.

On a lattice tower, for example, prevent the solar panel from being in the shadow at the best time of the day.

In order to set the right inclination a rotating bracket is supplied along with the product.

Optimization strategies for LoRaWan antenna and product placement

Optimizing LoRa antenna performance requires prioritizing line-of-sight (LoS) by elevating antennas, as obstacles like buildings and trees can significantly reduce signal range and strength. While LoRa can achieve ranges of several kms or more in rural areas with specific antennas, for the current SCA50L design, the signal range is limited to 0.5km.

- Maximize Elevation: Elevate antennas as high as possible, such as on rooftops or masts, to reduce ground-level obstacles. Each additional meter of height can significantly increase LoS range.
- Determine where you intend to collect the data from and clear the Fresnel Zone. The Fresnel zone—an elliptical area surrounding the direct path between antennas—must remain at least 60% free of obstructions to prevent significant signal loss.
- Minimize Physical Obstructions: Avoid placing antennas near concrete walls, metal shields, large trees, or bodies of water, which absorb RF energy and can reduce range by 50% or more.
- Optimal Placement: For indoor setups, place antennas near windows. For outdoor gateways, ensure a 5–7 meter height above the roofline to minimize obstruction.
- Antenna Orientation: Maintain a vertical orientation to ensure maximum, consistent coverage.
- Avoid Antenna Detuning: Keep antennas at least 70 cm away from surrounding objects to avoid detuning and increased signal noise.
- Use High-Quality Cables: Keep antenna cables as short as possible and use low-loss coaxial cables (e.g., LMR-400) to minimize signal attenuation.

By adhering to these principles, you can maximize the range and reliability of LoRa communication in any environment.

Optimization strategies for GPS antenna
The product features an embedded GPS antenna. It is assumed that if the solar panel gets sunlight, so does the GPS get the signal.

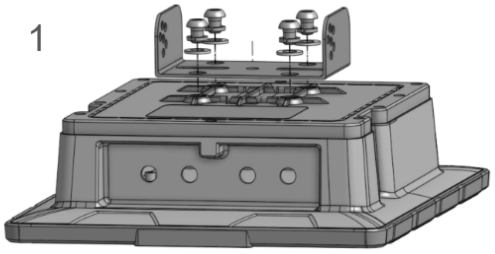
Choice of the right brackets
The product is delivered with 3 brackets:

- The rotating bracket aiming at orientation of the product in the right angles for optimum solar exposure,
- The extension bracket aiming at offsetting the device from a wall or an object and which can serve as a platform for the antenna,
- The pole strapping bracket.

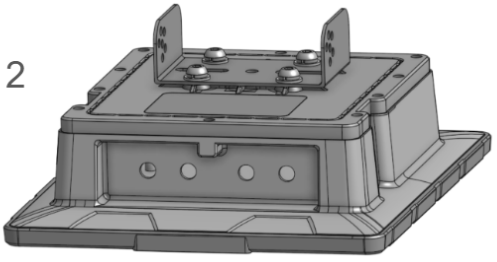
7.4.2. Brackets installation

Rotating bracket, part 1.

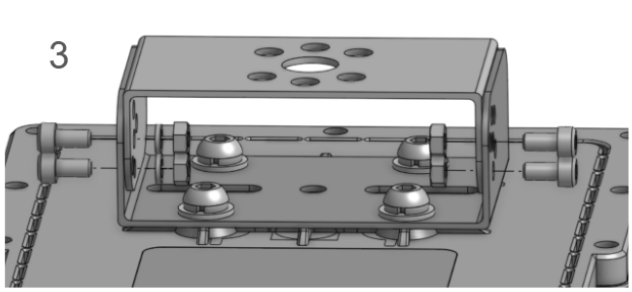
1

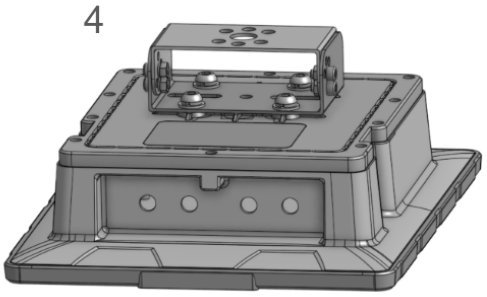


2

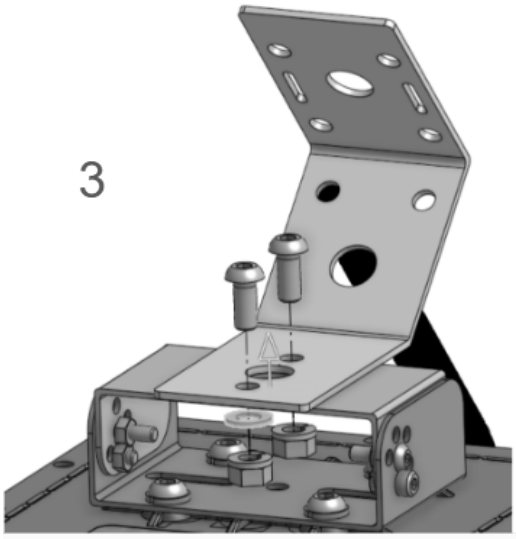


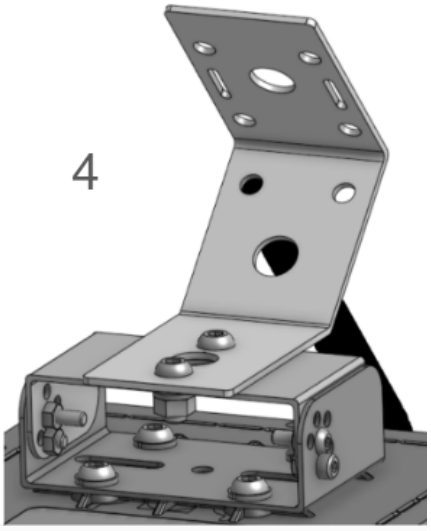
Rotating bracket, part 2.



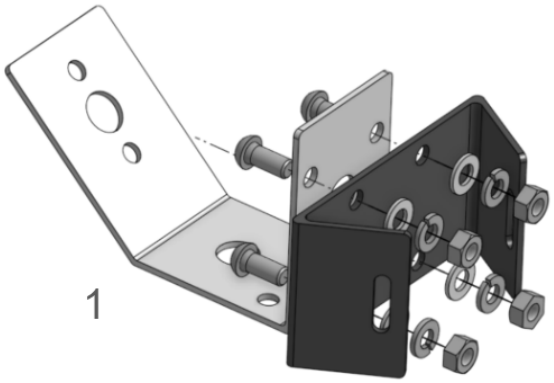


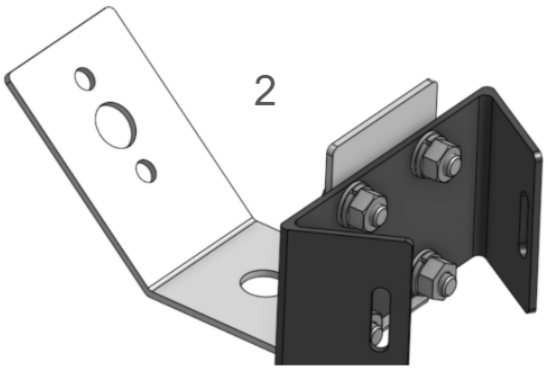
Extension plate





Strapping plate



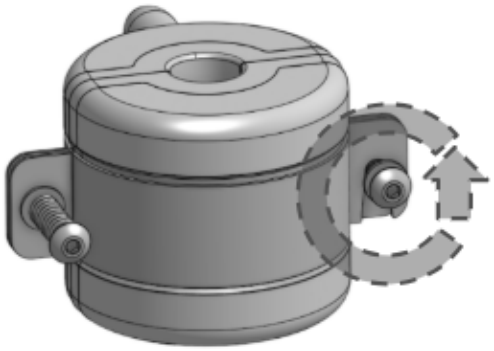


7.4.3. Current transformer mounting

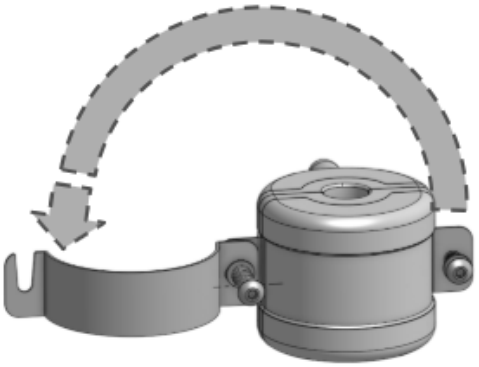
Measure the cable diameter and refer to the table below to determine the length of the rubber sheet required to securely faster the split core on the ground cable/wire/lead.

Cut the rubber sheet at the proper length. Roll the piece of rubber sheet around the cable. Please make sure to remove the white protective film of the rubber sheet.

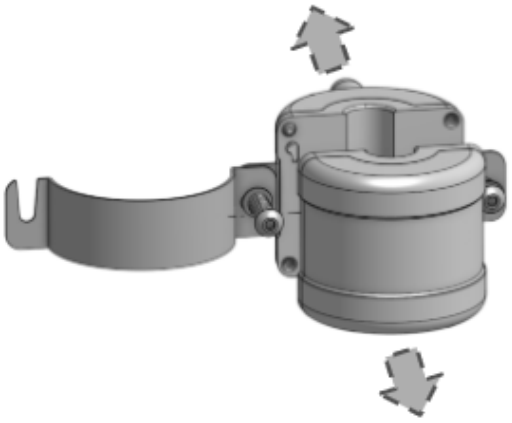
Diameter of the rod in mm	Rubber sheet in mm
5-6	105-100
7-8	95-90
9-10	85-80
11-12	75-70
13-14	60-50
15-16	50-40



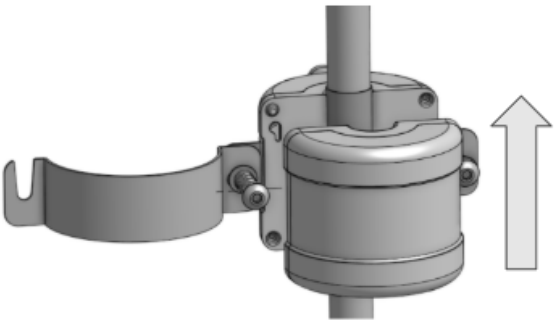
Untighten on about 15mm the bolt located at the slotted clamp part



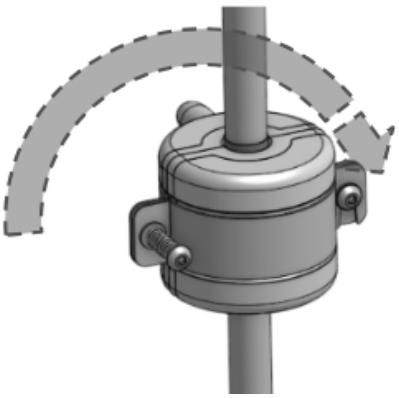
Open the clamp without removing any of the bolts



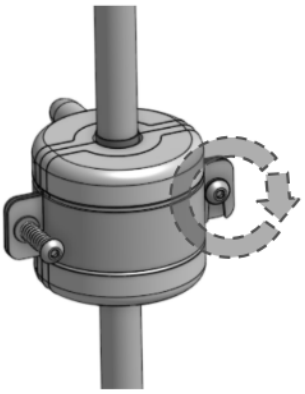
Unjoin the split core transformers



Insert the grounding lead/cable/rod equipped with the adequate turns of rubber sheet

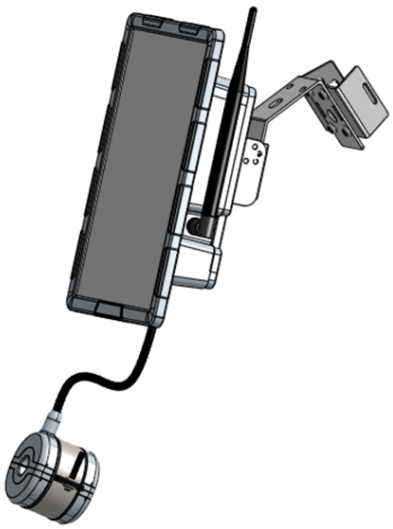


Put back the clamp ON

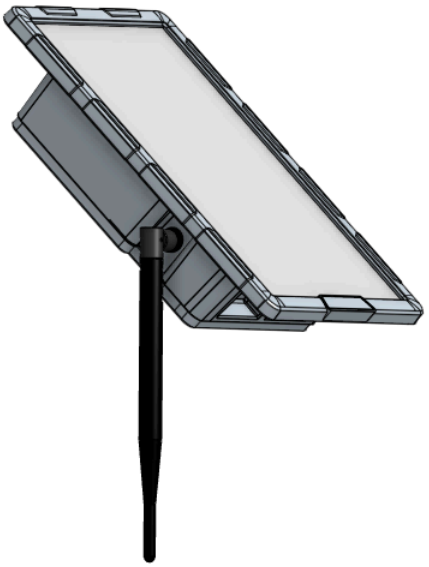


Re-retighten the bolt

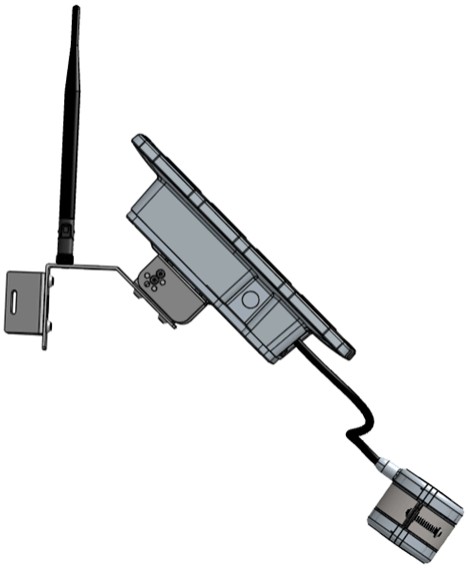
7.4.4. Mounting the antenna



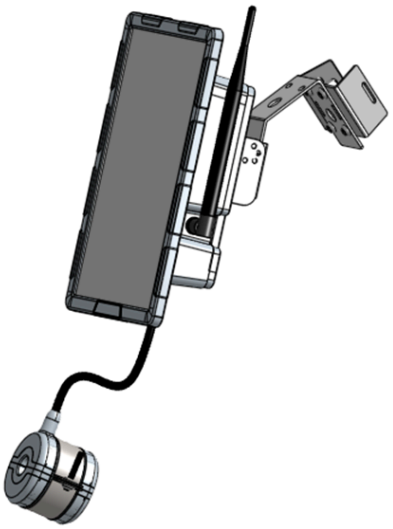
When installing the device below 25m high, please install the antenna pointing UP.



When installing the device above 25m high, please install the antenna pointing DOWN.

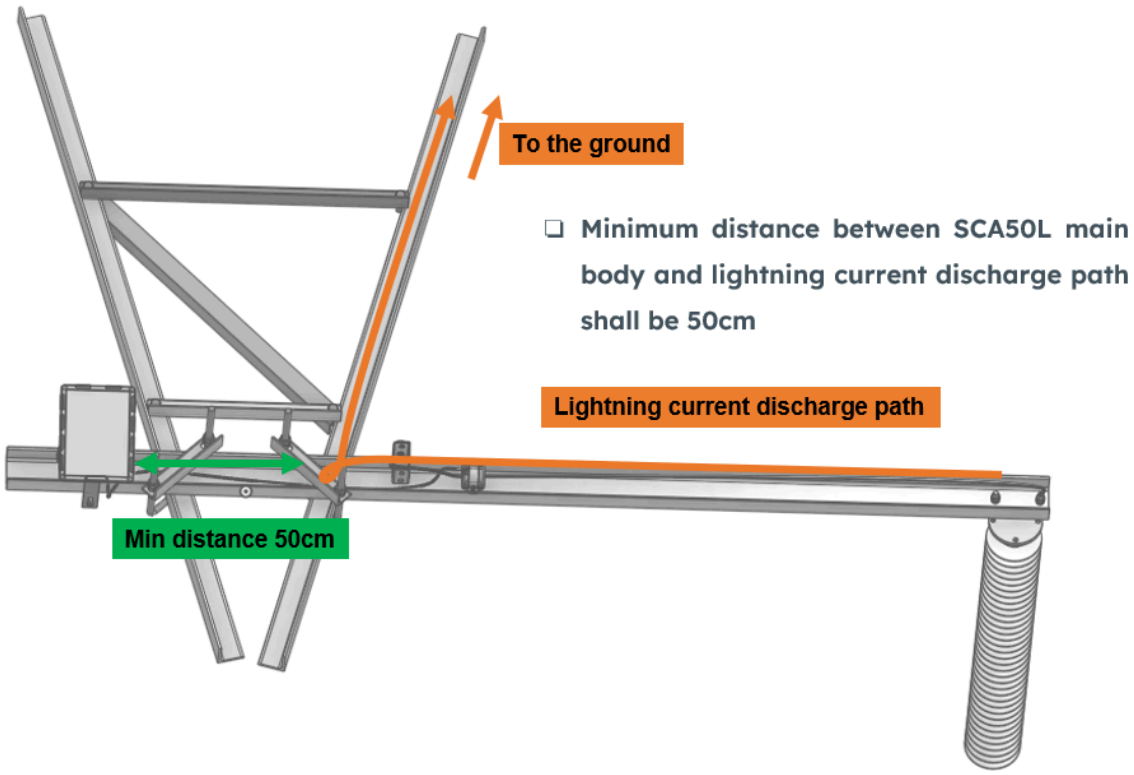


Antenna can be mounted on the extension bracket through a cable not supplied



Antenna can be mounted directly on the SCA50L port directly.

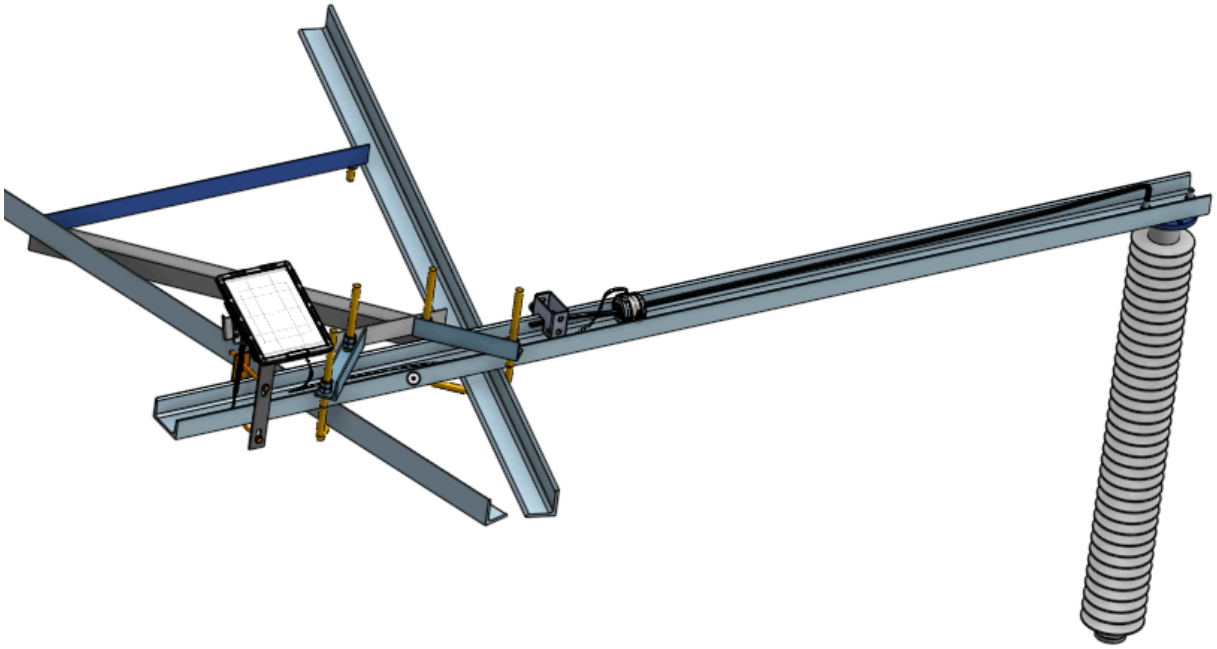
7.4.5. Off the path safety distance



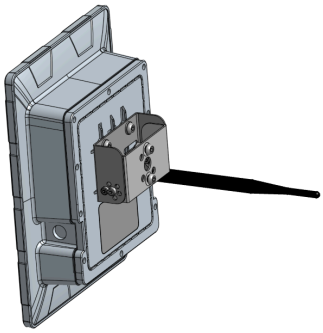
7.4.6. Lattice towers, suspension.

The following mounting instructions are for suspension type lattice towers. Please install the SCA50L as per one of the following methods from the most preferable one to the least preferable one.

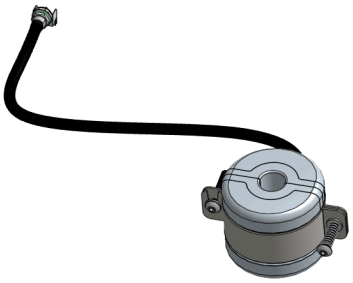
Installation S1
Lattice tower, suspension method, U-shape cross arm, installation at the very end of the surge arrester suspension U-shape cross arm.



Material required

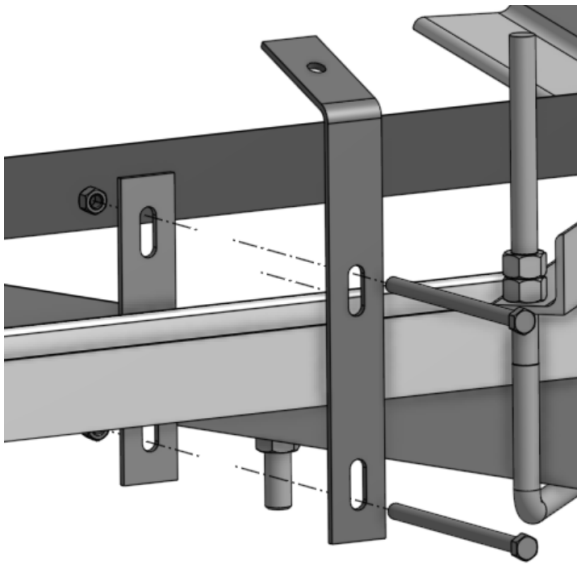


SCA50L fitted with the rotating bracket and the antenna.
All supplied in the SCA50L package

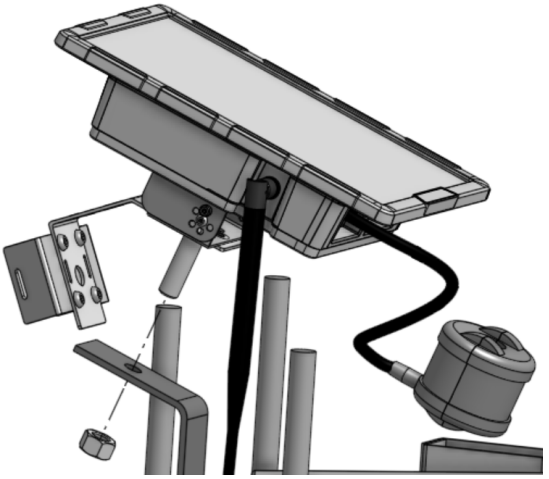


Split core current transformer
Supplied with the SCA50L

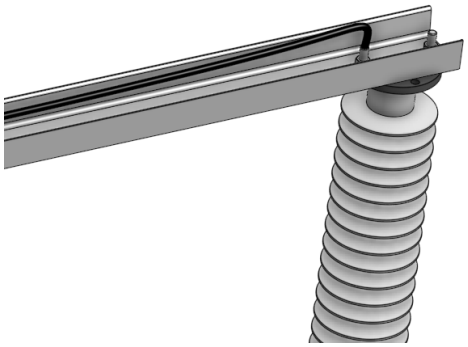
U-Shape bar clamp with a M12 nuts and bolt set
Optional supply.



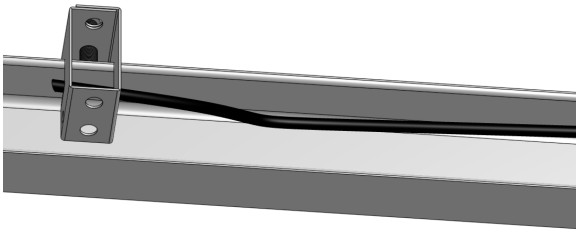
Fit the U-shape bar clamp to the U-shape bar



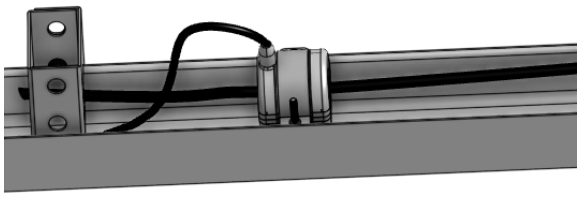
Mount the SCA50L with the rotating bracket on the U-bar clamp using M12 nuts, bolts and split ring



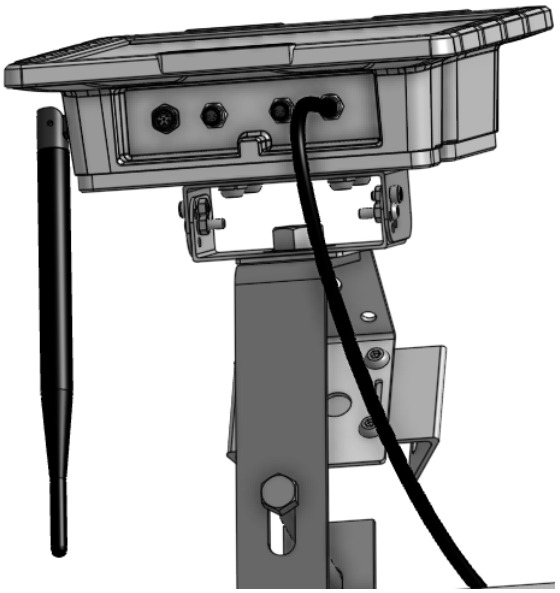
Install the grounding cable from the surge arrester



Attached the ground lead to the U-bar with the beam clamp

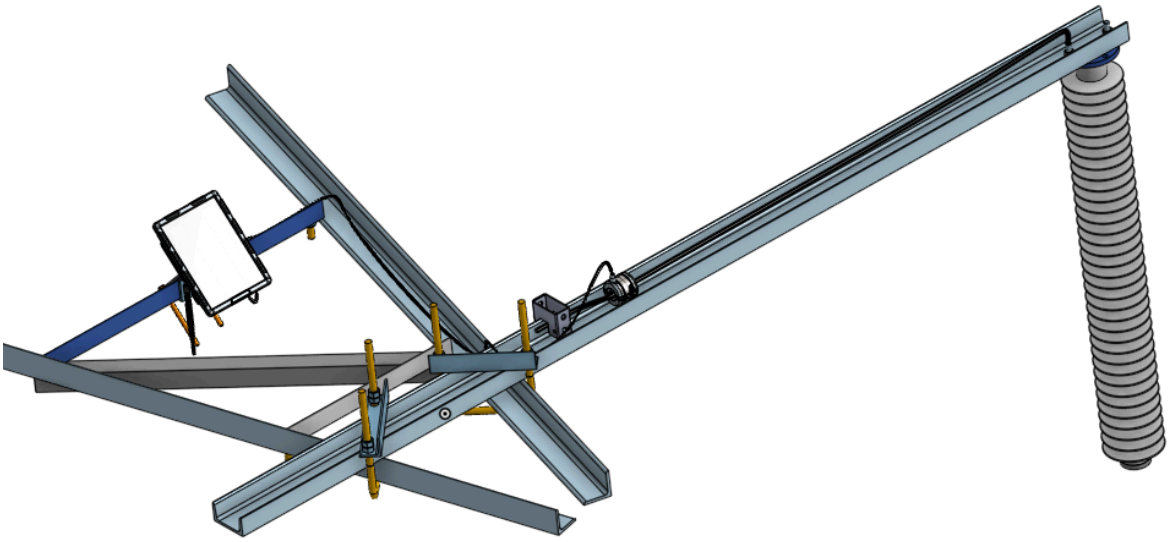


Mount the current transformer on the ground lead

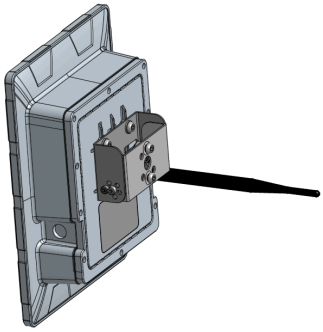


Connect the current transformer to the SCA50L

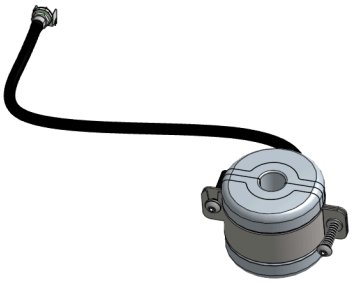
Installation S2
Lattice tower, suspension method, *L-shape cross arm*, installation at L-shape cross arm.



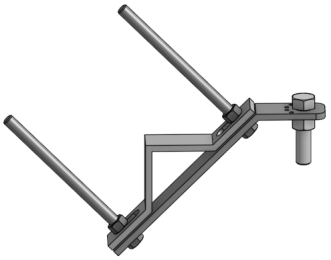
Material required



SCA50L fitted with the rotating bracket and the antenna.
All supplied in the SCA50L package

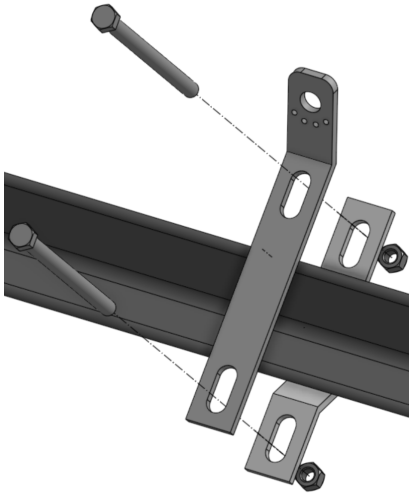


Split core current transformer
Supplied with the SCA50L

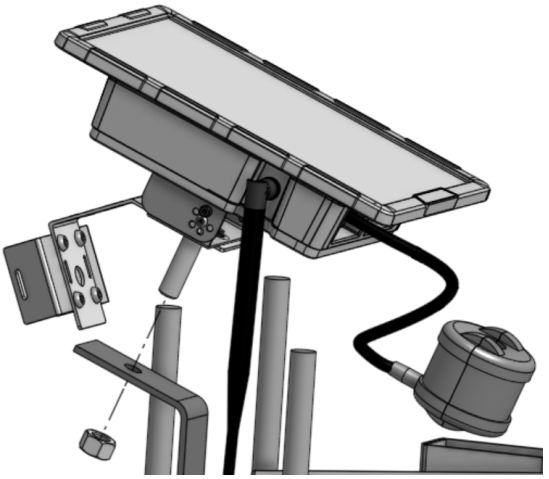


L-Shape bar clamp with a M12 nuts and bolt set
Optional supply.

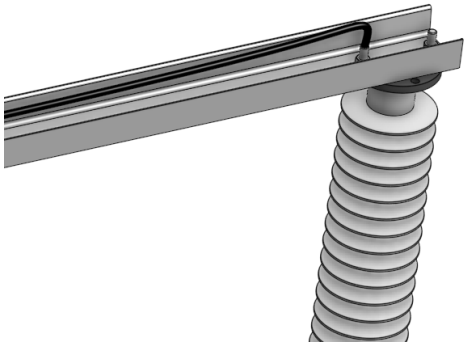
Instructions



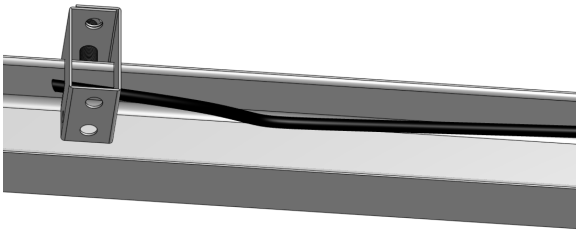
Fit the U-shape bar clamp to the U-shape bar



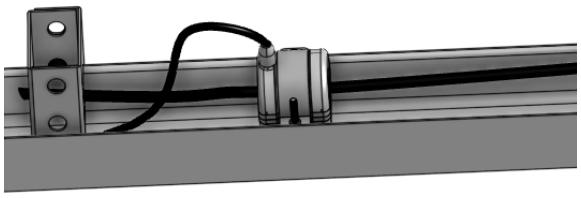
Mount the SCA50L with the rotating bracket on the U-bar clamp using M12 nuts, bolts and split ring



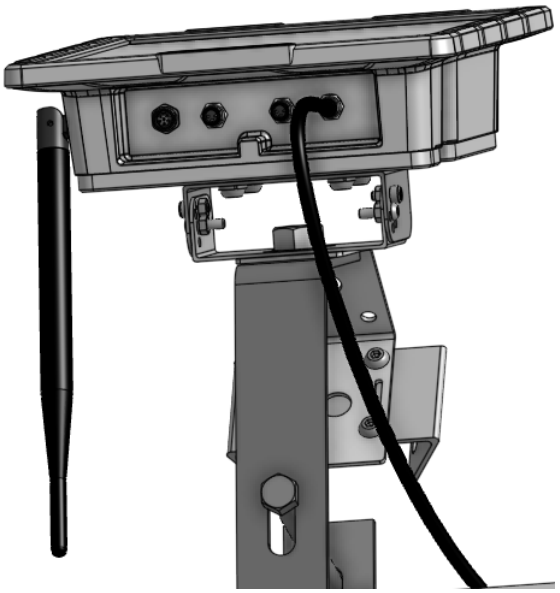
Install the grounding cable from the surge arrester



Attached the ground lead to the U-bar with the beam clamp



Mount the current transformer on the ground lead

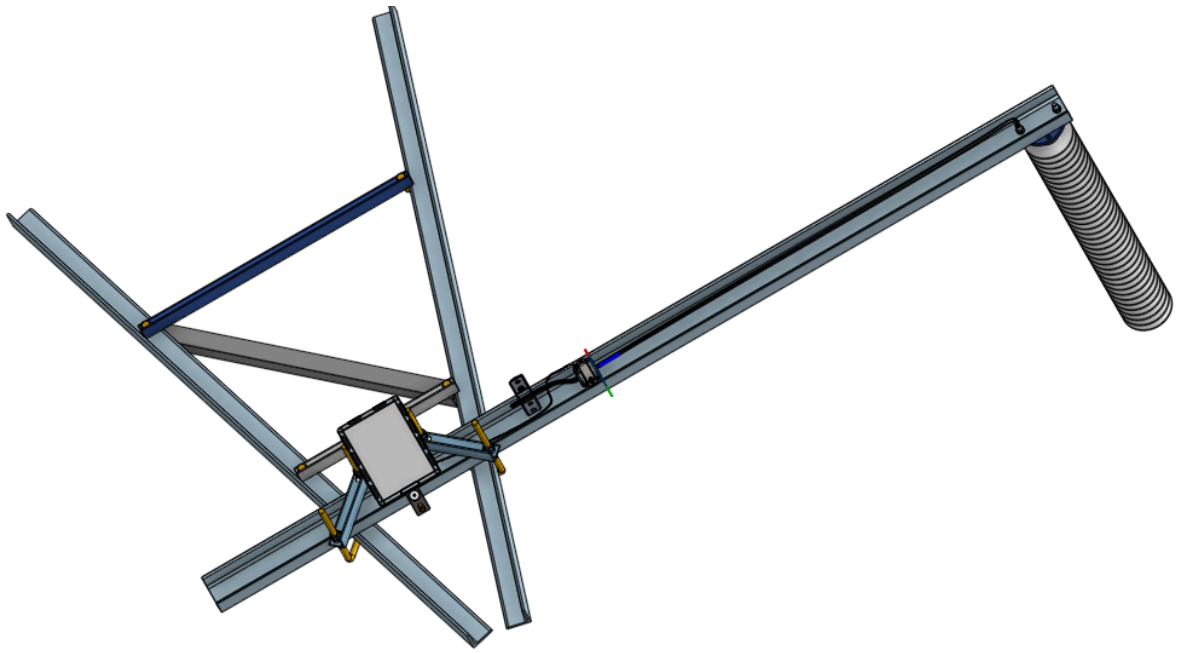


Connect the current transformer to the SCA50L

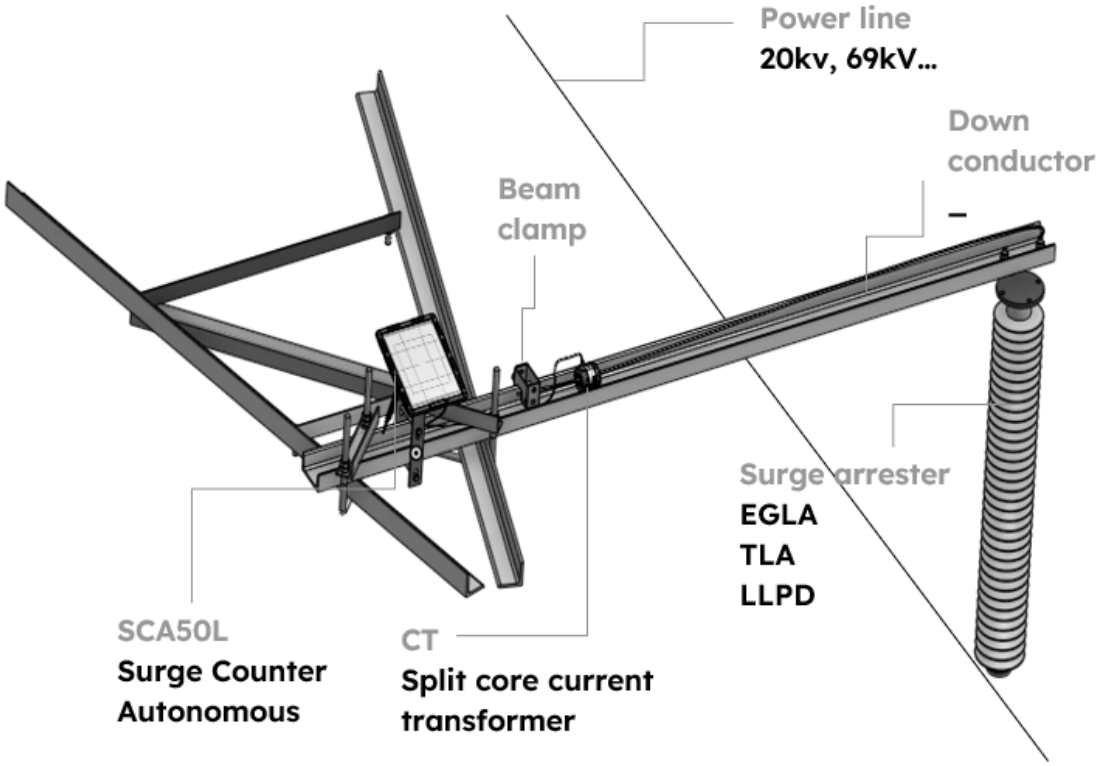
Installation S3

Lattice tower, suspension method, U-shape cross arm, installation at the middle of the surge arrester suspension U-shape cross arm.

Overview

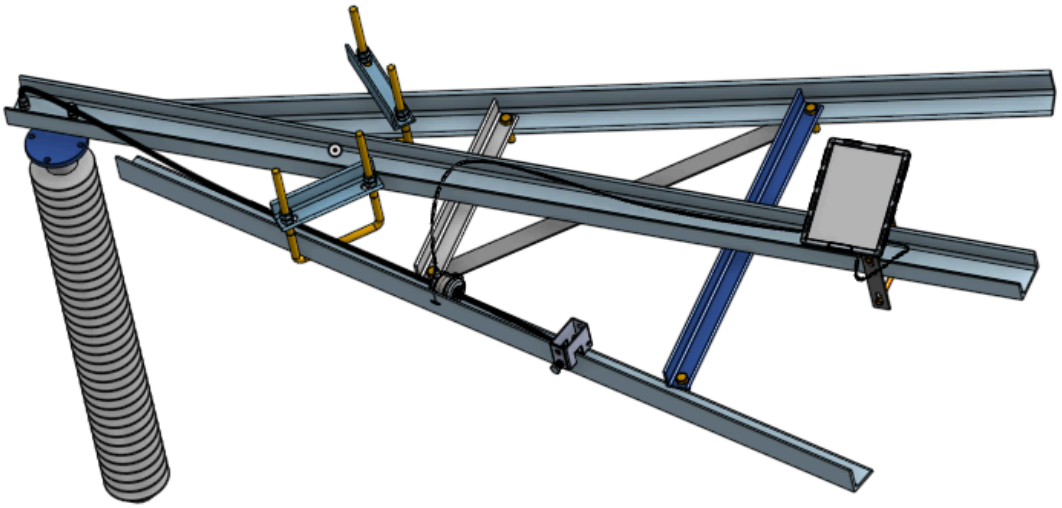


Components



Material required, as per Installation S1, see paragraph "Lattice towers, suspension"

7.4.7. Lattice towers, tension.



Material required, as per Installation S1, see paragraph “Lattice towers, suspension”

7.5. Live line installation procedure

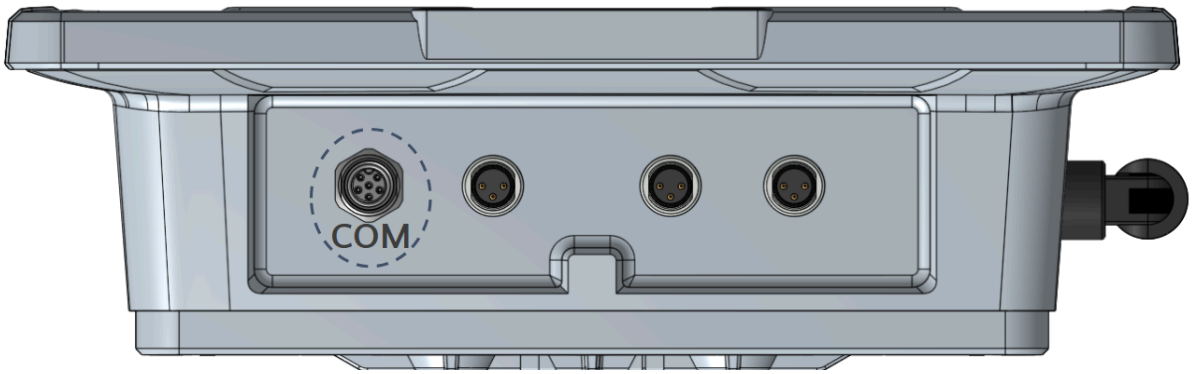
Consult us

8. Connections

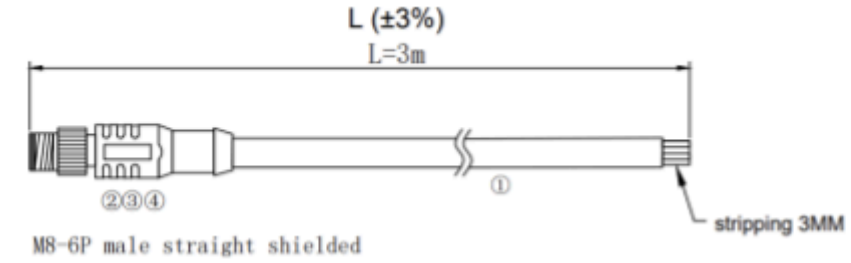
The device has the following connectors:

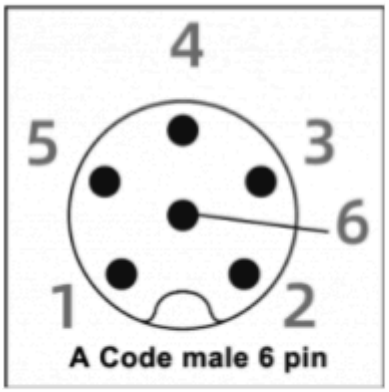
Label	Connector Type	Function
ANT-L	SMA-RP female	LoRaWAN antenna
COM	M8 6-pin female	USB charging and communication
CT1	M8 3-pin female	Surge event sensor (Current Transformer) phase 1
CT2 (optional)	M8 3-pin female	Surge event sensor (Current Transformer) phase 2
CT3 (optional)	M8 3-pin female	Surge event sensor (Current Transformer) phase 3

8.1. USB Charging and Communication Port



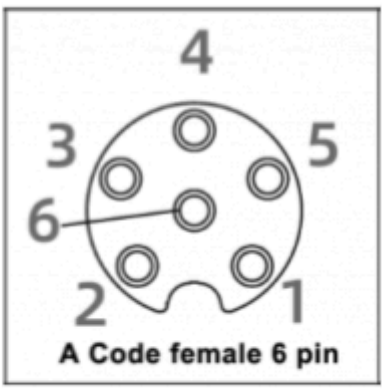
The device features one M8 6-pin connector (COM) for the charging and communication USB port.





Plug-in Cable Side

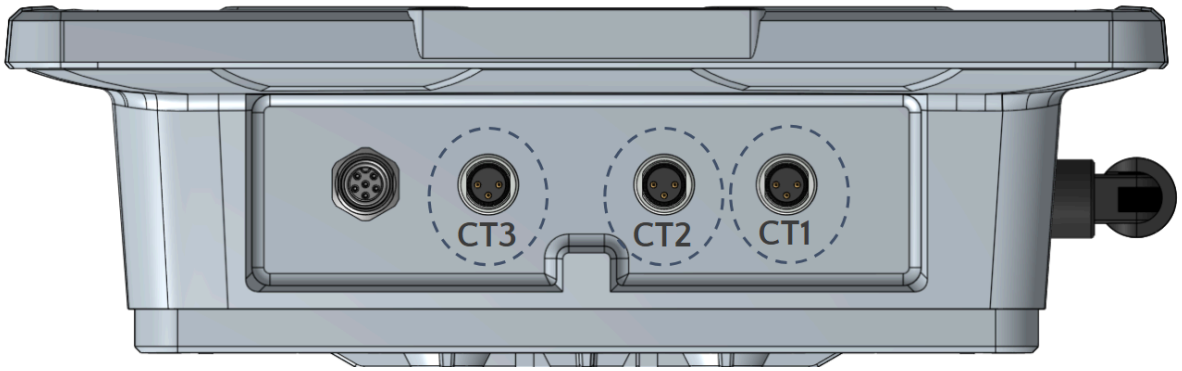
Pin 1 – Red : D+
Pin 2 – White : D-
Pin 3 – Blue : GND
Pin 4 – Black : GND
Pin 5 – Yellow : VBUS
Pin 6 – Green : VBUS

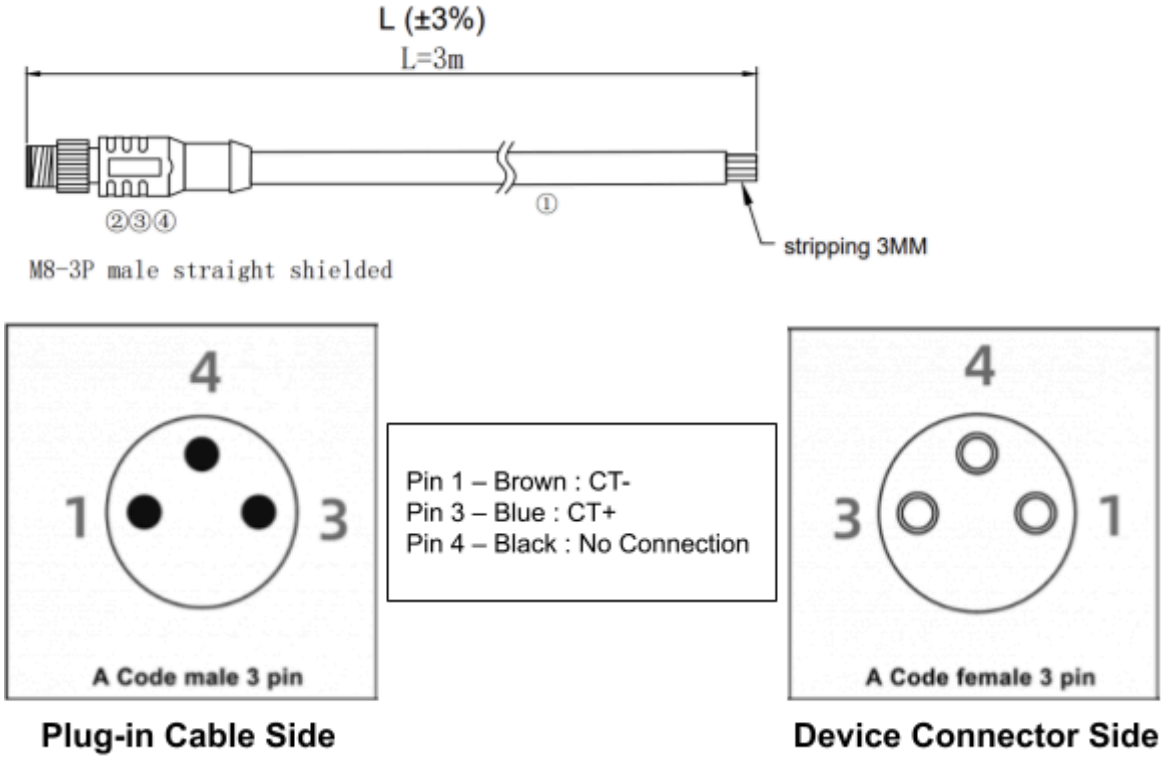


Device Connector Side

8.2. Split core current transformer

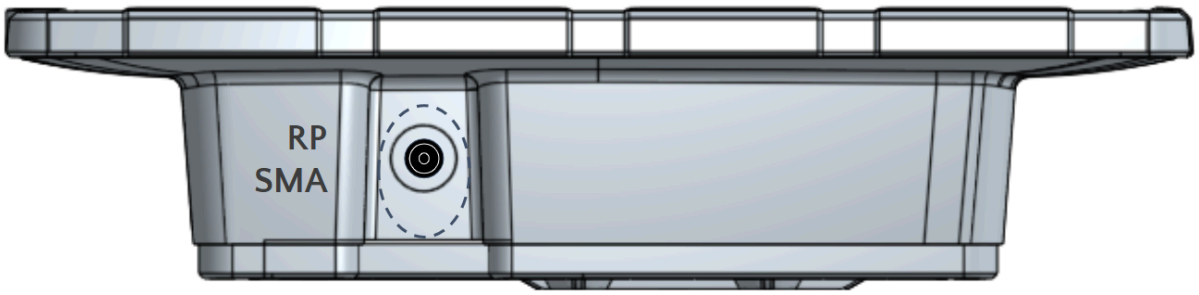
The device features one or three M8 3-pin connectors (CT1-CT3) for surge detection sensors.

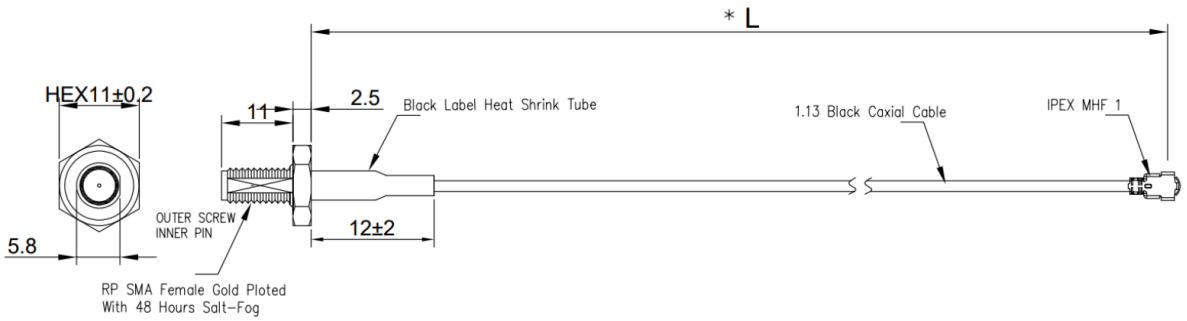


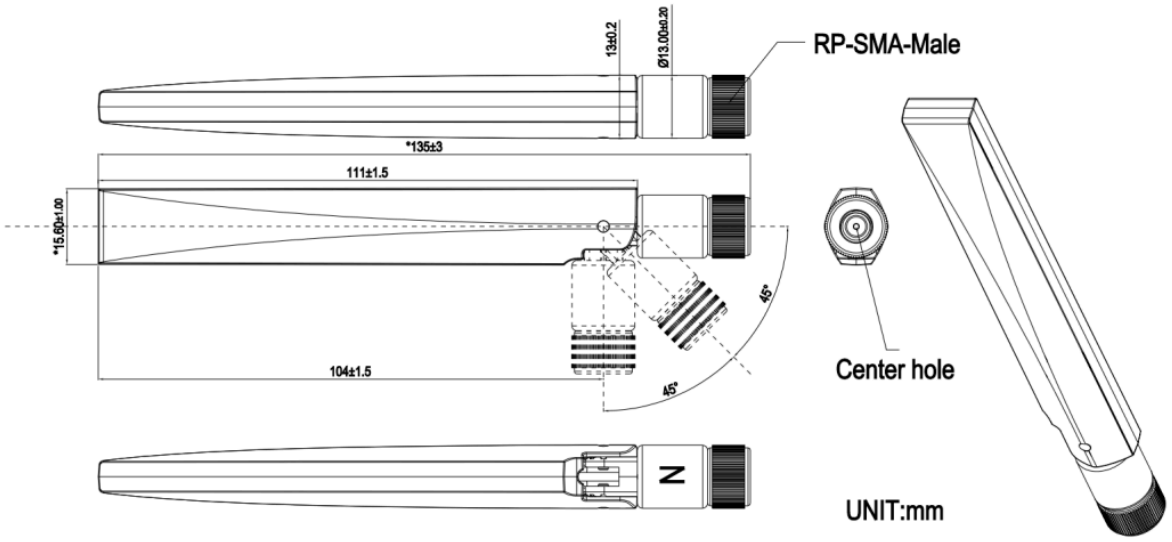


8.3. LoRaWAN antenna

The device features one RP-SMA female connector for the LoRaWAN antenna.
Using any antenna models that are not provided by the manufacturer is strictly prohibited.





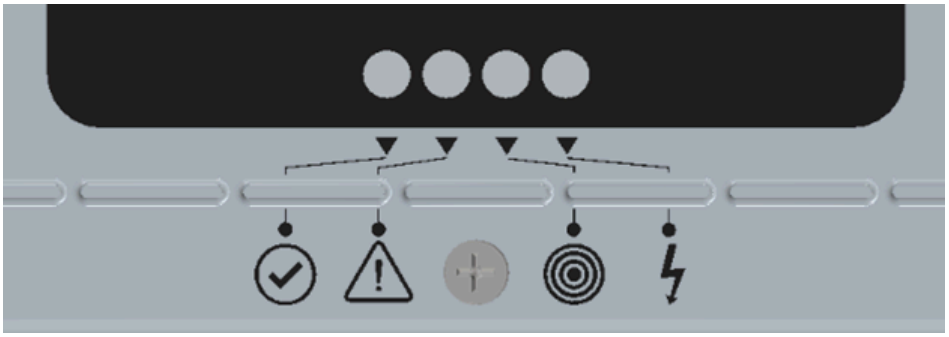


Note: If you use a torque wrench, the recommended force for mounting the antenna is 0.9Nm and the maximum torque to prevent antenna damage is 1.17Nm.

9. LEDs

The device features 4 status LEDs (from the left to the right):

1) Green - active (alive) status
2) Red - active error
3) Blue - communication status
4) Orange - surge event or button indication



The green LED indicates that the device is operating.
The indicator has the following states:

LED state	Period	Meaning
2 short blinks	5 seconds	The device is operating. The battery is normal.
1 short blink	5 seconds	The device is operating. The battery is low.
Constant	-	The device is starting.

The red LED indicates that the device has an active error.
The indicator has the following states:

LED state	Period	Meaning
short blinks	5 seconds	An error presents.
Constant	-	The device is starting.

The blue LED indicates the state of LoRaWAN communication.
The indicator has the following states:

LED state	Period	Meaning
1 short blink	5 seconds	The device is not connected to the LoRaWAN network.

3 short blinks	-	The device is sending a message to the LoRaWAN network.
Constant	-	The device is starting.

The orange LED indicates a surge event or applying a magnet.
The indicator has the following states:

LED state	**Period**	**Meaning**
1 blink	1 second	A magnet is applied.
3 short blinks	-	A surge event just happened.
Constant	-	The device is starting.

10. DISPLAY

The device features an electronic-ink display for showing surge events counters and essential diagnostic information.

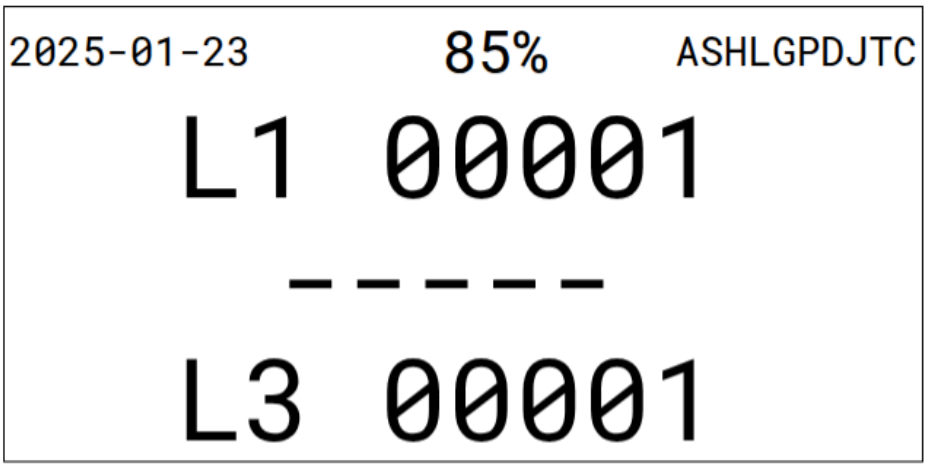
There are 4 screens that can be displayed:
1) Start screen
2) Main screen (default)
3) Modules Diagnostic screen
4) Power Diagnostic screen

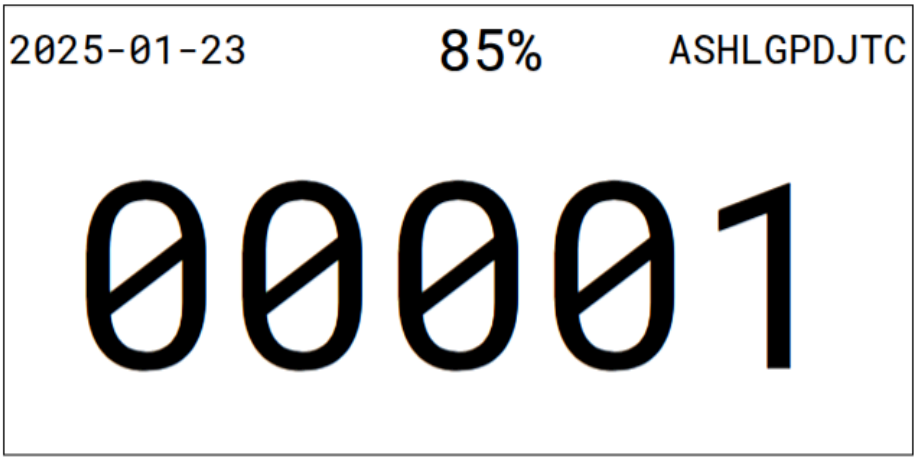
If the USB cable is connected, the device automatically switches screens every 10 seconds.

If the USB cable is not connected, the device displays only the main screen. Information on the screen is refreshed every 1 minute in normal conditions or every 10 minutes when the battery level is low. In case of a surge event the device will refresh the main screen immediately.

The user can access other screens anytime by placing a magnet on the lower-left corner of the device. To advance to the next screen, the magnet must be held in place for 5 seconds (each second is indicated with the orange LED). The device automatically returns to the main screen with the launch of the next refresh cycle scheduled by the programmed timer.

10.1. Main Screen

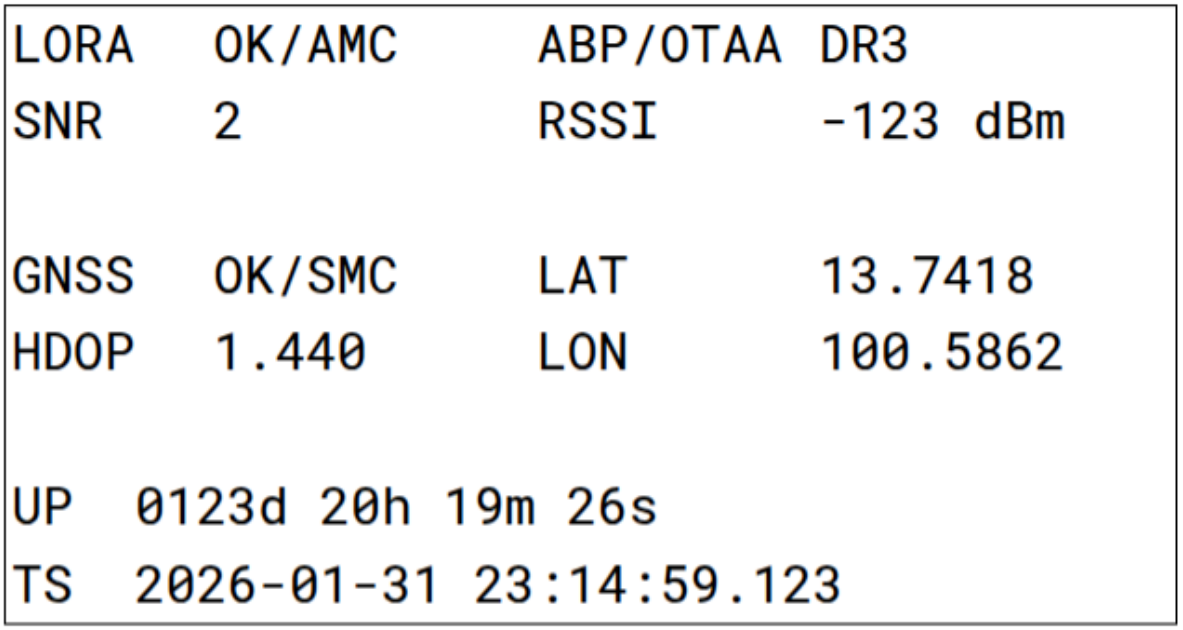




The main screen displays the following information:

1) Date
2) Battery Level in %
3) Active module errors
    - A - authorization error (last applied password was invalid)
    - S - surge detection module error
    - H - HMI error
    - L - LoRa / LoRaWAN error
    - G - GNSS error
    - P - Power Management Unit error
    - D - surge events database error
    - J - system journal database error
    - T - board temperature is out of range
    - C - configuration error
4) Surge event counters for one or several phases

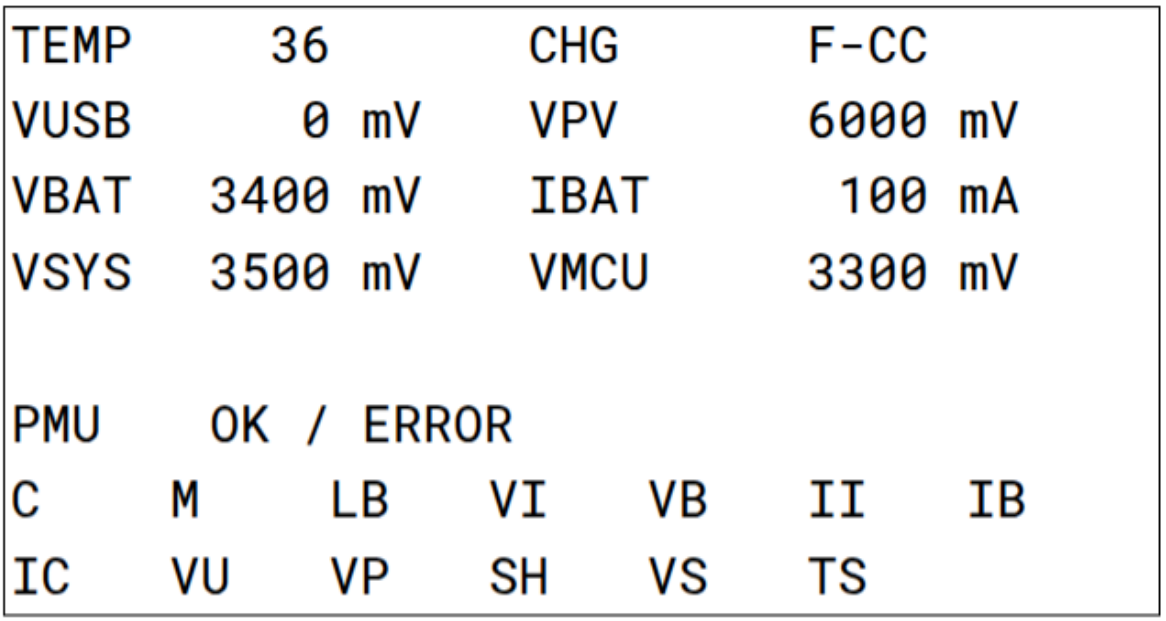
10.2. Modules Diagnostic Screen



The modules diagnostic screen displays the following information:

1) LoRa / LoRaWAN module status or errors
   - `OK` - no active errors
   - `A` - device is not connected to LoRaWAN network (not activated / joined)
   - `M` - hardware module error
   - `C` - configuration error
2) LoRaWAN activation method
   - `ABP`
   - `OTAA`
3) Active Data Rate
   - `DR0 - DR5`
4) Downlink Signal to Noise Ratio (SNR)
5) Received Signal Strength Indicator (RSSI) in dBm
6) GNSS module status or errors
   - `OK` - no active errors
   - `S` - time synchronisation error
   - `M` - hardware module error
   - `C` - configuration error
7) Obtained position latitude
8) Horizontal Dilution of Precision (HDOP)
9) Obtained position longitude
10) Uptime
11) System time (UTC)

10.3. Power Diagnostic Screen



The power diagnostic screen displays the following information:

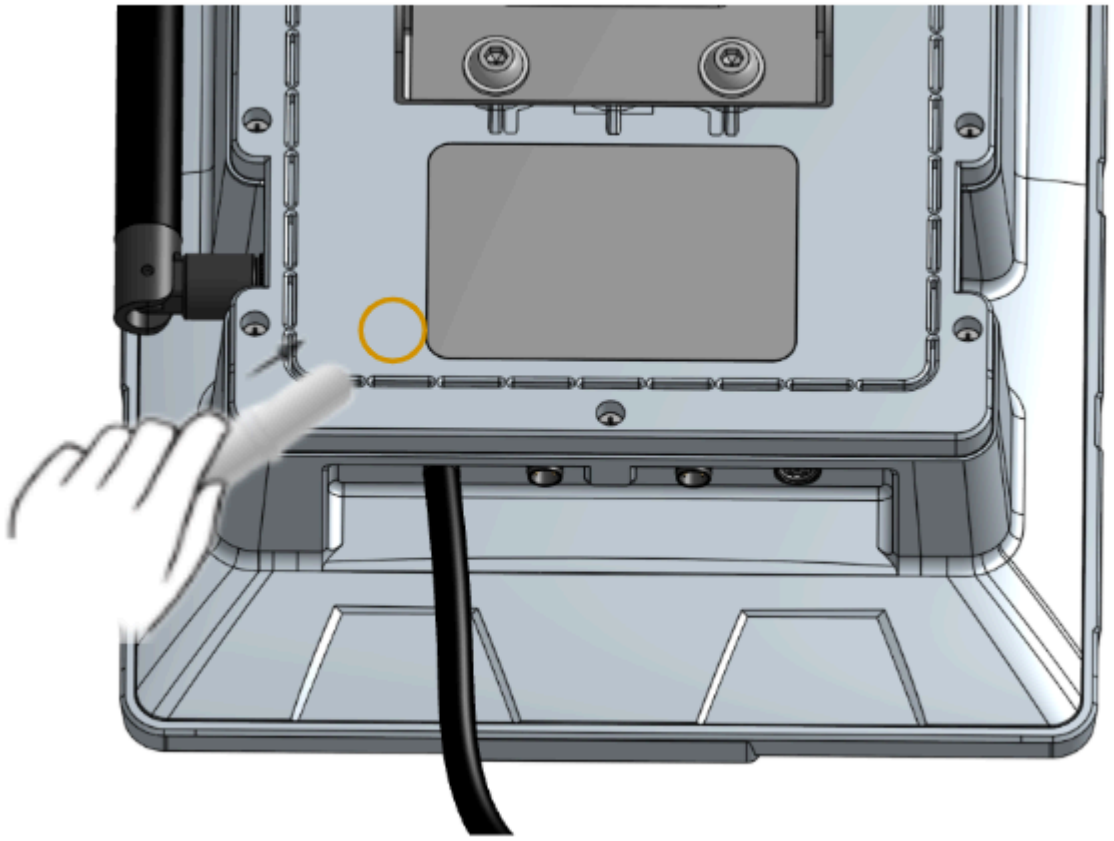
1) Board temperature in Celsius degrees (TEMP)
2) Battery charging status
    - `IDLE` - battery is not charging (no power source available)
    - `TRCKL` - trickle charging
    - `PRE` - pre-charging
    - `F-CC` - fast charging in Constant Current mode
    - `T-CV` - taper charging in Constant Voltage mode
    - `T-OFF` - timeout after battery charging completed
    - `TERM` - charging cycle complete (terminated)
3) USB input voltage in mV (VUSB)
4) PV input voltage in mV (VPV)
5) Battery voltage in mV (VBAT)
6) Battery charging / discharging current in mA (IBAT)
7) Power Management Unit output voltage in mV (VSYS)
8) Microcontroller voltage in mV (VMCU)
9) Power Management Unit status or error flags (PMU):
    - `OK` - no active errors
    - `C` - configuration error
    - `M` - hardware module error
    - `LB` - low battery level
    - `VI` - input bus over-voltage (VBUS)
    - `VB` - battery over-voltage (VBAT)
    - `II` - input bus over-current (IBUS)
    - `IB` - battery ove-rcurrent (IBAT)
    - `IC` - converter over-current (ICONV)

- VU - USB-input over-voltage (VUSB)
- VP - PV-input over-voltage (VPV)
- SH - output short-circuit
- VS - output over-voltage (VSYS)
- TS - thermal shutdown

…

11. Magnetic switch (button)

To interact with the device and perform various functions, the user can apply a south-pole magnet to the left-bottom corner of the display surface.



While the magnet is applied, the orange LED will blink every second, serving as a time counter for the operation.

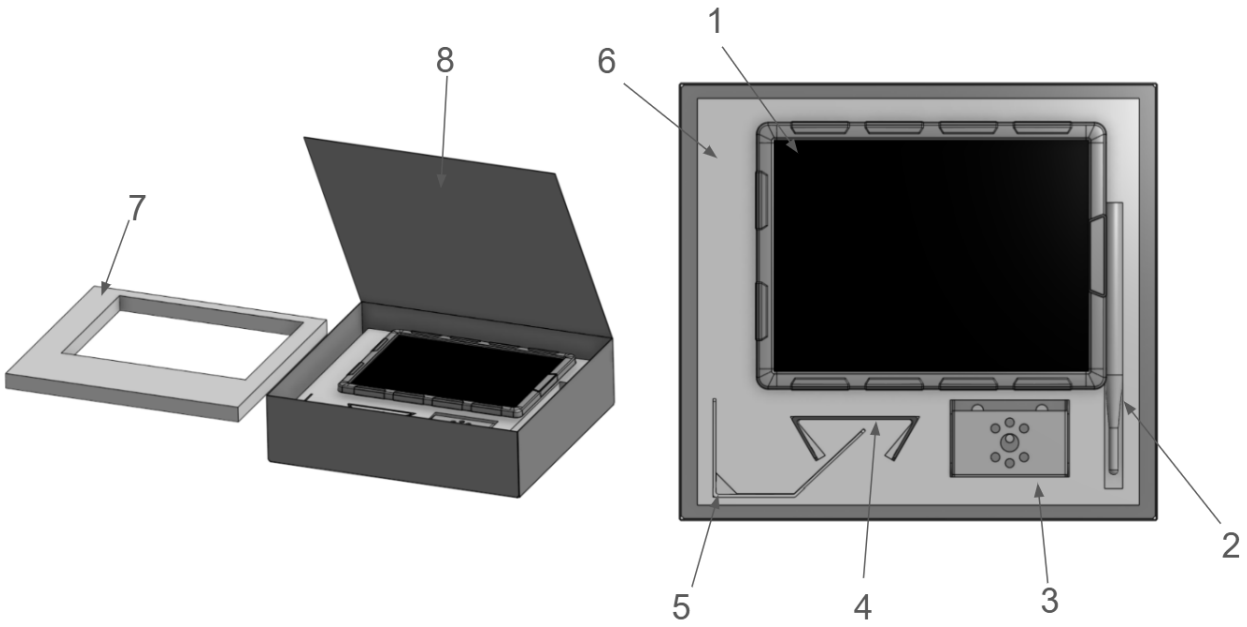
Follow these steps based on the desired action:

Action	Duration of Magnet Application (LED Blinks)
Refresh Screen	3 seconds (3 blinks)
Switch Screen	5 seconds (5 blinks)
Reboot Device	12 seconds (12 blinks)

After the specified duration (blinks), remove the magnet to perform the action.

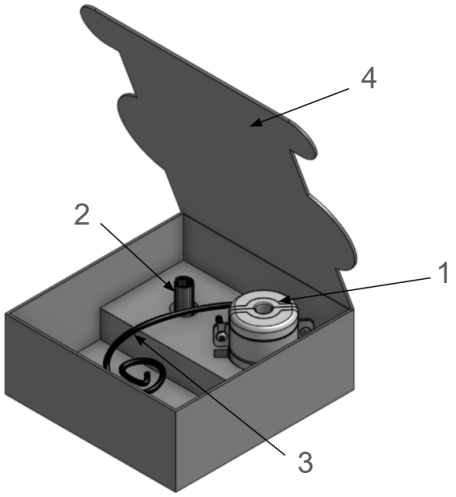
12. Packaging And References

Box 1/2



No. Item	Nomenclature or Description	Note
1.	SC050-L	Included
2.	Antenna	Included
3.	Rotating Bracket	Included
4.	Pole Bracket	Included
5.	Extension Bracket	Included
6.	Packaging Spacer	Included
7.	Packaging Foam	Included
8.	Packaging Box B3	Included

Box 2/2



No. Item	Nomenclature or Description	Note
1.	Current Transformer	Included
2.	Rubber Coil	Included
3.	CT Wire	Included
4.	Packaging Box B5	Included

13. Maintenance

13.1. Storing

The device must be stored in a power-off state to prevent battery discharge.

The following actions has to be performed to switch off the device:

S1. Fully cover the solar panel of the device with non-transparent material
S2. Connect USB cable to the device
S3. Open provided software platform and establish connection with the device
S4. Execute the Shutdown command
S5. Disconnect the USB cable

To make sure the device is in the power-off state check that the display is blank and there are no LED blinking within 10 seconds.

If the solar panel is not covered properly the device can accidentally power-on if the panel catches a certain amount of artificial or ambient light.

13.2. Charging

The device must be pre-charged before installation to operate with effective power-cycles. The device shall be installed with an initial battery level more than 90%.

To charge the device connect the USB cable to the charger with a USB port.
The charger must comply with at least one of the following specifications:

- USB Battery Charging 1.2 (BC 1.2)
- USB 3.0
- USB 2.0

The device with firmware versions 1.0 and lower supports the following charger types:

- Standard Downstream Port (SDP) - charging current up to 500 mA

To ensure the device is charging check the following parameters on the Power Diagnostic Screen:

- VUSB is more than 4900 mV
- IBAT is positive
- Charging status (CHG) is not IDLE

The end of charging can be identified by checking the following parameters:

- Battery Level is more or greater than 98%
- Charging status (CHG) is either T-OFF or TERM
- VBAT is more than 3500 mV
- IBAT is less than 20 mA

13.3. Commissioning

The following parameters must be checked **before starting commissioning** and installation of the device:

- Surge sensors are properly connected to the device
- LoRa antenna is properly connected to the device
- Device is powered-on and the active status LED (green) blinks every seconds
- The battery level is more than 90%
- Open the Power Diagnostic screen and check the solar panel voltage (VPV) is more than 4000 mV during the daylight time
- Open the Modules Diagnostic screen and check the device system time (TS) is up to date and GNSS coordinates are obtained

The **commissioning** process consists of the following steps:

S1. Connect USB cable to the device and to the computer with provided software platform
S2. Follow the software platform configuration manual
S3. Complete configuration of the device in the software platform
S4. Disconnect the USB cable
S5. Reboot the device by applying the magnet
S6. Check that the device is connected to the software platform after reboot

The **final checks** before installing the device:

- Surge sensors are properly connected to the device
- LoRa antenna is properly connected to the device
- The battery level is more than 90%
- The solar panel voltage (VPV) is more than 4000 mV during the daylight time
- The device system time (TS) is up to date and GNSS coordinates are obtained
- The device is connected to the software platform
- The downlink RSSI parameter is more than -90 dBm when device is 2~5 meters away from the receiver
- The downlink SNR parameter is more than 3.0
- There is no active errors and alarms
- Surge events counters are reset or set according to the customer records

13.4. Monitoring

The recommended interval for monitoring the device is from 1 day to 6 months.

The longer intervals may lead to greater amounts of data to be transferred between the device and software platform during the monitoring session. The shorter monitoring intervals may also help to diagnose any possible issues with the device.

The following schedule is recommended for initial monitoring the installation:

Time interval	Note
-	Installation
1 day	Ensure communication with the software platform
1 month	Ensure battery level state and lack of system errors
3 month	Ensure battery level state and lack of system errors
6 month	Monitoring following the customer schedule

The following parameters shall be checked to ensure the device is operating normally:

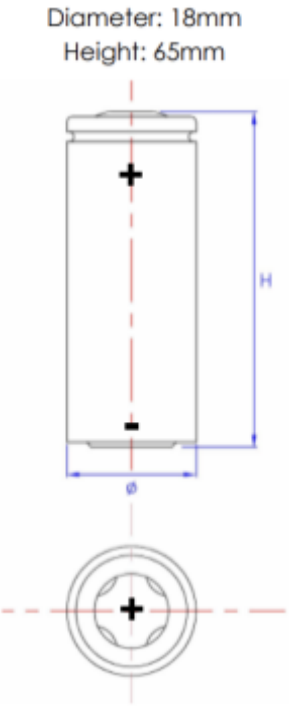
- Connection with the software platform can be established
- There is no active errors in module statuses
- The battery level is more than 70% for clear sky weather conditions and more than 50% for cloudy weather conditions
- The device temperature is less than 50 °C
- The system time of the device is up to date
- There is no critical errors in the System Journal
- The device uptime indicates no reboots of the device since the last check
- The solar panel voltage (VPV) is more than 4000 mV in daytime

Follow the software platform manual to perform wireless monitoring of the device.

14. Battery (re)placement

Battery Specifications

Name	FERPHOS 18650
Type	LiFePO4
Product Configuration	1S3P
Total Product Battery Capacity	54000mAh (3 x 18000mAh)
Nominal Voltage	3.2V
Operating Voltage	2.5V - 3.65V
Working Temperature	Charge: 0°C to 55°C
	Discharge: -20°C to 60°C



Battery Charger

Name	LiitoKala Lii-S12
Input Voltage	DC12V/4A
Charging Mode	LiFePO4-3.20V

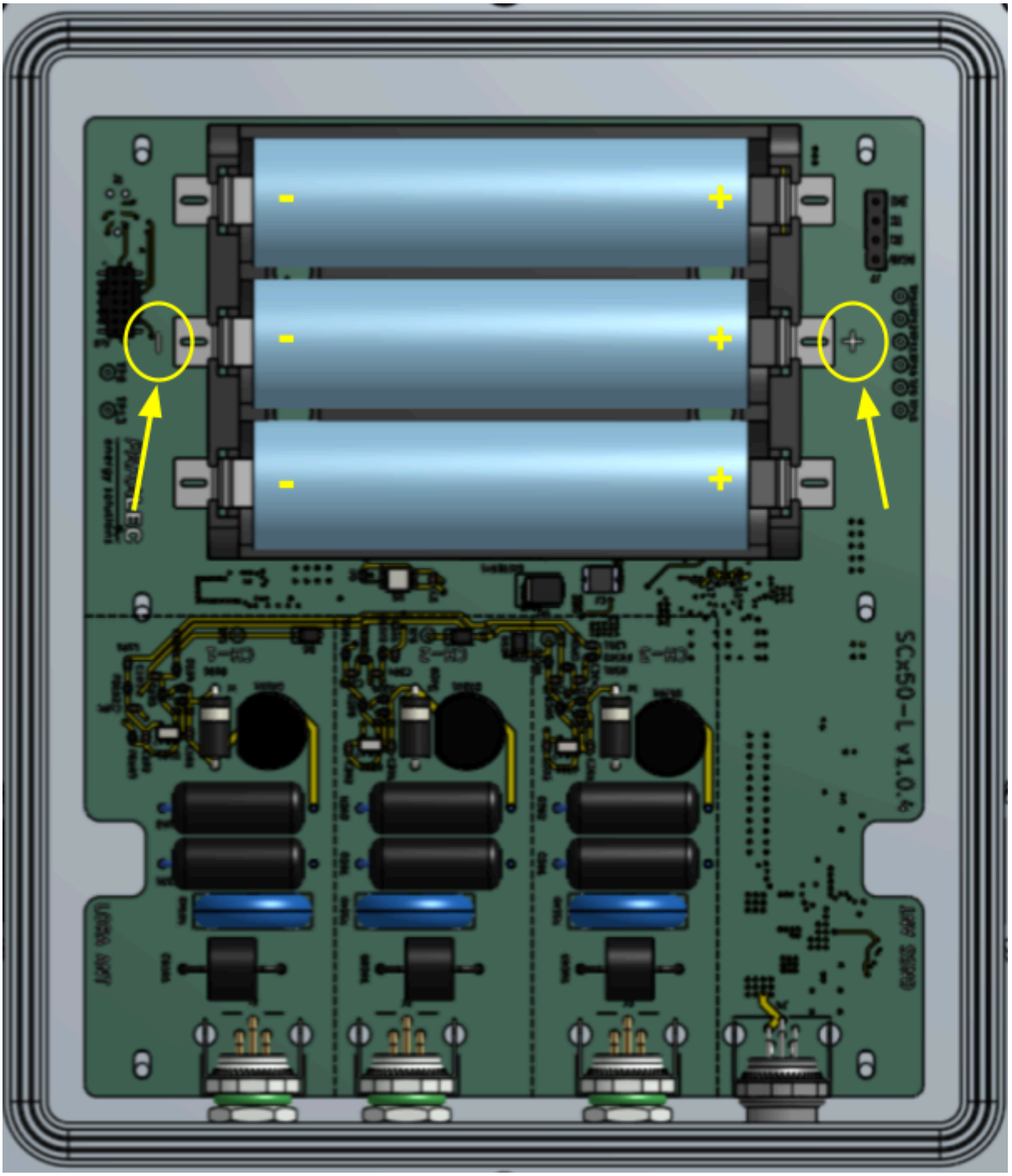
Before inserting the 18650 batteries into the product, please ensure each battery is fully charged with our provided charger (LiitoKala Lii-S12).

Charging Instructions

1. After the charger is connected to the power supply, the LCD screen will display fully for about 3 seconds, and then only null will be displayed.
2. Start inserting the batteries into the slot (we recommend 2 batteries at a time). The screen of the corresponding slots will be blinking while the batteries are being inserted.
3. While the screen is blinking, press the MODE button until the Charging mode is selected to LiFePO4. Please note that the MODE will be assigned to all of the blinking slots.
4. If the MODE is incorrectly selected or did not get selected in time of the blinking, please try again by removing the battery from the charging slot and inserting the battery into the slot again.
5. Once the MODE is selected to LiFePO4, wait for several seconds until the screen stops blinking. The battery will start charging afterwards.
6. Once the battery reaches 100%, it may be removed from the charger.

In the case where batteries are needed to be replaced, please make sure to dismount the device from the installed location to a safe and dry place. Carefully remove the old batteries from the device one by one. Please make sure to store and dispose of the old batteries properly for environmental safety and to prevent fire hazards.

Place 3 fully charged batteries into the product (one battery at a time). Please make sure the polarities of the battery are on the correct side before inserting into the slots. The silkscreen on the PCB can help indicate where + and - sides are. Once all 3 batteries are fully inserted into the device, follow the instructions to restart the device and/or update new firmware if required.



15. Troubleshooting

Work in progress

16. Certification / Performance & Type Tests

Tests	Values
Lightning current impulse test 10/350µs, Iimp_max | IEC 62561-6, paragraphs 6.6.4	**3x-100kA & 3x+100kA**
Lightning current impulse test 8/20µs, In_min | IEC 62561-6, paragraphs 6.6.2	**1x-100A & 1x+100A**
Nominal current impulse test 8/20µs, In | IEC 62561-6, paragraphs 6.6.2	**5x-10kA & 5x+10kA**
Nominal current impulse test 8/20µs, In | IEC 62561-6, paragraphs 6.6.2	**5x-15kA & 5x+15kA**
High current impulse test 4/10µs | IEC 62561-6, paragraphs 6.6.4	**3x-100kA & 3x+100kA**
Dielectric withstand AC / 45-65 Hz / 1min according to IEC 61180-1	**2 kV, rms**

17. Contact

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