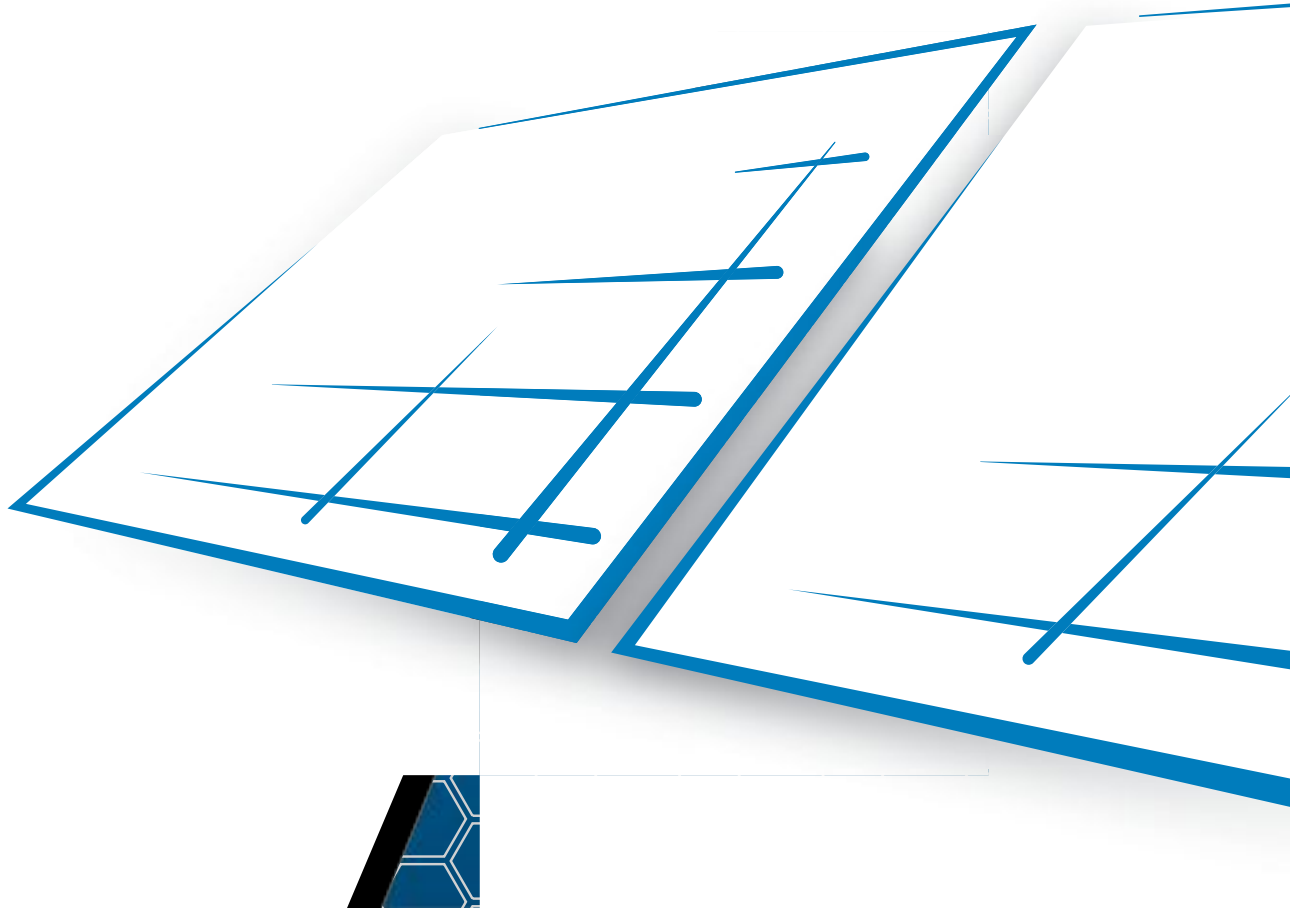


# MAX310 BEESMART

## SOLAR

### MICRO INVERTER 260

USER MANUAL





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## Disclaimer of liability

This manual only describes the product and is not a warranty of performance or characteristic.

Contents of the manual has been reviewed against the hardware and software described. Any liability can be accepted for any errors or omissions contained in the information given.

The installation, handling and use of Letrika micro inverters are beyond company control. Letrika d.d. does not assume any responsibility for loss, damage, injury or expense resulting from the improper installation, handling, use or maintenance.

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We reserve the right to change this document at any time without notice.

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## Who should read this manual

This manual is intended to be used during installation, commissioning and maintenance as a reference for installers, system integrators and other qualified personnel with knowledge of local standards and regulations. They should always follow local electrical safety and fire protection guidelines. Only technically qualified personnel should install or replace Letrika Micro inverters.

## Table of contents

1	Introduction	4
1.1	Main features	4
1.1.1	PV Power Plant with Letrika Solar Micro inverters 260	5
1.2	Hardware Structure of Solar Micro Inverter 260	6
2	Safety	8
2.1	Symbols legend used in this manual and/or equipment	8
2.2	Safety and general warnings	8
2.3	General installation safety guidelines	9
3	Installation procedure	10
3.1	Compatible PV modules	10
3.1.1	Landscape versus portrait panels placement	11
3.1.2	Mounting hardware compatibility	12
3.1.2.1	Al profile selection	12
3.1.2.2	Inverter fixing screws positions	12
3.1.2.3	Inverter cooling consideration	13
3.2	Connecting cables to micro inverter	14
3.3	Connecting micro inverter system to utility grid	14
3.3.1	Simple single phase connection with I.P.S. device	15
3.3.2	Single phase connection without I.P.S. interface to grid	15
3.3.3	Three phase connection	16
3.3.4	Trunk cable extension and cable end covering	17
4	Commissioning	18
4.1	Preliminary checks	18
4.2	Sequence of operations	18
5	Troubleshooting	19
5.1	List of errors in alarm list	19
6	Storage	22
7	Disposal	22
8	Maintenance	22
9	Registration and warranty	23
10	Appendix	23
10.1	Technical specification	23
10.2	Certificate	24
10.3	Identification and ordering code	25
10.4	Dimensions	25
10.5	Compatible dc connector systems	26
10.6	Compatible AC connector system	26
10.6.1	Trunk cable data	26
10.6.2	Accessories	27
10.6.2.1	Waterproof cap	27
10.6.2.2	Cable end cap	28
10.6.2.3	Cable joiner	28
11	Contact	29

# 1 Introduction

## 1.1 Main features

- Nominal Apparent Power            290 VA at power factor  $f$  0,9
- Nominal Real Power                260W
- Nominal Reactive Power            260 VAR at 0,95
- Max. Reactive Power                260 VAR
- Great efficiency                      96,1%
- Large voltage and power input range - corresponds to the majority of PV modules
- Reactive power capability – wide range
- Dynamic power factor
- Incorporated relay for safe grid disconnection
- Galvanic isolation of DC side from AC side with HF transformer
- Low ripple current
- 0.0 W standby consumption
- WMBUS standard wireless communication
- DC circuit is isolated and insulated from ground
- Quick installation
- Full power at ambient temperature 65°C
- Die cast aluminum enclosure with completely potted electronics
- IP 67 – dust tight, no ingress of dust; immersion in water up to 1 m for 30 minutes
- Foiled capacitor, long life
- Design flexibility
- Letrika 50 years' experience in automotive and heavy duty electronics and electro mechanics

### Protection Function

- Over and under voltage protection
- Over and under frequency protection
- Anti-Island protection
- Surge protection device (SPD) integrated
- Mains Monitoring Switching Device (MSD) integrated according to VDE 4105

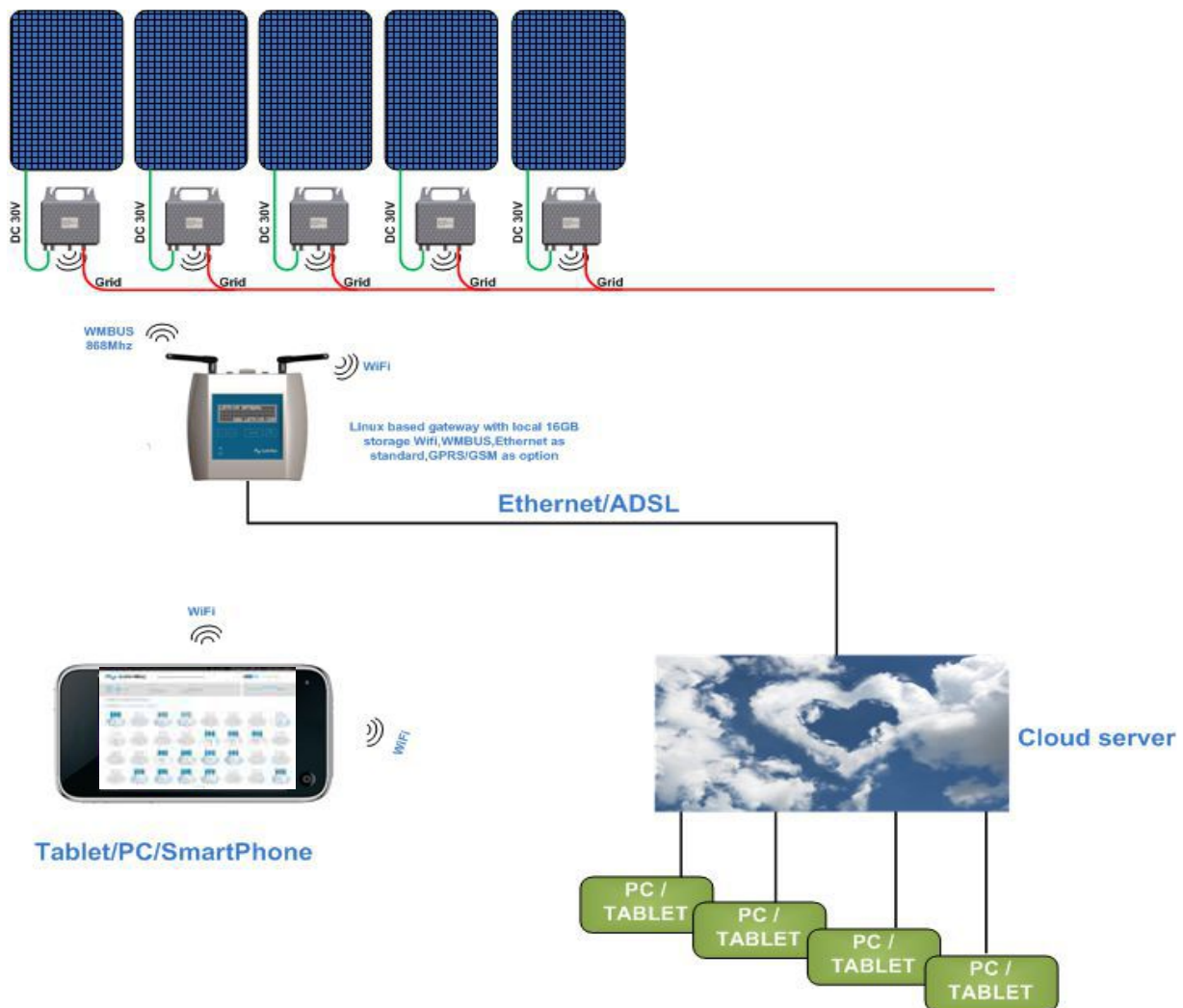
## 1.2 PV Power Plant with Letrika Solar Micro inverters 260

PV power plant with Letrika Solar Micro inverters 260 consists of several components. PV module directly convert sunlight into DC electricity, micro inverters change electrical current from DC to AC. Electricity is then transferred via, trunk cables, junction boxes and main distribution switch to the grid.

Each PV module is directly connected to Letrika Solar Micro inverter 260. PV module and micro inverter is individual power unit operating at maximum available power. The operation of such power unit is independent and does not affect the operation and performance of other power units.

PV modules of different characteristic can be installed in different position and orientation without interfering with each other.

The operation of micro inverters can be controlled via Linux based Gateway. Gateway communicates over wireless WMBUS with Letrika Solar micro inverter 260 and over a Wi-Fi or Ethernet with computer, smart phone or tablet. We can monitor and analyze individual micro-inverters or the whole power plant using browser on computer, smart phone or tablet.



## 1.3 Hardware Structure of Solar Micro Inverter 260

Solar Micro inverter converts direct current (DC) generated from a single PV module to alternating current (AC). Each micro inverter use Maximum Power Point Tracking (MPPT) to maximize production of single PV module.

Micro inverter has several functional units:

**Input filter** on DC side decouples PV panel from high frequency transients during DCDC converter switching.

**DC side power supply** of the primary (DCDC) logic is active until minimum panel voltage is reached.

**Primary DSP controller (16bit , 70MIPS, high performance DSP)** calibrates analog system, then starts to sample PV panel open circuit voltage. After PV voltage reaches sufficient voltage for reliable start of main flyback power supply, secondary(AC) side logic is turned on.

At this point, power supply to both power sections is activated, **secondary DSP (32bit,60Mips controller)** is started.

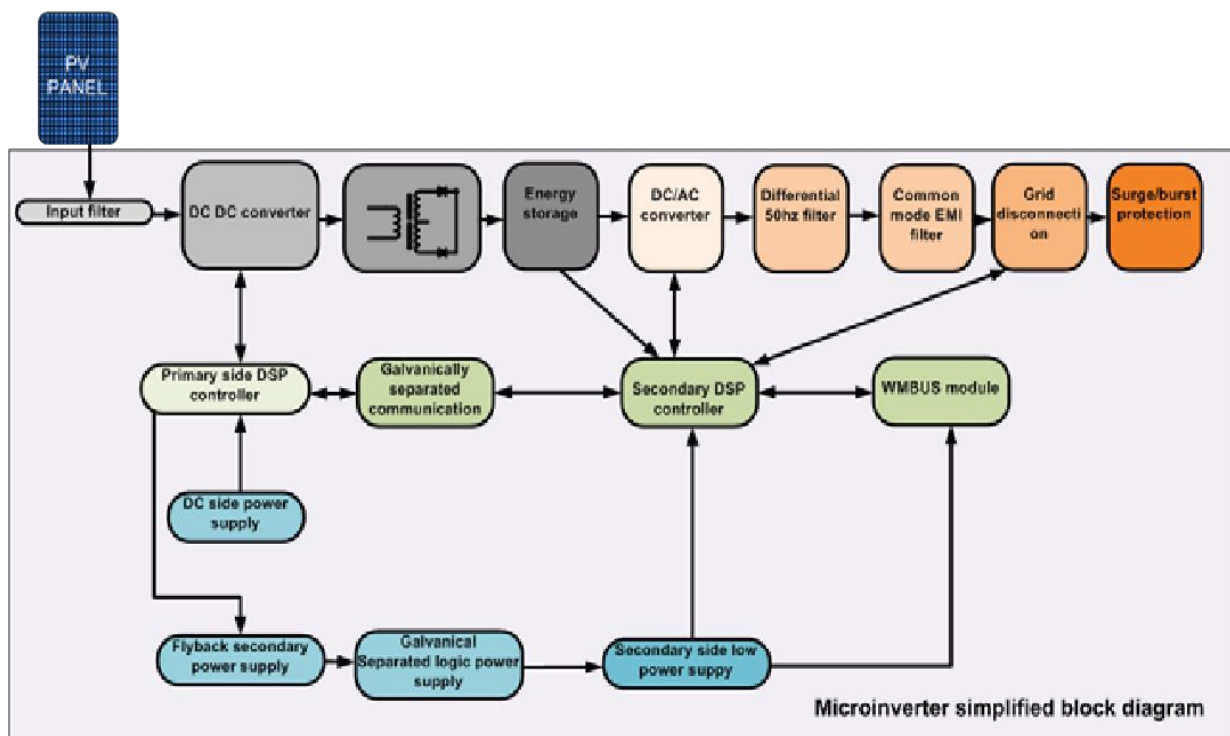
After successful connection with primary DSP controller, secondary controller will execute auto calibration and after 10 seconds activate **WMBUS RF** module. This delay is necessary for WMBUS module to stabilize operating parameters and also to avoid unnecessary power ON/OFF

cycling in case of low irradiation. **WMBUS module** converts inverter serial data into 868Mhz data stream according to WMBUS standard. Data from micro inverter can be received by Letrika data gateway or by any device compatible with WMBUS standard.

The power **DCDC converter** is started in constant current mode and high voltage. **Energy storage** capacitor is charged up to minimum voltage needed for reliable start. Voltage level in energy storage capacitor changes with grid voltage, optimizing switching losses on power section. **Foiled capacitors** are use because they have lower aging compared with electrolytic capacitors.

Concurrently **DSP2** algorithms are synchronized with grid and operating limits are checked. Once DC voltage reaches minimum level, **AC inverter** power stage is enabled, **grid disconnection relay** (if present) is turned on and grid current is gradually (according to standards limits) increased.

**DCDC converter** switches to MPPT tracker mode and begins to track PV panel maximum power point. A high speed



processor with special algorithm is used to achieve high efficiency and best possible harvest from sun.

**Differential mode** filters are used for filtering 50 Hz current from inverter carrier frequency,, .

**Common mode EMC** filters are used for EMC interferences filtering. THD for

**Surge and Burst** protections are used for protecting inverter from lightening phenomena's and grid over voltages. It is strongly recommended to install external overvoltage protection class II on AC side, it is also condition for the validity of Limited Warranty.

Solar Micro inverter is in standby until there is insufficient irradiance and a specific minimum voltage is present in the inverter. The consumption in standby is 0W. The micro inverter starts to fully operate when the sun begins to supply energy and the voltage in PV module reach 22Vdc.

When the voltage drops below the minimum voltage value (15Vdc) feed-in mode ends and the inverter switches off.



## 2 Safety

### 2.1 Symbols legend used in this manual and/or equipment

<b>CAUTION</b>	Generic danger - Important safety information.	Connection to ground protection.
<b>WARNING</b>	Dangerous voltage. All precautions and protections against high voltage electric shock should be taken.  HOT SURFACE ! Danger of burns, do not touch product.  Manual shall be consulted that must be available for future use and not damaged.	Note. Please read paragraph marked with this icon carefully.

### 2.2 Safety and general warnings

<b>WARNING</b>	Letrika inverters must be installed only by technically qualified personal.	<b>CAUTION</b>	In case of fault on PV installation with Letrika micro inverters, do not attempt disconnect PV or grid cables from inverters or junction boxes until qualified personal checks the installation.
<b>WARNING</b>	All electrical installations must be performed in accordance with local and national electrical standards and codes.	<b>HOT SURFACE</b>	Metal surface of Letrika micro inverters can reach more than 70 degrees in operation. To reduce risk of burns do not touch the inverter while in operation. After switching off micro inverter wait at least 10 minutes before touching it.
<b>WARNING</b>	Do not connect wet connectors. Connectors must be dry before any attempt to connect them.	<b>CAUTION</b>	If required by local standards, AC wiring must be additionally protected with RCDs and Earth Fault Monitors where required.
<b>WARNING</b>	Do not cut, bend or modify original connectors and/or cables supplied with inverters.	<b>CAUTION</b>	Before starting inverters for first time, inspect the wiring, measure isolation resistance between PV+,PV- and protective ground.
<b>WARNING</b>	Lightning protection must be placed on each inverters branch. Avoid wiring loops or rings. Keep cable paths short as possible.	<b>CAUTION</b>	Micro inverters should be mounted on aluminum frame holding the PV modules. Preferably on upper side to avoid prolonged submersion of inverters into water or snow. Do not left inverters unfixed on the roof.
<b>WARNING</b>	Inverter and all metal components must be grounded according to local standards.		
<b>WARNING</b>	Inverter PV side is galvanically separated from dangerous voltages; however do not attempt to disconnect PC cables from inverter during operation.		
<b>WARNING</b>	Always mount grid disconnection switch between micro inverter installation and grid.		
<b>WARNING</b>	There are no user serviceable parts inside Letrika micro inverter. It is strictly forbidden any intervention on micro inverter internal structure.		



## 2.3 General installation safety guidelines

The installation must be wired according to local regulations and standards where inverters are mounted.

Follow local guidelines for grid monitoring devices and other safety devices to be located between inverters and grid.

**CAUTION** Grounding of all metal parts of the construction is the responsibility of installer.

**WARNING** Micro inverters generates power from more than one source

**WARNING** When micro inverter is connected to PV module and exposed to light, dangerous voltages may appear on output in case of malfunction.

**WARNING** Inverters with damaged enclosure or wiring must not be repaired and must be returned to producer

**WARNING** It is forbidden to connect DC input of micro inverter to the battery or any other DC power supply. Solar micro inverter can be connected only to PV module.

**WARNING** Use only originally supplied cables. Use original end cap from ALTW cable producer to ensure IP67 protection on whole cable trunk.

**CAUTION** Connect circuit breaker with overcurrent protection according to PV plant power and local standards.

**CAUTION** Always fix cables to the frame. Do not allow PV and grid cables to float free.

**CAUTION** If equipment is not used as specified in this manual and other Letrika documents, protection provided by the equipment may be impaired.



## 3 Installation procedure

During installation it is a good idea to follow a check list of operations. We will describe general approach that allows installation of the inverters that is easy to manage and maintain.

### 3.1 Compatible PV modules

Letrika micro inverters are compatible with monocrystalline and polycrystalline panels with 60 and 72 cells per panel.

Thin film panels are normally not suitable because of higher panel dc voltage incompatible with micro inverter input range. However some thin film panels with output voltage of approx. 50V can still be used with Letrika micro inverters. Thin film modules have a risk of TCO corrosion. Consult the producer of thin film panels how to ground the positive or negative terminal of the PV module. Letrika Solar micro inverter 260 allows using the positive or negative grounding.

PV modules from 220Wp up to 310Wp can be connected to the inverter. Using lower power PV modules, the micro

inverter power is not entirely used, efficiency is lower and this affects the production of electricity.

When higher power PV modules are used, consider that the micro inverter can deliver approx. 300W of AC power for approx. 20 minutes at 30°C.

During selection of PV modules power consider also average and peak operating ambient temperature. From the point of view of micro inverter performances, there is no derating in performances until 65 degrees ambient temperature is reached.

Open circuit voltages ( $U_{oc}$ ) and short circuit currents ( $I_{sc}$ ) of PV modules shouldn't exceed the declared values in technical specification.

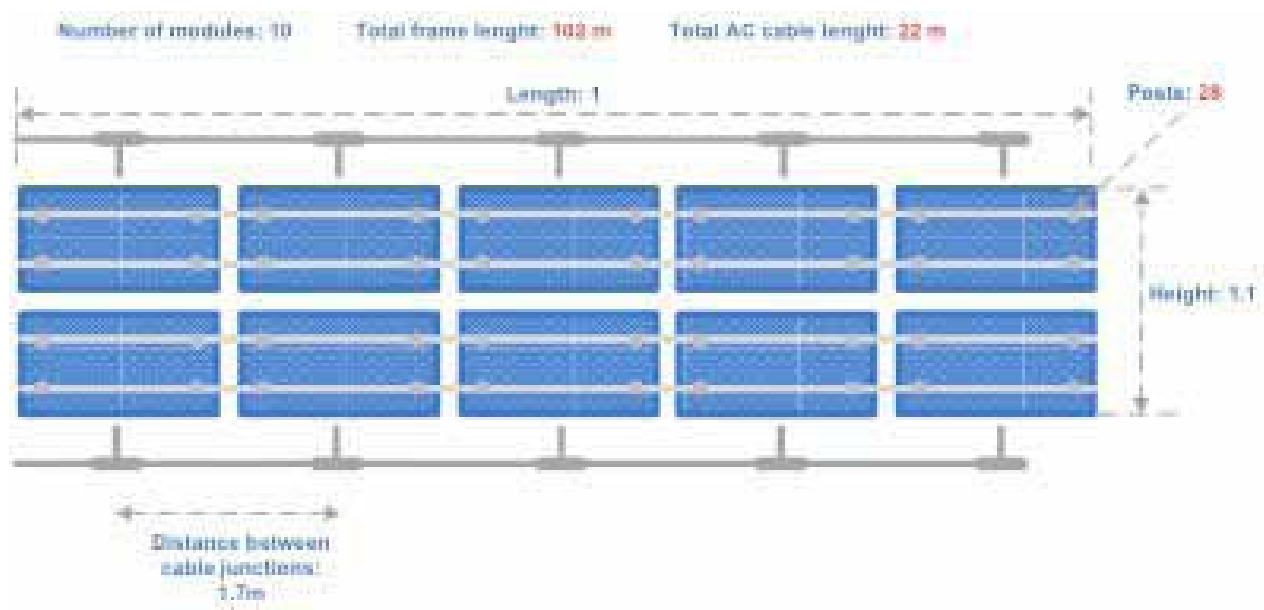
### 3.1.1 Landscape versus portrait panels placement

Portrait or landscape layout could be used when installing more PV panels.

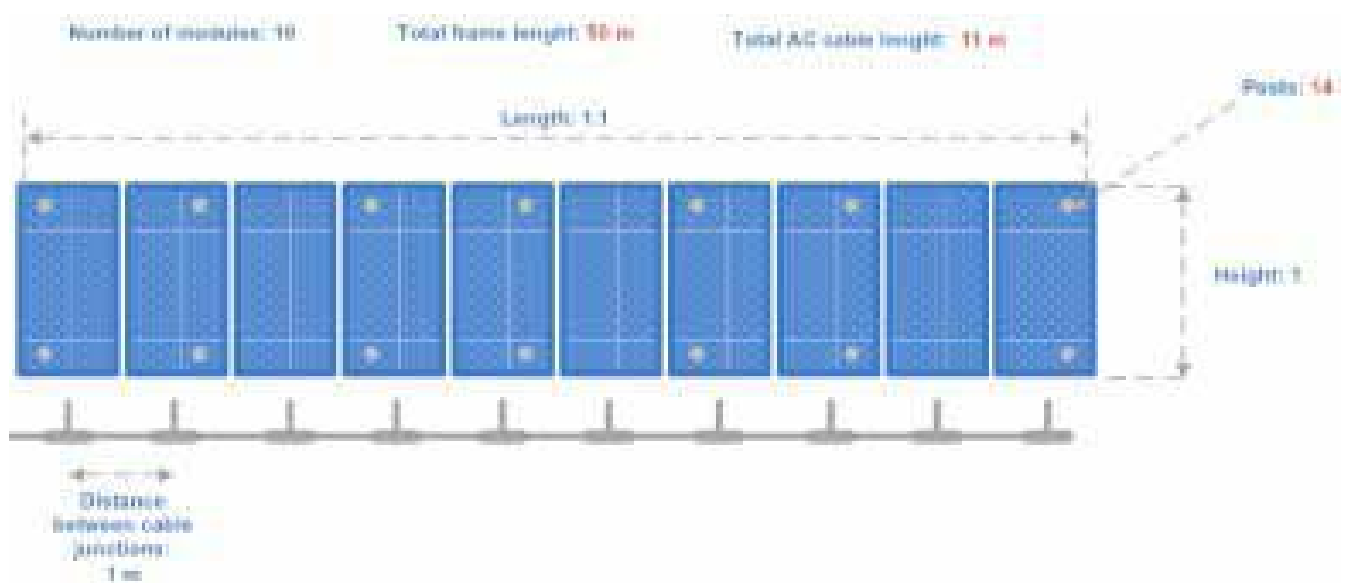
Layout of PV panels will affect the choice of trunk cable.

If the layout is portrait the distance between the connections on trunk cable are every 1,05 m.

If the layout is landscape the distance between the AC connections on trunk cable are every 1,70 m or 2,00 m.



Landscape panels orientation



Portrait panels orientation

## 3.1.2 Mounting hardware compatibility

Letrika Solar micro inverter is designed to be compatible with most standard AL frames. During frame selection few important thing must be observed.

### 3.1.2.1 Al profile selection

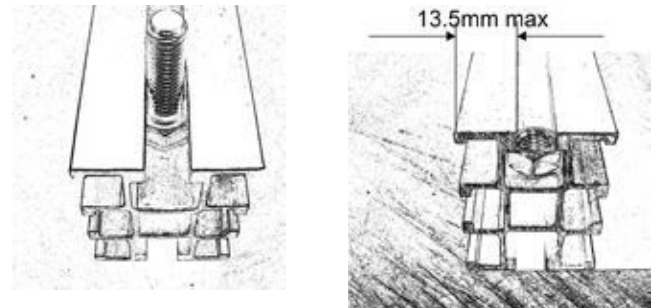
Al profile must have a T shaped groove for M8 or M6 nut.

M8 screw inserted into T shaped groove. If screw is inserted it is easier to place and fix the micro inverter. Screws must be inserted before the frame is assembled, since they can't be moved across frame junctions.

If M8 or M6 nuts are inserted into profile care should be taken during screw length selection, since long screws can damage the AL profile or they cannot fix micro inverter adequately.

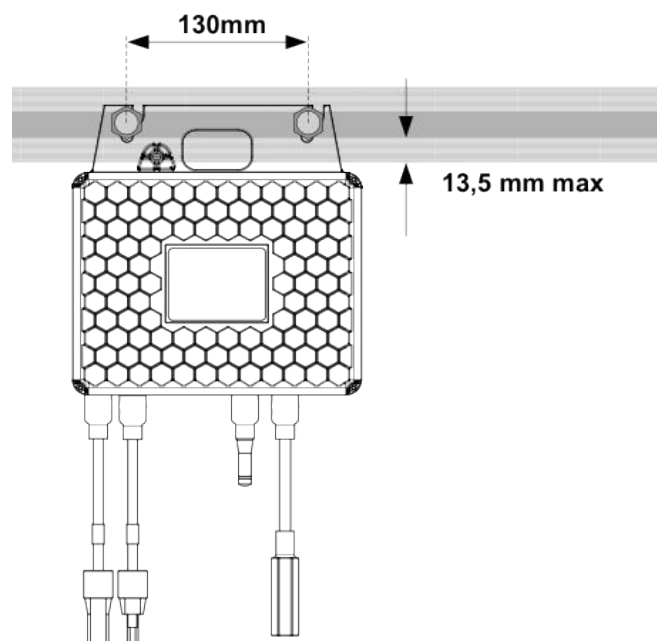
Use M8 or M6 screws and nuts. Do not use smaller or larger screws for fixing the micro inverter

Al profile width must match micro inverter fixing tab length. There are several possibilities how to mount the inverter on the profile each with advantages and disadvantages.



### 3.1.2.2 Inverter fixing screws positions

Install the mounting screws (M8 x 16) on the body of the supporting structure at intervals of 130 mm and installation of the casing by tightening the bolts to torque Nm 9. Do not over torque.



### 3.1.2.3 Inverter cooling consideration

For proper inverter operation and full performance delivery some mounting guidelines must be observed.

Although micro inverter does not need any forced ventilation and is cooled by natural heat exchange with surrounding air, it still need some air around its aluminum enclosure to cool efficiently.

We strongly suggest to place micro inverter at least 15mm below the panel surface and to leave at least 20mm between inverter and underneath surface to avoid panel heating and micro inverter overheating.

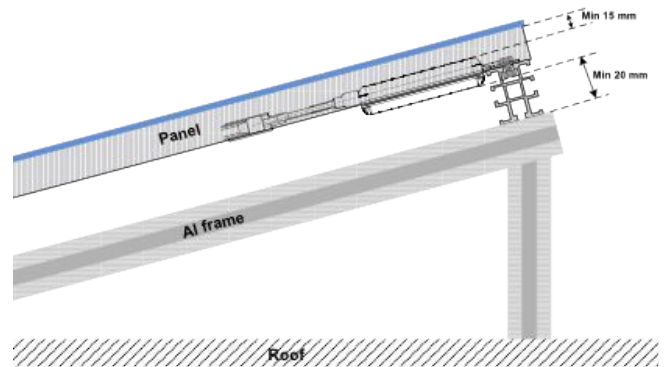
Micro inverter can be positioned above or below supporting Al frame, as indicated on drawings below. Placing micro inverter on bottom side of Al support, decrease heat transfer from micro inverter to solar panel, increasing efficiency on high ambient temperatures.

Mount micro inverter in locations, which are out of direct sunlight.

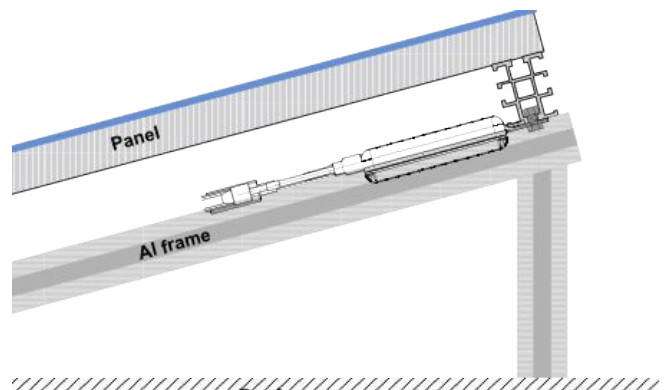
We do not recommend mounting micro inverter directly between panel and roof surface since air irculation is not guaranteed. Efficiency of the system will be decreased and the micro inverter and

the panel can be overheated if mounted like shown on bellow drawing.

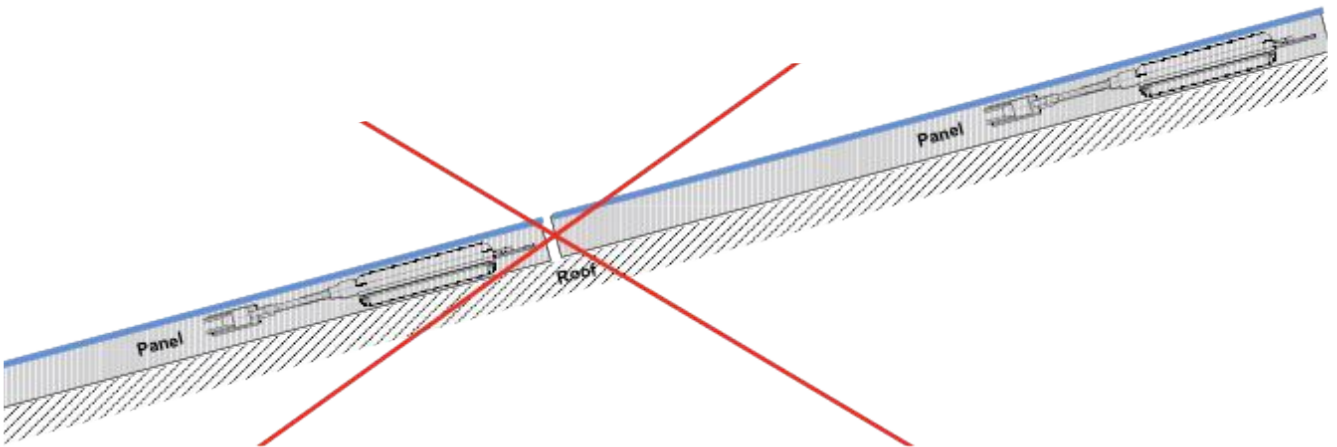
If micro inverters are mounted as showed above, warranty period is voided.



Recommended mounting for optimal heat dissipation (micro inverter on bottom side of supporting frame)

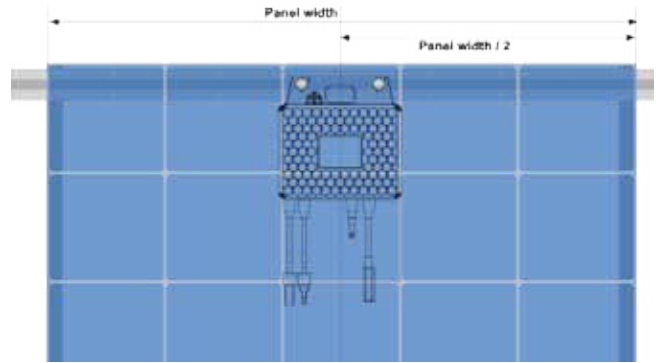


Recommended mounting for optimal heat dissipation (micro inverter on top of supporting frame)



Forbidden micro inverter mounting

It is a good practice to mount inverter in the middle of the panel width, regardless if the panel is placed in portrait or landscape position.



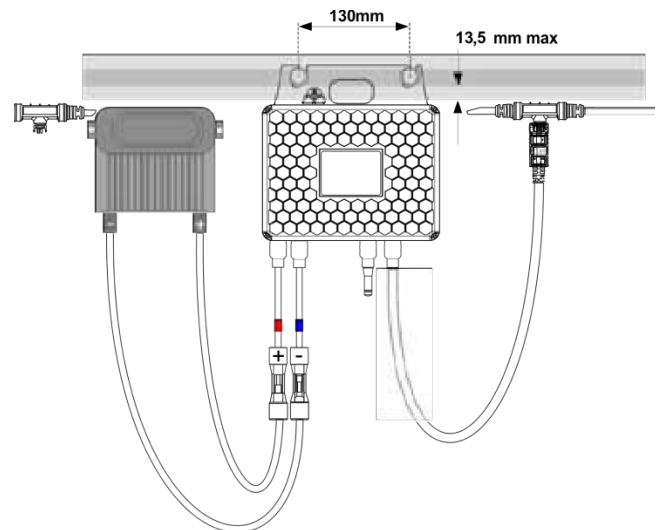
Horizontal placement of the inverter

## 3.2 Connecting cables to micro inverter

Connecting cables to micro inverter is simple. Just connect DC cables connectors into matched panel DC connectors coming from panel junction box. Push connectors together until they latch with audible CLICK.

Some DC connectors are marked with + and – engraved on plastic. Polarity is valid for panel side. On micro inverter, we placed two additional colored signs on DC wires. BLUE for DC- and RED for DC+ wire. Please take care about right polarity while connecting inverters. Before connecting the inverter measure voltage polarity on PV module.

Insert AC connector from inverter into T junction connector on the cable. Again, push connectors until audible CLICK is heard and connector is latched.



Connecting cables to micro inverter

## 3.3 Connecting micro inverter system to utility grid

Micro inverter must be connected to the utility grid in accordance with local standards and permissions.

Letrika Solar micro inverter 260 has built in interface protection system (IPS) according to VDE 4105. All frequency, voltage and anti-islanding protections are embedded inside micro inverter. Also power factor, voltage control functions are built-in. Inside micro inverter is a relay with double contacts to physically disconnect micro inverter from the grid. External IPS must be connected between micro inverters and grid if required by local standards and permission.

We strongly suggest to mount surge protection devices into roof junction box or better, to use surge protector systems that are mounted in same housing as micro inverter and can be connected to standard ALTW PT 3 wire system allowing placement of surge protections also in between micro inverters improving surge immunity.

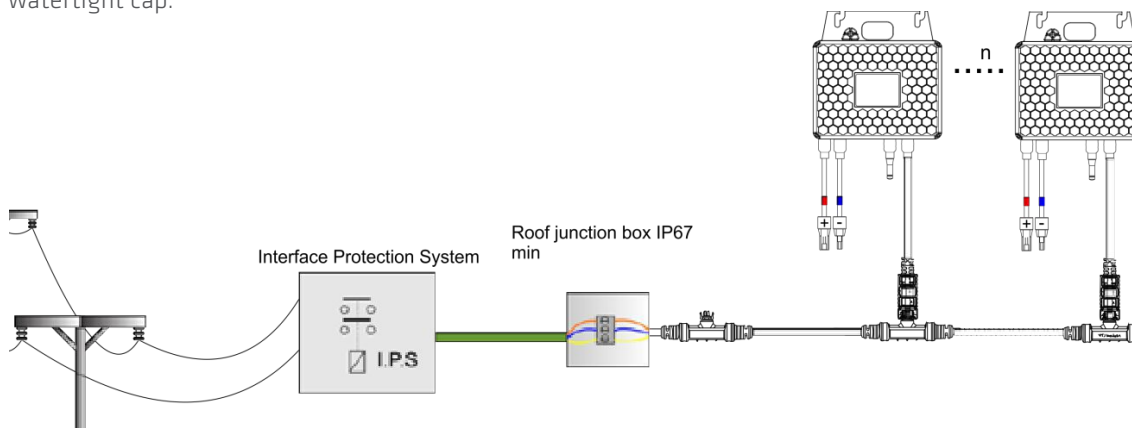
Please contact Letrika for details on surge protection devices.

### 3.3.1 Simple single phase connection with I.P.S. device

Inverters are simply connected to ALTW PT-3 trunk cable. See table 1 for maximum allowed number n of micro inverters per trunk.

I.P.S. device may vary from country to country, please check with local distributor company.

Not used T junctions on trunk cable must be covered with watertight cap.

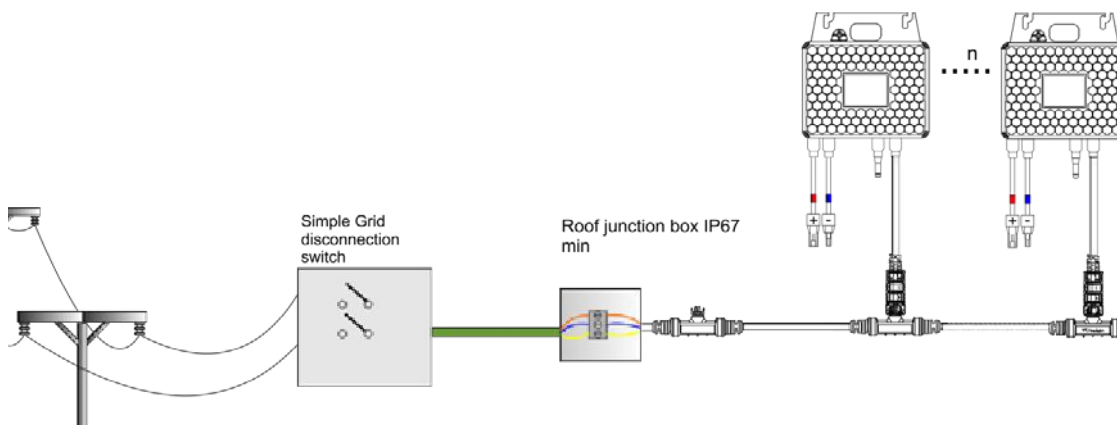


Single phase system with I.P.S

### 3.3.2 Single phase connection without I.P.S. interface to grid

Since Letrika micro inverters have built in I.P.S. according to VDE 4105 standard with incorporated disconnection relay, they can be used, if a local standard permits,

without additional I.P.S. device interfacing to grid, only grid disconnection switch must be used.

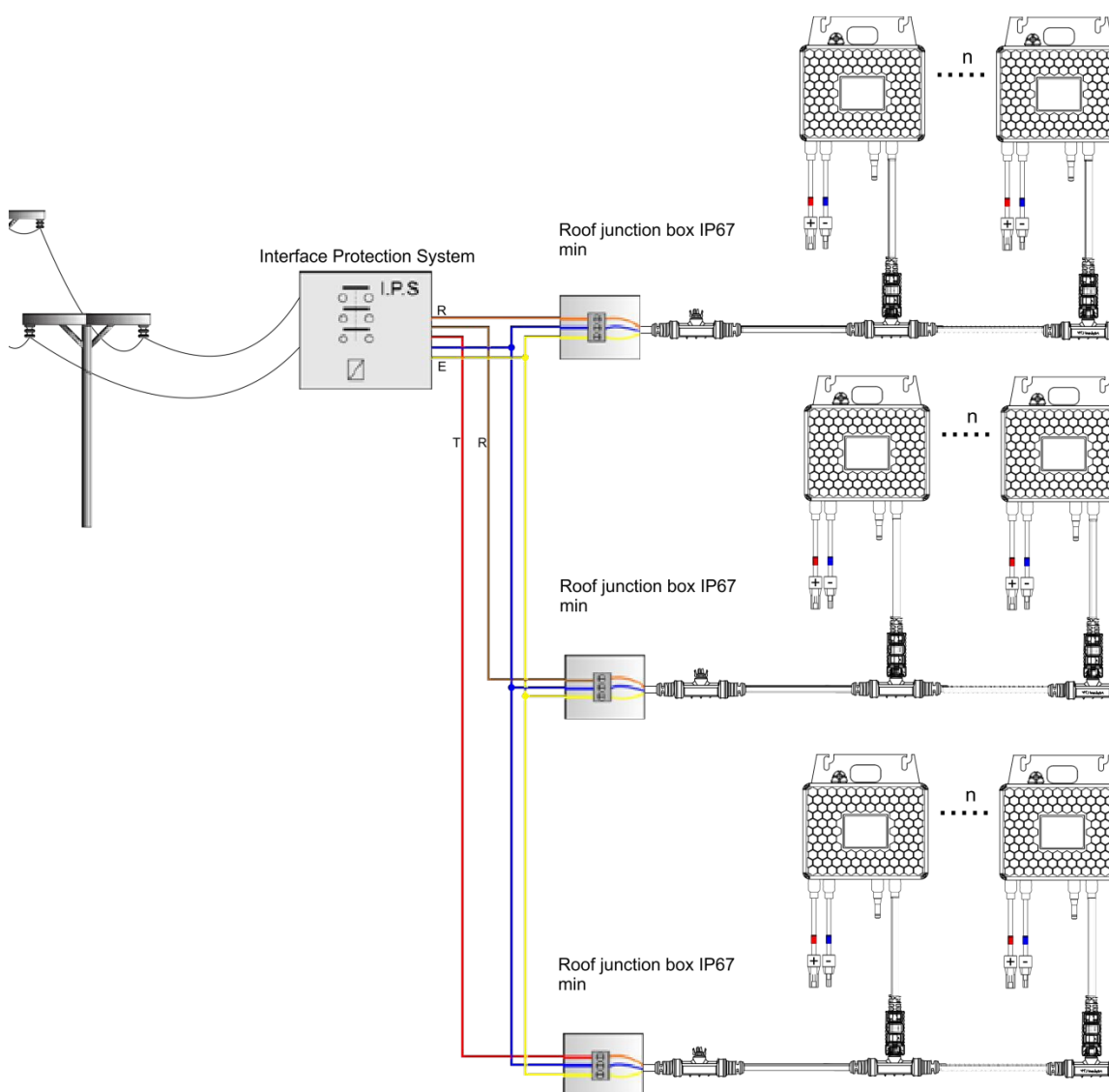


Single phase connection without I.P.S interface

### 3.3.3 Three phase connection

Micro inverters can be connected also on three phase grid system. Although they can operate even in event of one or two phase failure, it is generally not recommended, and in

some countries also forbidden to operate with one or more phases interrupted or in short circuit. It is recommended to use protection against unbalanced load.





### 3.3.4 Trunk cable extension and cable end covering

Guidelines for trunk cable extension and cable end covering are showed below. It's not allowed to extend the trunk cable above maximum number of T junctions specified in Table 1. Trunk extension is normally necessary when panels and micro inverters are mounted on different places on the roof, making difficult to connect them only by using trunk cable.

Always use original cable joiner CX-04BCM32-7002 to ensure trunk cable join point water tightness.

Insert CAP-WTCASMA2 on exposed cable end since original water tight cap ensure IP67 protection of exposed trunk cable end.

If trunk extension is done by using customer supplied cable, please note that the cable must be UV reinforced cable with cold bending 90 degrees at -40°, 90° maximum temperature.

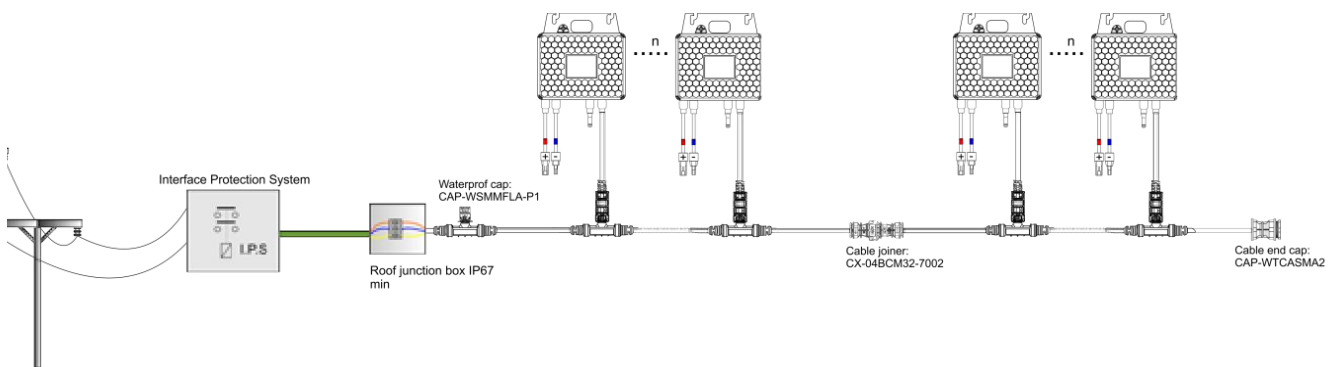


Figure 12 Trunk cable extension and cable ending



## 4 Commissioning

Commissioning should be done by technically qualified personal.

Connecting cable output AC and DC voltage input cables should be carried out in accordance with the manufacturer's instructions (AMPHENOL).

### 4.1 Preliminary checks

- Check the data on micro inverter and verify compliance of these data with grid data
- Peel the label with Serial number and attach it to the matrix in the same order as they are installed.
- When conducting the checks, ensure that the main AC disconnect switch (downstream from the system) and any other possible isolation switches are switched off position
- Ensure that all conductors and protective grounding points are connected
- Check the position of all connection cables and the tightness of all nuts and terminals
- Check the micro inverter is firmly mounted
- Ensure that all electrical safeguards have been correctly installed
- Ensure that the complete system has been checked, tested and approved in accordance with the local standards and codes

### 4.2 Sequence of operations

- Switch on the main AC disconnect switch (downstream from the system) and any other possible isolation switches
- Proceed with configuration of Gateway. Details are described in Gateway User Manual.

# 5 Troubleshooting

The operating state of the micro inverters can be monitored on the Gateway LCD. LCD shows the status of the plant on default view. In normal operation the status is »working«, it means that everything is OK.

If an internal or external fault occurred, the LCD displays status: »alarm«. Gateway stores errors in alarm list, which

can be at any time retrieved from it with web application. The inverter will not feed the grid while the alarm on LCD is present.

Only technically qualified personal may perform work on electrical installation.

VIEW:     

## ALARM HISTORY

Panel ID 	Microinverter ID 	Time 	Alarm no. 	Error
A1	494-000001EE	6. januar 2015 14:58:46	15	ERR_GRID_DISCONNECTED
A3	496-000001F0	6. januar 2015 14:58:36	12	ERR_GRID_FREQUENCY
A1	494-000001EE	6. januar 2015 14:58:35	15	ERR_GRID_DISCONNECTED

Example of Alarm history from web application

## 5.1 List of errors in alarm list

1	<b>ERR_OVER_CURRENT_SW</b>	Over current on AC side is detected by software. Possible cause is short circuit on grid lines or sudden voltage drop on grid lines. Proposed action: <ul style="list-style-type: none"> <li>• Check connecting lines</li> <li>• Check surge protections on lines</li> <li>• Check external power capacitors banks for power factor corrections</li> <li>• Scan grid voltage for deeps</li> </ul>
2	<b>ERR_OVER_CURRENT_HW</b>	Over current is detected by hardware. Possible cause is very high short circuit current, very deep voltage transients or high voltage surge spikes. Proposed action: <ul style="list-style-type: none"> <li>• Check connecting lines</li> <li>• Check surge protections on lines</li> <li>• Check external power capacitors banks for power factor corrections</li> <li>• Scan grid voltage for deeps</li> </ul>
3	<b>ERR_OVER_VOLTAGE</b>	This signal is active if DC high voltage too high. Possible cause for DC high voltage to rise above safety limits is very unstable grid with changing shadows on PV module. Proposed action: High voltage spikes from grid are transferred to DC high voltage capacitors Check grid voltage and transients



4	<b>ERR_UNDER_VOLTAGE</b>	<p>DC high voltage is too low. During operation on high output power, deep shadowing occurred. It is possible that DC voltage drops too low and it is not possible to push the current into the grid.</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• Check DC connectors</li> <li>• If under voltage is repeated on same panels, check all connections</li> </ul>
5	<b>ERR_ADC</b>	<p>Internal circuit problem Internal circuit calibration failed</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• Replace inverter</li> </ul>
6	<b>ERR_PANEL_VOLTAGE_LOW</b>	<p>Panel voltage is too low to operate. Inverter detected too low voltage on PV panel to ensure correct energy transfer to secondary side.</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• Wait panel voltage to rise up, if this error insist under heavy sun, then check panel voltage or replace inverter</li> </ul>
7	<b>ERR_OVER_TEMPERATURE_CONTROLLER</b>	<p>DC or AC side power section over temperature. Temperature on DC or AC power section reached maximum allowed temperature, approx. 90 degrees centigrade.</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• check ambient temperature is lower then 65 degrees</li> <li>• check inverter exposure to direct sun light</li> <li>• air is not circulating across inverter enclosure</li> </ul>
8	<b>ERR_PARAMETERS_CORRUPTED</b>	<p>Internal Country and other parameters corrupted. Internal FRAM memory corrupted.</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• Replace inverter</li> </ul>
9	<b>ERR_ADC_OFFSET_ERROR</b>	<p>Internal ADC offset to high. Internal analog to digital converter offset is out of adjustable range.</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• Replace inverter</li> </ul>
10	<b>ERR_INTERPROC_COM</b>	<p>CRC error in interprocessor communication. An CRC error occurred between both DSP controllers on inverter.</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• Error should reset automatically after some time, if not, replace inverter</li> </ul>
11	<b>ERR_GRID_VOLTAGE</b>	<p>Grid voltage to high or too low. Grid voltage is out of limits, according to country standard.</p> <p>Proposed action:</p> <ul style="list-style-type: none"> <li>• Too much inverters on grid line</li> <li>• Installation close to grid low voltage transformer</li> <li>• Grid without power factor correction capability</li> </ul>

12	<b>ERR_GRID_FREQUENCY</b>	<p>Grid frequency out of range. Grid frequency is out of range prescribed in standard for given country. Proposed action:</p> <ul style="list-style-type: none"> <li>• Verify grid frequency, if condition insist or this error is noticed on all inverters in installation,</li> <li>• Check for locally installed generators, other solar installations or wind turbines, which can cause frequency slipping</li> <li>• Check for islanding operation of the inverters</li> </ul>
13	<b>ERR_SYSTEM_SW</b>	<p>Firmware CRC error. Inverter firmware auto test detected firmware CRC error in one of DSP controllers. Proposed action:</p> <ul style="list-style-type: none"> <li>• Replace inverter</li> </ul>
14	<b>ERR_COMMUNICATION_TIMEOUT</b>	<p>No communication between DSP processors. Main DSP processor can not see any communication from DCDC DSP controller. Proposed action:</p> <ul style="list-style-type: none"> <li>• Wait inverter to reset during the night. If condition persist, replace inverter</li> </ul>
15	<b>ERR_GRID_DISCONNECTED</b>	<p>No grid Grid is disconnected or internal PLL can not catch any valid sinusoidal signal Proposed action:</p> <ul style="list-style-type: none"> <li>• No grid connected, very distorted grid current, very low grid voltage.</li> </ul>
16	<b>ERR_IGRID_DC_COMPONENT</b>	<p>DC current injected to grid is too high. Internal circuit detected too high DC current injected to grid. If condition is rare, than some transients can cause inverter to trigger this error. Proposed action:</p> <ul style="list-style-type: none"> <li>• If condition repeats continuously, then check other sources on the grid that might cause DC current in it, restart inverter, or if condition persists, replace inverter.</li> </ul>
17	<b>ERR_FAST_LOOP_INT</b>	<p>Internal firmware errors, safety shut down. Proposed action:</p>
18	<b>ERR_SLOW_LOOP_INT</b>	<ul style="list-style-type: none"> <li>• If problem persist, replace inverter</li> </ul>
19	<b>ERR_STATE_MACHINE</b>	



## 6 Storage

The equipment must be stored in suitable warehouses. After long period of storage clean accurately micro inverter before installing it. Check the contacts that are not oxidized.

## 7 Disposal

The owner of micro inverter must dispose it in accordance with local directives and regulations. It is forbidden to deposit electrical and electronic equipment as municipal waste.

The complete procedure after lifetime should comply with Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

Micro inverter can be send back to manufacturer or provider for disposal. Delivery costs in this case are covered by sender or owner.

Component and material identification:

- Housing Aluminum
- Filler - PU
- Gaskets and seals Rubber / Teflon / Viton
- Electrical cables Copper / Rubber
- Conduits Polyethylene / Nylon
- HF Transformer - Fe

## 8 Maintenance

Micro inverter should be inspected and cleaned if necessary at least once a year. It is recommended to regularly check for signs of damage. Regularly check for dust, dirt and moisture. If necessary clean the device. For cleaning use compressed air, a vacuum cleaner or special brushes.

Although original cable system used on Letrika micro inverters is state of the art with extra-long live, resistant to water, UV, temperature, oil and moisture, we suggest to check connections between inverters every year. Special attention should be placed on junction boxes where most of bad connections and problems can occur.

## 9 Registration and warranty

The standard product warranty for Solar Micro inverter 260 and is 5 years. It is possible to extend the system warranty to 7 years by registering to Letrika Sol at [www.letrikasol](http://www.letrikasol).

sol. By registering also Limited warranty for 25 years becomes valid.

All warranty conditions are available on the web side.

## 10 Appendix

### 10.1 Technical specification

DC OPERATING PARAMETERS		
Maximum DC input power	310 Wp	
Maximum DC input voltage	60 V	
MPPT voltage range	22-55 V	
Operating range	15-60 V	
Start-up DC input voltage	21 V	
Maximum DC input current	10.5 A	
Short Circuit DC input current	12 A	
Panel ripple current	50m A	
DC connection system	Amphenol MC4	
AC OPERATING PARAMETERS		
Nominal apparent power	290 VA	
Nominal real power	260 W	
Nominal reactive power	128 VAR at	cosϕ=0,9
Grid voltage range	185-270 V	1ph
Maximum AC current	1.26 A	
Nominal frequency	50 Hz	47.5..50.5Hz
Peak Power 15 min	290 W	limited with ambient temperature
Power factor range	0.8-1	<ul style="list-style-type: none"><li>• Dynamic with power</li><li>• Dynamic with voltage-frequency</li><li>• Fixed between 0.8 to 1</li></ul>
Maximum overcurrent protection	2 A	
Inverters per trunk	20	
AC connection system	Amphenol LTW SPS 03	connection system UL & VDE approved



AC PROTECTION		
Anti-Islanding	According to local standard	
Overcurrent	2A	
PERFORMANCE		
Peak Efficiency	96,1%	
CEC Efficiency	95.5%	
EURO Efficiency	95,3%	
MPPT tracking Efficiency	99.9%	
Stand-by consumption	0W	
ENVIRONMENTAL		
Ambient temperature	-40 ... +65 °C	no derating
Relative humidity	0..100%	
Ingress Protection Rating	IP 67	
Maximum altitude	2000m	
Noise	30db(A)@1m	
Cooling	Natural	
Dimensions	209x243x38mm with brackets	
Mounting brackets	M8x16, distance 130 mm	
Weight	2200g	
Housing	Die casted aluminium	
Communication	WMBUS	EN 13757-1 ... 5
Lifetime expectancy	25 years	
Limited Warranty	25 years	
Standards	VDE 4105	
	CEI 0-21	
	EN 62109-1	
	EN 62109-2	
	EN 61000-6-3	
Isolation Level	HF transformer	reinforced insulation
Safety class	I	
Overvoltage Category	II (input DC) III (input AC)	

## 10.2 Certificate

Solar Micro Inverter 260 was tested in accreditation laboratory according to international standards.

Certificate can be downloaded at: [www.letrikasol.si](http://www.letrikasol.si)



## 10.3 Identification and ordering code

Ordering code:

AEI-1101-S-C70-P260-F50-U230-VDE-ALTW-G




Where:

AEI	Family name
1101	Family member
S	Input type – S is for solar photovoltaic DC input
C70	Cells on PV panel
P260	Output power 260W
F50	Output frequency 50Hz
U230	Output voltage 230Vac
VDE	Settings according to standard VDE4105, other CEI for CEI-0-021, G83, CSL
ALTW	type of AC connector
G	for grid connection

### SOLAR MICRO INVERTER 260

P/N: 11.261.005 AEI1105

S-C60-P260-F50-U230-AS-ALTW-G

		
<b>P<sub>max</sub>:</b> 310 Wp		<b>U<sub>n</sub>:</b> 230 V
<b>U<sub>max</sub>:</b> 60 V		<b>f<sub>n</sub>:</b> 50 Hz
<b>U<sub>MPPT</sub>:</b> 21...55 V		<b>S<sub>n</sub>:</b> 290 VA
<b>I<sub>max</sub>:</b> 10.5 A		<b>P<sub>n</sub>:</b> 260 W
<b>I<sub>sc max</sub>:</b> 12.5 A		<b>Q<sub>n</sub>:</b> 125 VAr
		<b>I<sub>n</sub>:</b> 1.15 A

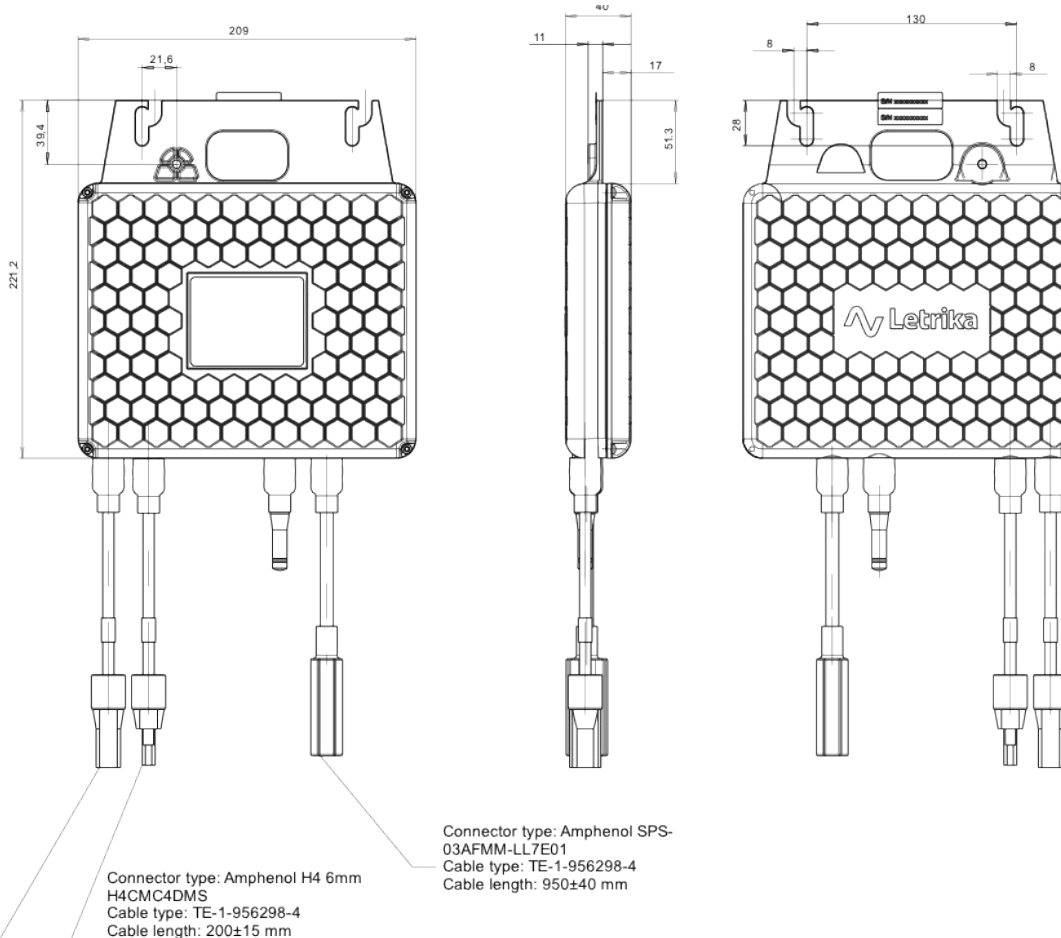


 **Letrika**



AS4777  
Made in Slovenia

## 10.4 Dimensions



Connector type: Amphenol H4 6mm  
H4CMC4DMS  
Cable type: TE-1-956298-4  
Cable length: 200±15 mm

Connector type: Amphenol SPS-  
03AFMM-LL7E01  
Cable type: TE-1-956298-4  
Cable length: 950±40 mm

Connector type: Amphenol H4 6mm  
H4CFC6DMS  
Cable type: TE-1-956298-4  
Cable length: 200±15 mm

## 10.5 Compatible dc connector systems

PV connectors are compatible with MC4 standard connectors. On request, other types of connectors are available. Amphenol LTW H4 connection system

## 10.6 Compatible AC connector system

Amphenol ALTW connection system is composed from one single AC cable from micro inverter and trunk cable where up to 20 inverters can be connected. Both AC cable and the trunk are equipped with locking connectors that can be separated by using special unlock key and they are IP67 rated.

Reliability, current capability and lifetime are considerably increased by using direct trunk connector and cable molding technology and by using insulation displacement main cable contacting, without interruption of main cable.

Two types of cables are available UL and VDE approved, while connectors are always the same. Cables and plastic materials are chosen and tested under most harsh conditions imaginable and they are UV, salt fog, oil, temperature and bending resistant.

Please, do not cut, disassemble or modify connectors and cables. Do not use matching products that are not produced by ALTW since cable performances can be altered and possible dangerous situations may occur.

In addition to two basic connectors, some more additional connectors are available for cable ending or joining.

### 10.6.1 Trunk cable data

Very important is to choose the right trunk cable pitch, depending on panel dimensions and orientation.

Consider that also maximum number of micro inverters per trunk change with connectors pitch. See bellow tables and drawings for details.

Trunk cable ID:	Panels orientation:	Max. number of T connectors on trunk :
PT-3-4A-105-00-020-EU	Portrait	20
PT-3-4A-170-00-018-EU	Landscape-170 cm panels	18
PT-3-4A-205-00-017-EU	Landscape-205 cm panels	17
PT-3-4A-105-00-020-UL	Portrait	20

Table 1 Trunk cable types and maximum number of micro inverters per trunk

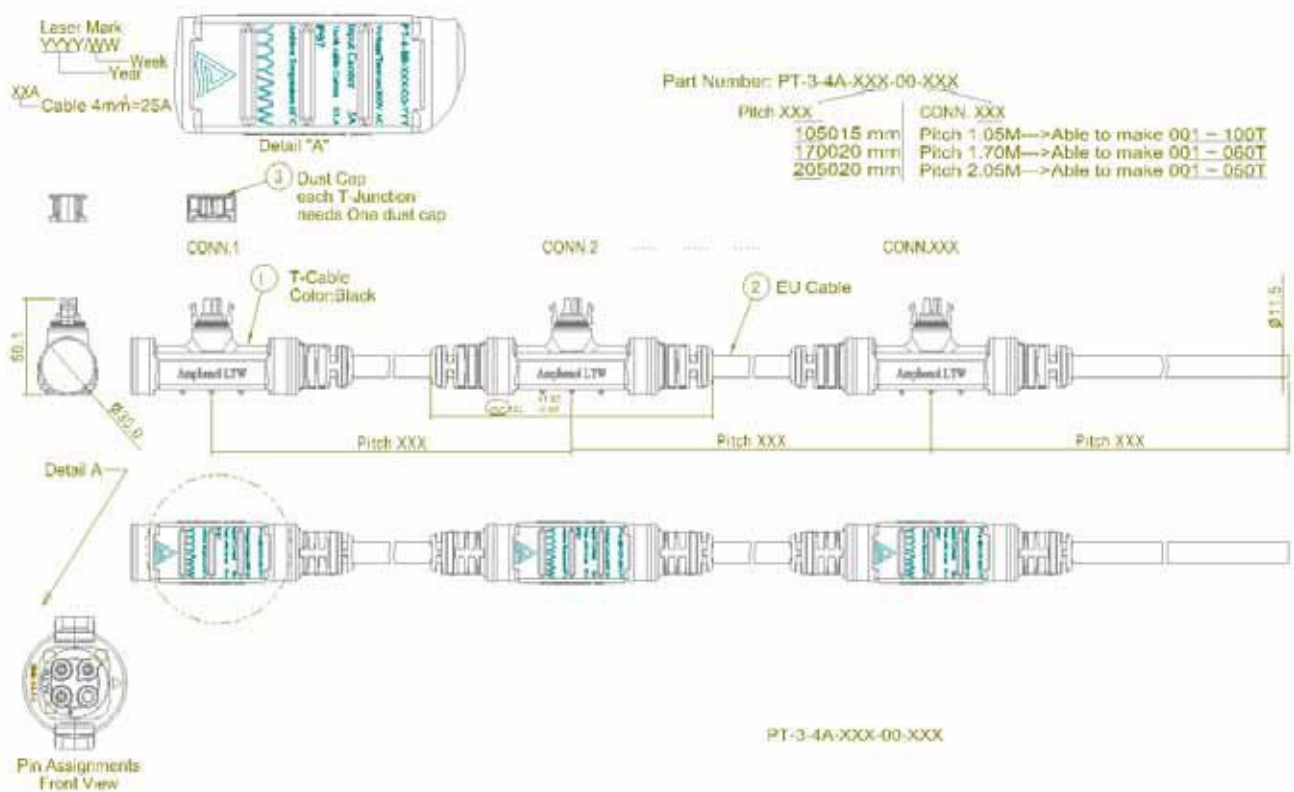


Figure 13 ALTW trunk cable drawing

## 10.6.2 Accessories

For easier waterproof cable elongation end ending, some additional accessories are available:

### 10.6.2.1 Waterproof cap

Waterproof cap is used as watertight cover on unconnected T junctions on trunk cable.

White plastic cap originally attached on T junctions IS NOT watertight; it is there only for dust and mechanical protection during transport and installation. In case some T junctions are left unconnected, use this cap to water tight the junction.

CAP-WSMMFLA-P1

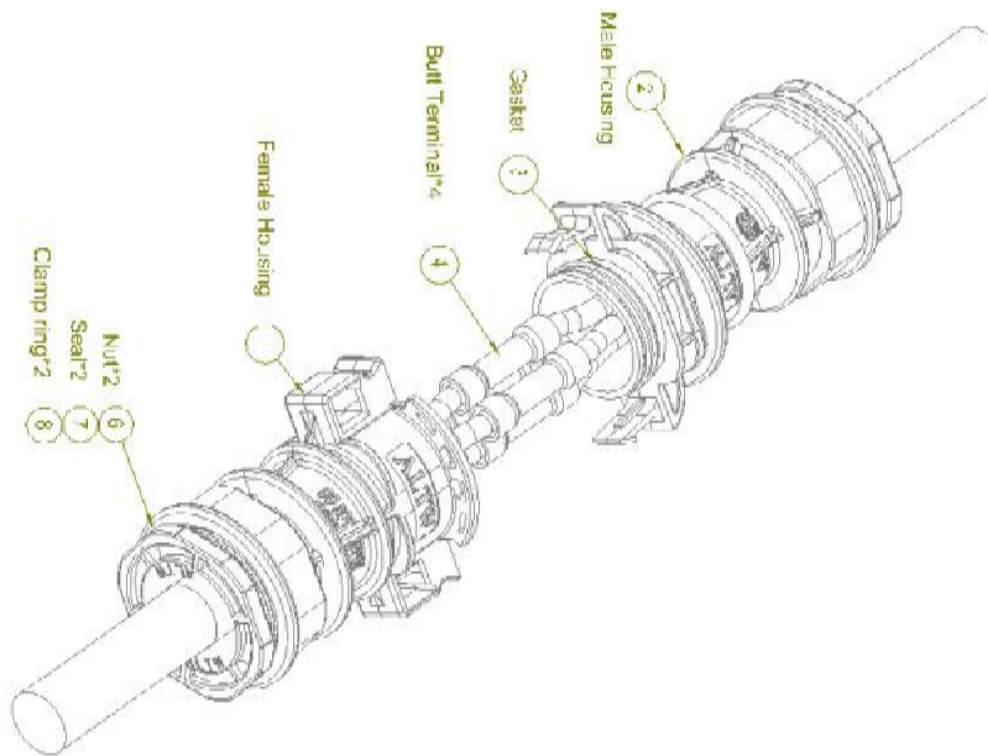
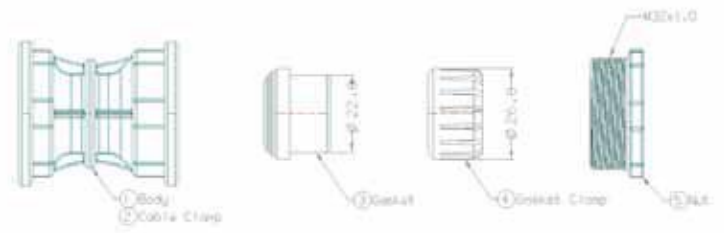


### 10.6.2.2 Cable end cap

Cable end cap is used for watertight closing of exposed cable end. Simply push the cable into end cap, the wires inside the cable are automatically separated to avoid short circuits and tight the nut.

Always use original trunk cable with this end cap.  
Waterproofness is not guaranteed with other cable types

CAP-WTCASMA2



### 10.6.2.3 Cable joiner

Cable joiner is used to join two ends of trunk cable. It is simple to use and after assembled, IP67 protected cable joining tool.

To assemble two cable ends together, please consult bellow picture

CX-04BCM32-7002



# 11 Contact

Letrika Sol d.d. is a joint venture between Cosylab d.d. and Letrika d.d.

## Headquarters

**Letrika Sol d.o.o.**

Vrtobenjska 64  
5290 Šempeter pri Gorici  
Slovenia

E: [info.sol@letrika.com](mailto:info.sol@letrika.com)  
[www.letrikasol.com](http://www.letrikasol.com)  
T: 00386 5 339 4262



**SMS Metering Ltd/SolarCorner**

41 London Road, Castle Court, Reigate RH2 9RJ

TEL: 0845 604 7244

E-mail: [sales@smsmetering.co.uk](mailto:sales@smsmetering.co.uk)

Web: [www.smsmetering.co.uk](http://www.smsmetering.co.uk)