SolarEdge Polyphase Backup Switchboard

Concept of Operation

The SolarEdge Polyphase Backup Switchboard has been designed by TROPAC in conjunction with SolarEdge Australia, it is designed to coordinate the single-phase loads of a property in the event of a grid failure.

Any 3Ph loads of the property are to remain wired upstream of this device. When the grid disconnects any 3ph loads of the property will lose AC supply and will de-energize.

In normal grid operation, the single-phase load supplied from the SolarEdge Polyphase Backup Switchboard will operate in their normal phase synchronized arrangement.

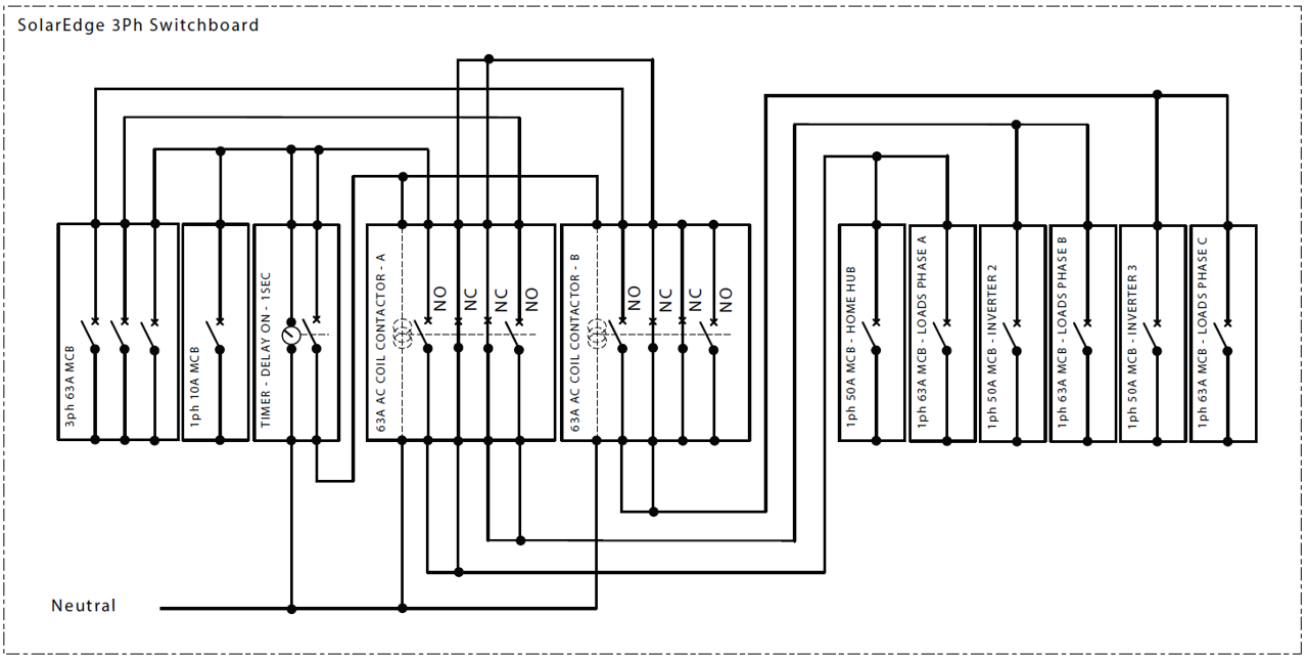
When the grid fails, the SolarEdge Polyphase Backup Switchboard will isolate itself from the grid supply.

The single-phase loads fed from the SolarEdge Polyphase Backup Switchboard will also de-energize.

After approximately a 3-second delay, the SolarEdge Home Hub inverter, via the monitoring and control of the SolarEdge Backup Interface, will re-supply AC power as it will now re-energize in grid forming mode.

At this stage, all of the single-phase loads, and inverter connections, will be merged into a single-phase synchronization.

When the grid comes back on, the single-phase loads fed from SolarEdge Polyphase Backup Switchboard disconnect for approximately 5 seconds before being automatically reconnect to the grid to ensure that each phase will self-synchronize back to its relevant phase.



WARNING!

Ensure that all conductors are de-energized and isolated before making any electrical connections.

3rd Party (non-SolarEdge) inverters are not supported.

The genertor input conenction into the SolarEdge Backup Interface is not supported.

Grid Supply Connections

The SolarEdge Polyphase Backup Switchboard has a maximum rating of 63A and should be installed no greater than 20m from the AC supply.

It is important to ensure that the correct cables are used for normal operation (supplying the single loads while allowing for the export of inverter generation back to the main switchboard).

As the MEN connection in the Main Switchboard is to remain, it is important to ensure that the Neutral and Earth conductors from the SolarEdge Polyphase Backup Switchboard are sized to allow for each of the three single-phase circuit and inverter circuits.

Assuming that three 10kW SolarEdge inverters are installed then ensure that the following cable sizes are used.

- **ACTIVE CONDUCTORS** - Cable size = 25mm CSA.
- **NEUTRAL CONDUCTOR** - Cable size = 16mm CSA.
- **EARTH CONDUCTOR** - Cable size = 16mm CSA.

Loads (Single Phase) Connections

The three single-phase load supplies from the SolarEdge Polyphase Backup Switchboard each have a maximum output rating of 63A.

Cables should be sized correctly by the installer based on the maximum demand calculation of each of the circuits and calculated in accordance with AS/NZS 3008.

SolarEdge Inverter Supply Connections

The SolarEdge Polyphase Backup Switchboard has been designed to accept three 10kW single-phase inverters (one per phase). Each has a maximum AC rating of 45.5A when in grid-connect mode.

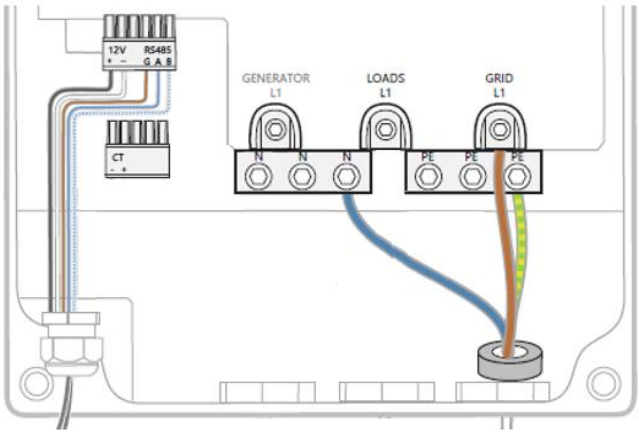
Assuming a route length of 10m from the inverter/s to the SolarEdge Polyphase Backup Switchboard and a 1% voltage drop the following cable sizes using V-90 standard twin core and earth cable is recommended.

- **ACTIVE CONDUCTORS** - Cable size = 10mm CSA.
- **NEUTRAL CONDUCTOR** - Cable size = 10mm CSA.
- **EARTH CONDUCTOR** - Cable size = 4mm CSA.

SolarEdge Backup Interface Connection

To enable the SolarEdge Home Hub inverter being able to switch into backup mode, the installation of the SolarEdge Backup Interface is a prerequisite component when installing the SolarEdge Polyphase Backup Switchboard.

Unlike conventional single-phase backup installations, the SolarEdge Backup Interface does not supply any power directly. Therefore, only the grid supply connection shall be made from the SolarEdge Polyphase Backup Switchboard via the dedicated 10A MCB.



Assuming the SolarEdge Backup Interface is 10m from the SolarEdge Polyphase Backup Switchboard, the following cables sizes are recommended.

- **ACTIVE CONDUCTORS** - Cable size = 2.5mm CSA.
- **NEUTRAL CONDUCTOR** - Cable size = 2.5mm CSA.
- **EARTH CONDUCTOR** - Cable size = 1.5mm CSA.

Backup Interface Communication Cable Connection

For setting up the Backup Interface, for backup operation (via the SolarEdge Single-Phase Home Hub Inverter only), a communication connection between the SolarEdge Backup Interface and the inverter needs to be made.

Use the following cable types:

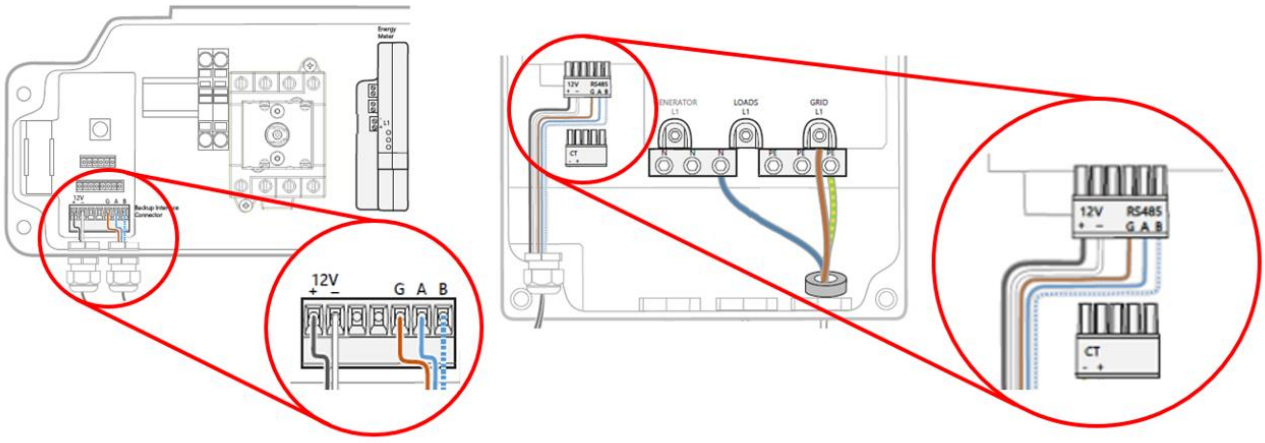
- **COMMUNICATION** - CAT6

WARNING!

Read carefully all handling and safety instructions in the installation guides that comes with the Backup Interface and the inverter.

WARNING!

Before connecting the Backup Interface to the inverter, ensure the battery and inverter power is off.



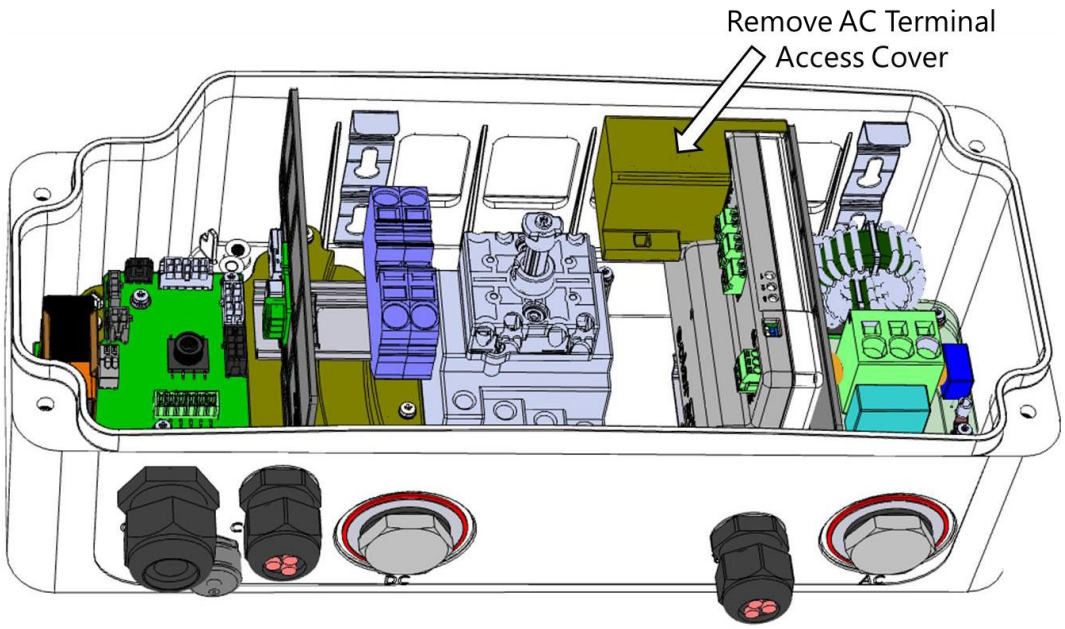
- CT Connections

  Do not use the CT connections inside the Backup Interface.

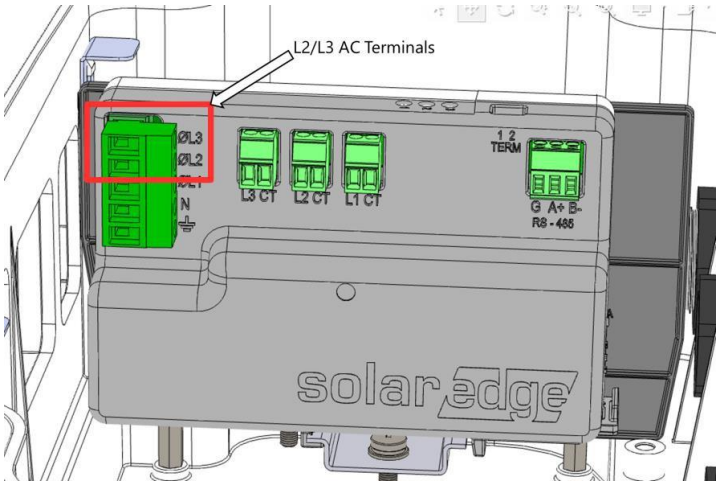
SolarEdge Home Hub 3Ph Metering Voltage Connections

As metering is required for a dual or 3Ph site configurations, the following procedure is required to enable the additional voltage references to the SolarEdge Home Hubs inbuilt Modbus meter.

To prepare the installation for use at a 3Ph site:



1. Remove the meter's AC terminal access cover.
2. Connect the additional AC conductors from the AC supply as required.



3. Replace AC terminal cover.
4. Fit additional current transformers as required.

Metering Connections for Multiple Home Hub Inverter Sites

When sites are being installed with multiple Home Hub inverters in leader/follower configuration, only the leader inverter requires a metering connection.

The Home Hub inverters come with a pre-installed Modbus meter, any follower inverter will have to have this meter either disabled and removed via SetApp, or alternatively physically disconnected inside the DCD by unplugging the RS485 terminal prior to turning on the inverter.

Connecting Multiple Inverters (Leader/Follower) via RS485

Before connecting multiple inverters, make sure your inverters' firmware version supports this feature. For further information, contact SolarEdge support.

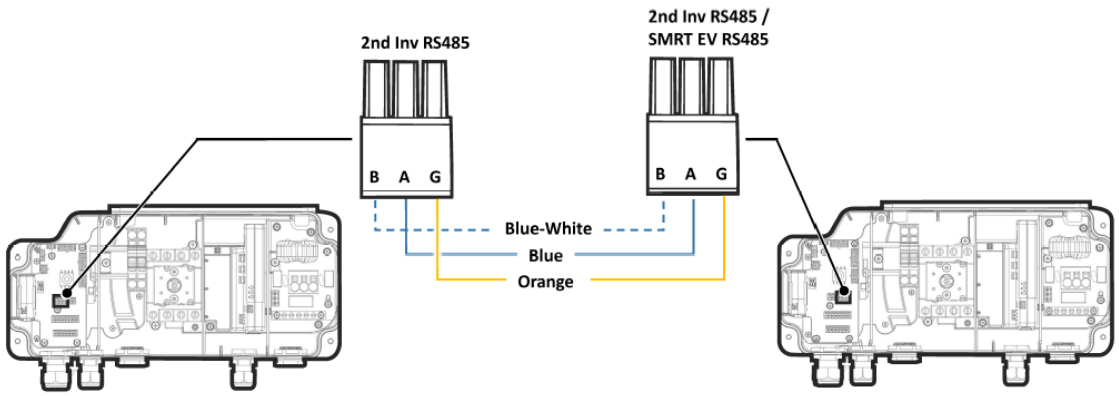
You can add 3 inverters to the SolarEdge Polyphase Backup Switchboard, one per each of the backup phases. It is possible to add two additional SolarEdge Single-Phase Genesis or Single Phase SolarEdge Home Hub Inverters.

When connecting multiple inverters, use the following cable types:

- **COMMUNICATION** - Cable size = 0.25mm 600V insulated CSA cable or CAT6.

→ To connect an additional SolarEdge Home Hub Inverter

1. Connect the Leader SolarEdge Home Hub inverter which would be wired to the L1 phase in the SolarEdge Polyphase Backup Switchboard, to the Backup Interface, as previously explained.



2. In both inverters, pass the communication cable through Communication Gland 2.
3. In the Follower inverter, connect the cable to the 2nd Inv RS485 connector.
4. In the Leader inverter, connect the cable to either the 2nd Inv RS485 connector or the SMRT EV RS485 connector.
5. Pull the cables lightly to make sure they are properly connected.
6. Close the communication glands of 5.5 N*m.

→ To connect an additional SolarEdge Genesis Inverter

In the SolarEdge Genesis inverter, connect one end of the communication cable to the RS485-1 connector on the communication board.

Pass the other end of the communication through Communication Gland 2 of the SolarEdge Genesis inverter.

Loosen the screws of pins A(+), B(-), and G on the left of the RS485 connector (RS485-1).

Connect the cable to the 2nd Inv RS485 connector on the communication board.

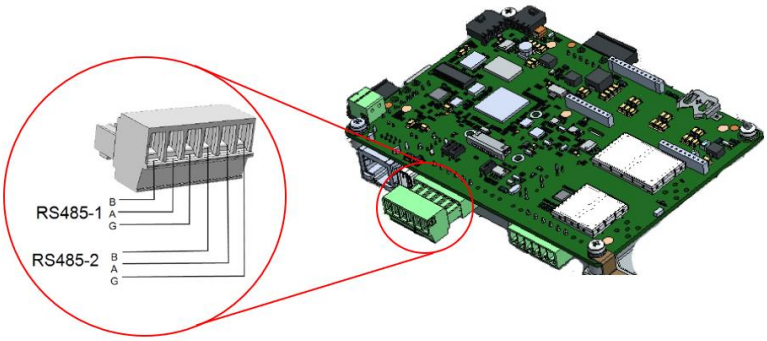
Insert the wire ends into the B, A and G opening on the connector. (You can use any colour wire for each of the B, A and G connections, as long as:

The same colour wire is used for all A pins the same colour for all B pins and the same colour for all G pins

The wire for G is not from the same twisted pair as A or B.

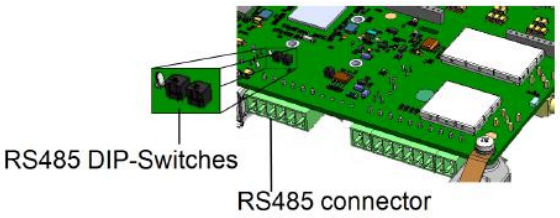
Pull the cables lightly to make sure they are properly connected.

Close the communication glands of 5.5 N*m.



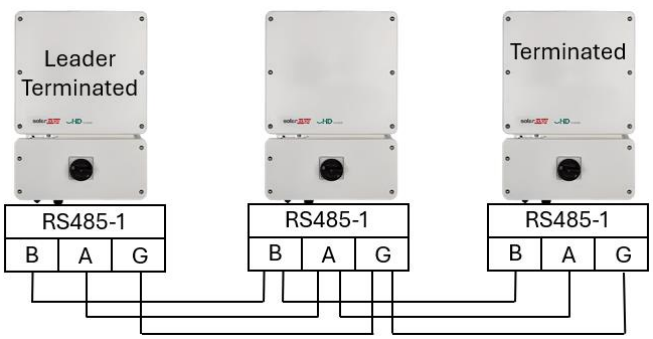
→ Terminate the Leader / Follower arrangement.

Terminate the first and last SolarEdge inverter in the chain. The inverter can be terminated by switching on (up) the left DIP switch on the communication board.



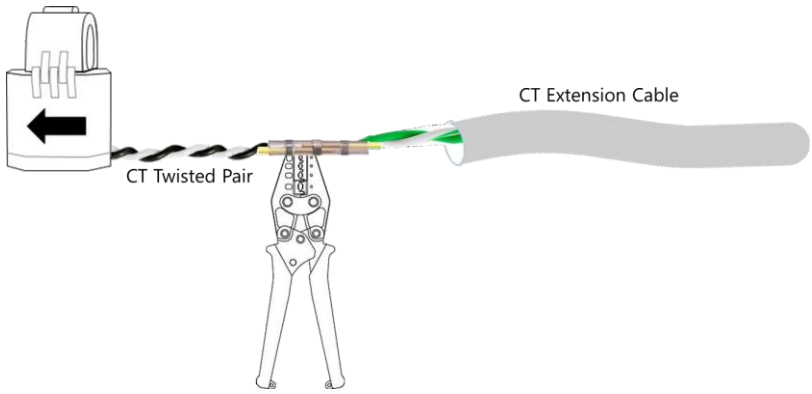
Only the first and last SolarEdge inverter in the chain must be terminated. In the other inverters in the chain, the DIP switch must be in the off (down) position.

For creating an RS485 bus, connect all B, A and G pins in all inverters.



Current Transformer (CT) Installation

The SolarEdge Home Hub inverter has a built-in Modbus meter within the DC Connections module (DCD), in most cases when the CTs are installed within the meter board the CT connection will need to be extended. A CAT6 shielded extension cable shall be used to connect the CT twisted pair to the meter. The extension cable should be routed via a dedicated conduit.



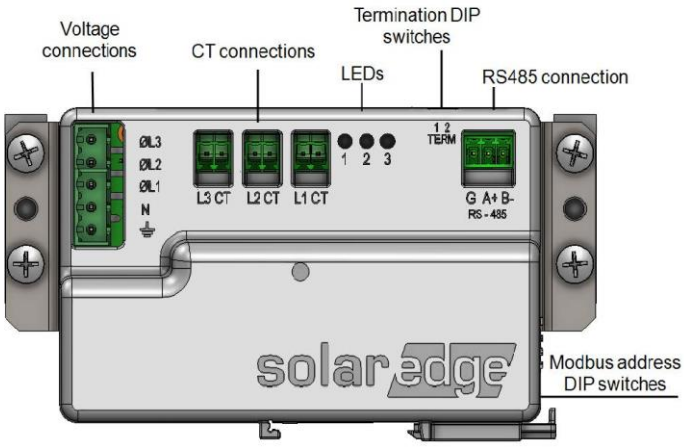
Do not use the method of twisting the wires and taping them together. This type of connection is not reliable, and the wires may eventually disconnect from each other.

CT's can be extended up to 100m. Connect the grid AC wiring – L and N – to the designated terminal blocks.

Three Phase Inverter Metering Connections

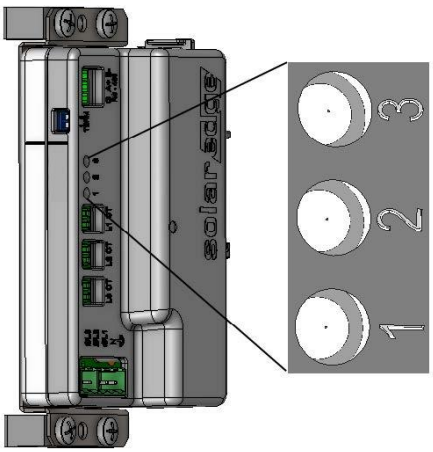
When metering a 3Ph site SolarEdge offers two metering options, one being via the Mobus meter (in-built into the SolarEdge Home Hub inverter or installed separately in the Main Switchboard), the second option being the SolarEdge Inline meter.

→ Modbus meter interface



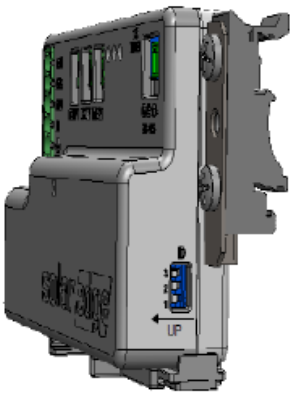
- **Voltage Connections:** - for connection to the grid: Wye: L1, L2, L3, N, Ground.
- **CT Connections** - (L1 CT, L2 CT, L3 CT): for connection to current transformers.
- **RS485** - for connection to the inverter.

- **LEDs** - On the front of the unit to indicate current status.



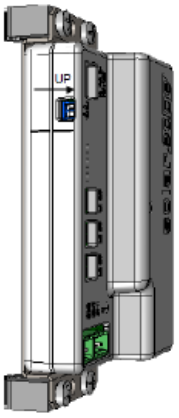
LED #	LED	Function	Indication
1	Green	Operational status	Blinking ON/OFF - normal operation
2	Yellow	RS485 Modbus communication	Blinking ON/OFF - communication OK
3	Yellow	Energy management	Single blink when the meter reads an energy change of ~1 kwH.

- **Modbus address DIP switches**- (ID 1, 2, 3): The Modbus address DIP switches are used to set the Modbus address of the meter. The addressing options are listed in the table below.



Modbus Address	Switch 1	Switch 2	Switch 3
0	Down	Down	Down
1	Up	Down	Down
2 (factory default)	Down	Up	Down
3	Up	Up	Down
4	Down	Down	Up
5	Up	Down	Up
6	Down	Up	Up
7	Up	Up	Up

- **Termination DIP switches**- (TERM 1, 2): used to set RS485 termination. termination options are listed in the table



RS485 Termination	TERM 1	TERM 2
Terminated	Down	Down
Not Terminated (factory default)	Up	Up

below.

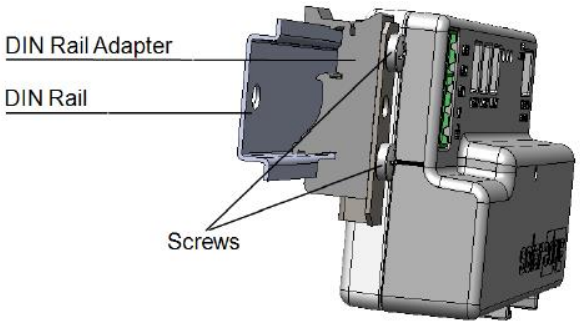
→ **Modbus meter installation:**

AC wire specifications: 1.3 to 2.0 mm diameter stranded wire, 600 V, type THHN, MTW, or THWN.

RS485 wiring specifications:

- Cable type: Min. 3-wire shielded twisted pair (a 4-wire cable may be used)
- Wire cross-section area: 0.2- 1 mm^2 (a CAT6 cable may be used)
- If using a cable longer than 10 meters in areas where there is a risk of induced voltage surges by lightning, it is recommended to use external surge protection devices.

- **Mount on a DIN rail using clips**- The supplied kit includes two DIN-rail adapters and four screws.



Attach the DIN-rail adapters to the DIN rail.

Connect the meter to the DIN-rail adapters and fasten them using the supplied screws.

- **Wiring the meter**

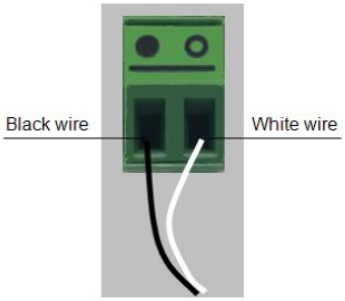
Verify that power is OFF before making connections.

Connect the AC side wires (meter input) to the grid connectors on the meter.

Connect the CT wires to the three 2-pin terminals on the meter.

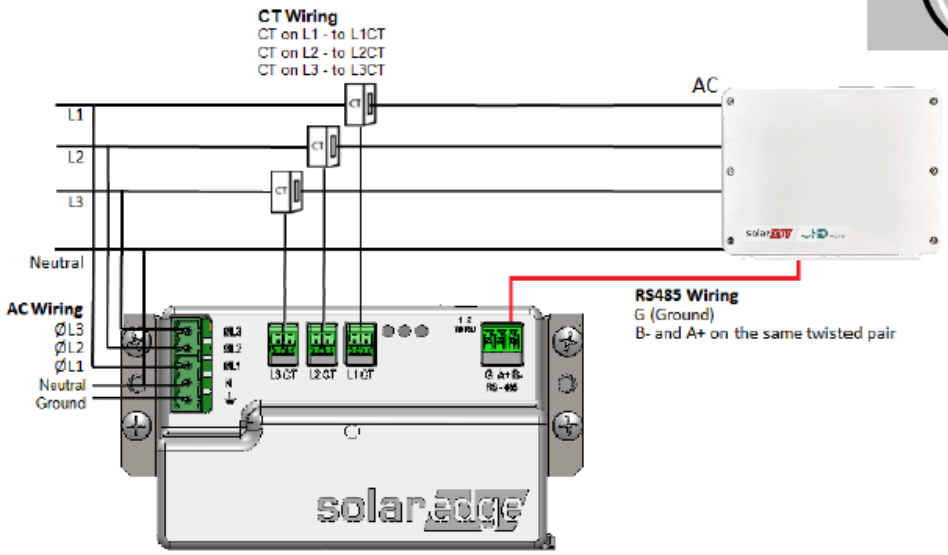
Turn off AC power before clamping on current transformers.

Install the CTs around the conductor to be measured. Split-core CTs can be opened for installation around a conductor. A nylon cable tie may be secured around the CT to prevent accidental opening.



Install the CTs with the arrows pointing to the grid for consumption or export measurement.

The meter communicates with the inverter/Commercial Gateway over an RS485 connection. Wire the meter in accordance with the three-phase connection diagrams below.



Connect the RS485 twisted pair cable to the 3-pin terminal on the meter: a.

Connect the wires to the A+ and B- terminals, and connect the shield to the G terminal. 5.

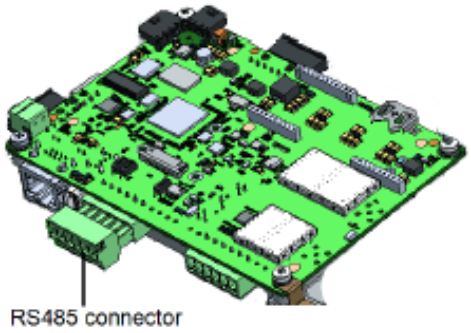
Set the meter's DIP switches as follows.

Set the termination DIP switches for Termination. Both switch 1 and switch 2 should be in the DOWN position.

Set the address DIP switches for Modbus Address 2: Set switch 2 to UP, and set switches 1 and 3 to DOWN.

Prepare to connect to one of the available RS485 ports of the device, as shown below:

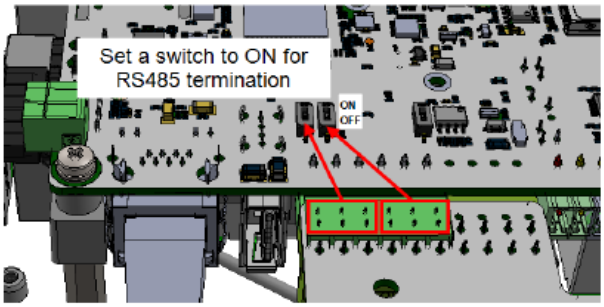
Inverter RS485-1 - pull out the RS485 connector located on the communication board.



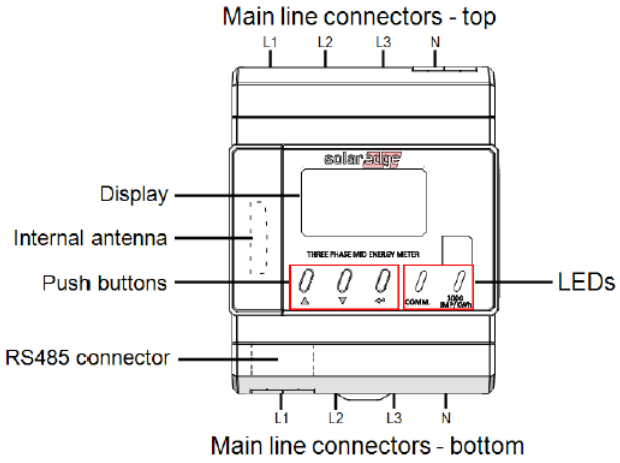
Connect the meter's RS485 G, A+, and B- connectors to the G, A, and B connecters in the inverter.

If the SolarEdge device is at the end of the RS485 bus, terminate as follows:

Inverter - Terminate by switching a termination DIP-switch inside the inverter to ON (top position).



→ Inline meter interface



- **Main line connectors::** - inputs/output terminal blocks
- **Internal antenna:**- for wireless connectivity with the inverter
- **RS485** - detachable connector for wired connectivity with the inverter.
- **Three push buttons::** - to operate the inline meter display.

Button	Function	Combination
Left	▪ Up ▪ Push the left button for 5 seconds in order to reset the meter.	Push the Left and Middle buttons simultaneously for 5 seconds in order to initiate an SolarEdge Home Network search session.
Middle	Down	
Right	Enter	

- **LEDs** - used to monitor meter status:
  - Orange: meter operation
  - Blue: SolarEdge Home Network/RS485 communication status

Function	LED	Indication
Energy measurements	Orange	Blinking rate of 1000 pulses per hour indicates 1 kWh of measured energy.
Communication status	Blue	▪ Blinking: Meter is searching for a SolarEdge Home Network, or is not connected to RS485 bus. ▪ Lit: Meter is in the reboot state, or has successfully paired with the SolarEdge Home Network, or was successfully connected to the RS485 bus. ▪ Fast blinking during configuration of the inline meter.

Display - Used for basic configuration and operation of the meter, and for reapplying factory default settings.

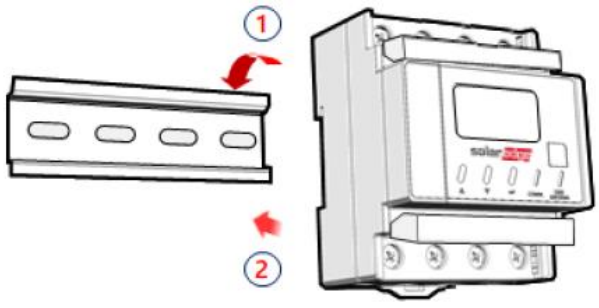
→ Inline meter installation

If an AC wiring extension is required, use the same type of AC wiring that is used in the cabinet.

RS485 wiring specifications:

- Cable type: Min. 3-wire shielded twisted pair (a 4-wire cable may be used)
- Wire cross-section area: 0.2- 1 mm^2 (a CAT6 cable may be used)
- If using a cable longer than 10 meters in areas where there is a risk of induced voltage surges by lightning, it is recommended to use external surge protection devices.

- **Mount on a DIN rail**- The inline meter is designed for permanent installation in indoor locations. It is intended for installation in switch cabinets or in small-installation distributors on a 35mm mounting rail as per DIN EN 60715.
- Mount the inline meter on the DIN rail as shown in the figure below. Fit the slot on the back of the meter over the DIN rail (see steps 1 and 2), and secure it in place on the DIN rail using the latching mechanism at the bottom of the meter.

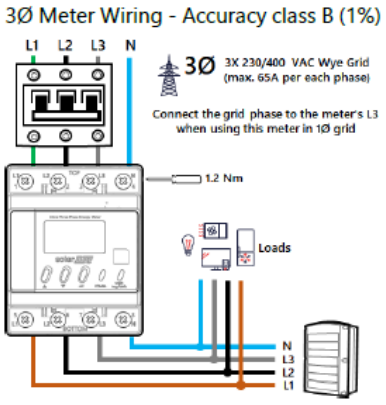


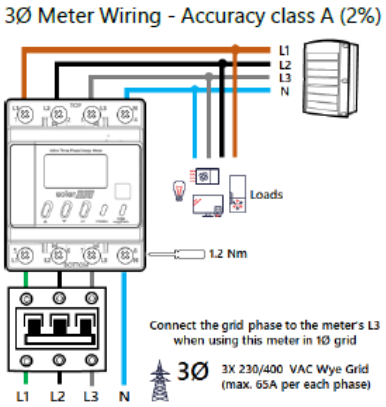
- **Wiring the meter**

Turn off the AC power (main circuit breakers) before connecting the inline meter.

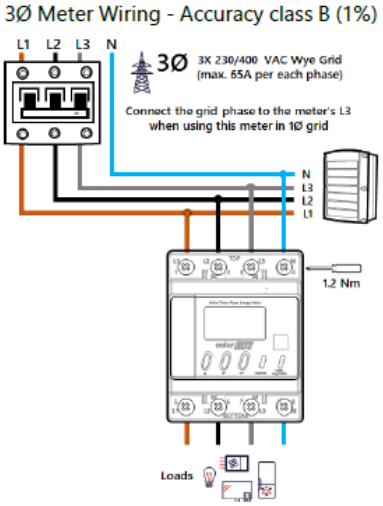
Using one of the below wiring schemes, connect the AC wiring to the terminal blocks at the top and the bottom of the inline meter

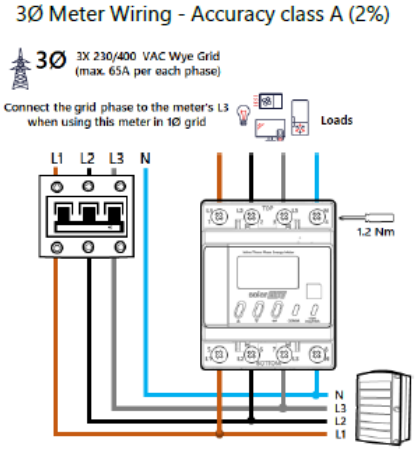
For Import/Export Metering





For Consumption Metering-



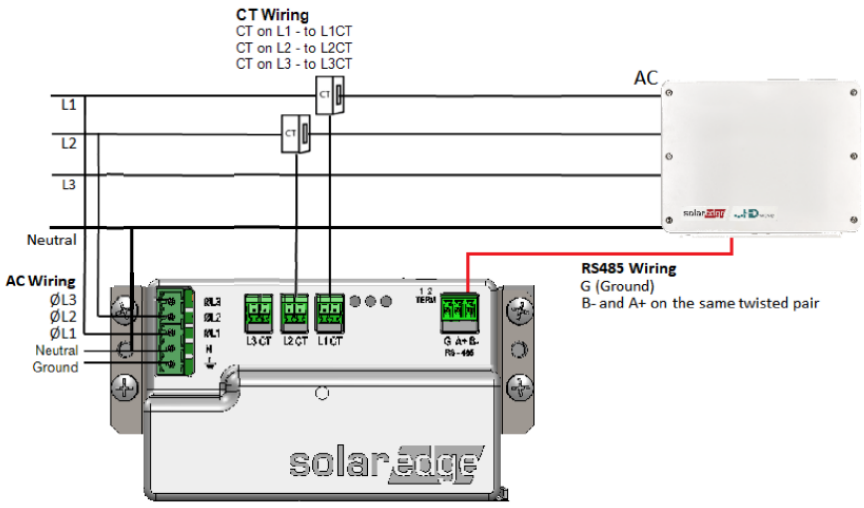


→ Dual Phase Metering

Both of the SolarEdge Meters act as 3 independent metering elements sharing the same reference point (Neutral). If installed onto dual-phase grids then two of the metering elements can be used, the voltage references need to be wired to cordite the CT references.

Modbus Meter with external CTs:

For dual-phase metering use the L1 and L2 AC terminals which should be aligned with the CT's.

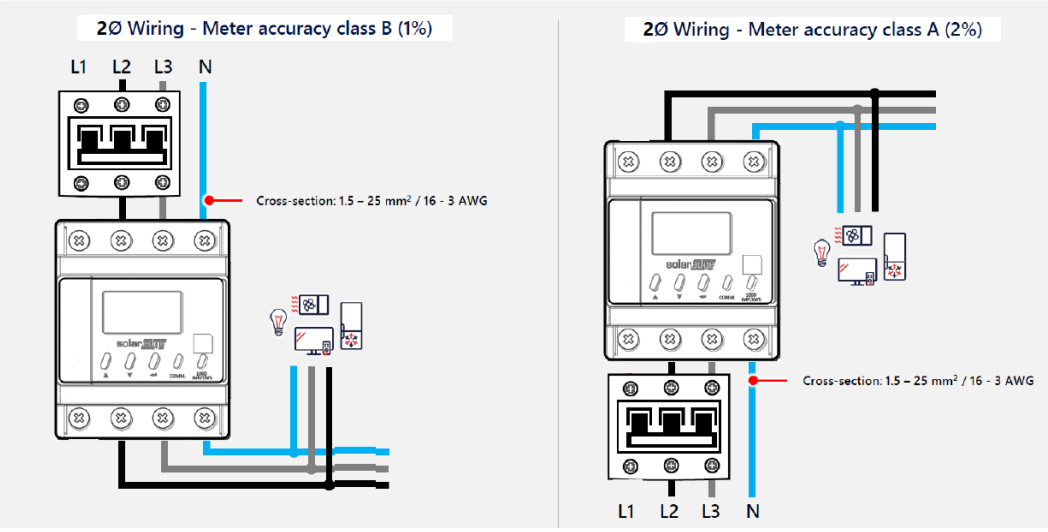


Inline meter:

The inline meter is powered between the L3 to N connections.

To operate in a dual-phase setup, connect phase 2 to L2 of the meter and physical phase 1 to L3 of the meter.

Neutral should be connected to N.



System Startup and Shutdown

→ To start up the system:

1. Turn ON the SolarEdge Home Battery/s MCB.
2. Move the SolarEdge Home Battery/s toggle to the ON position.
3. Switch to the ON position, the DC Isolator on the inverters DCD.
4. Move the SolarEdge inverters toggle to the ON position.
5. Switch to the ON position, the AC to the inverters at the adjacent AC isolator (if installed) and inside the SolarEdge Polyphase Backup Switchboard.

→ To shut down the system:

1. Move the SolarEdge inverters toggle to the OFF position and wait until the green LED is blinking, indicating that the DC voltage is safe (<50V), or wait five minutes before continuing to the next step.
2. Switch to the OFF position, the AC to the inverters at the adjacent AC isolator (if installed) and inside SolarEdge Polyphase Backup Switchboard
3. Switch to the OFF position the DC Isolator on the inverter/s DCD.
4. Move the SolarEdge Home Battery/s toggle to the OFF position.
5. Turn OFF the SolarEdge Home Battery/s MCB.

→ To shut down the system in case of emergency:

1. Switch to the OFF position, the AC to the inverters at the adjacent AC isolator (if installed) and inside the SolarEdge Polyphase Backup Switchboard
2. Switch to the OFF position the DC Isolator on the inverters DCD.
3. Turn OFF the SolarEdge Home Battery/s MCB.

Guidance Relating to RCD Requirements

PV System Residual Current Factors

In every PV installation, several elements contribute to the current leakage to protective earth (PE). These elements can be divided into two main types:

- **Capacitive discharge current** - Discharge current is generated mainly by the parasitic capacitance of the PV modules to PE. The module type, the environmental conditions (rain, humidity) and even the distance of the modules from the roof can affect the discharge current. Other factors that may contribute to the parasitic capacitance are the inverter's internal capacitance to PE and external protection elements such as lightning protection.

  During operation, the DC bus is connected to the alternating current grid via the inverter. Thus, a portion of the alternating voltage amplitude arrives at the DC bus. The fluctuating voltage constantly changes the charge state of the parasitic PV capacitor (i.e. capacitance to PE). This is associated with a displacement current, which is proportional to the capacitance and the applied voltage amplitude.
- **Residual current** - if there is a fault, such as defective insulation, where an energized cable comes into contact with a grounded person, an additional current flows, known as a residual current.

Residual Current Device (RCD)

All SolarEdge inverters incorporate a certified internal RCD (Residual Current Device) to protect against possible electrocution in case of a malfunction of the PV array, cables or inverter (DC). The RCD in the SolarEdge inverter can detect leakage on the DC side. There are 2 trip thresholds for the RCD as required by the DIN VDE 0126-1-1 standard. A low threshold is used to protect against rapid changes in leakage typical of direct contact by people. A higher threshold is used for slowly rising leakage currents, to limit the current in grounding conductors for fire safety. The default value for higher speed personnel protection is 30mA, and 300mA per unit for lower speed fire safety.

Installation and Selection of an External RCD Device

Section 7.3.4.1 of AS/NZS 3000:2018 details the general requirements for the AC isolation switch in accordance with clause 2.3.2.2. Requirements of AS/NZS 4777 series are deemed to satisfy these requirements, however. Section 2.6.2.2 defines the specific types of RCD's and their application. There are 6 different types of RCD's available and complaint for installation depending upon the characteristic of supply, these being:

- **Type A RCD** - Residential sinusoidal waveforms.
- **Type A RCD** - Residential pulsating direct currents
- **Type I RCD** - Residual alternating currents not exceeding 10mA, interrupt time not exceeding 40ms
- **Type F RCD** - Composite residua, pulsating direct or high frequency leakage currents
- **Type B RCD** - Residual sinusoidal up to 1000Hz, alternating or pulsating, residual direct currents
- **Type S RCD** - Specifically designed where tripping is delayed after a pre-determined time

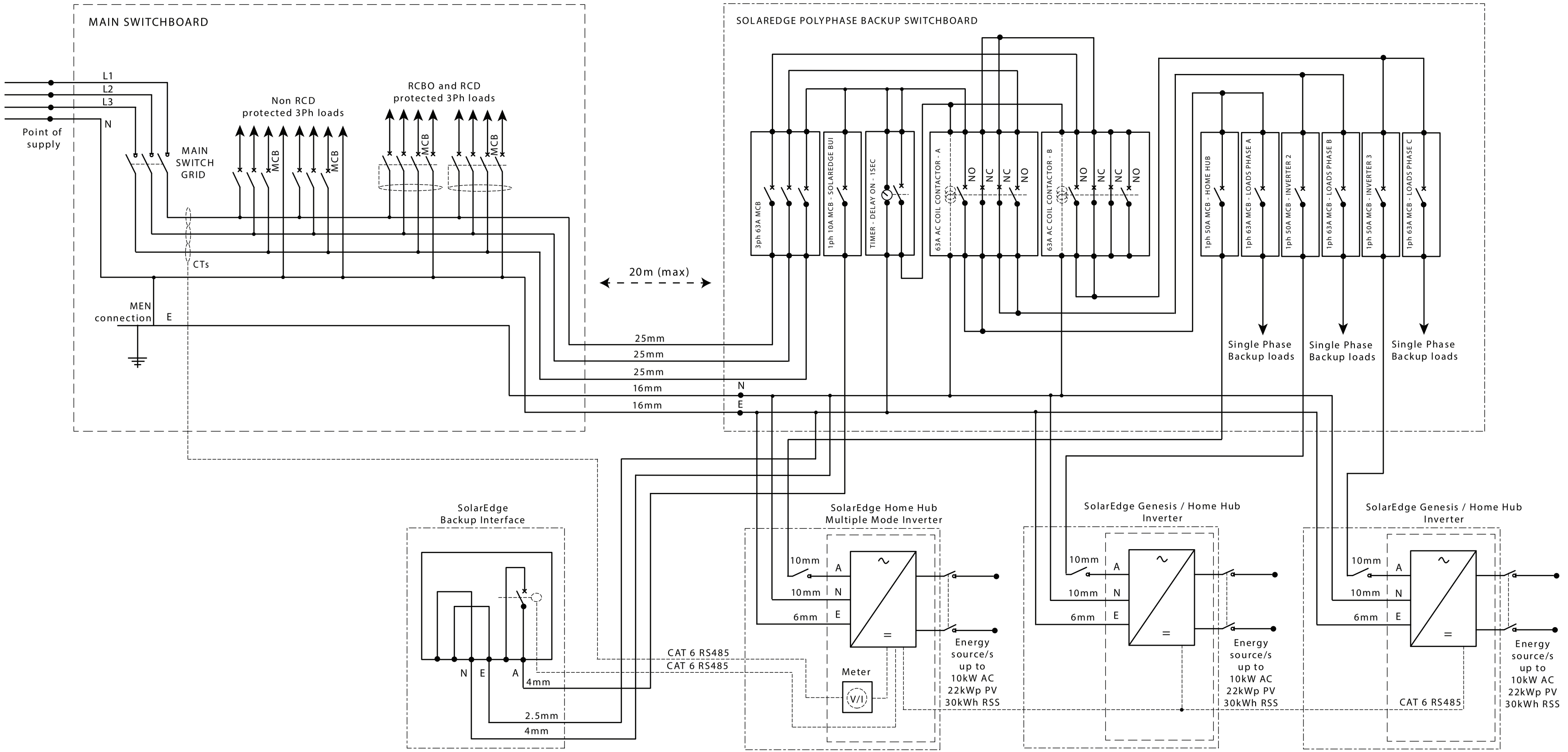
Mitigation of Nuisance Tripping

Section 2.6.3.2.3.3 of AS/NZS 3000:2018 details the requirements wherever a 30mA RCD shall be provided for final subcircuits with a rating not exceeding 32A. However, exceptions to these requirements apply as per clause 2.6.3.2.3.3 Exceptions 3 (II) which states that 'These requirements need not apply to the following'...' may cause spurious nuisance tripping through high leakage currents being generated in the normal operation of the equipment'.

Installation and Selection of an External RCD Device

Installation of an RCD must always be conducted in accordance with local electrical regulations and standards. SolarEdge recommends the use of a type-A RCD. Unless a lower value is required by the specific local electric regulations.

For Single Phase inverter installations SolarEdge suggests an RCD value between 30mA and 100mA. If an RCD is used, 100mA is required for installations above 20kWdc whereas a 30mA RCD is required for installations below 20kWdc.


MAIN SWITCHBOARD
L1
L2
L3
N
Point of supply
MAIN SWITCH GRID
Non RCD protected 3Ph loads
RCBO and RCD protected 3Ph loads
MCB
CTs
MEN connection
E
20m (max)
25mm
25mm
25mm
16mm
16mm
N
E
SOLAREDGE POLYPHASE BACKUP SWITCHBOARD
3ph 63A MCB
1ph 10A MCB - SOLAREDGE BUI
TIMER - DELAY ON - 1SEC
63A AC COIL CONTACTOR - A
63A AC COIL CONTACTOR - B
NO
NC
1ph 50A MCB - HOME HUB
1ph 63A MCB - LOADS PHASE A
1ph 50A MCB - INVERTER 2
1ph 63A MCB - LOADS PHASE B
1ph 50A MCB - INVERTER 3
1ph 63A MCB - LOADS PHASE C
Single Phase Backup loads
Single Phase Backup loads
Single Phase Backup loads
SolarEdge Backup Interface
N
E
A
4mm
2.5mm
4mm
CAT 6 RS485
CAT 6 RS485
SolarEdge Home Hub Multiple Mode Inverter
10mm
A
10mm
N
6mm
E
Meter
V/I
Energy source/s up to 10kW AC 22kWp PV 30kWh RSS
SolarEdge Genesis / Home Hub Inverter
10mm
A
10mm
N
6mm
E
Energy source/s up to 10kW AC 22kWp PV 30kWh RSS
SolarEdge Genesis / Home Hub Inverter
10mm
A
10mm
N
6mm
E
CAT 6 RS485
Energy source/s up to 10kW AC 22kWp PV 30kWh RSS