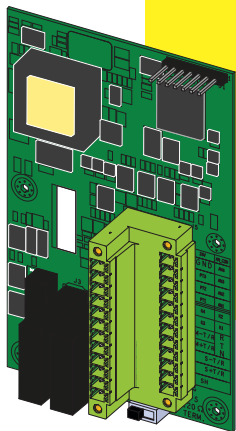


**FIMER**



# **Solar Inverter PMU expansion board**

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## **Quick Installation Guide**

# 1. Main components

The main components of the PMU expansion board are shown in the figure below and described in the following table:

## Main components

Terminal block for the connection of:

- PMU control signals
- "RS485 (M)" serial Master
- Analogue inputs AN3 and AN4
- Digital inputs K1, K2, K3 and K4
- 2 analogue sensor inputs AN1 and AN2
- PT100/PT1000 sensor
- 16 V / 100 mA auxiliary output
- "RS485 (S)" serial Slave

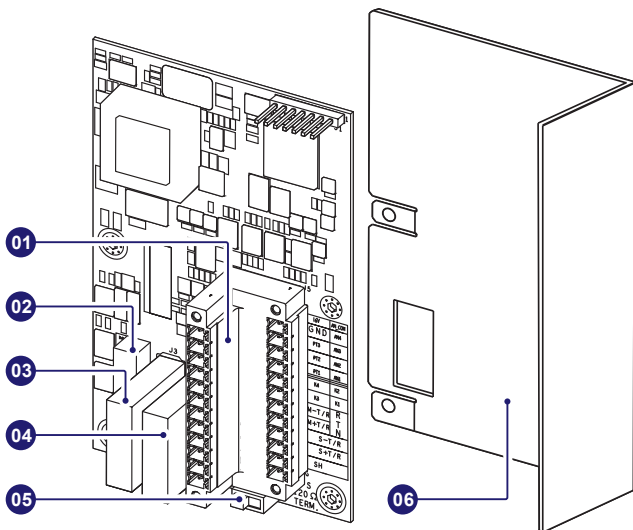
02 Connector for the interconnection to the inverter

03 RS485 (S) communication card housing

04 RS485 (M) communication card housing

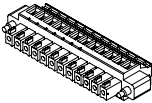
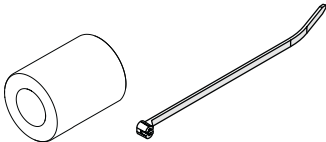
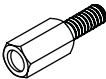
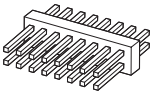
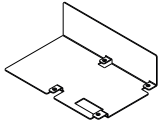

05 RS485 line (S) termination resistance selector switch

06 Metal shield



## 2. Supplied component list

The packaging contains all the components required to correctly install and connect the PMU expansion board:

Components available in the kit	Quantity
	Connector for connecting the communication and control signals 2
	Toroid + Cable Tie 1 + 1
	Spacers 4
	Terminals for the connection of the PMU board to the inverter 1
	Metal shield 1
	Technical documentation 1

## 3. Operating diagram

A single PMU expansion board can be used to control the PMU functions and to monitor the system on a single RS485 line within multi-inverter installations. With the PMU expansion board, it is possible to manage the active and reactive power and to:

- Connect up to 4 configurable analogue sensors and a PT100/PT1000 sensor to

monitor the system's environmental conditions.

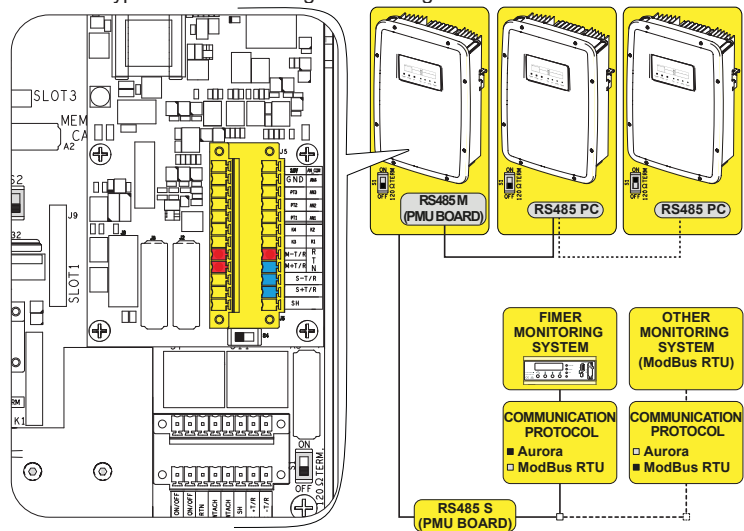
**NOTE** – The board has 4 analogue inputs which may be used for PMU functions (active power limitation/reactive power management) or for the connection of environmental sensors. If the AN3 and AN4 analogue inputs are used for PMU functions, they will not be available for the connection of sensors.

- Power such sensors with the 16 V DC output.

To connect a monitoring device and transmit management controls for the PMU functions on a single RS485 bus, the following connections are required:

1. Connect the monitoring system to the PMU board RS485 S (S +T/R; S -T/R; RTN). This serial port can be configured to operate on Aurora or ModBus RTU communication protocols.
2. Carry out the daisy-chain connection of the inverters present on the plant, starting with the RS485 M serial port (M +T/R; M -T/R; RTN) on the PMU board and continuing on the RS485 PC native serial port (PC +T/R; PC -T/R; RTN) of the inverters present on the plant.
3. Connect the inverters in daisy-chain on the inverter native RS485 PC serial port (PC +T/R; PC -T/R; RTN).

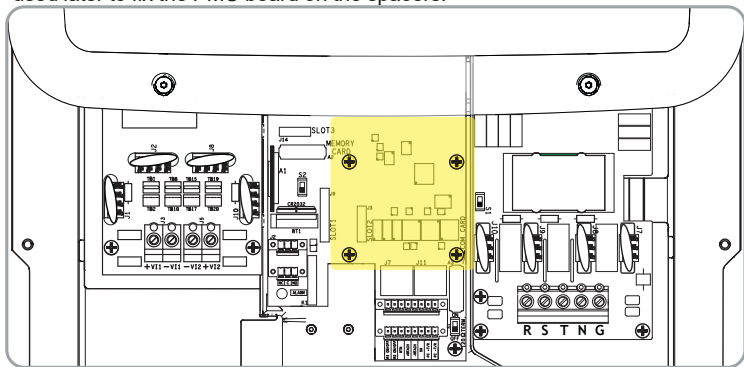
Below is a typical installation diagram showing the connections above:



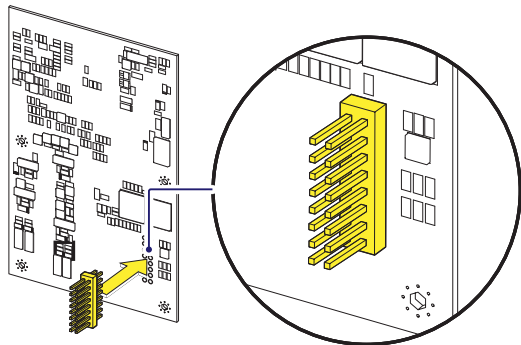
## 4. Assembly Instructions

**⚠ ATTENTION** – The inside of the inverter may only be accessed after the equipment has been disconnected from the grid and from the photovoltaic generator.

- Turn off the inverter by physically disconnecting the AC and DC voltages, as well as any voltage connected to the multi-function relay.
- Open the inverter front cover.
- Replace the 4 screws with the supplied spacers. The 4 removed screws will be used later to fix the PMU board on the spacers.



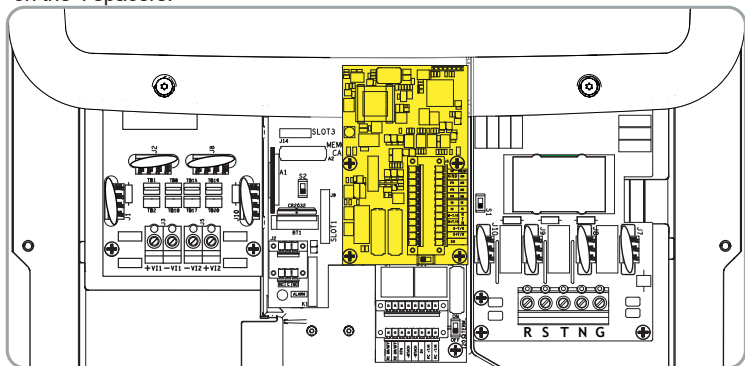
- Insert the connection terminals in the lower part of the PMU board. The plastic base of the terminals has an offset. Insert the terminals with the short side towards the PMU board.



- Position the metal shield on the 4 spacers previously installed
- Fit the PMU board on the inverter by inserting the previously mounted terminals on the special receptacle located on the inverter control and communication board (SLOT 2).

**⚠ ATTENTION** – During this step, check that all the terminals are correctly aligned. Any terminal misalignment may result in damage to the PMU board and/or to the inverter.

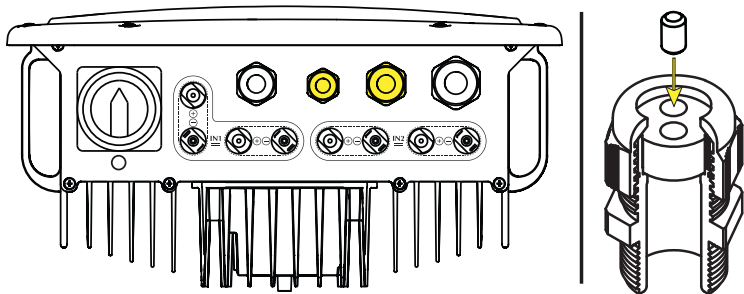
- Fix the PMU board to the inverter by tightening the 4 previously removed screws on the 4 spacers.



Once the installation is completed, the control and communication signals can be connected.

## 5. Input/output connections

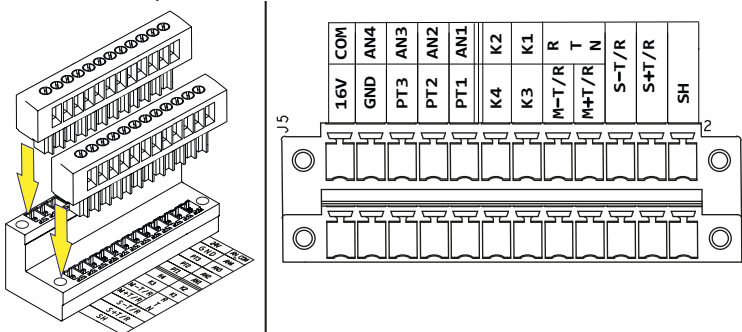
All the connection cables for the communication and control signals to the PMU board must be fed through the inverter service cable glands shown in the picture below:



**NOTE** – All cable glands can be fitted with the two-hole gaskets (supplied with the inverter) to feed small-diameter cables

The communication and control signal cables must be connected to the dedicated terminal block on the PMU expansion board.

The connection terminal block (01) is composed of two removable parts for an easier connection. Each part comprises 12 terminals intended for specific signal connections, as printed on the PMU board.



The connections on the PMU board are divided into three categories:

1. Management signals for PMU functions  
analogue input for the management of active power (AN3 and COM terminals)

analogue input for the management of reactive power (AN4 and COM terminals)  
digital inputs (K1, K2, K3, K4 and RTN terminals)

RS485 M serial communication line (terminals M +T/R, M -T/R and RTN) for the transmission of management controls for active and reactive power

2. Monitoring system on RS485 S serial line (terminals S +T/R, S -T/R and RTN) configurable with Aurora or ModBus RTU communication protocol

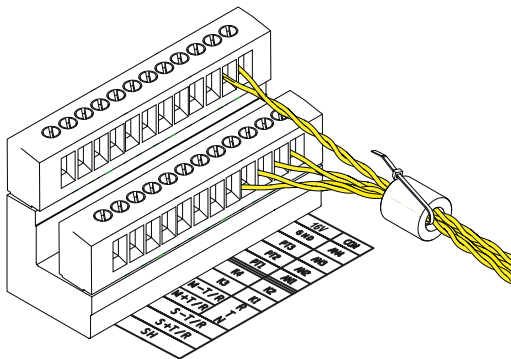
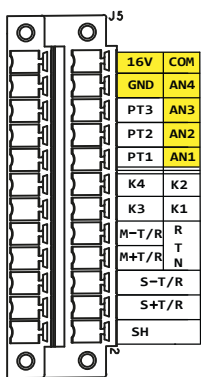
3. Analogue inputs for environmental sensors (terminals AN1, AN2, AN3, AN4 and AN\_COM) and a PT100 or PT1000 input (terminals PT1, PT2 e PT3)

If inputs AN3 and AN4 are employed to control the PMU functions, they cannot be used for the connection of environmental sensors.

A 16 V DC output voltage is also available for environmental sensors that require a power supply (16 V and GND)

**⚠ ATTENTION** – To ensure compliance with the electromagnetic compatibility requirements, all the connection cables for the PMU board (inside the inverter) should be intertwined.

**⚠ ATTENTION** – In case of connection of the signals AN1, AN2, AN3, AN4, COM, 16V and GND it is necessary that cables are passed through the toroid supplied with the accessory board.

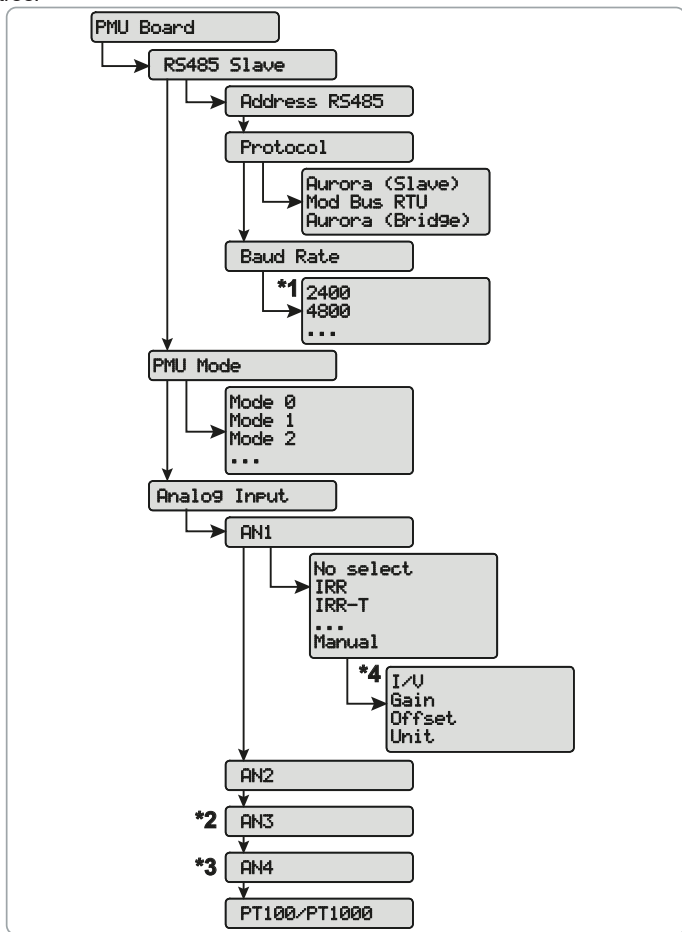


At the end of the installation block the cables with the cable tie.



## 6. On-display configuration

Upon starting the inverter for the first time after the PMU board has been installed, a new “PMU Board” section is added to the SETTINGS menu, with the following tree:



- **“RS485 Slave” section**

- View of the RS485 address for the RS485 S line (if more than one PMU board is installed)
- Sets the communication protocol (Aurora or ModBus RTU)
- \*1 Sets the communication line baud rate, configurable only if the “ModBus RTU” protocol is selected

- **“PMU Mode” section**

Sets the PMU to the desired operation mode

**The table in the following section shows the modes**

- **“Analogue Input” section**

Assigns each analogue input (AN1, AN2, AN3 and AN4) to the relevant environmental sensor connected, choosing from a list of ABB sensors.

In case the connected sensor does not appear in the list, the configuration parameters (sensor type: voltage/current; gain; offset; measurement unit) can be set manually (“Manual”).

It also allows setting the input to PT100 or PT1000 mode, based on the type of the connected sensor

**\*2,\*3 If AN3 and AN4 analogue inputs are used to control PMU functions, you can set the type of input (current or voltage)**

**\*4 Settings available by selecting “Manual” from the list of available sensors**

## 7. PMU operation

The PMU board runs the active power limitation and reactive power management functions in different operation modes. Each mode allows to manage and “translate” the digital input states and the analogue input levels into corresponding controls, which are then transmitted via the RS485 M serial port to one or more inverters connected to the RS485 bus, without interfering with the operation of any monitoring device that may be connected to the same bus. The PMU controls are effectively transmitted as broadcast commands, with the PMU interrupting for a few milliseconds the communication line used for monitoring in order to send the PMU function control signals.

- The active power control is defined (based on the chosen operation mode) either by the state of the digital inputs or by the level of analogue input AN3.
- The active and reactive power management controls transmitted to the inverters connected to the RS485 M line define:
  - Set point: set point for the active and reactive power
  - Smooth time: the time the inverter requires to reach the new (active and/or reactive) power set point
  - Timeout: the time during which the inverter holds the set point (60 sec.)

The table below illustrates the active power limitation / reactive power management modes that can be selected on the inverter display:

Displayed name	Operation	Inputs
Mode 0	No PMU function selected	-
Mode 1	4-step active power reduction	K1, K2, K3, K4
Mode 2	Active power reduction via analogue inputs	AN3
Mode 3	4-step active power reduction Reactive power control via analogue inputs	K1, K2, K3, K4 AN4 (Type 2)
Mode 4	Active power reduction via analogue inputs Reactive power control via analogue inputs	AN3 AN4 (Type 2)
Mode 5	4-step active power reduction Reactive power control via analogue inputs	K1, K2, K3, K4 AN4 (Type 4)
Mode 6	Active power reduction via analogue inputs Reactive power control via analogue inputs	AN3 AN4 (Type 4)
Mode 7	Reactive power control via analogue inputs	AN4 (Type 2)
Mode 8	Reactive power control via analogue inputs	AN4 (Type 4)
Mode 9	11-step active power reduction Reactive power control via analogue inputs	K1, K2, K3, K4 AN4 (Type 4)
Mode 10	Active power reduction via analogue inputs Reactive power control via analogue inputs	AN3 AN4 (Type 4)

#### - 4 step active power control via digital inputs

This control type is used in operation modes 1, 3, 5.

The digital inputs used for the active power limitation function are K1, K2, K3 and K4

K1	K2	K3	K4	Maximum active power as % of the inverter nominal power
Closed	Open	Open	Open	100
Open	Closed	Open	Open	60
Open	Open	Closed	Open	30
Open	Open	Open	Closed	0

#### - 11 step active power control via digital inputs.

This control type is used in operation mode 9.

The digital inputs used for the active power limitation function are K1, K2, K3 and K4

K1	K2	K3	K4	Maximum active power as % of the inverter nominal power
Open	Closed	Open	Closed	100
Closed	Open	Open	Closed	90
Open	Open	Open	Closed	80
Closed	Closed	Closed	Open	70
Open	Closed	Closed	Open	60
Closed	Open	Closed	Open	50
Open	Open	Closed	Open	40
Closed	Closed	Open	Open	30
Open	Closed	Open	Open	20
Closed	Open	Open	Open	15
Closed	Closed	Open	Closed	0

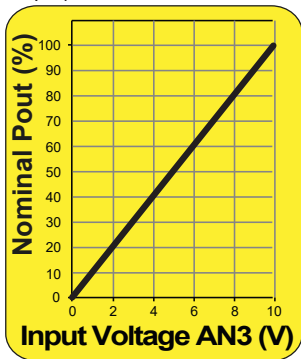
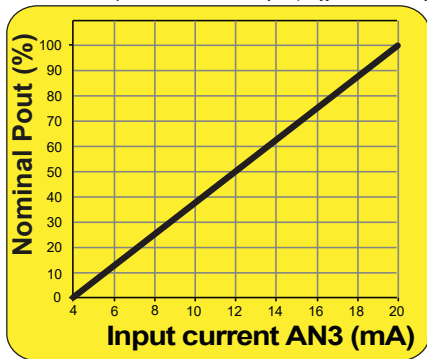
### -Active power control via analogue input (AN3).

This control type is used in operation modes 2, 4, 6, 10.

The analogue input used for the active power limitation function is AN3.

This control dynamically manages the output active power based on the level of the input analogue signal. This can be either a current (4...20 mA) or a voltage (0...10 V) signal.

The inverter nominal output power limitation is applied as shown in the characteristics below (left → current input; right → voltage input):



### - Reactive power control via analogue input (AN4).

This control type is used in operation modes 3, 4, 5, 6, 7, 8, 9 and 10. The management modes follow different behaviours, as described below.

The analogue input for the reactive power control function is AN4.

This control dynamically manages the reactive power based on the level of the input analogue signal. This can be either a current (4...20 mA) or a voltage (0...10 V) signal.

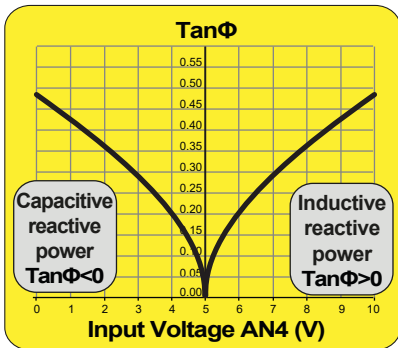
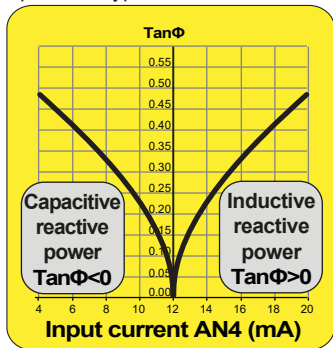
2 reactive power management modes are available:

Type 2 → Fixed  $\tan(\phi)$ , based on the instantaneous output power

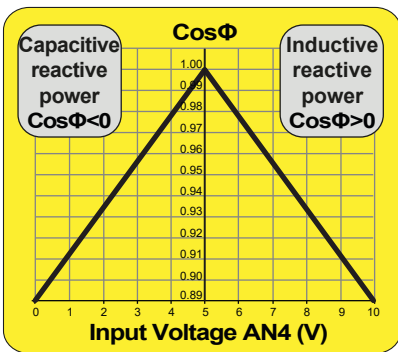
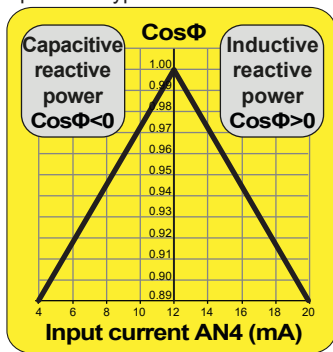
Type 4 → Fixed  $\cos(\phi)$ , based on the instantaneous output power

The inverter reactive power management is applied as shown in the characteristics below (left → current input; right → voltage input):

### Operation Type 2



### Operation Type 4



## 8. Characteristics and technical data

### PMU Expansion board

#### RS485 M - Master serial port (PMU)

Communication protocol	Aurora
Serial interface	RS485 Half-duplex
Baud Rate	19200 bps
Maximum number of inverters on the 485 bus	32
Maximum line length	1 km with shielded cable

#### RS485 S - Slave serial port (Monitoring)

Communication protocol	Configurable: Aurora or ModBus RTU
Serial interface	RS485 Half-duplex
Baud Rate (Aurora protocol)	19200 bps
Baud Rate (ModBus RTU protocol)	Configurable from 2400 to 115200 Default: 19200 bps
Maximum number of inverters on the 485 bus	32
Maximum line length	1 km with shielded cable

#### Analogue inputs

Number of inputs	4 configurable analogue inputs <sup>(1)</sup> and 1 PT100/PT1000 input
Input type	Configurable: current or voltage
Input current range	4...20mA
Input voltage range	0...10Vdc

## PMU Expansion board

### 16 V DC output

Output voltage	16Vdc
Output current	150mA

### Digital inputs

Number of inputs	4
Input activation	Contact active when shorted to ground (RTN)
Nominal voltage	15Vdc
Output current	50mA

1. If analogue inputs AN3 and AN4 are used to control the PMU, the number of analogue inputs available for the connection of environmental sensors is reduced to 2 (AN1 and AN2)

**The features that are not specifically mentioned in this data sheet are not included in the product**

## FIMER\_PMU expansion board\_Quick Installation Guide\_EN\_RevD

05/05/2021



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