



# Power Meter

CET-HD-PM2-1



## Product User Manual

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# Safety Notices

1. Please read and follow the warning and instructions contained in this document carefully.
2. This product must not be operated outside of the specified Operating Temperature Range.
3. Do not connect this product to a power supply outside of the range specified in the Technical Specifications.
4. This device should be installed by technically qualified personnel. Failure to install in compliance with national and local electrical codes and according to recommendations provided by Combined Energy Technologies may result in electrical shock or fire hazard, unsatisfactory performance, or equipment failure.
5. Repair and maintenance of this product can be performed by qualified service personnel only. Do not attempt to repair the product if damaged. If the product is damaged or inoperable please contact Combined Energy.
6. This product is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience or knowledge, unless they have been given supervision or instruction concerning use of the product by a person responsible for their safety.
7. When installed, a readily accessible disconnect device (e.g. circuit breaker) must be incorporated external to this product.

# Compliance with Local Wiring Rules and Network Requirements

The recommendations in this document do not relieve Installers of their responsibility to ensure that all wiring operations are performed in compliance with the latest version of AS/NZS 3000 and any additional requirements imposed by the DNSP (Distribution Network Service Provider). Specific DNSP requirements may include meeting higher levels of protection. Where there is conflict between the recommendations in this document and the requirements of AS/NZS 3000 and/or DNSP network connection rules, the latter should take precedence.

It is the responsibility of Installers to comply with the requirements of any other authority who has jurisdiction over the installation. It is also the responsibility of the Installer to ensure they are suitably qualified under relevant state and federal laws to legally carry out the installation works.

Care must be taken to ensure both mains (LV – Low Voltage) wiring and communications (e.g. Ethernet) cabling is installed strictly in accordance with AS/NZS 3000 (latest version) requirements for “Segregation of different voltage levels” and that AS/NZS 3000 (latest version) requirements of double insulation are met for LV **and** ELV wiring. Any further DNSP network connection requirements beyond those mandated by AS/NZS 3000 (latest version) must also be adhered to.

Note: When calculating “highest voltage present” as defined in AS/NZS 3000, in 3 phase installations the highest voltage present is across phases and hence greater than that of a single phase installation.

# Introduction

The CET-HD-PM2 Power Meter (“PM2”) is a three-phase six-channel power meter and load controller for use in Combined Energy home energy management systems.

The CET-HD-PM2 accepts up to six clip-on current transformers (CTs) for monitoring net energy flow to the site in addition to solar inverters and other loads of interest.

The wired Ethernet and RS485 interfaces enable the integration of a wide range of third-party solar inverters, battery inverters, and control systems.



# Technical Specifications

**Type:** Combined Energy Power Meter

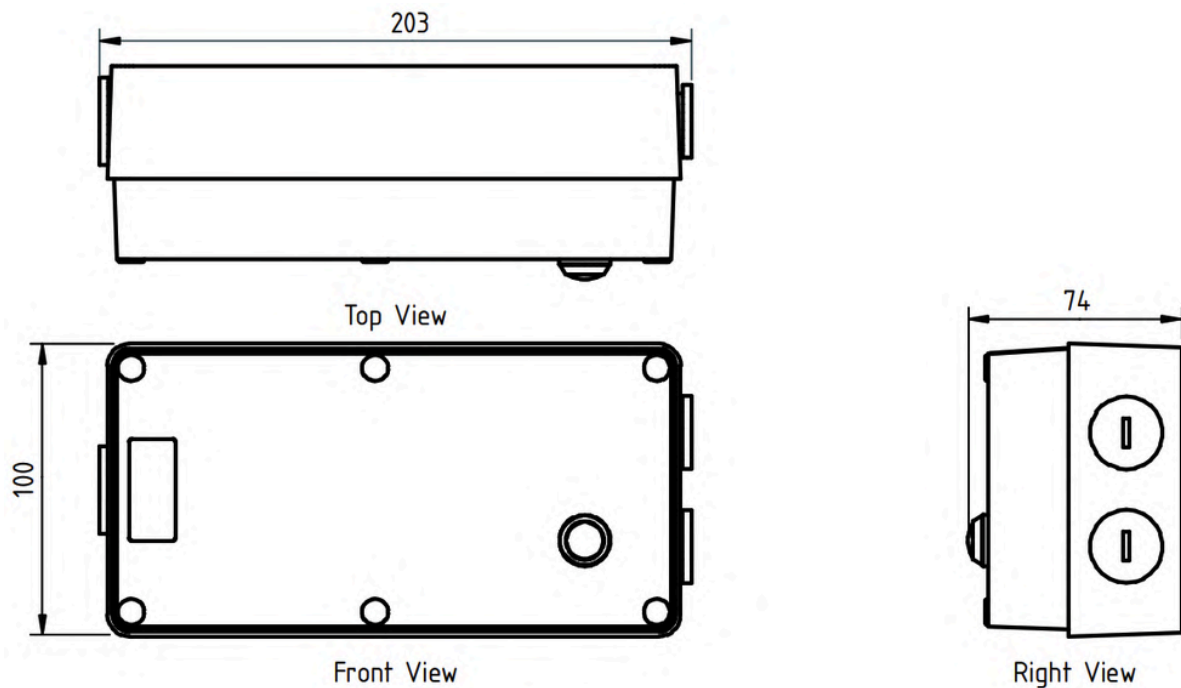
**Model:** CET-HD-PM2-1

**Power Supply Input:** 100 - 240VAC 1W + N 50/60Hz 80-30mA

**Metering Input:** 100 - 240VAC 3W + N + E 50/60Hz 1mA

**Average power consumption:** <8W

**Dimensions:** 203 x 100 x 74mm



**Mass:** 0.57kg

**Operating Temperature Range:** 0C to +50C

**IP Rating:** IP56 (when installed according to the instructions in this User Manual)

**Standards:**

- IEC 60950-1, AS/NZS 60950-1 - Information Technology Directive
- IEC 62368-1:2018 - Audio/video, information and communication technology equipment
- EN 50561-1 – Electromagnetic Compatibility for PLC products

# Product Features

## **Power Metering:**

- Three-phase voltage (L-E)
- 6 current channels (clip-on CT)
- Voltage (L-N), Current, Frequency, Power Factor, Active/Reactive Power, Active/Reactive Import/Export Energy, Phase-Phase angle
- Class 1 accuracy
- MASS-compliant frequency trigger and logging functionality

## **Communications Interfaces:**

- 1 x Power-Line Communications (PLC) modem
- 1 x Wired Ethernet (RJ45, 10/100 Base-T)
- 1 x RS485 port (RJ11, Serial / Modbus RTU)

## **Outputs:**

- 1 x 50mA TRIAC output for control of third-part relay/contactors

## **Human Interfaces:**

- 1 x Front panel button for manual network reset and diagnostics view
- 2 x LED status indicator (built into front panel button)

## **Included Accessories:**

- Enclosure mounting accessories

## **Optional Accessories:**

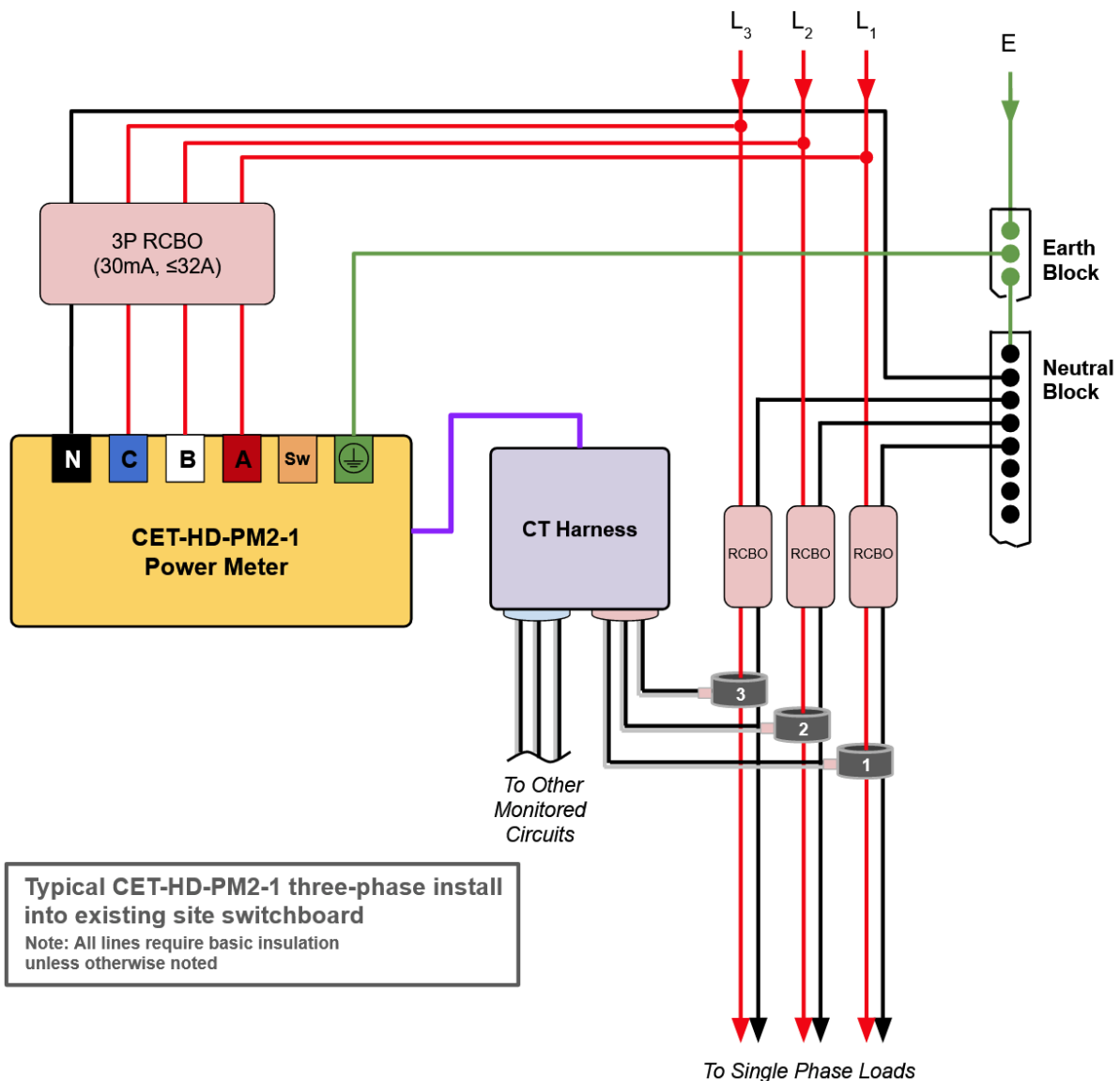
- Combined Energy CT Bundles (up to 2)
  - Standard ratings of 60A, 120A and 200A with 3 CTs per Bundle
  - Larger CT Bundles rated to 400A, 800A and 1200A available on request
- Combined Energy CT Harness (required to connect CT Bundles to Power Meter)
  - Available in 0.5m and 3m lengths





## Three-Phase System

The following is an example wiring diagram for a typical 3-phase installation:



In a three-phase system it is necessary to connect a reference for each phase of the supply to the CET-HD-PM2-1, in addition to the Neutral and Earth connections.

The CET-HD-PM2-1 must be protected by an upstream protection device (or a combination of devices) with a trip current of 32A or less and an earth-leakage trip current of 30mA or less.

The CET-HD-PM2-1 must be installed with a disconnect device. The disconnect device shall disconnect simultaneously all line conductors of the AC MAINS SUPPLY.

## Mount the Enclosure Base

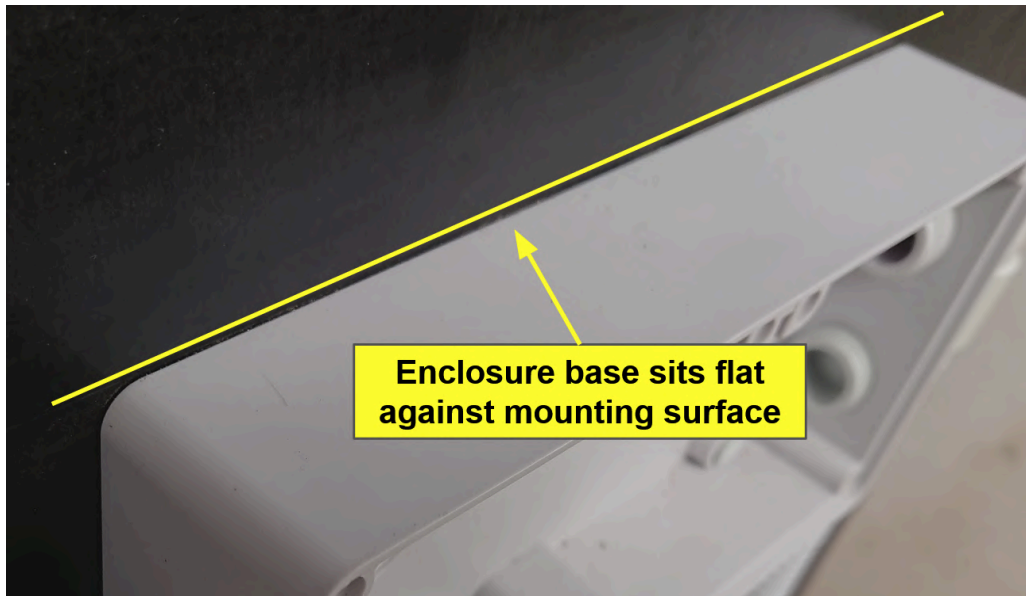
1. Select a location to mount the CET-HD-PM2. The product can be mounted inside the electrical switchboard or behind the panel (with reference to local installation rules), or may be surface mounted externally.

**Note: Ensure the product is mounted close enough to the switchboard so that the selected CT Harness and CT Bundles can reach the required metering points in the switchboard.**

2. If the product is installed outdoors, all conduit ports (including unused ports) and mounting screw positions must be sealed with silicone adhesive or PVC glue to maintain the product's IP rating.
3. Install the enclosure base using the included mounting accessories (screws, neoprene washers, wall plugs):



4. Ensure that the enclosure base is mounted flat against the surface and that the base is not warped. If the enclosure base is warped the lid will not seal to the base correctly and the product IP rating may be compromised:



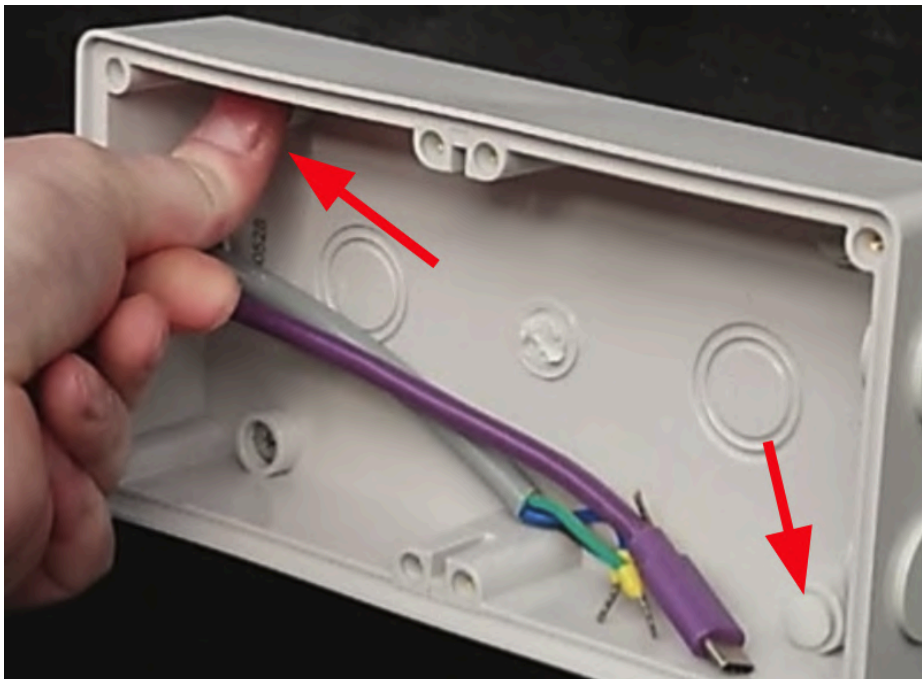
5. Ensure that the included neoprene washers are used when fastening the wall mounting screws:



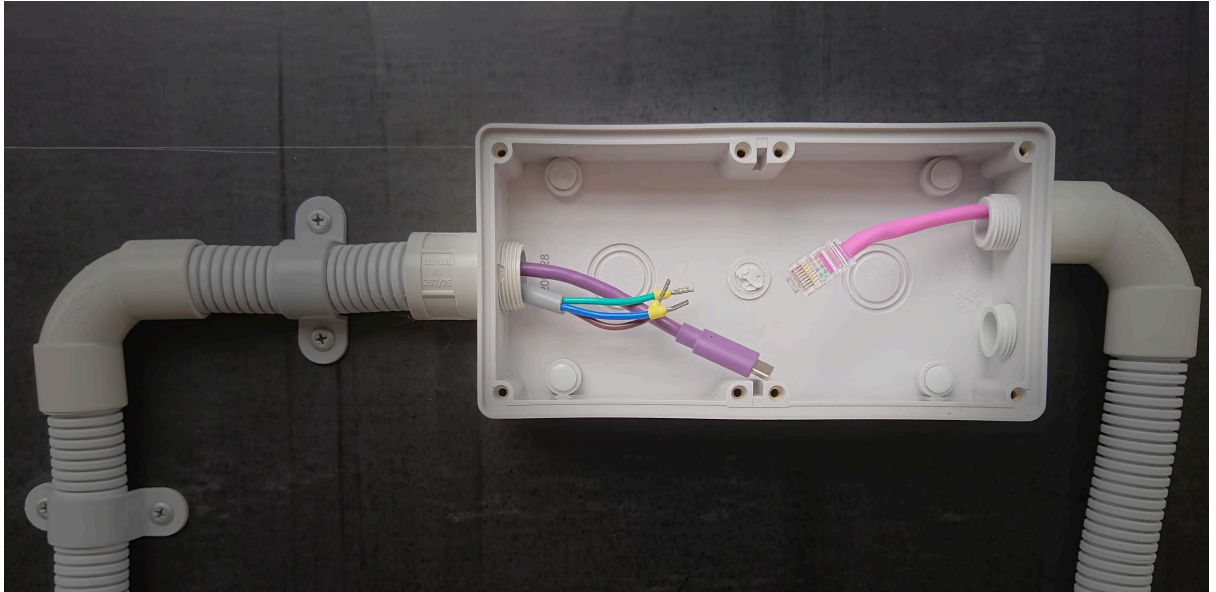
6. Silicone adhesive should be used to seal the mounting screws if the product is installed outdoors:



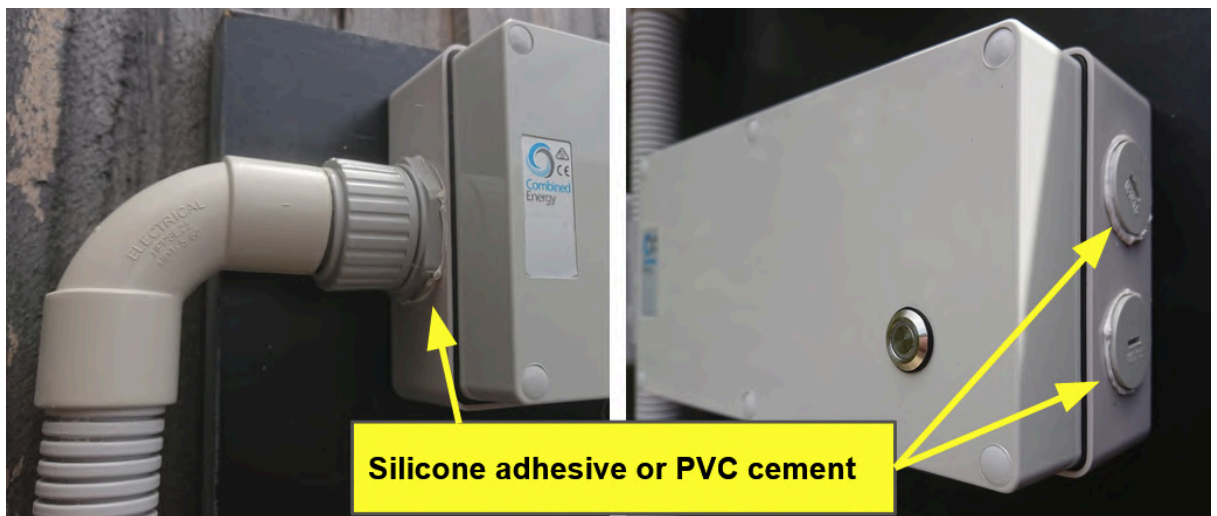
7. Press the included plastic screw covers into the mounting screw holes:



8. Install all required power and data conduit and cables into the enclosure base.



9. All enclosure openings must be sealed to ensure the product is waterproof. Conduit glands and plugs must be sealed with PVC cement or a silicone adhesive.



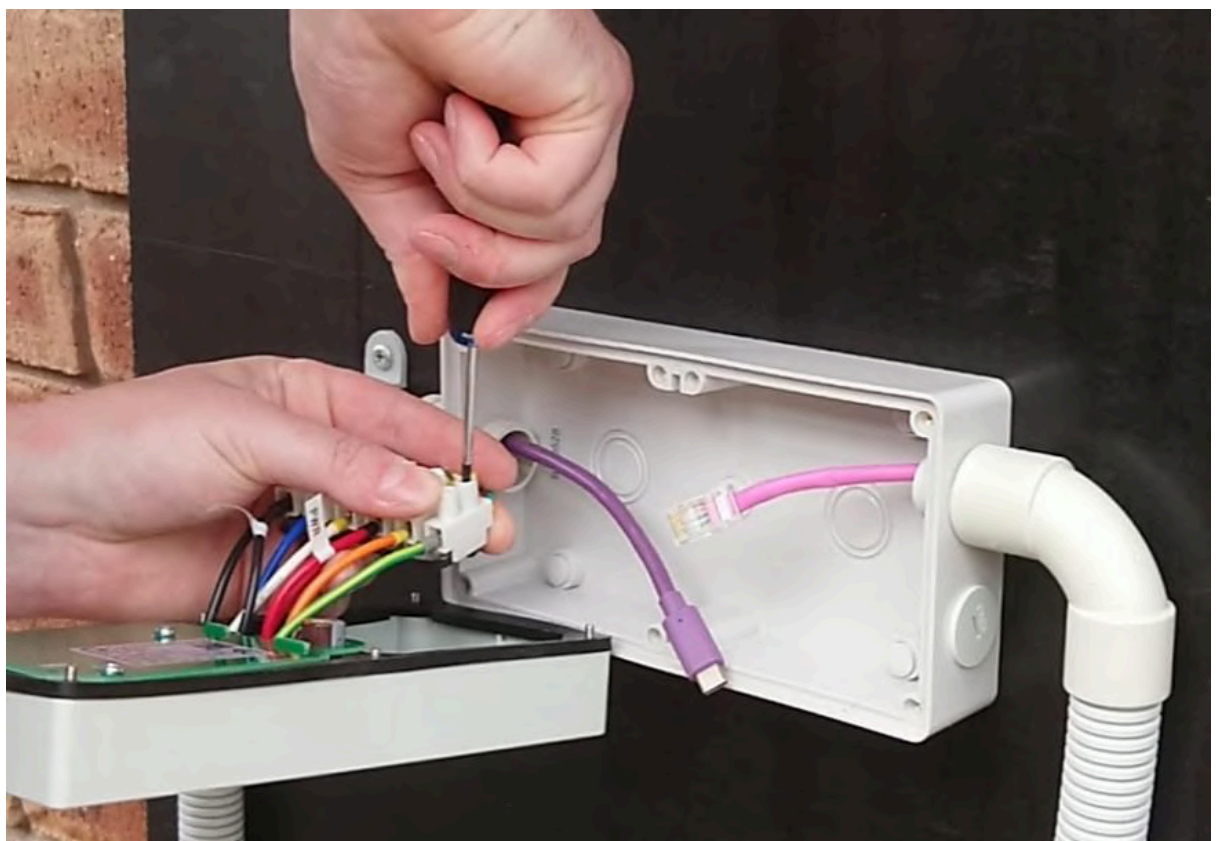
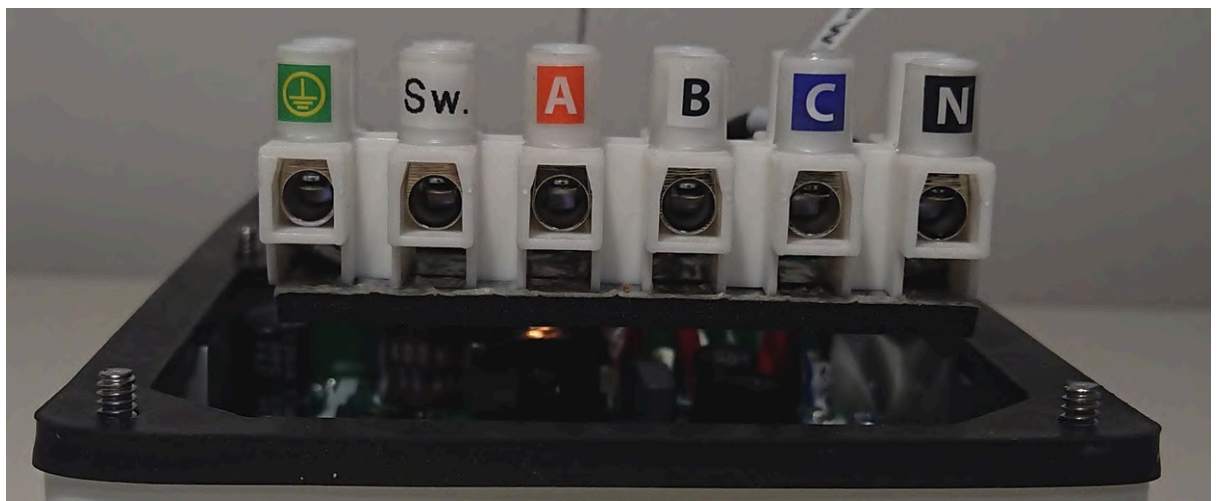


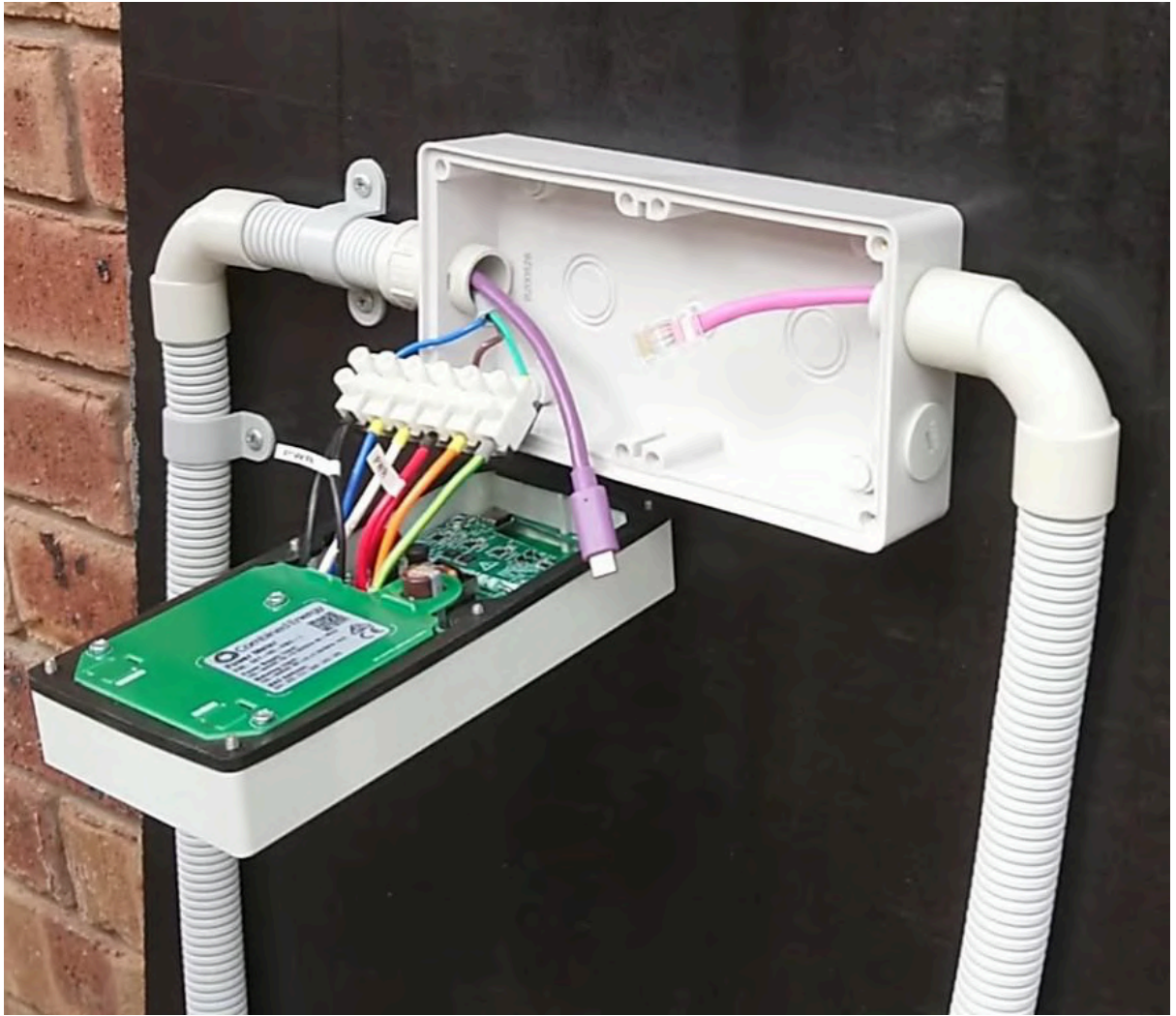
## Connect LV Power Supply Cables

10. Connect the 240VAC supply cables to the terminal block assembly.

Neutral, Earth and at least one Line connection (Phase A) is required for the product to function.

If the CET-HD-PM2 is being used to monitor a 2-phase or 3-phase supply, one reference must be connected for each additional phase (to the Phase B and Phase C positions on the terminal block).



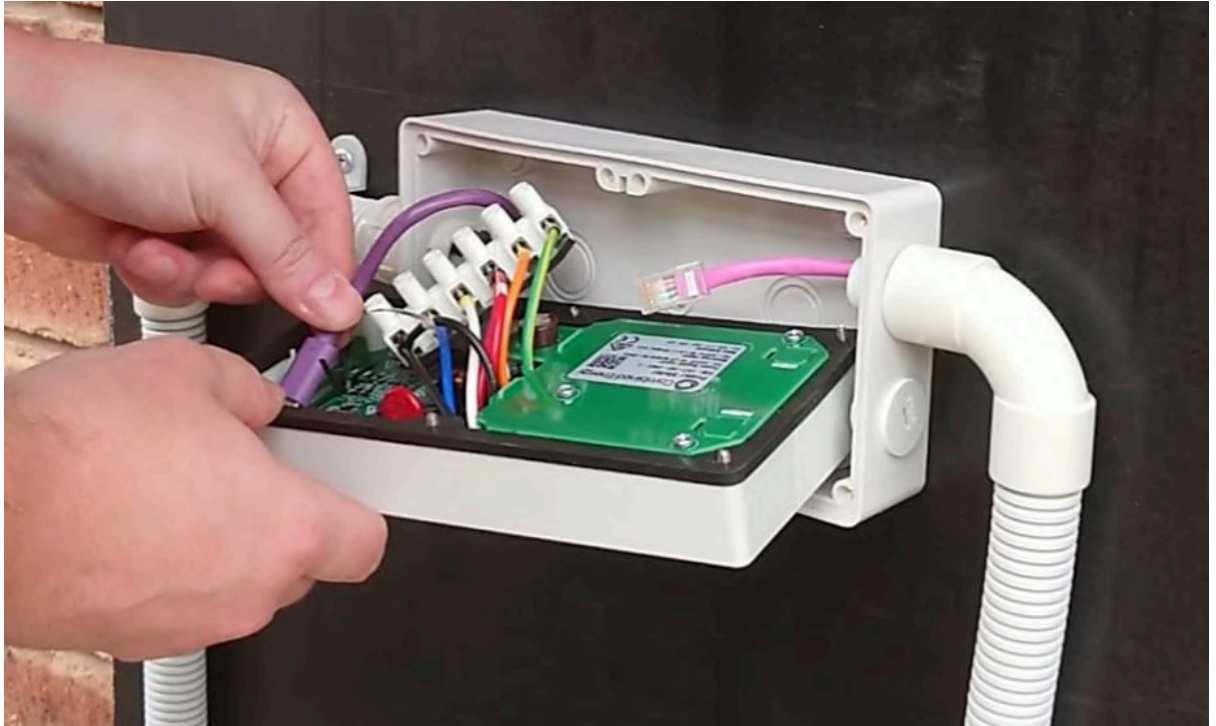


11. All power supplies to the CET-HD-PM2 must be protected by an upstream protection device (or a combination of devices) with a trip current of 32A or less and an earth-leakage trip current of 30mA or less.

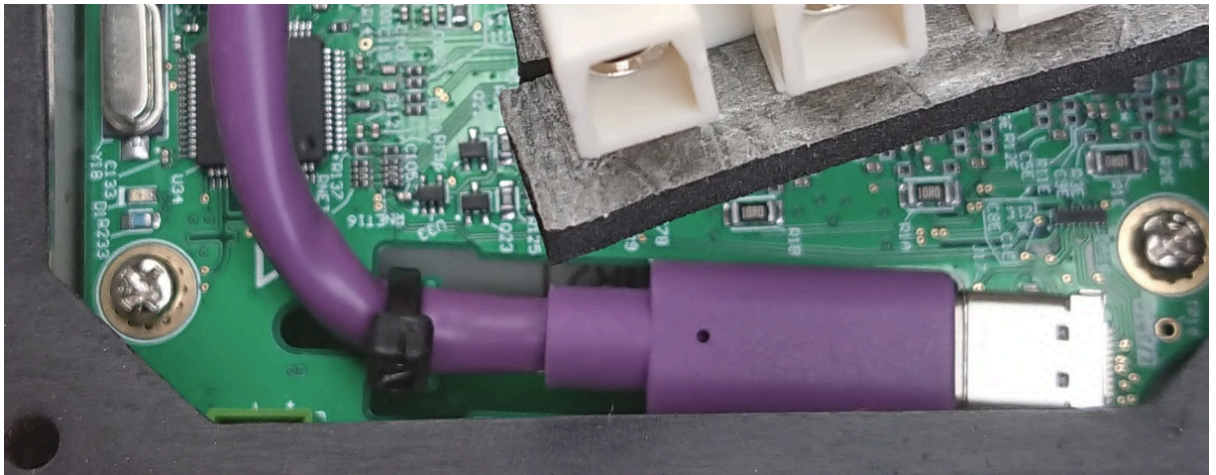
The CET-HD-PM2 must be installed with a disconnect device. The disconnect device shall disconnect simultaneously all line conductors of the AC MAINS SUPPLY.

## Connect CT Harness and Data Cables

12. If a CT Harness is being installed with the CET-HD-PM2, connect the CT Harness cable to the USB-C port:



The USB-C cable should be secured in place using the supplied cable tie:



13. If an Ethernet connection is required (e.g. for a data connection to a solar Inverter), please see the **Ethernet Connection Installation** section for more details
14. If an RS485 connection is required (e.g. for a data connection to a solar Inverter), please see the **RS485 Serial Connection Installation** section for more details



## Assemble Enclosure and Perform Functional Tests

15. Secure the enclosure lid to the base using the 6 supplied screws.

**Ensure the rubber gasket is properly seated on the enclosure lid during this process and does not get pinched or fouled by the enclosure.**

Check that there are no debris or tears on the gasket prior to assembly which could compromise the waterproof seal.

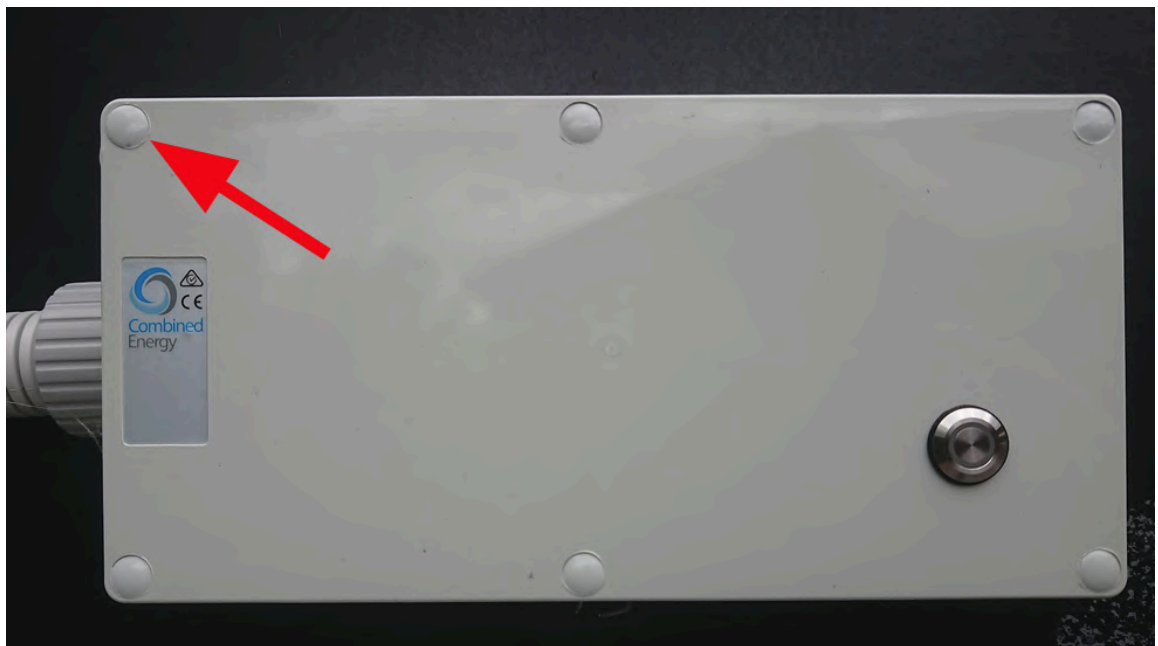




16. Once the lid has been secured, apply power to the CET-HD-PM2 and check it is operating correctly. The button will illuminate when power is applied and turn red (if there is no EMU in range) or green (if the site EMU is installed and communicating with the CET-HD-PM2 correctly):



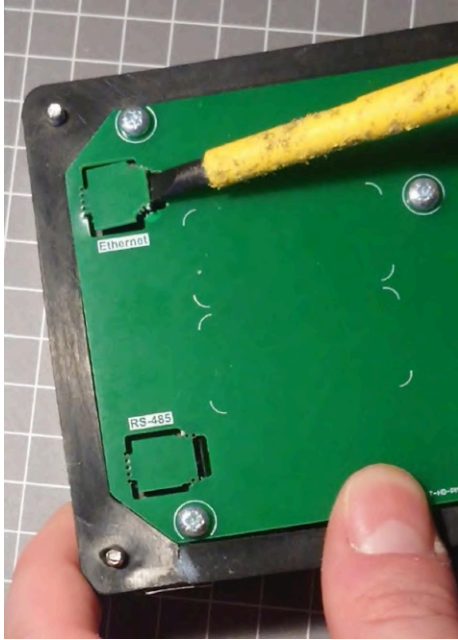
17. When correct operation of the device has been confirmed, insert the plastic screw caps into the 6 lid screw positions:



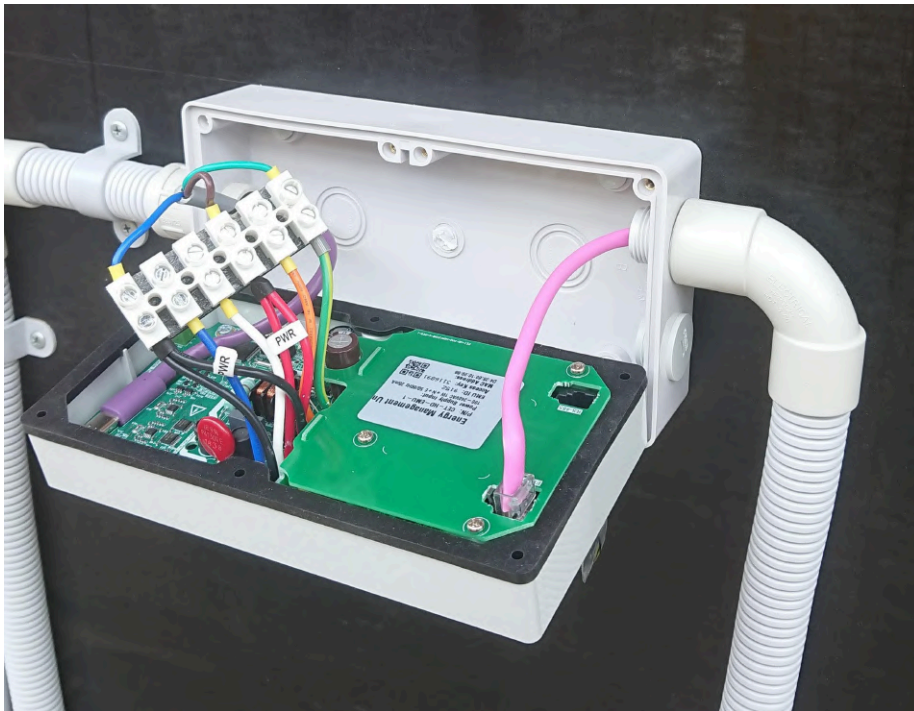
**Important: these plastic caps must be fitted to ensure the product remains weatherproof.**

## Ethernet Connection Installation

1. Using a flat blade screwdriver, carefully remove the breakout tab covering the RJ45 "Ethernet" port:



2. Connect the remote equipment to the RJ45 port using a double insulated Ethernet cable (e.g. Clipsal 5005C305B).

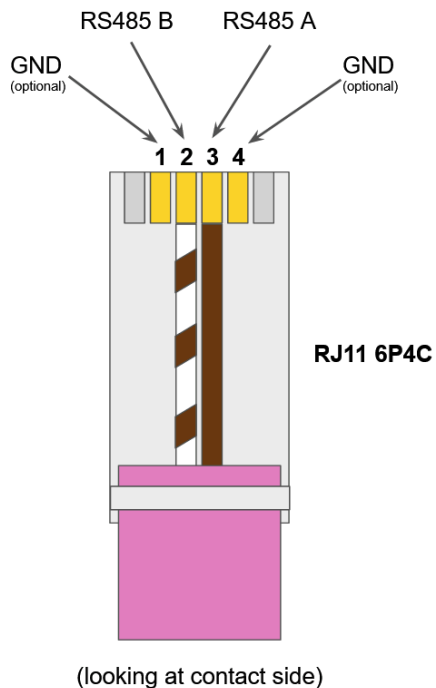


## RS485 Serial Connection Installation

1. Using a flat blade screwdriver, carefully lever out the breakout tab covering the RJ11 "RS-485" port:



2. Connect the remote equipment to the RJ11 6P4C port using a double insulated data cable (e.g. Clipsal 5005C305B). The pinout for the RS485 cable is shown below:



An RJ11 6P4C crimp connector is included in the standard set of accessories in the PM2 box. An RJ12 connector would also be compatible using pins 3 & 4.



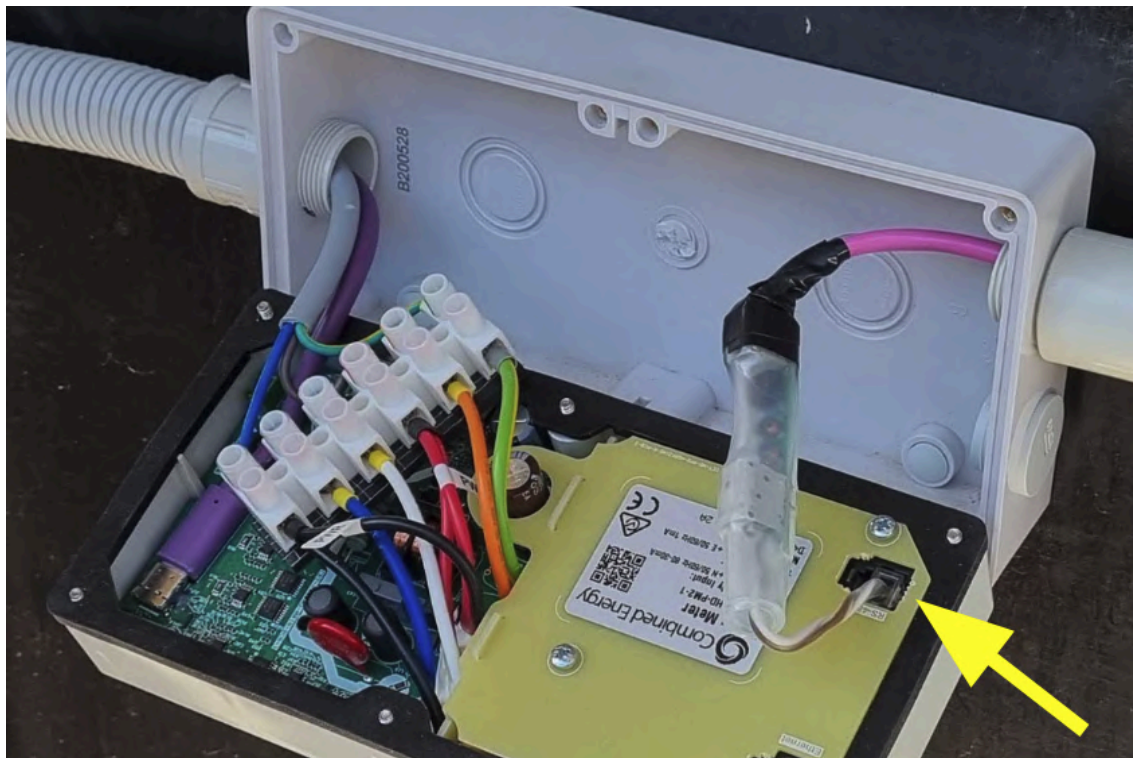
## RS485 Filter for Goodwe DNS, TDS, ES G2 (ES-20) Inverters

When connecting to a Goodwe DNS, TDS, or ES G2 (ES-20) series inverters with RS485 (e.g. GW5000D-NS, GW5000-ES-20), an additional filter is required to block interference from the inverter from disrupting the CET-HD-PM2-1's powerline communications.

The CET-IT2-485FILT-1 RS485 filter is not supplied with the CET-HD-PM2-1 but can be ordered separately in a pack of 5 filters (PN: CET-IT2-485FILPK-1). A pack of 5 RS485 filters is included in the CET Installer Kit (PN: CET-HD-INST-KIT-1).

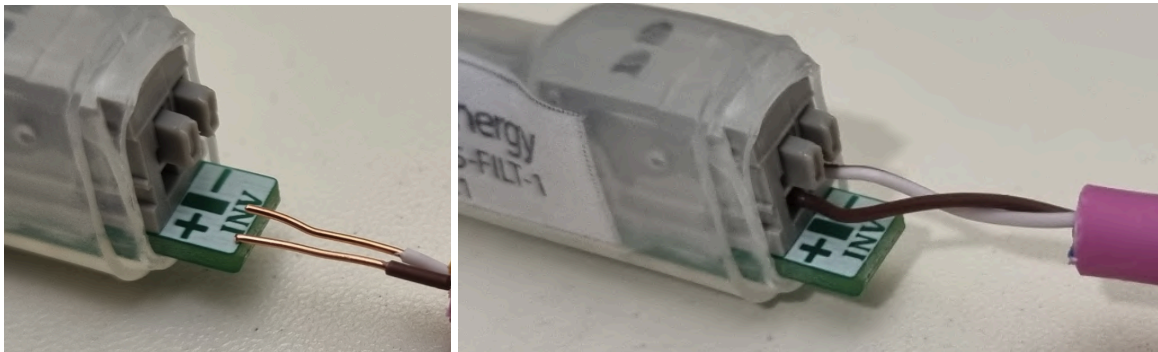


To install the RS485 filter, connect the RJ11 connector to the RS485 port on the CET-HD-PM2.



Terminate the **brown wire** from the Inverter to the data positive "+" INV terminal of the RS485 filter, and the brown-white wire to the data negative "-" INV terminal.

Strip 11mm of insulation from the wires before termination:



Wrap the terminated wires in **6 layers of electrical tape** to ensure the finished assembly is properly insulated:



## External Contactor Control using TRIAC output

The Sw output of the CET-HD-PM2-1 Power Meter is a 240VAC output controlled by an onboard TRIAC. This output can be used to energise the coil of an external relay/contactor for discrete control of large loads.

The maximum output current of the Sw terminal is 50mA. The output current at the Sw terminal is sourced from the Phase A input of the Power Meter.

### Compatible Contactors

The Hager ESC series of contactors are recommended for use with the CET-HD-PM2-1 Power Meter.

Other contactor brands / models can be used provided they have a 240VAC coil and a coil current below 50mA.

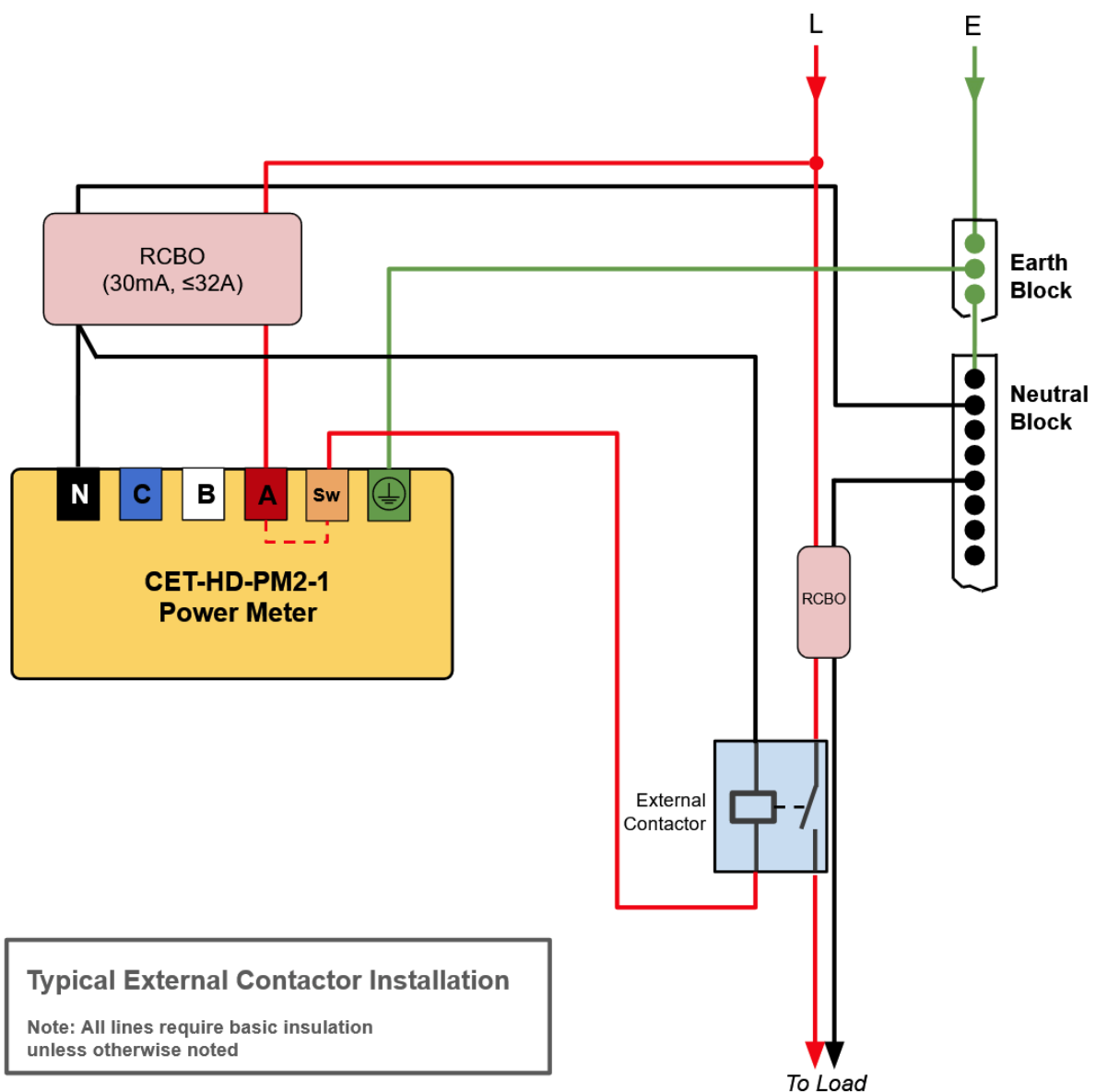
**Important: contactors with a 'hum free' coil will NOT work correctly with the CET-HD-PM2-1 Power Meter's TRIAC output. Please ensure that the selected contactor does not have a 'hum free' feature, i.e. the contactor should use a simple coil with no additional supporting electronics.**



## Installation Instructions

**Important:** the neutral side of the relay/contactator coil must be terminated at the protected neutral of the same RCBO that provides power to the CET-HD-PM2-1 Power Meter.

**Important:** The TRIAC that drives the Sw output is sensitive to over-voltage conditions - never connect a switch in series with the TRIAC output.



# CT Harness and CT Bundles

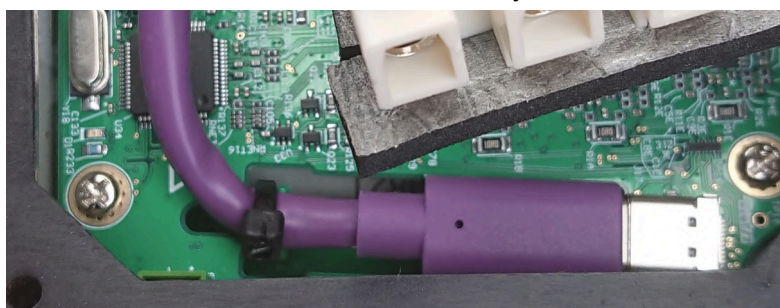
The Combined Energy **CT Harness** system enables easy connection of up to 6 Current Transformers (CTs) to Combined Energy metering products:



The CT Harness accepts up to two **CT Bundles**, each with three CTs:



The purple **USB-C cable** provides a single-cable link between the CT Harness and the CET-HD-PM2. The USB-C cable can be easily pulled through conduits to access external switchboards, and features a rotationally-invariant termination at the CET-HD-PM2:



## CT Bundle Options

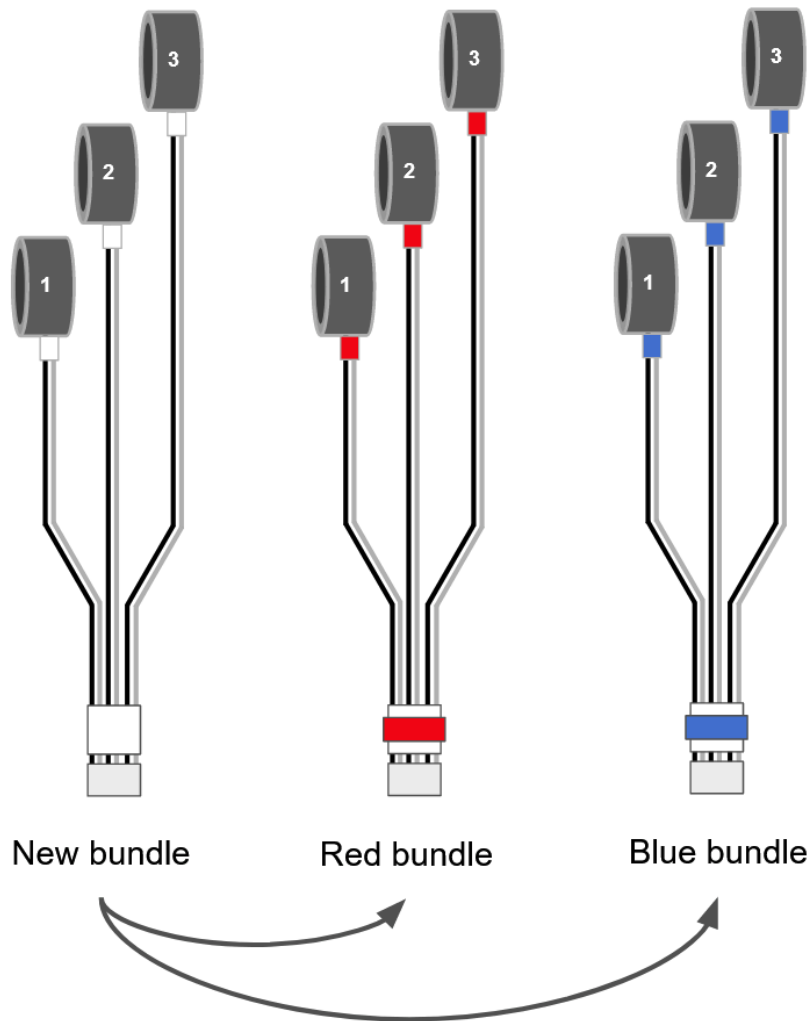
CT Bundles are available to suit a range of residential and commercial monitoring requirements:

Part Number	Nominal Current ( $I_N$ )	Window Size	Linear Measurement Range	Maximum Rated Continuous Primary Current (overload)
CET-CT1-B060606-1	60A	Ø 10mm	5%-110% $I_N$	2 x $I_N$
CET-CT1-B121212-1	120A	Ø 16mm	5%-110% $I_N$	2 x $I_N$
CET-CT1-B202020-1	200A	Ø 23.8mm	5%-115% $I_N$	2 x $I_N$
CET-CT1-B404040-1	400A	33 x 43mm	5%-110% $I_N$	2 x $I_N$
CET-CT1-B808080-1	800A	50.8 x 90mm	5%-110% $I_N$	2 x $I_N$

## CT Bundle Labelling

A sheet of Red and Blue labels is supplied with each CT Bundle.

It is recommended to label each bundle either RED or BLUE **prior to installation**, as this makes it much easier to configure the power meter and to debug issues with CT placement.



# Meter Configuration

Once installed, the CET-HD-PM2-1 must be configured for correct operation by defining the phases and CTs that relate to specific Devices within the Site. The meter configuration can be set by Combined Energy, or can be manually configured using the *onSite* web app.

1. Ensure that there is an Energy Management Unit (EMU) installed at the Site with access to the Internet, and that the Power Meter is able to communicate with the EMU (indicated by a green light on the button after power up).

For assistance with troubleshooting connection issues, please contact CET Support at <https://onsite.combined.energy/>

2. Ensure CT Bundles are **marked with red or blue colour labels** according to the positions they are connected to on the CT Harness
3. Place CTs so the CT arrow is pointing towards the device of interest (*away* from the switchboard):
  - a. For a grid CT, point the CT arrow towards the grid
  - b. For a solar CT, point the CT arrow towards the inverter
  - c. For a load CT (e.g. air-conditioner), point the CT arrow towards the air-conditioner
4. Note the **phase** and **power supply (tariff)** that supplies each circuit with a CT
5. Visit <https://onsite.combined.energy/> and either contact CET Support or use the *onSite* web app to manually configure the Power Meter. If manual configuration of the Power Meter you have installed is not yet available through the app, please use the *onSite* web app to contact CET Support.

# Button

## Show Connection Status

Pressing the front panel button once will turn the LED connection status display on for 2 minutes. See the *Connection Status Indications* section below for details.

## Network Reset

In some cases it may be necessary to manually reset the Powerline Communications (PLC) network. This can be done by pressing and holding the tactile push button on the front panel of the CET-HD-PM2-1 for at least 20 seconds and releasing the button when the light begins blinking fast.

After holding the button for 15 seconds the LED will blink slowly to indicate that the reset is about to happen, and after 18 seconds the LED will blink fast to indicate that the button should be released to complete the reset.

# Connection Status Indications

## When device is powered on, or button is pressed

Powering the device on, or pressing the front panel button once, will turn the Connection Status Indication on for 2 minutes:

- **Solid Green** means the CET-HD-PM2-1 is connected to a PLC network (i.e. there is an EMU present)
- **Double Green Blink + Solid Green** means the CET-HD-PM2-1 is connected to an Ethernet network
- **Red** means the CET-HD-PM2-1 can not see, or is not able to join, a PLC network OR an Ethernet network.

## When device is idle

After 120 seconds have elapsed the LED connection status display will turn off, and the connection status will instead be represented with a short blink (green or red) every 10 seconds:

- **Single Green Blink** means the CET-HD-PM2-1 is connected to a PLC network (i.e. there is an EMU present)
- **Double Green Blink** means the CET-HD-PM2-1 is connected to an Ethernet network
- **Red Blink** means the CET-HD-PM2-1 can not see, or is not able to join, a PLC network OR an Ethernet network.

# Identify Blink

During installation the product can be put into an 'Identify' mode using the Combined Energy *onSite* Installation app. In identify mode the LED will blink for at least 10 seconds with the following pattern:

**GREEN - OFF - GREEN - OFF - RED - OFF - RED - OFF**