

# EMS 1.0 AV2



## Description

EMS 1.0 is an all-in-one smart meter, gateway, web-server and controller. It is an energy analyser that can monitor one three phase load (or 3 single-phase loads), expandable to 10 three-phase loads via ESY bus add-ons.

EMS 1.0 is a gateway that supports several communication protocols including Modbus (TCP/IP and RTU), BACnet IP, FTP, FTPS, SFTP, Rest-API and MQTT which allow for rapid integration with third-party software and any other device connected to the network (e.g., building energy management systems and inverters or charging stations).

EMS 1.0 is a stand-alone controller: with two Ethernet ports, RS485 ports and Wi-Fi communication for a easy and simple programming via smart-phone; energy data readings can be pushed to external servers/Cloud and can be stored in the internal memory of the device.

EMS 1.0 is a web server: for data analytics presented via dashboards, charts and reports.

By combining accurate metering, a powerful linux powered CPU in a small case, EMS is really a complete Energy Management System in a box.

## Benefits

- **All-in-one Energy Management System:** fully integrated smart meter, data logger, gateway, web server and controller.
- **High measurement accuracy.**
- **User-friendly installation and set up:** the start-up and each function can be managed and configured by a unique web app (compatible with PC and smart-phones).
- **Real-time data acquisition.**
- **Accurate and reliable 3-phase energy measurement for consumption and feed-in.**
- **Direct connection** of up to 65 A.
- **Scalability:** it is easy to scale up the system thanks to additional ESY accessories.
- **Interoperability.** By leveraging its automation-server functions, it is easy to exchange data with other systems via FTP, SFTP, FTPS, SMTP, Rest-API, MQTT, Modbus and BACnet.
- **Powered by MAIA Cloud:** secure and reliable system for remotely managing, setting and operating EMS 1.0 units Worldwide.
- **Optimised user interface and data management.** Improved user experience for fast commissioning and easy daily operation thanks to a multi-user system.
- **Fleet management.** It is possible to update the EMS modules or fleets of modules thanks to MAIA Cloud.
- **Quick configuration.** The configuration wizard that runs when the system is started for the first time allows you to put the unit into operation without errors and in few seconds.
- **Cybersecurity (IoT Security Rating):** Security Capabilities Verified by UL to Level SILVER for EMS 1.0 (Security Enhancement).
- **Optional Open-EM system:** for allowing third party software modules to be embedded into EMS 1.0 so to build custom solutions for specific applications.

## References

### How to order



EMS10 AV2

Enter the code option instead of ☐

| Code                     | Options | Description      |
|--------------------------|---------|------------------|
| EMS10 AV2                | -       | -                |
| <input type="checkbox"/> | S1      | RS485 Modbus RTU |
| <input type="checkbox"/> | O1      | Digital output   |
| <input type="checkbox"/> | X       | -                |

### MAIA Cloud licences

| Information        | Description                      | Document                                         |
|--------------------|----------------------------------|--------------------------------------------------|
| EMS-LICENCE-M01B   | MAIA PLUS LICENCE-12 MONTHS VPN  | MAIA Licence A4 pdf<br>Licence Code EIM pdf      |
| EMS-LICENCE-M02B   | MAIA PLUS LICENCE-24 MONTHS VPN  |                                                  |
| EMS-LICENCE-M04B   | MAIA PLUS LICENCE-48 MONTHS VPN  |                                                  |
| EMS-LICENCE-M05B   | MAIA PLUS LICENCE-60 MONTHS VPN  |                                                  |
| EMS-LICENCE-M25B   | MAIA PLUS LICENCE-300 MONTHS VPN |                                                  |
| EMS-ACTIVATION-KEY | MAIA ACTIVATION LICENCE          | MAIA Activation A4 pdf<br>Activation Key EIM pdf |

### Accessory modules

| Module code | Connectable CT | Size  |
|-------------|----------------|-------|
| ESY3XMV     | 3 x 333 mV     | 1 DIN |
| ESY3XAV5    | 3 x 5 A        |       |

 **Main metering functions**

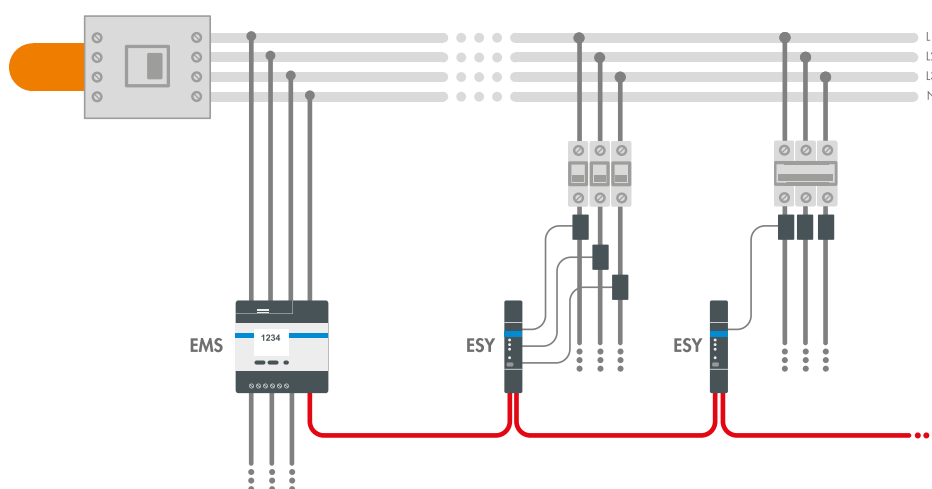
- Measure active, reactive and apparent energy
- Measure the main electrical variables
- Measure the load/analyser run hours
- Measure the total harmonic distortion (THD) of current and voltages
- Multi Load monitoring via plug'n play ESY BUS add-on modules

 **Main IoT features**

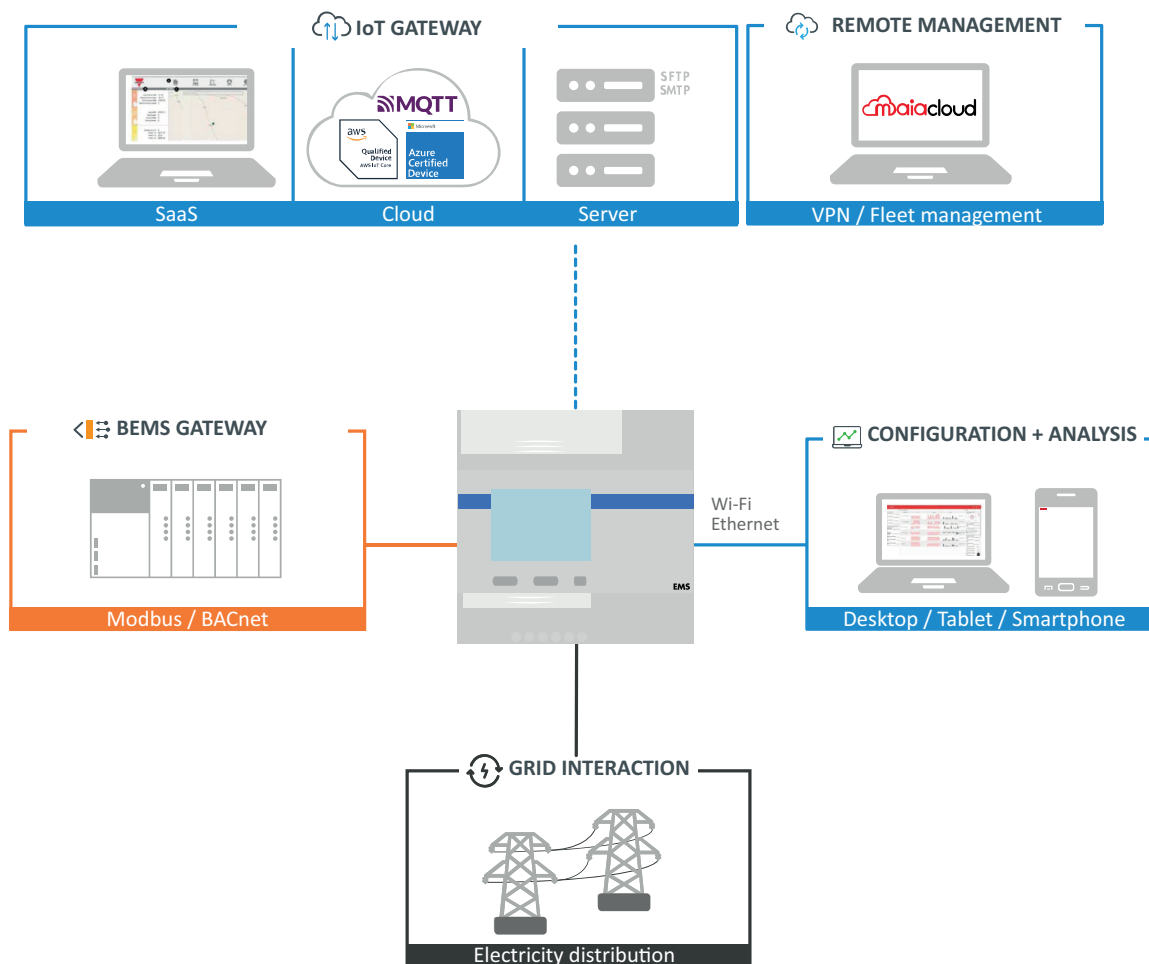
- Self power supply via voltage inputs
- Data transmission via Modbus BACnet, MQTT, FTP, SFTP, FTPS, Rest-API
- Embedded Wi-Fi for easy programming/data analysis
- Reliable data storage within the embedded database
- Data analytics organized in dashboards and widgets
- Display analytics based on the stored data via the embedded web server
- Embedded reporting system (scheduled or on-demand reports)
- Secure multi-user access either local (embedded web app) or remote (MAIA Cloud)
- Remote access and firmware update via MAIA Cloud (commissioning and troubleshooting)
- Two Ethernet ports (switch mode for easy cascading of connected devices)
- BTL certified
- IoT certification for Amazon AWS and Microsoft Azure
- Embedded display for diagnostics and variables

# Architecture

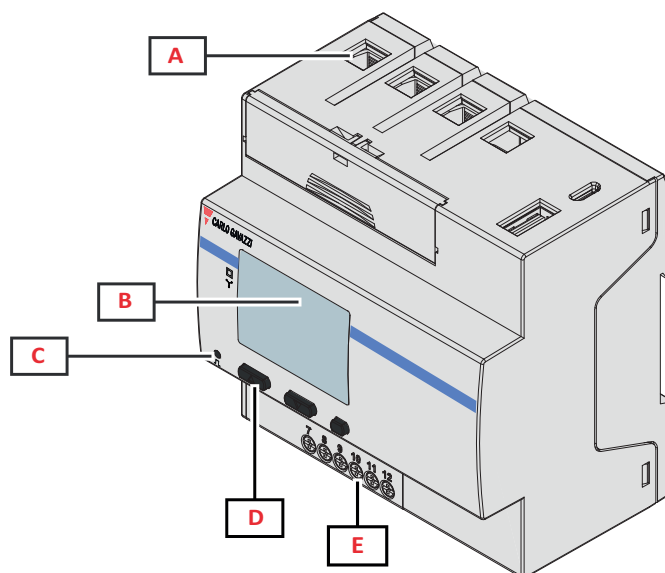
## Electrical connection



## Connectivity



## Structure



| Area | Description                                                 |
|------|-------------------------------------------------------------|
| A    | Voltage and current inputs                                  |
| B    | Display                                                     |
| C    | LED                                                         |
| D    | Browsing and configuration buttons                          |
| E    | Digital input, digital output and communication connections |

## Features

### General

|                             |                                                                                                                                                                                                                   |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Material</b>             | Housing: PBT<br>Transparent cover: polycarbonate<br>Compliant with UL and CE marks                                                                                                                                |
| <b>Dimensions</b>           | 5-DIN module                                                                                                                                                                                                      |
| <b>Weight</b>               | Approx. 500 g                                                                                                                                                                                                     |
| <b>Protection degree</b>    | Front: IP40; Screw terminals: IP20                                                                                                                                                                                |
| <b>Terminals</b>            | Measurement inputs (Phase 1, 2, 3, N): 2.5 to 16 mm <sup>2</sup> / 8 to 13 AWG, 2.5 Nm / 22.12 lbin max.<br>Inputs, outputs and communication: 0.2 to 1.5 mm <sup>2</sup> / 15 to 24 AWG, 0.4 Nm / 3.54 lbin max. |
| <b>Mounting</b>             | DIN rail                                                                                                                                                                                                          |
| <b>Overvoltage category</b> | III                                                                                                                                                                                                               |
| <b>Pollution degree</b>     | 2                                                                                                                                                                                                                 |

## Environmental

|                              |                                          |
|------------------------------|------------------------------------------|
| <b>Operating temperature</b> | From -25 to +70 °C / from -13 to +158 °F |
| <b>Storage temperature</b>   | From -30 to +70 °C / from -22 to 158 °F  |

Note: R.H. < 90 % non-condensing @ 40 °C / 104 °F.

## Power Supply

|                    |                   |
|--------------------|-------------------|
| <b>Type</b>        | Self power supply |
| <b>Frequency</b>   | 50/60 Hz          |
| <b>Consumption</b> | 10 W / 24 VA      |

## Compatibility and conformity

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Directives</b> | <b>RED</b> 2014/53/EU<br><b>RoHS</b> 2011/65/EU                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Standards</b>  | <b>Radio:</b> EN 300 328 V2.2.2<br><b>EMC (Electro Magnetic Compatibility):</b> EN 301 489-1 V2.2.3, EN 301 489-17 V3.2.4, EN 62052-11.2021<br><b>Safety:</b> EN IEC 61010-1<br><b>Health:</b> EN 62311:2020<br><b>Metrology:</b> EN IEC62053-21, EN IEC 62053-23<br><b>FCC (USA) Radio Emission:</b> FCC CFR title 47 Part 15C, FCC CFR title 47 Part 2.1091<br><b>IC (canadian) radio emission:</b> ISED RSS-247 Issue 3; ISED RSS-102 Issue 5 |
| <b>Approvals</b>  |                                                                                                                                                                                     |



## Electrical specifications

| Electrical system         |                                                |
|---------------------------|------------------------------------------------|
| Managed electrical system | Single-phase (2-wire)                          |
|                           | Two-phase (3-wire)                             |
|                           | Three-phase with neutral (4-wire)              |
|                           | Three-phase without neutral (3-wire)           |
|                           | Wild-leg system (three-phase, four-wire Delta) |

| Voltage inputs     |                  |
|--------------------|------------------|
| Voltage connection | Direct           |
| Rated voltage L-N  | 120 to 277 V AC  |
| Rated voltage L-L  | 208 to 480 V AC  |
| Voltage tolerance  | +/- 15%          |
| Overload           | 1.5 Un max       |
| Frequency          | From 48 to 62 Hz |

| Current inputs                      |                                         |
|-------------------------------------|-----------------------------------------|
| Current connection                  | Direct                                  |
| Base current (I <sub>b</sub> )      | 5 A                                     |
| Minimum current (I <sub>min</sub> ) | 0.25 A                                  |
| Maximum current (I <sub>max</sub> ) | 65 A                                    |
| Overload                            | For 10 ms: 30 I <sub>max</sub> (1950 A) |
| Input impedance                     | < 3.4 VA                                |
| Crest factor                        | 4 (I <sub>max</sub> peak 92 A)          |



## Measurements

|               |                                          |
|---------------|------------------------------------------|
| <b>Method</b> | TRMS measurements of distorted waveforms |
|---------------|------------------------------------------|

### Measurement accuracy

| Current           |                 |
|-------------------|-----------------|
| From 2 A to 65 A  | $\pm 0.5\%$ rdg |
| From 0.5 A to 2 A | $\pm 1\%$ rdg   |

| Phase-phase voltage                        |                 |
|--------------------------------------------|-----------------|
| From $U_n$ min. -20%<br>to $U_n$ max. +15% | $\pm 0.5\%$ rdg |

| Phase-neutral voltage                      |                 |
|--------------------------------------------|-----------------|
| From $U_n$ min. -20%<br>to $U_n$ max. +15% | $\pm 0.5\%$ rdg |

| Active and apparent power                   |                 |
|---------------------------------------------|-----------------|
| From 1.0 A to 65.0 A (PF=0.5 L - 1 - 0.8 C) | $\pm 1\%$ rdg   |
| From 0.5 A to 1.0 A (PF=1)                  | $\pm 1.5\%$ rdg |

| Reactive power                                                                         |                         |
|----------------------------------------------------------------------------------------|-------------------------|
| From 1.0 A to 2.0 A (sin $\phi$ =0.5 L - 0.5 C)<br>From 0.5 A to 1.0 A (sin $\phi$ =1) | $\pm 2\%$ rdg           |
| From 2.0 A to 65.0 A (sin $\phi$ =0.5 L - 0.5 C)<br>From 1.0 A to 65.0 A (PF=1)        | $\pm 2.5\%$ rdg         |
| <b>Active energy</b>                                                                   | Class 1 EN IEC 62053-21 |
| <b>Reactive energy</b>                                                                 | Class 2 EN IEC 62053-23 |

| Frequency        |                 |
|------------------|-----------------|
| From 45 to 65 Hz | $\pm 0.1\%$ rdg |



### Measurement resolution

| Variable            | Display resolution   | Resolution by serial communication |
|---------------------|----------------------|------------------------------------|
| Energy              | 0.001 kWh/kvarh/kVAh |                                    |
| Single phase energy | N.A.                 | 0.001 kWh                          |
| Power               | 0.001 kW/kvar/kVA    | 0.1 W/var/VA                       |
| Current*            | 0.001 A              | 0.001 A                            |
| Voltage             | 0.1 V                |                                    |
| Frequency           | N.A.                 | 0.001 Hz                           |
| THD                 | 0.01 %               |                                    |
| Power factor        | 0.01                 | 0.001                              |



## Digital outputs/inputs

### Digital inputs

|                                 |                                                                                                                                                                                                                                                                       |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Connection type</b>          | Screw terminals                                                                                                                                                                                                                                                       |
| <b>Number of inputs</b>         | 1                                                                                                                                                                                                                                                                     |
| <b>Type</b>                     | Free contact                                                                                                                                                                                                                                                          |
| <b>Function</b>                 | Remote status<br>Tariff management<br>Partial meter start/pause<br>Partial meter reset                                                                                                                                                                                |
| <b>Features</b>                 | Open contact voltage: 5 V DC +/- 5%<br>Closed contact voltage: 5 mA max<br>Input impedance: 11.6 k $\Omega$<br>Open contact resistance: $\geq 25$ k $\Omega$<br>Closed contact resistance: $\leq 840$ $\Omega$<br>Maximum voltage applicable with no damages: 30 V AC |
| <b>Configuration parameters</b> | Input function                                                                                                                                                                                                                                                        |
| <b>Configuration mode</b>       | Via web app                                                                                                                                                                                                                                                           |

### Digital output

|                                  |                                                                   |
|----------------------------------|-------------------------------------------------------------------|
| <b>Connection type</b>           | Screw terminals                                                   |
| <b>Maximum number of outputs</b> | 1                                                                 |
| <b>Type</b>                      | Opto-mosfet                                                       |
| <b>Function</b>                  | Remote output, alarm                                              |
| <b>Features</b>                  | $V_{ON}$ 2.5 V AC/DC, max 100 mA<br>$V_{OFF}$ 42 V AC/DC          |
| <b>Configuration parameters</b>  | Output function (remote/alarm)<br>Output normal status (NO or NC) |
| <b>Configuration mode</b>        | Via web app                                                       |

## Input and output insulation

| Type               | Measurement inputs | Digital input     | Digital outputs   | RS485 serial port |
|--------------------|--------------------|-------------------|-------------------|-------------------|
| Measurement inputs | -                  | Double/Reinforced | Double/Reinforced | Double/Reinforced |
| Digital input      | Double/Reinforced  | -                 | none              | none              |
| Digital outputs    | Double/Reinforced  | none              | -                 | -                 |
| RS485 serial port  | Double/Reinforced  | none              | -                 | -                 |

According to EN IEC 61010-1. Overvoltage category III. Pollution degree 2.

## Display

|                  |                                                      |
|------------------|------------------------------------------------------|
| Type             | Graphical matrix display                             |
| Refresh time     | 500 ms                                               |
| Description      | 128 x 96 backlit LCD                                 |
| Variable readout | Instantaneous: 5+1 dgt or 5+3 dgt<br>Energy: 8+3 dgt |

## LED

|                 |                                                             |
|-----------------|-------------------------------------------------------------|
| <b>Function</b> | Red colour, pulse weight proportional to energy consumption |
| <b>Constant</b> | 1000 pulse/kWh                                              |

## Ports

### Ethernet

|                          |                                                                                                                                         |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Number of ports</b>   | 2                                                                                                                                       |
| <b>Standard</b>          | ISO9847                                                                                                                                 |
| <b>LAN configuration</b> | Static or DHCP<br>IP Address; Net Mask; Default Gateway, DNS (primary, secondary)                                                       |
| <b>Protocols</b>         | HTTP, HTTPS, FTP, FTPS, SFTP, Modbus TCP/IP, SMTP, NTP, Azure IoT Hub, AWS IoT, BACnet IP, Rest-API, Multicast DNS (mDNS)               |
| <b>Connection type</b>   | 2 x RJ45 connector (10 Base-T, 100 Base-TX)<br>Maximum distance: 100 m<br>Integrated switch function to connect another Ethernet device |

### RS485

|                        |                   |
|------------------------|-------------------|
| <b>Number of ports</b> | 1                 |
| <b>Function</b>        | Modbus slave port |
| <b>Protocol</b>        | Modbus RTU        |

### ESY bus

|                                        |                                                         |
|----------------------------------------|---------------------------------------------------------|
| <b>Number of ports</b>                 | 1                                                       |
| <b>Function</b>                        | Connection with ESY bus accessories                     |
| <b>Cable type</b>                      | Min. Cat. 5E, not crossed                               |
| <b>Cable length</b>                    | Max. 100 m                                              |
| <b>Bus type</b>                        | Daisy chain (refer to standard Modbus RTU requirements) |
| <b>Number of ESY extension modules</b> | Max. 10 units                                           |

### USB micro bus

|             |                            |
|-------------|----------------------------|
| <b>Type</b> | High-speed USB 2.0 micro-B |
| <b>Mode</b> | Device                     |

|                 |                                                                    |
|-----------------|--------------------------------------------------------------------|
| <b>Speed</b>    | 60 MB/s                                                            |
| <b>Function</b> | RNDIS (virtual Ethernet)<br>Network access via IP: 192.168.254.254 |

 **USB type A port**

|                              |                                            |
|------------------------------|--------------------------------------------|
| <b>Type</b>                  | High-speed 2.0 Type-A                      |
| <b>Mode</b>                  | Host                                       |
| <b>Communication speed</b>   | 60 MB/s                                    |
| <b>Function</b>              | Modem communications                       |
| <b>Supported devices</b>     | USB modem/router can be directly connected |
| <b>Supported file system</b> | USB mass storage not supported             |

## Available measurements

| Active energy                         | Unit | System | Phase |
|---------------------------------------|------|--------|-------|
| Imported (+) Total                    | kWh+ | ●      | ●     |
| Imported (+) partial                  | kWh+ | ●      | -     |
| Exported (-) Total                    | kWh- | ●      | ●     |
| Exported (-) partial                  | kWh- | ●      | -     |
| Imported (+) Total by tariff (t1, t2) | kWh+ | ●      | -     |
| Quadrant I, II, III, IV               | kWh  | ●      | -     |

| Reactive energy         | Unit   | System | Phase |
|-------------------------|--------|--------|-------|
| Imported (+) Total      | kvarh+ | ●      | ●     |
| Imported (+) partial    | kvarh+ | ●      | -     |
| Exported (-) Total      | kvarh- | ●      | ●     |
| Exported (-) partial    | kvarh- | ●      | -     |
| Quadrant I, II, III, IV | kvarh  | ●      | -     |

| Apparent energy         | Unit | System | Phase |
|-------------------------|------|--------|-------|
| Total                   | kVAh | ●      | -     |
| Partial                 | kVAh | ●      | -     |
| Quadrant I, II, III, IV | kVAh | ●      | -     |

| Run hour meter | Unit    | System | Phase |
|----------------|---------|--------|-------|
| Total (kWh+)   | hh:mm   | ●      | -     |
| Partial (kWh+) | hh:mm   | ●      | -     |
| Total (kWh-)   | hh:mm - | ●      | -     |
| Partial (kWh-) | hh:mm - | ●      | -     |
| Total ON time  | hh:mm   | ●      | -     |

| Electrical variable | Unit | System | Phase |
|---------------------|------|--------|-------|
| Voltage L-N         | V    | ●      | ●     |
| Voltage L-L         | V    | ●      | ●     |
| Current             | A    | ●      | ●     |
| Neutral current     | A    | ●      | -     |



| Electrical variable | Unit      | System | Phase |
|---------------------|-----------|--------|-------|
| Active power        | W         | •      | •     |
| Apparent power      | VA        | •      | •     |
| Reactive power      | Var       | •      | •     |
| Power factor        | PF        | •      | •     |
| Frequency           | Hz        | •      | -     |
| THD current*        | THD A %   | -      | •     |
| THD voltage L-N*    | THD L-N % | -      | •     |
| THD voltage L-L*    | THD L-L % | -      | •     |

\*Up to 31<sup>th</sup> harmonic



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