INSTRUCTION MANUAL

# COUNTIS E23/E24

## Three-phase energy meter
## Direct - 80 A MODBUS

EN

COUNTIS E23

COUNTIS E24 - MID

www.socomec.com/
en/countis-e2x

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# 1. DOCUMENTATION

All documentation on the COUNTIS E23/E24 is available on the website at the following address:
www.socomec.com/en/countis-e2x

# 2. HAZARDS AND WARNINGS

The term "device" used in the paragraphs below refers to the COUNTIS E23/E24.

The assembly, use, servicing and maintenance of this equipment must only be carried out by trained, qualified professionals.

SOCOMEC shall not be held responsible for failure to comply with the instructions in this manual.

## 2.1. Risk of electrocution, burns or explosion

- This device must only be installed and serviced by qualified personnel who have in-depth knowledge of installing, commissioning and operating the device and who have had appropriate training. He or she should have read and understood the various safety measures and warnings stated in the instructions.
- Before carrying out any work on the unit, switch off the voltage inputs.
- Always use an appropriate voltage detection device to confirm the absence of voltage.
- Replace all devices, doors and covers before turning on power to this equipment.
- Always power the device with the correct rated voltage.
- Install the unit following the recommended installation instructions and in a suitable electrical cabinet.

**Failure to take these precautions could cause death or serious injuries.**

## 2.2. Risk of damaging the unit

To ensure that the unit operates correctly, make sure that:

- The unit is correctly installed.
- There is a maximum voltage at the voltage input terminals of 288 VAC phase-neutral
- The network frequency indicated on the device is observed: 50 or 60 Hz.
- There is a maximum current of 80 A at the current input terminals (I1, I2 and I3).

**Failure to respect these precautions could cause damage to the unit.**

## 2.3. Responsibility

- Assembly, connection and use must be carried out in accordance with the installation standards currently in force.
- The unit must be installed in accordance with the rules given in this manual.
- Failure to observe the rules for installing this unit may compromise the device's intrinsic protection.
- The unit must be positioned within an installation which complies with the standards currently in force.
- Any cable which needs to be replaced may only be replaced with a cable having the correct rating.

# 3. PRELIMINARY OPERATIONS

To ensure the safety of staff and the equipment, it is vital to read and absorb the contents of these instructions thoroughly before commissioning.

Check the following points as soon as you receive the package containing the unit:

- The packaging is in good condition
- The unit has not been damaged during transportation
- The device reference number conforms to your order
- The package includes:
  - 1 device
  - 1 sealing kit (for COUNTIS E24)
  - 1 Quick Start guide

# 4. INTRODUCTION

## 4.1. Introducing the COUNTIS E23 / E24

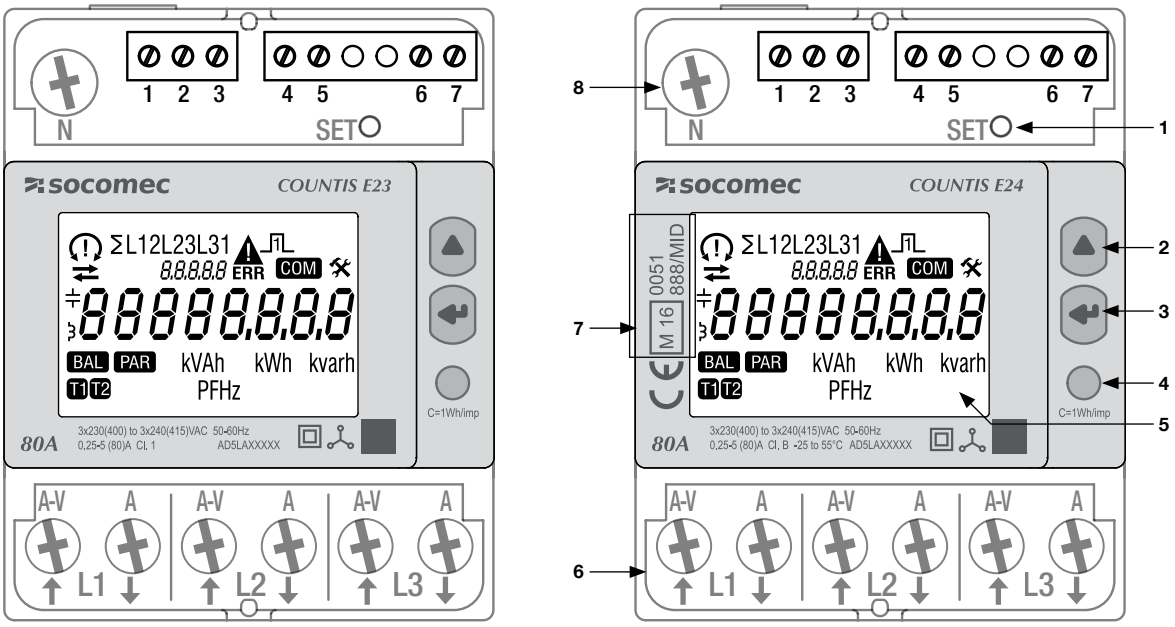
The COUNTIS E23 and E24 are modular active and reactive electrical energy meters that display consumed energy. They are designed for three-phase networks and allow a direct connection of up to 80 A. They are equipped with a MODBUS communication Bus.

## 4.2. Functions

- Measures and displays total and partial energy
- Dual tariff management: T1 / T2
- Electrical parameter measurements: I, U, V, f
- Power, power factor
- RS 485 Modbus communication
- MID version (according to reference)

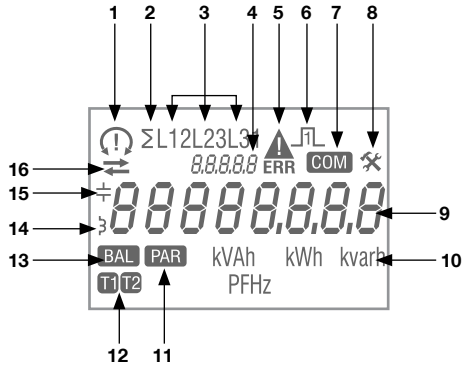
| ***Description*** | ***Reference*** |
|---|---|
| COUNTIS E23 | 4850 **3050** |
| COUNTIS E24 - Version MID | 4850 **3051** |

## 4.3. Front panels




1. SET button
2. UP button
3. ENTER key
4. Metrological LED
5. LCD display
6. Three-phase network connection
7. Information relating to MID certification
8. Neutral connection

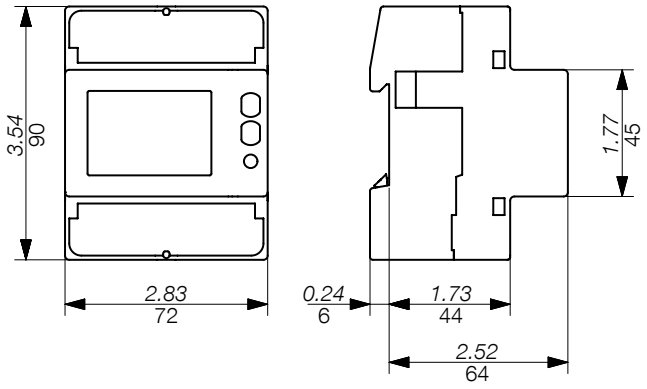
## 4.4. LCD display




1. Phase sequences:
   - 132
   - 123
   - one or multiple phases are not detected
2. System value
3. Value by phase
4. Identification of current menu
5. Device malfunction. Replace the device
6. Active pulse output
7. Active communication
8. Setup menu
9. Main zone
10. Measurement Unit
11. Partials meters. Flashing = partial meter has stopped
12. Tariff display
13. Energy balance
14. Inductive value
15. Capacitive value
16. Imported (→) or exported energy or power (←)

## 4.5. Dimensions

Dimensions: *in*/mm



## 4.6. Electrical values measured

### 4.6.1. Measurements

Settings vary by model.

| ***Realtime values*** | ***Symbol*** | ***Measure-ment Unit*** | ***LCD display*** | ***Via communication*** |
|---|---|---|---|---|
| Neutral voltage | ∑V | V | ● | ● |
| | V1, V2, V3 | | | ● |
| Phase to phase voltage | ∑U | | ● | ● |
| | U12, U23, U31 | | | ● |
| Current | ∑I | A | ● | ● |
| | I1, I2, I3, IN | | | ● |
| Power factor | ∑PF | | ● | ● |
| | PF1, PF2, PF3 | | | ● |
| Apparent power | ∑S, S1, S2, S3 | kVA | ● | ● |
| Active power | ∑P, P1, P2, P3 | kW | ● | ● |
| Reactive power | ∑Q, Q1, Q2, Q3 | kVAr | ● | ● |
| Frequency | f | Hz | ● | ● |
| Phase sequence | CW / CCW | | ● | ● |
| Direction of current | ⇄ | | ● | |
| ***Logged data*** | | | | |
| Total active and reactive energy | Ea, Er (∑ & by phase) | kWh, kvarh | ● | ● |
| Total apparent energy | Eap (∑) | kVAh | ● | ● |
| | Eap (by phase) | | | ● |
| Total reactive, inductive and capacitive energy | Er (∑) | kvarh | ● | ● |
| | Er (by phase) | | | ● |
| Total active, reactive and apparent energy for each tariff (T1/T2) | Ea, Er (∑) | kWh, kvarh | ● | ● |
| | Ea, Er, Eap (∑ & by phase) | kWh, kvarh, kVAh | | ● |
| Total reactive, inductive and capacitive energy for each tariff (T1/T2) | Er (∑) | kvarh | ● | ● |
| | Er (by phase) | | | ● |
| Active, partial energy for each tariff (T1/T2) | Ea (∑) | kWh | ● | ● |
| Active, reactive and apparent partial energy | Ea, Er, Eap (∑) | kWh, kvarh, kVAh | ● | ● |
| Energy balance | ∑ | kWh, kvarh | ● | ● |
| ***Miscellaneous*** | | | | |
| Current tariff | T | 1/2 | ● | ● |
| Partial meters | BY | START/STOP | ● | |
| State of the pulse output | ⎍ | Active / inac-tive | ● | |

*NOTE: ∑ is the sum of the meter readings for each phase, divided by 3.*

### 4.6.2. Energy balance; definition

| | ***Formula*** |
|---|---|
| kWh | (+kWh T1) – (-kWh T1) + (+kWh T2) – (-kWh T2) |
| kvarh | (+kvarh T1) – (-kvarh T1) + (+kvarh T2) – (-kvarh T2) |

# 5. INSTALLATION

The paragraphs below describe how to install the device.

## 5.1. Recommendations and safety

Refer to the safety instructions (section "2. Hazards and warnings", page 4)

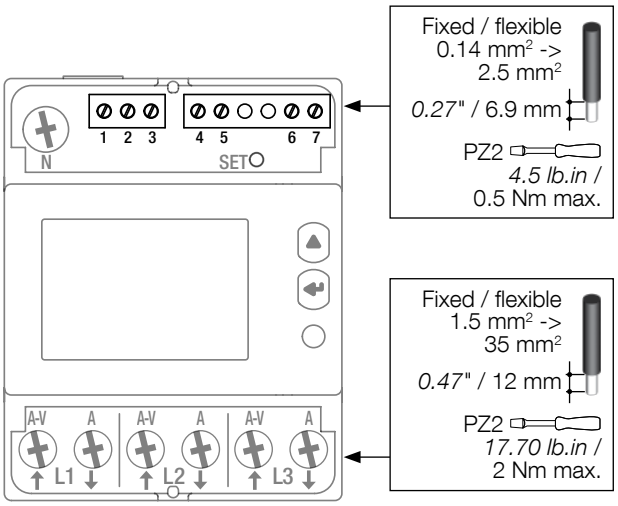
- Keep away from electromagnetic interference generator systems,
- Avoid vibrations with accelerations greater than 1 g for frequencies lower than 60 Hz.

## 5.2. DIN rail mounted

The COUNTIS E23/E24 can be mounted on a 35-mm DIN rail (EN 60715TM35). They must be used inside electrical cabinets.

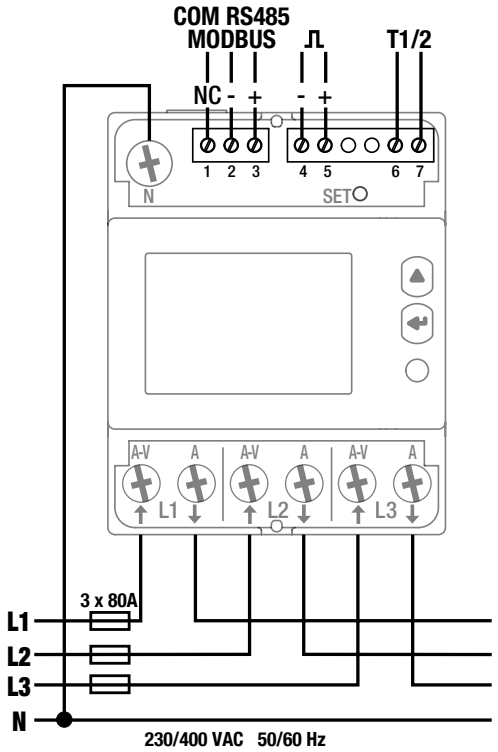
# 6. CONNECTION

## 6.1. Connecting the COUNTIS E23/E24




## 6.2. Connection to the electrical network and to the loads

The COUNTIS E23/E24 are intended for three-phase networks with neutral.




**MODBUS**
1: NC (not connected). May be used for shielding continuity.
2: -
3: +

**Pulse output**
4: -
5: +

*Optocoupler pulse outputs*
Terminals 4-5 must be supplied with voltage between 5 and 27 VDC (27mA max)

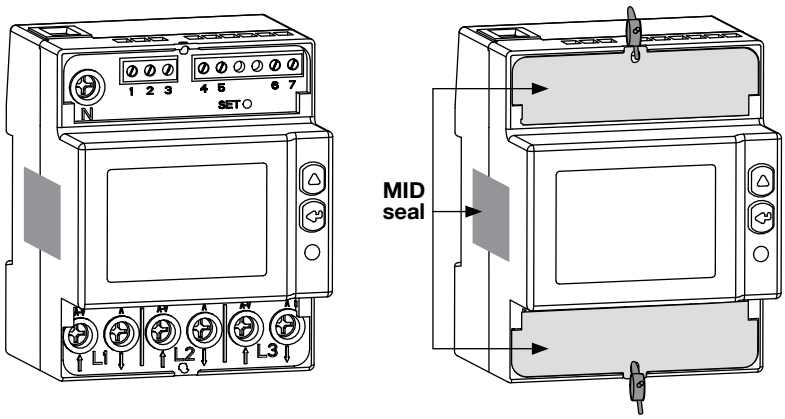
**Price list**
6-7: Switch tariffs:
0 VAC/DC -> Tariff 1
80-276 VAC/DC -> Tariff 2

**Mains**
L1 A-V: Phase input
L1 A: Phase output
L2 A-V: Phase input
L2 A: Phase output
L3 A-V: Phase input
L3 A: Phase output
N: Neutral connection

# 7. MID COMPLIANCE

The following points must be taken into consideration to ensure that the device is used in compliance with directive MID 2014/32/EU:

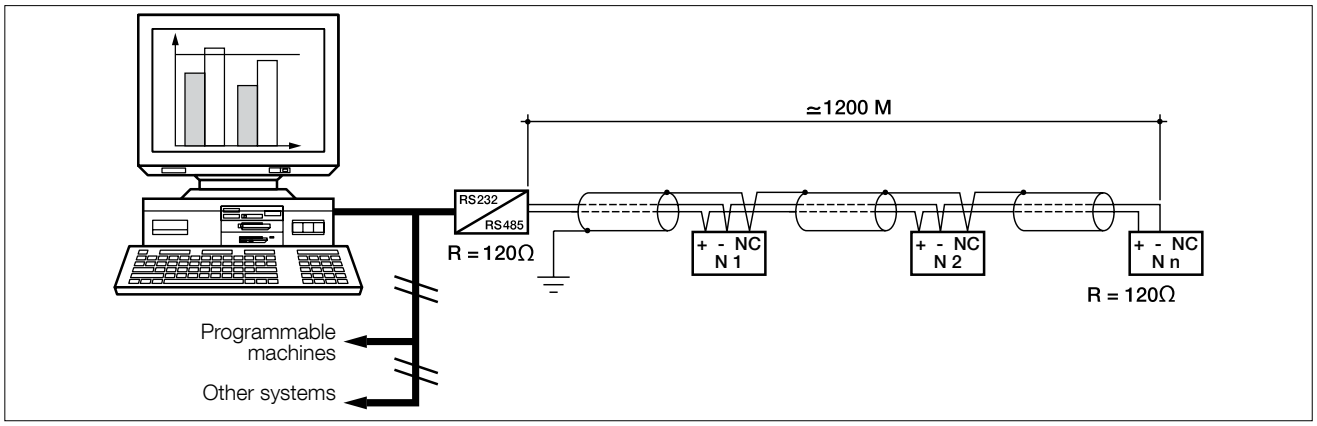
- **Type of network**
  COUNTIS E24 meters comply with the MID directive for connection to networks: 3P+N (see "6.2. Connection to the electrical network and to the loads", page 10)
- **Fitting terminal covers**
  After connecting the device, ensure that the terminal covers are fitted properly and secured by the plastic seals provided with the device.
- **Locking the program button**
  Make sure the SET program button is locked after fitting the terminal cover.
- **RS485 communication**
  The information provided via the RS485 COM is transmitted for information only and has no legal value.
- **MID Declaration of Conformity**
  The MID Declaration of Conformity is available on the website: www.socomec.com/en/countis-e2x

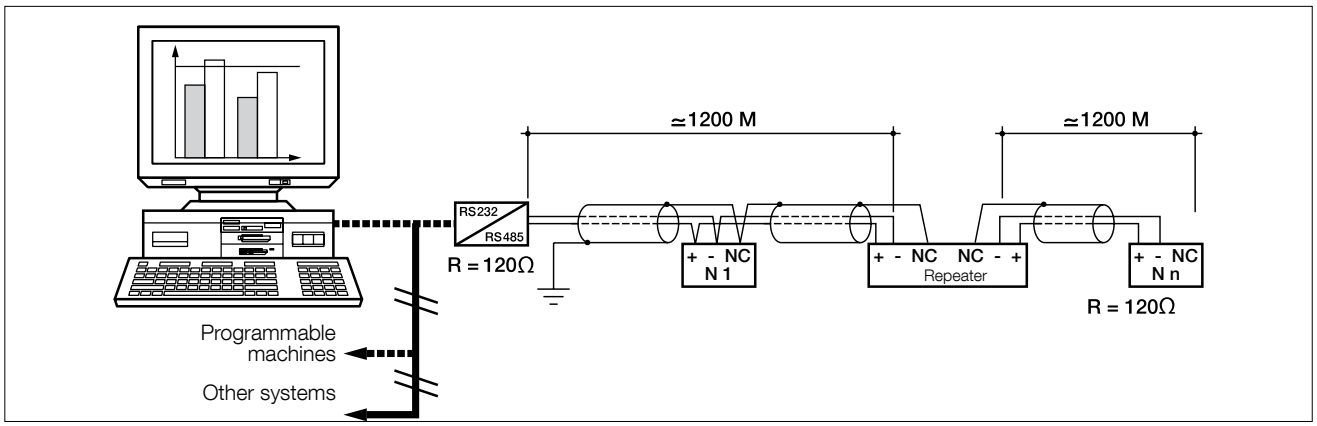


# 8. COMMUNICATION

## 8.1. General information

The Modbus communication available on the COUNTIS E23/E24 communicates via an RS485 series link (2 or 3 wires) which is used to operate devices from a PC or an API.
In a standard configuration an RS485 connection is used to connect 32 devices to a PC or a controller over 1200 metres.




## 8.2. RS485 rules

A LIYCY shielded twisted pair must be used. We recommend using a shielded twisted pair with a general LIYCY-CY shielding in an environment where there is interference or in a very long network with a number of devices.
If the distance of 1200 m is exceeded and/or the number of devices is greater than 32, a repeater must be added to enable additional devices to be connected.
A 120 Ohm resistor must be fixed at both ends of the connection.

## 8.3. Communication structure

The device communicates via a Modbus protocol which involves a dialogue in accordance with a master/slave structure. The communication mode is the RTU (Remote Terminal Unit) mode with hexadecimal characters composed of at least 8 bits.

Modbus frame structure (master -> slave question):

| Slave address | Function code | Address | Number of words to be read | CRC 16 |
|---|---|---|---|---|
| *1 byte* | *1 byte* | *2 bytes* | *2 bytes* | *2 bytes* |

To comply with the Modbus protocol, the inter-character time must be ≤ 3 silences.
This means the time for 3 characters to be emitted so that the message is processed by the COUNTIS E23/E24.
In order to use the information correctly, you must use the Modbus functions in accordance with the codes:

- 3: to read n words (maximum 128).
- 6: to write one word.
- 16: to write n words (maximum 128).

N.B.:
1 word <=> 2 bytes <=> 16 bits
2 words <=> 4 bytes <=> 32 bits

The broadcast communication is available for the log that stores the tariff.

## 8.4. Communication tables

The communication tables and relevant notes are available on the COUNTIS E23/E24 documentation page on the website at the following address:
www.socomec.com/en/countis-e2x

# 9. CONFIGURATION

The device can be configured directly from the COUNTIS E23/E24 screen in programming mode or via the communication link. The paragraphs below describe configuring using the screen.

## 9.1. Onscreen configuration

From the screen, go to programming mode to change your communication settings. How to browse through the programming mode is described in the following stages:

| Function | Where | Buttons | Press |
|---|---|---|---|
| Switch menus | Every page with the exception of SETUP 1/2 | ↵ | Realtime |
| Switch pages within a menu | Every page within a menu | ▲ | Realtime |
| Go to menu SETUP 2 | Menu page SETUP | ↵ | > 3 sec |
| Go to menu SETUP 1 | Every page with the exception of SETUP 1 | **SET** | > 3 sec |
| Change a value/digit | Pages SETUP 1/2 | ▲ | Realtime |
| Confirm a value/digit | Pages SETUP 1/2 | ↵ | Realtime |
| Exit menu SETUP 1/2 | Menu SETUP 1/2 | ↵ | > 3 sec |
| Start/stop the displayed partial meter | Partial meter menu | ↵ + ▲ | Realtime |
| Reset the displayed partial meter to zero | Partial meter menu | ↵ + ▲ | > 3 sec |
| Display test | Every page with the exception of SETUP 1/2 | ↵ + ▲ | > 10 sec |

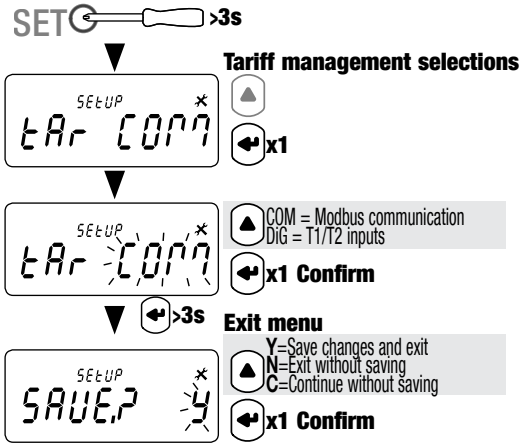
### 9.1.1. Detailed view of menu "SETUP 1"

You can change the current tariff either via the communication link or via the device's T1/2 inputs.

In the "SETUP 1" menu you can select the tariff management mode.

Press SET for 3 seconds using a screwdriver to put the device into programming mode.

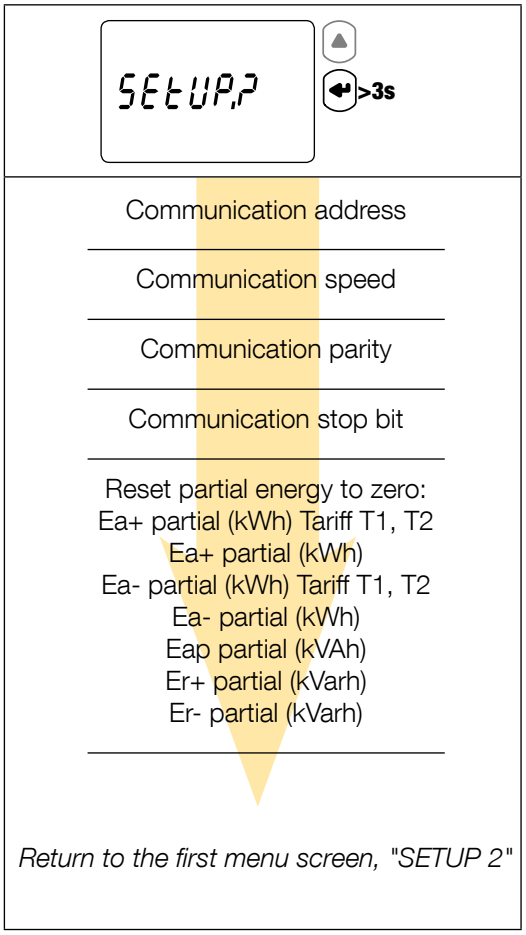
Press ▲ to go to the two programming options: COM = Modbus connection or DiG = T1/T2 inputs



### 9.1.2. View all of the menu "SETUP 2"

In the SETUP 2 menu, press "↵" for 3 seconds to put the device into programming mode.

You can go to the different screens by pressing "▲":



## 9.1.3. Detailed view of menu "SETUP 2"

| **Communication address** | |
|---|---|
| | 1, 2, ... **5**, ..., 246, 247 |

| **Communication speed** | |
|---|---|
| | 1200, 2400, 4800, 9600, 19200, **38400**, 57600, 115200 |

| **Communication parity** | |
|---|---|
| | **n** = no<br>o = odd<br>E = even |

| **Communication stop bit** | |
|---|---|
| | **1**, 2 |

| **Reset energies** | |
|---|---|
| | Ea+ partial Tariff T1, T2; Ea+ partial; Ea- partial Tariff T1, T2; Ea- partial; Eap partial; Er+ partial; Er- partial |

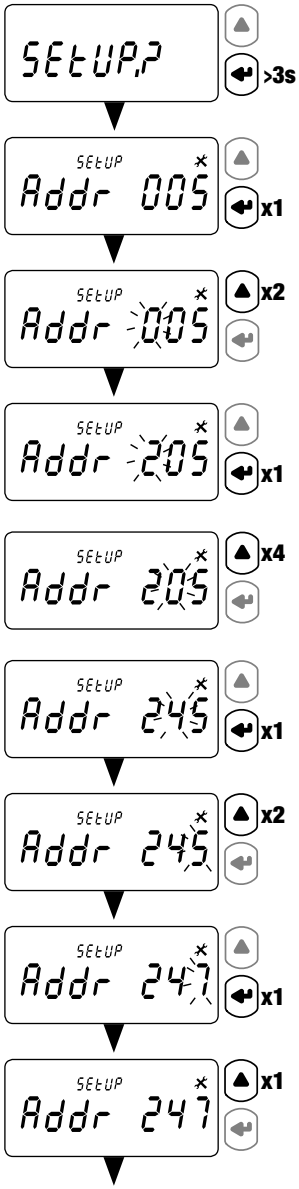
*Return to the first menu screen, "SETUP 2"*

**XX** = default value

## 9.1.4. Example: setting the communication address

In "SETUP 2" mode (see page 14), go to the "Addr communication address" screen

Example: changing the communication address to 247.



# 10. USE

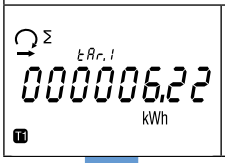
Switch menus by pressing "↵". Press "▲" to see the electrical readings or information within a menu.

The menus and related measurements are described in the table below:

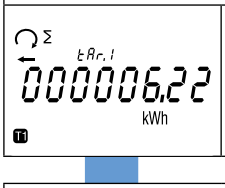
| Tariff 1 (Tar.1) | Tariff 2 (Tar.2) | Total (tot) | Partial readings and energy balance (Par.b) | Realtime values (rt) | Information (inFo) |
|---|---|---|---|---|---|
| Tariff 1 - Imported and exported active energy | Tariff 2 - Imported and exported active energy | Total imported and exported active energy | Partial imported active energy by tariff | Active, apparent and reactive power | Metrological firmware version |
| Tariff 1 - Imported and exported inductive reactive energy | Tariff 2 - Imported and exported inductive reactive energy | Total apparent energy | Partial imported active energy | Phase/phase and phase/neutral voltage | Non-metrological firmware version |
| Tariff 1 - Imported and exported capacitive reactive energy | Tariff 2 - Imported and exported capacitive reactive energy | Total imported and exported inductive reactive energy | Partial exported active energy by tariff | Three-phase current | Checksum of metrological firmware |
| Tariff 1 - Imported and exported reactive energy | Tariff 2 - Imported and exported reactive energy | Total imported and exported capacitive reactive energy | Partial exported active energy | Power factor | Checksum of non-metrological firmware |
| *Go back to first screen, menu "Tar.1"* | *Go back to first screen, menu "Tar.2"* | Total imported and exported reactive energy | Partial apparent energy | Frequency | Installed communication port |
| | | *Go back to first screen, menu "tot"* | Partial imported and exported reactive energy | *Go back to first screen, menu "rt"* | *Go back to first screen, menu "info"* |
| | | | Active energy balance | | |
| | | | Reactive energy balance | | |
| | | | *Go back to first screen, menu "Par.b"* | | |

## 10.1. Detailed view of the menu for tariff 1, "Tar.1"

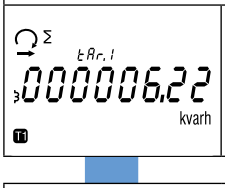
**Imported active energy, tariff 1**



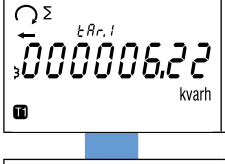

**Exported active energy, tariff 1**



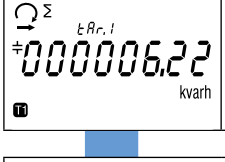

**Imported inductive reactive energy, tariff 1**




**Exported inductive reactive energy, tariff 1**




**Imported capacitive reactive energy, tariff 1**




**Exported capacitive reactive energy, tariff 1**

**Imported reactive energy, tariff 1**

**Exported reactive energy, tariff 1**

*Go back to first screen, menu "Tar.1"*

## 10.2. Detailed view of the menu for tariff 2, "Tar.2"

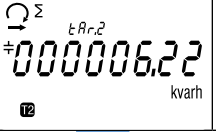
**Imported active energy, tariff 2**

**Exported active energy, tariff 2**

**Imported inductive reactive energy, tariff 2**

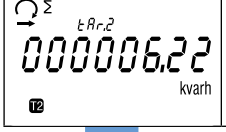
**Exported inductive reactive energy, tariff 2**

**Imported capacitive reactive energy, tariff 2**




**Exported capacitive reactive energy, tariff 2**

**Imported reactive energy, tariff 2**




**Exported reactive energy, tariff 2**

*Go back to first screen, menu "Tar.2"*

## 10.3. Detailed view of the total menu, "tot"

**Total imported active energy**

L1, L2, L3, ∑

**Total exported active energy**

L1, L2, L3, ∑

**Total apparent energy**

∑

**Total imported inductive reactive energy**

∑

**Total exported inductive reactive energy**

∑

**Total imported capacitive reactive energy**

∑

**Total exported capacitive reactive energy**

∑

**Total imported reactive energy**

L1, L2, L3, ∑

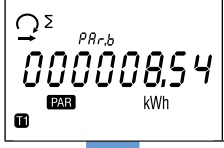
**Total exported reactive energy**

L1, L2, L3, ∑

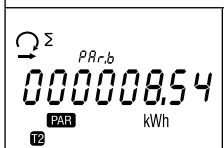
*Go back to first screen, menu "tot"*

## 10.4. Detailed view of the menu showing partial readings and the energy balance "Par.b"

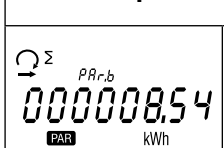
**Imported partial active energy for tariff T1**




**Imported partial active energy for tariff T2**

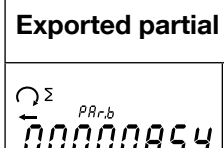



**Partial imported active energy**

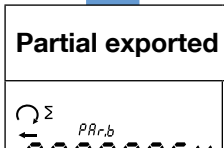



**Exported partial active energy for tariff T1**

**Exported partial active energy for tariff T2**

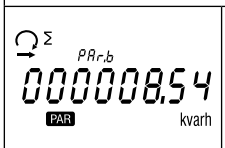



**Partial exported active energy**

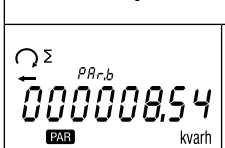



**Partial apparent energy**

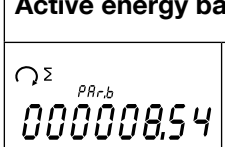
**Partial imported reactive energy**



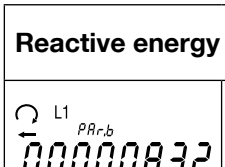

**Partial exported reactive energy**




**Active energy balance**

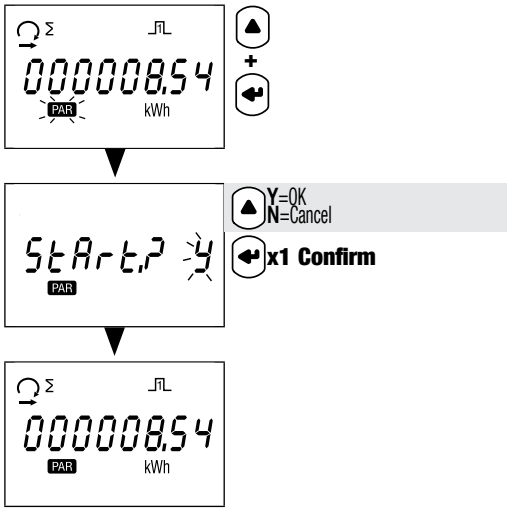



**Reactive energy balance**

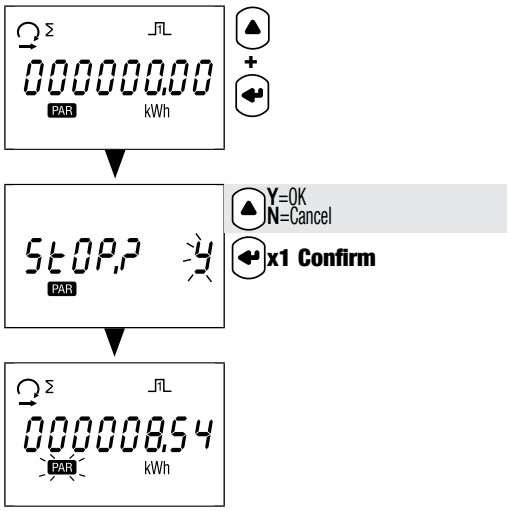



*Go back to first screen, menu "Par.b"*

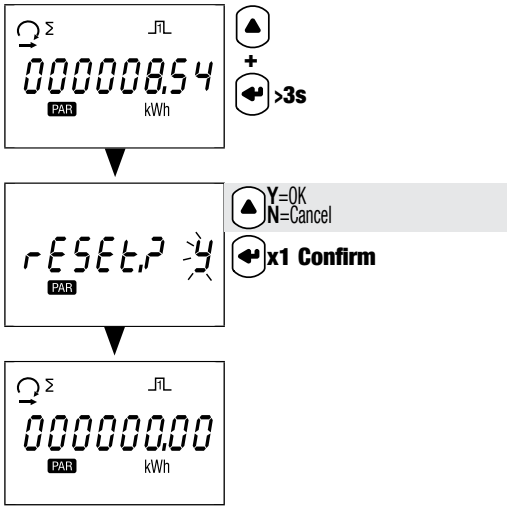
### 10.4.1. Starting up the partial energy meter




### 10.4.2. Stopping the partial energy meter

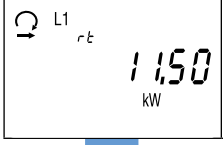



### 10.4.3. Resetting the partial energy meter to zero



## 10.5. Detailed view of the menu for realtime readings, "rt"

**Realtime active power**

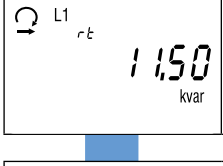



L1, L2, L3, ∑

**Realtime apparent power**

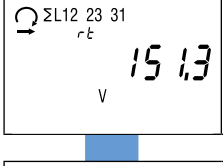
L1, L2, L3, ∑

**Realtime reactive power**



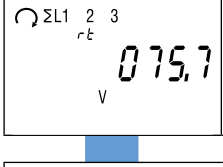

L1, L2, L3, ∑

**Realtime phase/phase voltage**



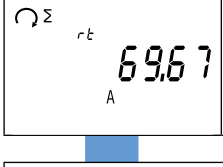

∑

**Realtime phase/neutral voltage**



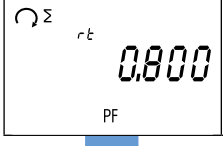

∑

**Realtime three-phase current**



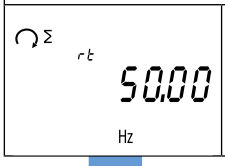

∑

**Realtime power factor**




∑

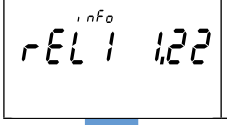
**Frequency**



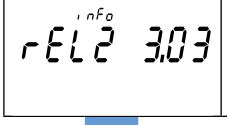

*Go back to first screen, menu "rt"*

## 10.6. Detailed view of the menu "info"

**Metrological firmware version**

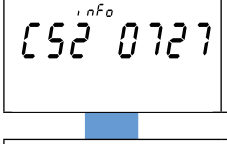



**Non-metrological firmware version**




**Checksum of metrological firmware**

**Checksum of non-metrological firmware**




**Installed communication port**

*Go back to first screen, menu "info"*

# 11. DIAGNOSTICS MESSAGES

The following messages appear if there are connection or malfunction errors.

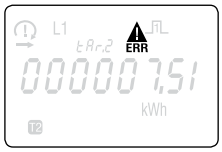
## 11.1. Missing phases

- If one or several phases are not detected, the exclamation point flashes on the screen. Example: phase not detected

## 11.2. Reversed phases

- If a 123 phase sequence is detected, the symbol appears.
- If a 132 phase sequence is detected, the symbol appears.

## 11.3. Malfunction




- If you see this message, the meter has malfunctioned and must be replaced.

# 12. ASSISTANCE

| **Causes** | **Solutions** |
|---|---|
| Device not working | Check the neutral and phase 1 cable connections. |
| Phases not shown onscreen | Check the connections |
| Phases reversed onscreen | Check the network configuration |
| Error message | Check the meter is working OK |

# 13. CHARACTERISTICS

| | |
|---|---|
| **GENERAL FEATURES** | |
| Compliant with | European EMC Directive No. 2014/30/EU dated 26/02/2014<br>LV Directive No. 2014/35/EU dated 26/02/2014<br>Measuring Instrument Directive MID No. 2014/32/EU dated 26/02/2014<br>EN50470-1/-3<br>IEC 62053-21/-23 |
| Frequency | 50 and 60 Hz (± 1 Hz) |
| Power supply | Self-supplied |
| Rated dissipated power (Wmax.) | 3.5VA (1 W) |
| **FEATURES** | |
| Three-phase connectivity | 4 wires 3x230/400V to 3x240/415V |
| Stores energy readings and settings | In FRAM memory |
| Identifies display of tariffs | T1 and T2 |
| **CURRENT MEASUREMENTS** | |
| Type | Three-phase - direct 80 A |
| Input consumption | 0.5VA max. per phase |
| Startup current (Ist) | 20mA |
| Minimum current (Imin) | 0.25A |
| Transition current (Itr) | 0.5A |
| Reference current (Iref) | 5A |
| Permanent overload (Imax) | 80A |
| Intermittent overload | 30 Imax for 1/2 cycle |
| **OVERLOAD CAPACITY** | |
| DC voltage Un | 288 VAC |
| Realtime voltage Un (1 s) | 300 VAC |
| DC current Imax | 80 A |
| Realtime current Imax | 30 Imax for 1/2 cycle |
| **VOLTAGE MEASUREMENTS** | |
| Range of measurement | 230-240V ± 20% |
| Consumption | 3.5VA max. per phase |
| Permanent overload | 290V phase-neutral / 500V phase-phase |
| **FREQUENCY MEASUREMENT** | |
| Frequency measurement | 45-65 Hz |
| **ENERGY MEASUREMENT** | |
| Active | Yes |
| Reactive | Yes |
| Total and partial reading | Yes |
| MID metering | Bidirectional with three-phase |
| Resolution | 10 Wh, 10 varh |
| **ENERGY ACCURACY** | |
| Active energy Ea+ | Class B (EN 50470-3) E24<br>Class 1 (EN 62053-21) |
| Reactive energy Er+ | Class 2 (EN 62053-23) |
| **TARIFF for Ea+** | |
| Tariff management | Yes (via input and communication) |

| | |
|---|---|
| Number of tariffs managed | 2 |
| Tariff input | Yes |
| Input type | Opto-isolated |
| Voltage | 0V --> Tariff 1<br>80-276 VAC-DC --> Tariff 2 |
| **METROLOGICAL LED (Ea+, Ea-)** | |
| Pulse value | 1000 pulses / kWh |
| Colour | Red |
| **PULSE OUTPUT** | |
| Type | Opto-isolated - 5 … 27VDC 27mA according to EN 62053-31 |
| Pulse weight | 100 Wh |
| **DISPLAY** | |
| Type | 8-digit LCD with backlight |
| Refresh time | 1 s |
| Backlight activation time | 10 s |
| Active energy: 1 display, 8-digit | 000000.01 - 999999.99 kWh |
| Reactive energy: 1 display, 8-digit | 000000.01 - 999999.99 kvarh |
| Apparent energy: 1 display, 8-digit | 000000.01 - 999999.99 kVAh |
| Realtime active power: 1 display, 4-digit | 00.00 - 99.99 kW |
| Realtime reactive power: 1 display, 4-digit | 00.00 - 99.99 kvar |
| Realtime reactive power: 1 display, 4-digit | 00.00 ... 99.99 kVA |
| Realtime voltage: 1 display, 4-digit | 000.0 ... 999.9 V |
| Realtime current: 1 display, 4-digit | 00.00 ... 99.99 A |
| Power factor: 1 display, 4-digit | 0.001-1.000 |
| Frequency: 1 display, 4-digit | 45.00-65.00 Hz |
| **COMMUNICATION** | |
| RS485 | 2 wires + shielding/ half duplex |
| Protocol | Modbus, RTU mode |
| Baudrate | 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200 bps |
| Insulation | SELV |
| Load unit | 1/8 |
| **SAVING** | |
| Energy registers | In FRAM memory |
| **ENVIRONMENTAL CONDITIONS** | |
| Mechanical environment | M1 |
| Electromagnetic environment | E2 |
| Operating temperature range | -25°C to +55°C |
| Storage temperature | -25°C to 75°C |
| Humidity | ≤ 80% |
| Installation | Internal (box/cabinet) |
| Vibrations | ±0.075 mm |
| **HOUSING** | |
| Dimensions W x H x D (mm) | Modular - width of 4 modules (DIN 43880) 72 x 90 x 64 |
| Mounting | On DIN rail (EN 60715) |
| Connection capacity, tightening torque | See chapter "6. Connection", page 10 |

| | |
|---|---|
| Protection index | Front: IP51 - casing: IP20 |
| Insulation class | Class II (EN 50470-1) |
| Weight | 440 g |

# 14. LIST OF ABBREVIATIONS

| | |
|---|---|
| info | Menu information |
| rEL1 | Metrological firmware version |
| rEL2 | Non-metrological firmware version |
| CS1 | Checksum of metrological firmware |
| CS2 | Checksum of non-metrological firmware |
| tAr.1 | Menu for Tariff 1 |
| tAr.2 | Menu for Tariff 2 |
| tot | Total menu |
| PAr.b | Partial readings and energy balance menu |
| rt | Realtime values menu |
| SEtuP.2 | Setup 2 menu |
| Addr | Slave address |
| bAud | Communication speed in bauds (bits per second) |
| Prty | Communication frame parity |
| n | No parity |
| o | Off parity |
| E | Even parity |
| StoP | Frame stop bit |
| 1 | 1 stop bit |
| 2 | 2 stop bits |
| rES | Reset partial energy |
| ConF? | Confirm selection |
| Y | Save and exit |
| N | Exit without saving |
| C | Continue without saving |
| tAr | Tariff management option |
| COM | Tariff management via communication |
| diG | Tariff management via device input |

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