INSTALLATION AND OPERATING MANUAL

EN

Three-phase energy meter
Direct - 80 A MODBUS

COUNTIS E23/E24

COUNTIS E23

COUNTIS E24 - MID

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1. DOCUMENTATION

All documentation on the COUNTIS E23/E24 is available online at:

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

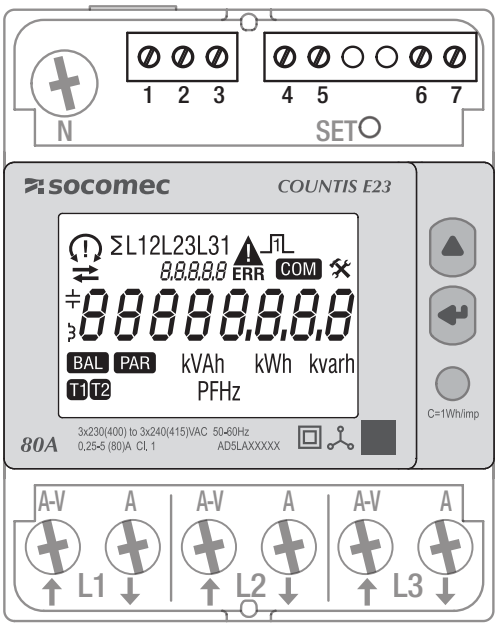
The COUNTIS E23 and E24 are modular active and reactive electrical energy meters that display consumed energy. They are designed for three-phase networks and allow a direct connection of up to 80 A. They are equipped with a MODBUS communication Bus.

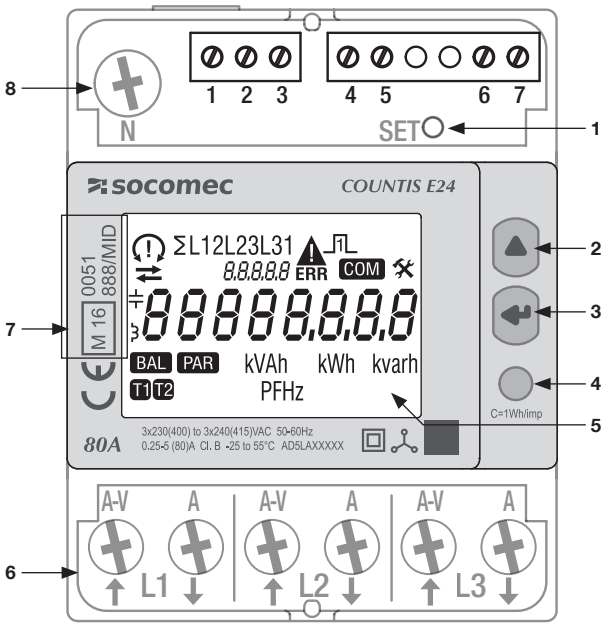
4.2. Functions

- 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**

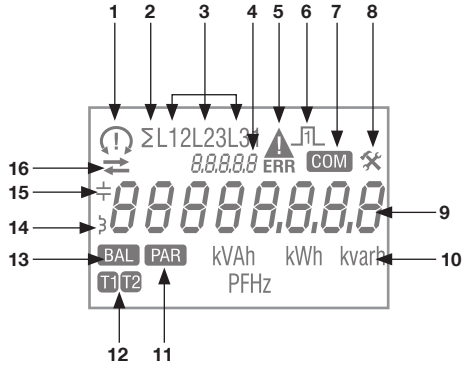
4.3. Front panels





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

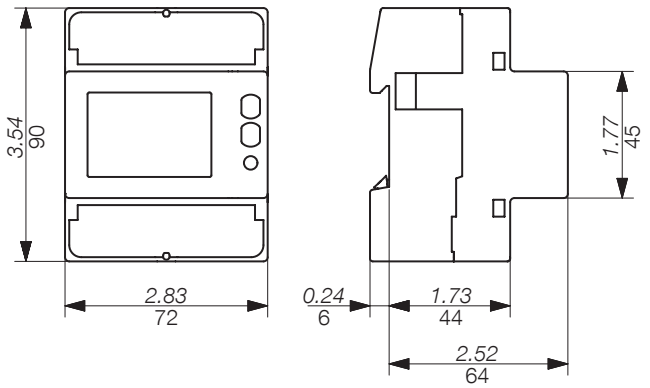
4.4. LCD display



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)

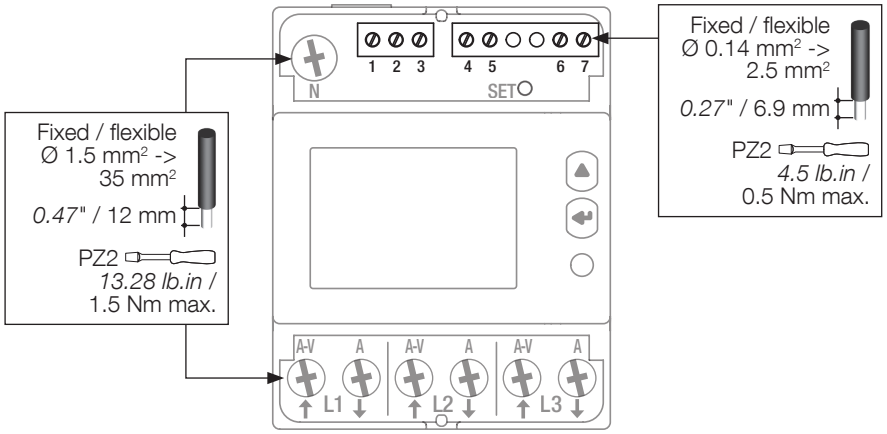
- Keep away from electromagnetic interference generator systems,
- Avoid vibrations with accelerations greater than 1 g for frequencies lower than 60 Hz.

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.

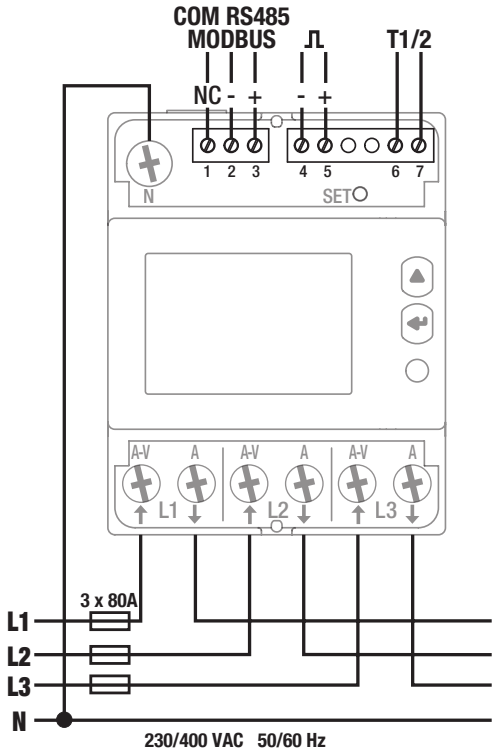
6. CONNECTION

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)

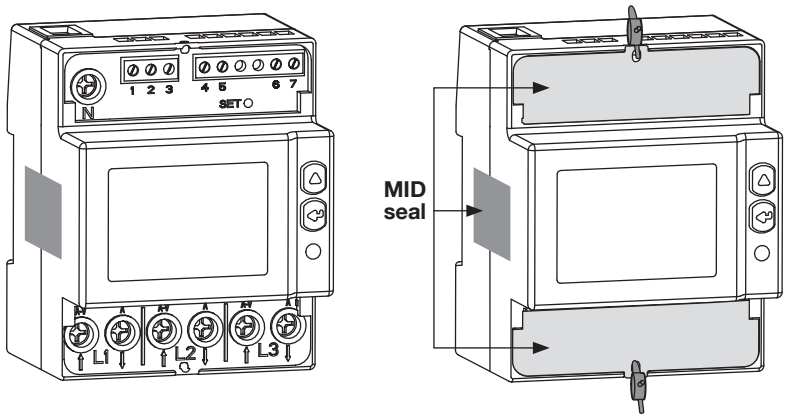
Price list
6-7: Switch tariffs:
0 VAC/DC -> Tariff 1
80-276 VAC/DC -> Tariff 2

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:

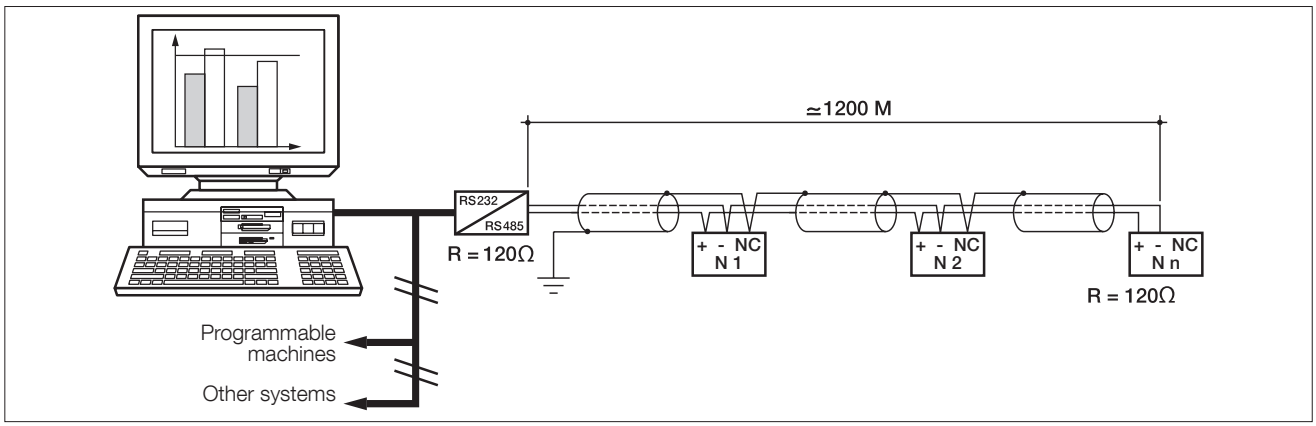
- **Type of network**
  COUNTIS E24 meters comply with the MID directive for connection to networks: 3P+N (see "6.2. Connection to the electrical network and to the loads", page 10)
- **Fitting terminal covers**
  After connecting the device, ensure that the terminal covers are fitted properly and secured 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

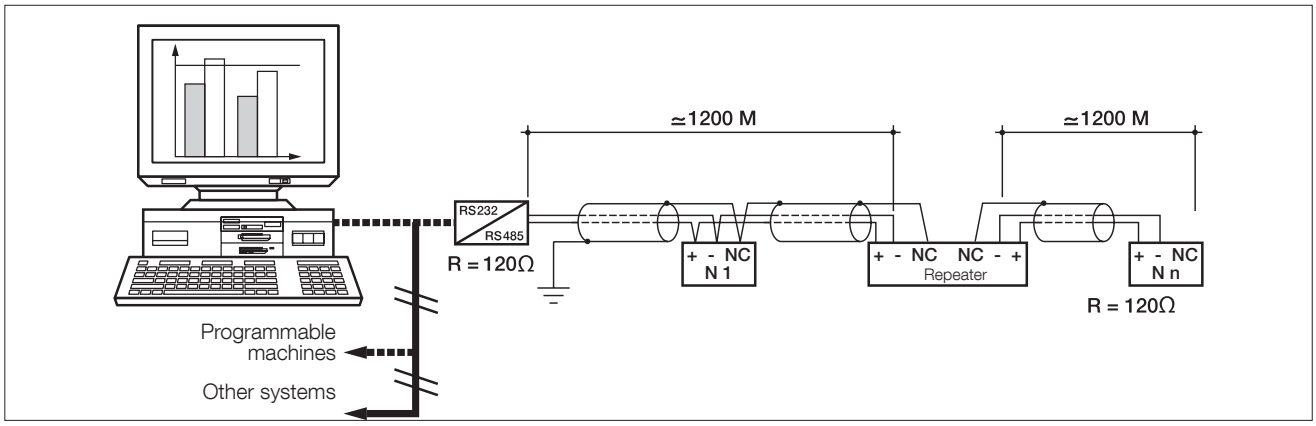


8. COMMUNICATION

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 are available online:

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

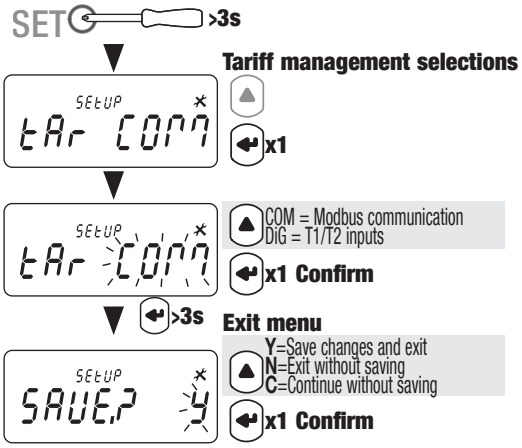
9.1.1. Detailed view of menu "SETUP 1"

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.

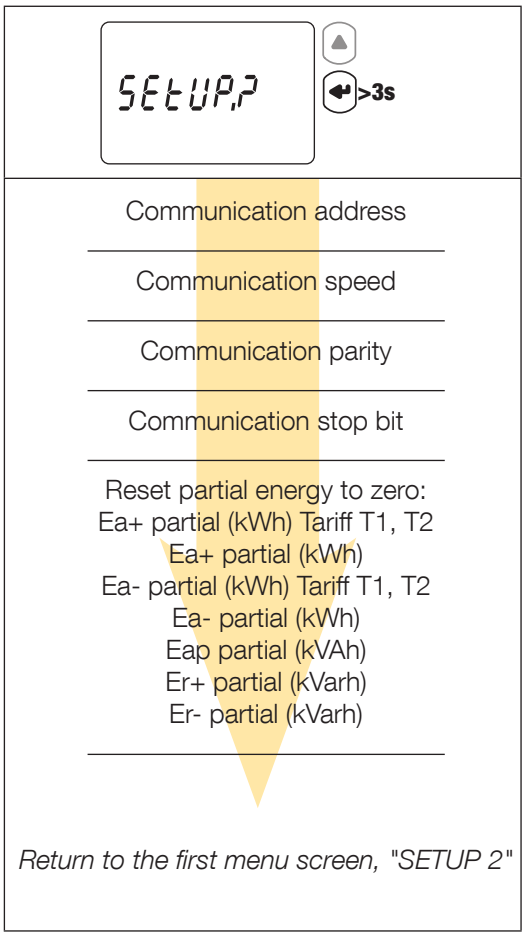
Press ▲ to go to the two programming options: COM = Modbus connection or DiG = T1/T2 inputs



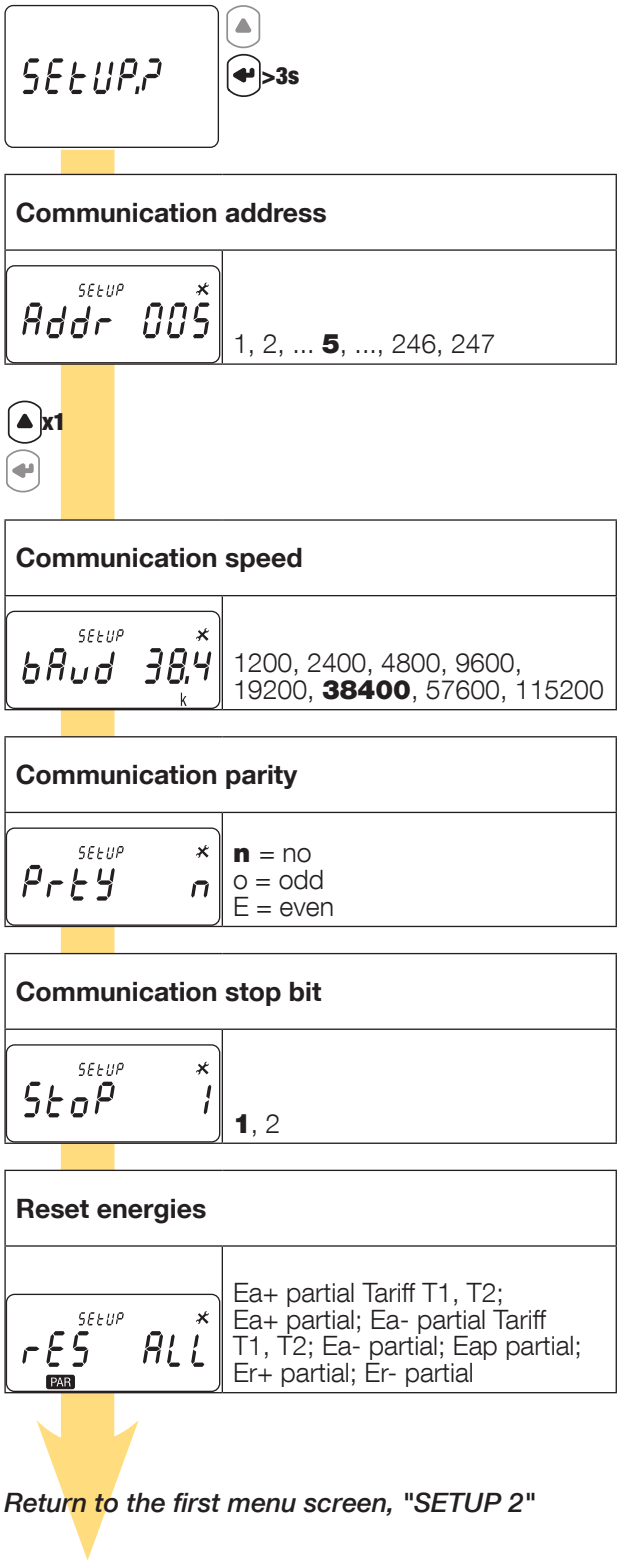
9.1.2. View all of the menu "SETUP 2"

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"

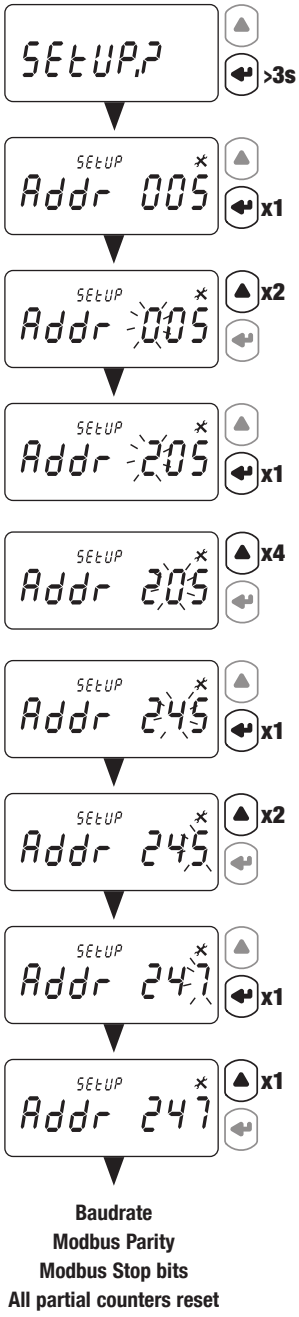


XX = default value

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.

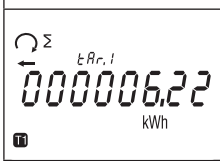
The menus and related measurements are described in the table below:

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"		

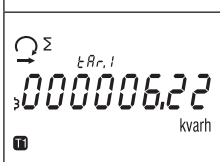
10.1. Detailed view of the menu for tariff 1, "Tar.1"

Imported active energy, tariff 1

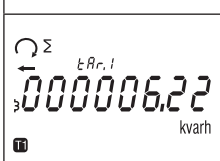
Exported active energy, tariff 1



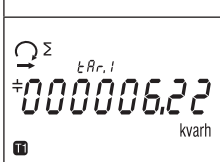
Imported inductive reactive energy, tariff 1



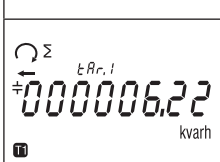
Exported inductive reactive energy, tariff 1



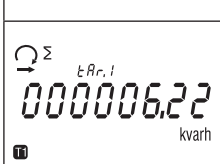
Imported capacitive reactive energy, tariff 1



Exported capacitive reactive energy, tariff 1



Imported reactive energy, tariff 1

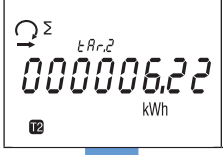


Exported reactive energy, tariff 1

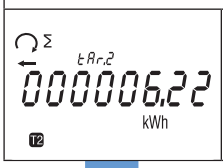
Go back to first screen, menu "Tar.1"

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

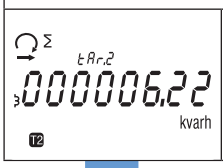
Imported active energy, tariff 2



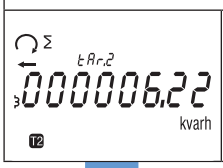
Exported active energy, tariff 2



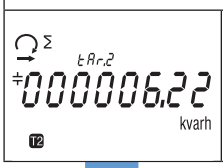
Imported inductive reactive energy, tariff 2



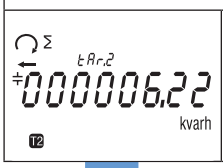
Exported inductive reactive energy, tariff 2



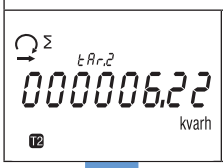
Imported capacitive reactive energy, tariff 2



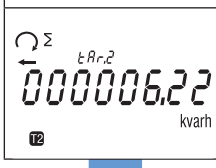
Exported capacitive reactive energy, tariff 2



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 tot 00000832 kWh	L1, L2, L3, ∑

Total exported active energy

L1 tot 00000832 kWh	L1, L2, L3, ∑

Total apparent energy

Σ tot 00000832 kVAh	∑

Total imported inductive reactive energy

Σ tot 00000832 kvarh	∑

Total exported inductive reactive energy

Σ tot 00000832 kvarh	∑

Total imported capacitive reactive energy

Σ tot 00000832 kvarh	∑

Total exported capacitive reactive energy

Σ tot 00000832 kvarh	∑

Total imported reactive energy

L1 tot 00000832 kvarh	L1, L2, L3, ∑

Total exported reactive energy

L1 tot 00000832 kvarh	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

Σ Par.b 000008.54 PAR kWh T1 ∑

Imported partial active energy for tariff T2

Σ Par.b 000008.54 PAR kWh T2 ∑

Partial imported active energy

Σ Par.b 000008.54 PAR kWh ∑

Exported partial active energy for tariff T1

Σ Par.b 000008.54 PAR kWh T1 ∑

Exported partial active energy for tariff T2

Σ Par.b 000008.54 PAR kWh T2 ∑

Partial exported active energy

Σ Par.b 000008.54 PAR kWh ∑

Partial apparent energy

Σ Par.b 000008.54 PAR kVAh ∑

Partial imported reactive energy

Σ Par.b 000008.54 PAR kvarh ∑

Partial exported reactive energy

Σ Par.b 000008.54 PAR kvarh ∑

Active energy balance

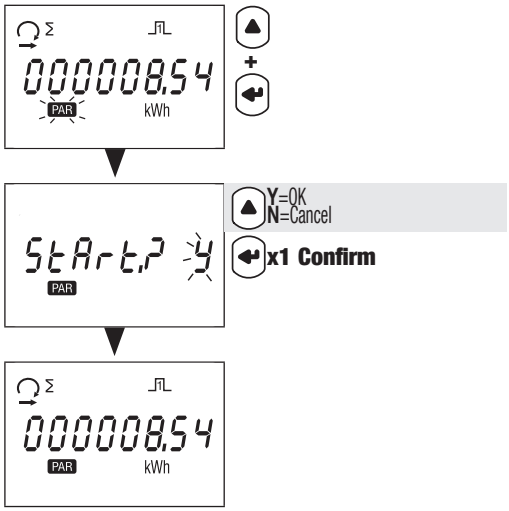
Σ Par.b 000008.54 BAL kWh

Reactive energy balance

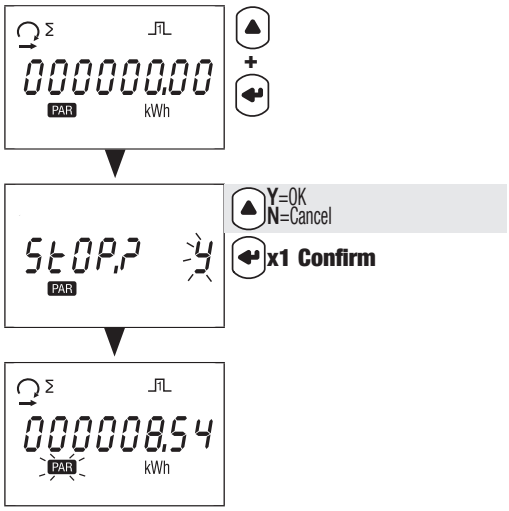
L1 Par.b 000008.32 kvarh

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

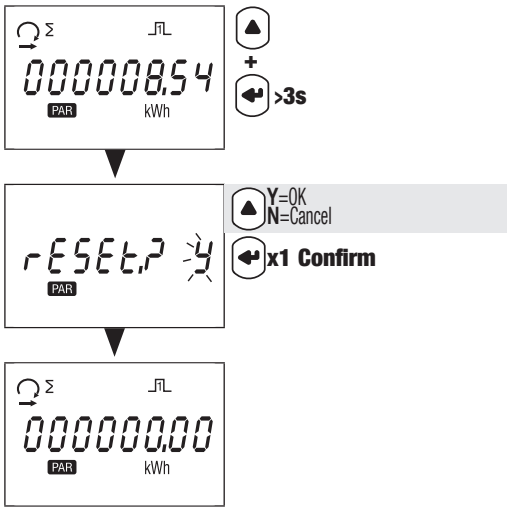
10.4.1. Starting up the partial energy meter



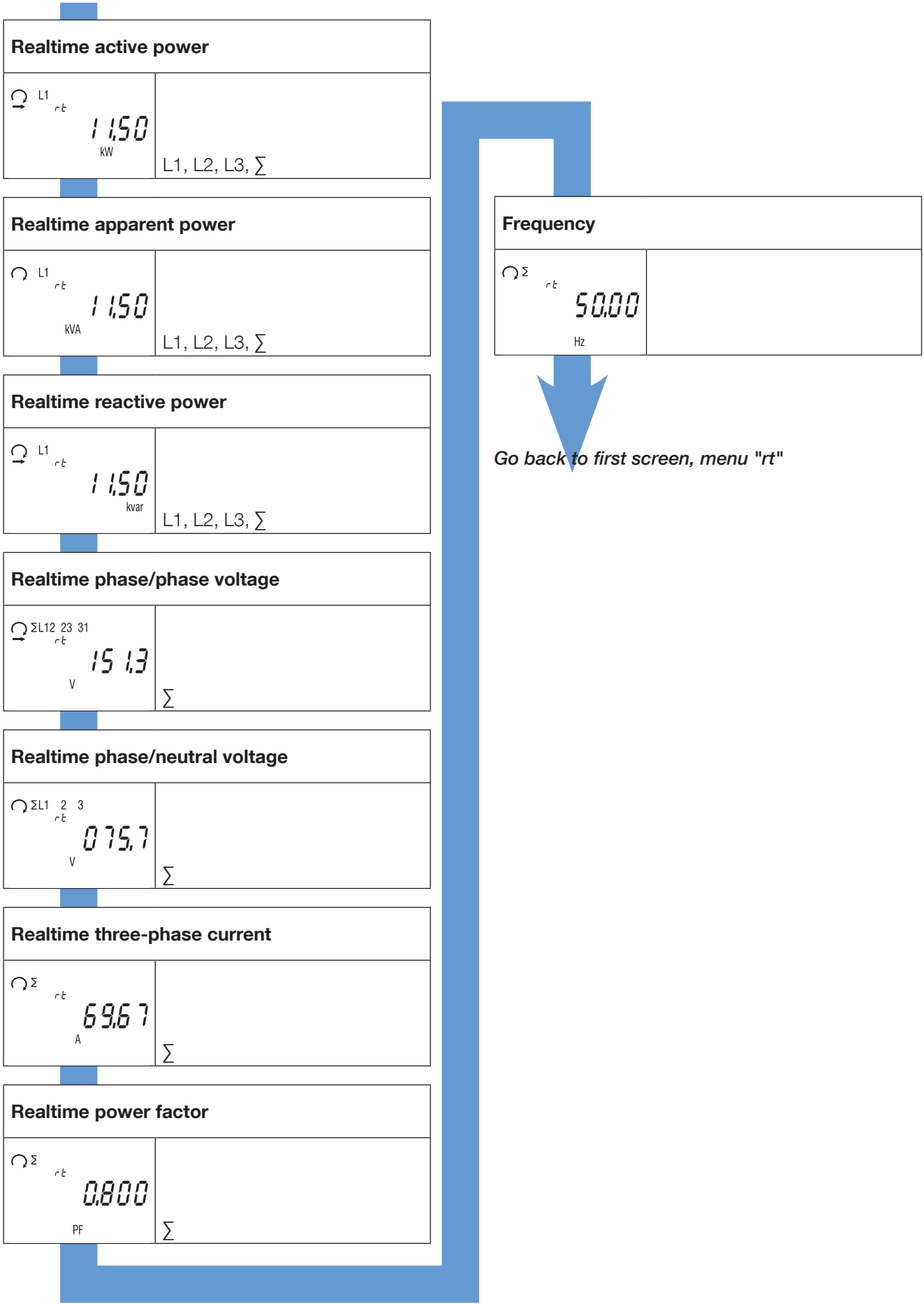
10.4.2. Stopping the partial energy meter



10.4.3. Resetting the partial energy meter to zero



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



10.6. Detailed view of the menu "info"

Metrological firmware version	
info rEL1 1.22	

Non-metrological firmware version	
info rEL2 3.03	

Checksum of metrological firmware	
info CS1 7A37	

Checksum of non-metrological firmware	
info CS2 0727	

Installed communication port	
info ModbuS	

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 LV Directive No. 2014/35/EU dated 26/02/2014 Measuring Instrument Directive MID No. 2014/32/EU dated 26/02/2014 EN50470-1/-3 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 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 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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