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SWITCH TO THE FUTURE

7M USER'S MANUAL

SERIES OF SINGLE PHASE METERS

7M.24.8.230.0001

7M.24.8.230.0010

7M.24.8.230.0110

7M.24.8.230.0210

7M.24.8.230.0310

7M SERIES

SINGLE-PHASE ELECTRICAL ENERGY METER

User and Installation manual

Security Advices and Warnings

Please read this chapter carefully and examine the equipment carefully for potential damages which might arise during transport and to become familiar with it before continue to install, energize and work with a single-phase energy meter 7M.24. This chapter deals with important information and warnings that should be considered for safe installation and handling with a device in order to assure its correct use and continuous operation.
Everyone using the product should become familiar with the contents of chapter »Security Advices and Warnings«.
If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

PLEASE NOTE

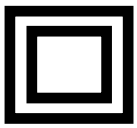
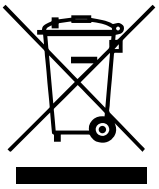
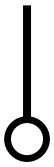
This booklet contains instructions for installation and use of single-phase energy meter 7M.24. Installation and use of a device also includes handling with dangerous currents and voltages therefore should be installed, operated, serviced and maintained by qualified personnel only. FINDER S.p.A assumes no responsibility in connection with installation and use of the product. If there is any doubt regarding installation and use of the system in which the device is used for measuring or supervision, please contact a person who is responsible for installation of such system.

Before Installing

Check the following before installing the device:

- Nominal voltage.
- Terminals integrity.
- Protection fuse for voltage inputs (recommended maximal external fuse size is 40 A).
- External switch or circuit breaker must be included in the installation for disconnection of the devices' power supply. It must be suitably located and properly marked for reliable disconnection of the device when needed.
- Proper connection and voltage level of I/O module.

Used symbols on devices' housing and labels

SYMBOL	EXPLANATION
	**WARNING** Indicates situations where careful reading of this manual is required and following requested steps to avoid potential injury is advised.
	Double insulation in compliance with the EN 61010–1: 2010 standard.
	Compliance of the product with directive 2002/96/EC, as first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste. It also seeks to improve the environmental performance of all operators involved in the life cycle of electrical and electronic equipment.
	Compliance of the product with European CE directives.
	Single phase meter.

Disposal

It is strongly recommended that electrical and electronic equipment (WEEE) is not deposit as municipal waste. The manufacturer or provider shall take waste electrical and electronic equipment free of charge. The complete procedure after lifetime should comply with the Directive 2002/96/EC about restriction on the use of certain hazardous substances in electrical and electronic equipment.

SOMMARIO

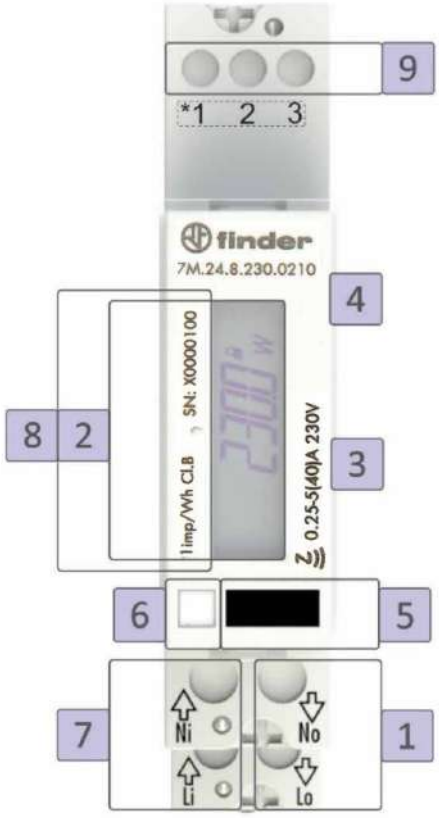
1. BASIC DESCRIPTION AND OPERATION

1.1 Description of the device

The single-phase energy meters 7M.24 are intended for energy measurements in single-phase electrical power networks and can be used in residential, industrial and utility applications. Meters measure energy directly in 2-wire networks according to the principle of fast sampling of voltage and current signals. They are equipped with a capacitive touch button that allows the user to scroll measurements and the menu, make settings,… and backlight for better visibility. A built-in microprocessor calculates active/reactive/apparent power and energy, current, voltage, frequency, power factor, power angle and frequency from the measured signals. This smart meter can also perform basic harmonic analysis (THDU, THDI). This enables a quick overview of harmonic distortion either coming from a network or generated by the load.
The microprocessor also controls LCD, LED, IR communication and optional extensions.
Connecting terminals can be sealed up against non-authorised access with protection covers. They are built to be fastened according to EN 60715 standard.

1.1.1 Appearance

Figure 1: Appearance of single-phase electric energy meter 7M.24



1 Current terminals – to load
2 Information display
3 IR communication port –on side
4 DIN-Rail fitting
5 Cap touch
6 LED indicator
7 Current terminal – source
8 NFC
9 AUX terminals (options)*:
- RS485
- M-Bus
- S0+/–

*vedi immagini 4, 5, 6

LCD Number of digits: 7
Height of digits: 5.5 mm
LED Colour: red
Pulse rate: 1000 imp/Wh or 1 imp/varh
LED on: no load indication

1.2 Single-phase energy meters application

7M.24 is a single phase energy meter that can be equipped with optical (IR) communication port on the side as a standard depending on model.

Meter can be equipped:

- **S0 output (pulse output)** is intended for connection to the devices that are checking and monitoring consumed energy.
- **RS485 (Modbus)** serial communication with the Modbus protocol. Data is available in different formats prepared for
- easier integration into third party control and monitoring systems.
- **M-Bus** serial communication, which enables data transmission and thus connection of the measuring places into the
- network for the control and management with energy.
- **NFC** communication for easy setting and downloading meter data via mobile app.

Communication modules enable data transmission and thus the connection of the measuring places into the network for the control and management with energy.
On the housing there are only two terminals, thus only one functional extension is possible (serial communication, M-Bus).
NFC communication is implemented for parametrization as well as for reading data (e.g. counters, measurements,…) from the smart meter. Special application available from our internet site has to be used to perform such operations.

1.3 Types of 7M.24 energy meters

7M.24.8.230.0001	Single phase energy meter 40 A, S0, without capacitive touch button
7M.24.8.230.0010	Single phase energy meter 40 A, S0, MID
7M.24.8.230.0110	Single phase energy meter 40 A, S0, IR, NFC, MID
7M.24.8.230.0210	Single phase energy meter 40 A, Modbus, IR, NFC, MID
7M.24.8.230.0310	Single phase energy meter 40 A, RS485 M-Bus, IR, NFC, MID

1.4 Main features

- Single-phase direct connected DIN-rail mounting meters
- Active energy class B for MID approved types according to EN 62053-21 and class 1 for other types (non-MID version) according to EN 50470-3
- Reactive energy Class 2 according to EN 62053-23
- Bidirectional energy measurement (import/export)
- Basic current 5 A (Ib)
- Maximum current 40 A (Imax)
- 230 V rated system voltage input (Un)
- Voltage operating range (-20%...+15%) Un
- Reference frequencies 50 Hz and 60 Hz (MID certified)
- Power consumption voltage circuit 10 VA at Un
- Power consumption current circuit < 0.1 VA at Ib
- Temperature range climatic condition as indoor meter (-25 °C…+55 °C) or (-25 °C…+70 °C) for 7M.24-0210 according EN 62052-11
- Custom LCD display with 7 digits (100 Wh resolution)
- Multifunctional front red LED
- LED constant 1 imp/Wh or 1 imp/varh
- IR(Modbus) serial communication (optional)
- Capacitive touch button for setting and control (optional)
- Backlight for better visibility (optional)
- Special functions added for easier integration into monitoring and control systems
- Measurement of
  - power (active/reactive/apparent)
  - energy (active/reactive/apparent)
  - voltage
  - current
  - frequency
  - power factor
  - power angle
  - active tariff (option)
  - THD of voltage
  - THD of current
- Pulse output according to EN 62053-31 (option)
- RS485 (Modbus) Serial communication (option)
- M-Bus Serial communication (option)
- NFC communication for easy setting and downloading meter data via mobile app
- Tariff management (up to 4 tariffs manageable via communication – option)
- DIN-rail mounting according to EN 60715
- Sealable terminal cover
- 1 DIN module width

2. CONNECTION

This chapter deals with the instructions for single-phase electrical energy meter 7M.24 connection. Both the use and connection of the device includes handling with dangerous currents and voltages. Connection shall therefore be performed ONLY by a qualified person using an appropriate equipment. Finder S.p.A. does not take any responsibility regarding the use and connection. If any doubt occurs regarding connection and use in the system which device is intended for, please contact a person who is responsible for such installations.

2.1 Mounting

Single-phase electrical energy meter **7M.24** is intended only for DIN-rail mounting. In the case of using the stranded wire, the ferrule must be attached before the mounting. Ferrule contact length should be 12 mm.

2.2 Electrical connection

WARNING

Wrong or incomplete connection of voltage or other terminals can cause non - operation or damage to the device.

- To prevent electrical shock and/or equipment damage, disconnect electrical power at the main fuse or circuit breaker before installation or any servicing
- Make sure, that no voltage is present in the installation
- Prevent the disconnecting device from being switched on accidentally
- Connect the module according to electrical diagram

WARNING

Security seal must be from plastic material

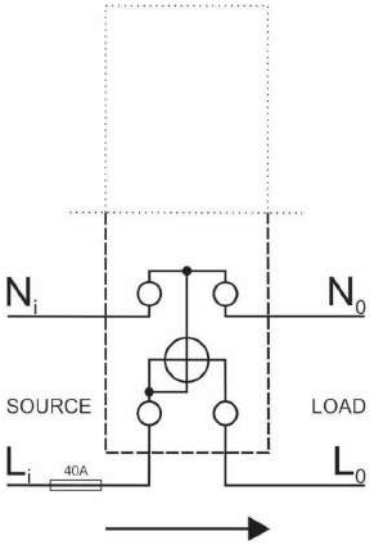
Meter is used for direct connection into the two-wire networks. Meter can be equipped with different modules. Pictures below are showing equipped combinations.

Recommended installation:

1 Mounting to DIN rail according to DIN EN60715

2 Power contacts:
- Power contacts capacity: Flexible (Rigid) 1.5 mm^2 – 10* mm^2 (*Ferrule contact length should be 12 mm Wire stripped to 14 mm.)
- Connection screws M3.5
- Max torque 0.8 Nm

3 Auxiliary terminals:
- Auxiliary terminals contact capacity: Flexible (Rigid) 0.05 mm^2 – 1 (2.5) mm^2
- Auxiliary terminals screws M3
- Max torque 0.6 Nm



MARK	MEANING
L_I	Line input
N_I	Neutral input
L_O	Line output
N_O	Neutral output

Figure 3: Electrical diagram 230 VAC

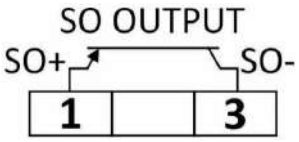


Figure 4: Connection diagram for pulse output

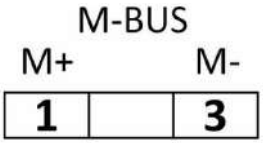


Figure 5: Connection diagram for M-Bus option

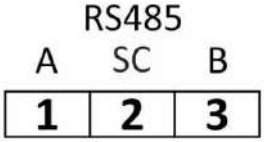


Figura 6: Connection diagram for RS485 communication

2.2.1 Communication connection

There are multiple options for communication available for interaction with the outside world.

- **IR communication module (option)** using the MODBUS. It can be used for setting and testing the meter using USB adapter
- **Pulse output (option)** module is used for counting the number of pulses depending on consumed energy
- **LED** is used for indication of no-load condition (I < 0,02A) and test output proportional to measured active energy (1 imp/Wh). It can be also switched to reactive energy for test purposes using communication
- **RS485(Modbus) (option)** communication module is a galvanic isolated from the meter. It enables setting the meter and data readout in the network
- **M-Bus (option)** communication module is galvanic isolated form meter. It enables setting the bound rate and the address of the meter (for more information see appendix 8.2)
- **NFC (option)** enables an easy setting and downloading meter data via mobile app
- **Cap touch** is used to select a display of desired measured or group of them

AUXILIARY TERMINAL	1	2	3
Pulse output	S0+		S0–
M-Bus	M+		M–
RS485	A	*SC	B

*It is intended to be used for shielding for RS485

Table 1: Survey of communication connection

PLEASE NOTE

Check connection diagram on the side of the meter to check what modules are built in

3. FIRST STEPS

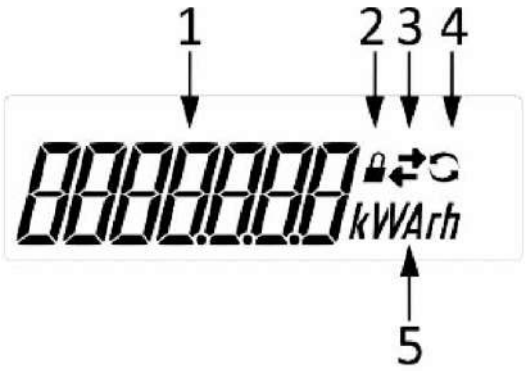
Programming a single phase energy meter **7M.24** is very transparent and user friendly.
Numerous settings are organized in groups according to their functionality.

3.1 Display

Measured data is presented on LCD. Display scrolls automatically. Displayed quantities and scroll time can be set via communication via mobile app using NFC.

Energy meters have LCD display with the following layout:

1 Actual Value
2 Non resettable (MID) energy register.
This simbol indicates which energy counter permanently counts (it can not be reset to zero or any other value)
3 (–>) Energy power import
(<–) Energy power export
4 The simbol indicates the specified counter is currently active (real-time data)
5 Unit of measurement



Energy registers are displayed with resolution 6 + 1 (kWh, kvarh and kVAh).

PLEASE NOTE

The meter can be set to Test measuring mode which displays energy registers with better resolution. The test mode is used for test purposes during type testing and test of meter constant during initial verification. After power off meter automatically goes back to normal operation.

3.1.1 Welcome screens

Segment check

Software version

Check sum

At power on the software version and check sum of MID approved measuring part of software is displayed.

3.2 LCD User Interface

After the electrical connection, the display shows a segment check screen, software version screen and check sum screen in a period of five seconds. After that is visible the basic display that shows the E1 MID counter for active energy (is possible that the display will show small amount of energy measured and/or other parameters depending on the test done in the production line as per request by MID production procedure). In order to read the other measurements, is necessary to touch the button "5" (see page 2) otherwise the display will continue to show the last measurement checked. For devices with NFC technology is possible to change the display settings like brightness intensity and choose the data to show on the display except for the MID counters (E1…4) that cannot be removed.

The LCD display allows displaying the following measurement values:

1. ENERGY METERS. We have to consider two different types of energy meters: resettable and non-resettable MID. The resettable energy counter can be reset and the parameters can be modified, while the non-resettable has been measuring the quantity continuously. The energy counter you reset starts to re-measure the value from the zero value.

I **Non resettable energy counters (E1, E2 MID certified)**

1. Energy counter E1
2. Energy counter E2
3. Energy counter E3
4. Energy counter E4

II **Resettable energy counters**

1. Energy counter C1
2. Energy counter C2
3. Energy counter C3
4. Energy counter C4
5. Energy counter C5
6. Energy counter C6
7. Energy counter C7
8. Energy counter C8

2. ACTUAL MEASURED VALUES

- Active Power
- Reactive Power
- Apparent Power
- Voltage
- Current
- Frequency
- Active Tariff
- Power Factor IX. Power Angle
- THD of voltage
- THD of current

The measured values can be selected by pressing button or scroll automatically (with Auto Scroll function selected by APP).

The LCD display has three types of actions:

- **short touch** (≤1s): for scrolling through the menu or measured values.
- **long touch** (1-4s): after 1 second, the display starts blinking and after touch release it enters in the first level of menu structure. Long touch is used also for every further sub-menu option or action confirmation,
- **extra long touch** (5s): if the touch is not released in 5 seconds, LCD returns in the initial cycling mode

3.2.1 Cap touch self calibration process

In a reported fixed 64s interval the average, minimum and maximum value of the cap touch sensor is calculated. If the conditions are stable (without interruptions) then the average value of the cap touch sensor is used as a reference value. If the new reference value deviates sufficiently from the permanently stored value, it is permanently saved. Permanently stored value is used when the power is turned on.

At the first switch on the cap button could take 60 s before start to work.

3.2.2 Energy counters

There are two sets of energy registers – four non-resettable registers which can be assigned for active energy (MID approved), reactive energy (national approval) or apparent energy (no approval). The meter with MID approval should have at least one register with active energy measurement. There are additional 8 energy registers which can be parameterised by the user regarding type of energy, active quadrants, direction of counting and tariff and they can also be resetted using MODBUS command or cap touch.

Indication of four non-resettable registers on the LCD is driven directly from the measuring part of SW.

On the LCD each energy counter is displayed with two screens. On the first screen, there is the counter designation and an additional code. For the code the user can choose between the OBIS code or letter description code. On the second screen there is the 7-digit numerical number which shows the value of the energy, the unit, lock sign for the fixed legally relevant non-resettable counters, energy direction sign and the sign of currently active register. The decimal dot is fixed and resolution is fixed to 100 Wh. The first screen is displayed for three seconds and the second screen for the pre-set cyclic period. In case of manual scroll with cap touch, no additional touch is needed to switch between these two screens.

Legally relevant non-resettable registers are designated with letters E1 to E4, while legally non-relevant resettable registers are designated with C1 to C8. The code is specified in the Table 1.

Table 1 (next page) contains descriptions and measured quantities as well as a list of possible measurements that can be set by the customer.

LEGEND:

1° letter:	2° letter:	0 = all tariffs
A = Active energy	I = Imported	1 = tariff 1…
r = Reactive Energy	E = Exported	4 = tariff 4
S = Apparent Energy	A = Absolute	

Table 1: counter description with Obis-coded and "Finder-coded"

REGISTER DESCRIPTION E1 TO E4	OBIS CODE	LETTER DESCRIPTION CODE
Active energy Q1+Q4 – all tariffs	1.8.0	A.I.0
Active energy Q2+Q3 – all tariffs	2.8.0	A.E.0
Active absolute energy– all tariffs (Abs(Q1+Q4) + abs(Q2+Q3))	15.8.0	A.A.0
Reactive energy – Q1+Q2 - all tariffs	3.8.0	r.I.0
Reactive energy – Q3+Q4 - all tariffs	4.8.0	r.E.0
Reactive absolute energy– all tariffs	95.8.0 (manufacturer specification)	r.A.0
Apparent absolute energy-all tariffs	9.8.0	S.A.0

REGISTER DESCRIPTION C1 TO C8	OBIS CODE	LETTER DESCRIPTION CODE
Active energy Q1+Q4 – all tariffs	1.8.0	A.I.0
Active energy Q1+Q4 – tariff 1 to 4	1.8.1 to 1.8.4	A.I.1 to A.I.4
All energy types – tariff 1 to 4	x.x.1 to x.x.4	x.x.1.to x.x.4
All energy types – mixed tariffs (example tariff 1 and tariff 2)	x.x.9	x.x
Active energy Q2+Q3 – all tariffs	2.8.0	A.E.0
Active absolute energy– all tariffs (Abs(Q1+Q4) + abs(Q2+Q3))	15.8.0	A.A.0
Active energy (signed)– all tariffs (Abs(Q1+Q4) – abs(Q2+Q3))	16.8.0	A.b.0
Active energy Q1– all tariffs	17.8.0	A. .0
Active energy Q2– all tariffs	18.8.0	A. .0
Active energy Q3– all tariffs	19.8.0	A. .0
Active energy Q4– all tariffs	20.8.0	A. .0
Reactive energy – Q1+Q2 - all tariffs	3.8.0	r.I.0
Reactive energy – Q3+Q4 - all tariffs	4.8.0	r.E.0
Reactive energy – Q1 - all tariffs	5.8.0	r. .0
Reactive energy – Q2 - all tariffs	6.8.0	r. .0
Reactive energy – Q3 - all tariffs	7.8.0	r. .0
Reactive energy – Q4 - all tariffs	8.8.0	r. .0
Reactive absolute energy – all tariffs	95.8.0 (specifiche del costruttore)	r.A.0
Apparent absolute energy – all tariffs	9.8.0	S.A.0
Apparent energy –Q1+Q4 – all tariffs	9.8.0	S.I.0
Apparent energy – Q2+Q3 – all tariffs	10.8.0	S.E.0
Other unspecified custom setting regarding power, quadrants	0.0.y y (0,1,2,3,4,9)	x. .y x x (A,r,S), y (0,1,2,3,4,» «)

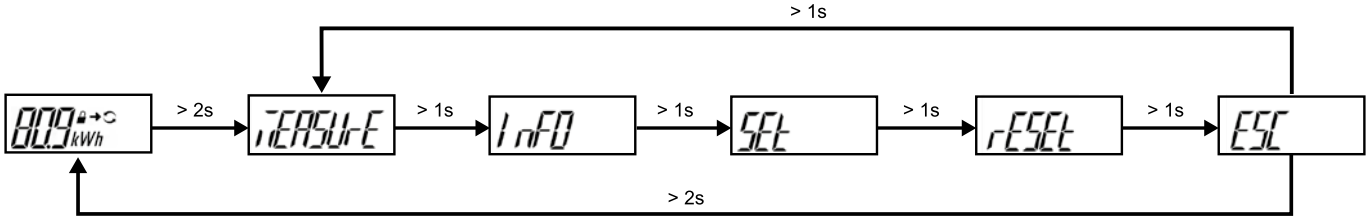
3.2.3 Actual measured quantities

The number on the screen shows the actual value of the measured quantity (P-W, Q-var, S, PF, U, f and I).
Furthermore the screen shows the direction of active energy flow (import/export = (/)) and reactance (inductive/capacitive = L/C).

ACTIVE POWER	
REACTIVE POWER	
APPARENT POWER	
VOLTAGE	
CURRENT	
FREQUENCY	
ACTIVE TARIFF	
COSΦ	
VOLTAGE-CURRENT PHASE ANGLE	
THD-U	
THD-I	

3.2.4 Initial display menu structure

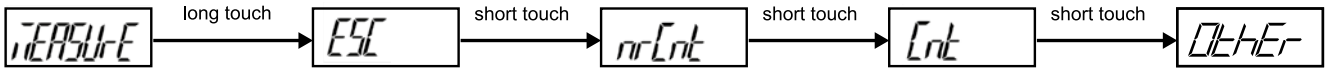
The display menu is entered by touching the capacitive button for more than one second. Blinking of the screen indicates that. Use short touches to move through the main menu. If the capacitive button is not used for more than one minute, the initial page will be shown automatically.



By holding the cap button when positioned on certain screen (e.g. measure, set, info, etc…) the sub-menus are entered.

3.2.4.1 Measure menu

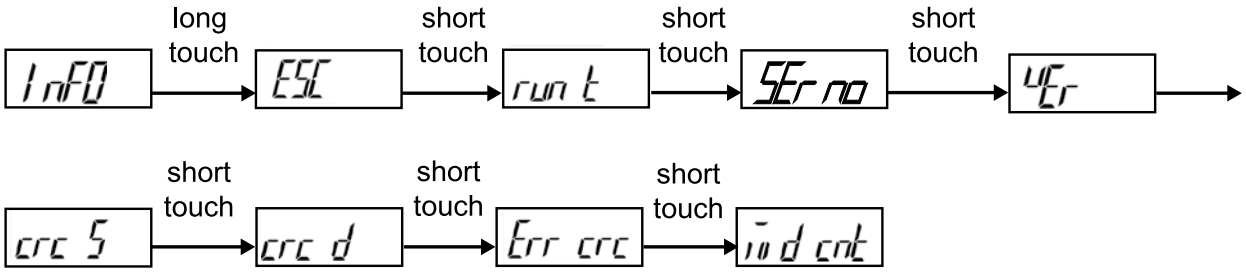
When in measure menu, short touches move user through it, allowing her/him to select a dedicated menu.



The screen COMM appears only in case the a ctual option is available on the meter.

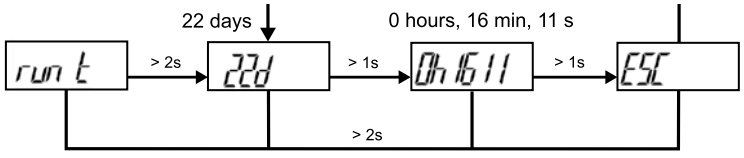
3.2.4.2 Info menu

When in info menu, short touches move user through it, allowing her/him to select a dedicated menu.



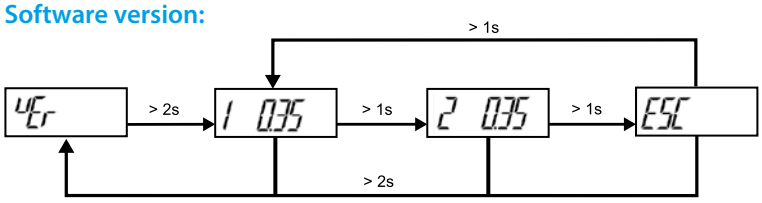
3.2.4.2.1 Info sub-menus

Run time (22 days, 0 hours, 16 minutes, 11 seconds):



ESC (escape) screen is replaced by LCD segment test screen.

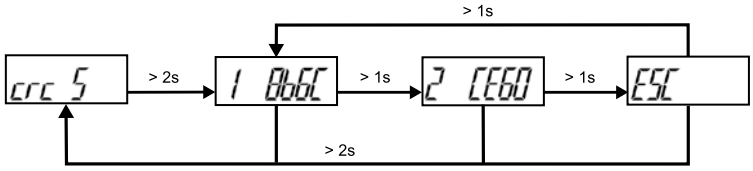
Software version:



Screen 1: – Measurement module SW version
Screen 2: – Functional module SW version

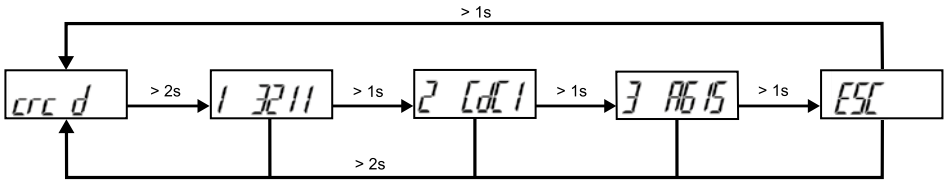
Software Check sum:

A **checksum** is a small-sized datum derived from a block of digital data for the purpose of detecting errors that may have been introduced during its transmission or storage.



Screen 1: Measurement module Check-sum
Screen 2: Functional module Check-sum

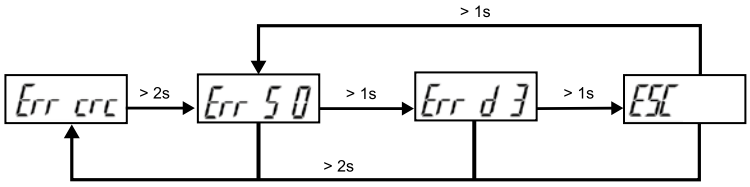
Parameters Check sum:



Screen 1: MID setting data Check-sum
Screen 2: Setting data Check-sum
Screen 3: Calibration data Check sum

Error description:

A cyclic redundancy check (CRC) is an error-detecting code commonly used in digital networks and storage devices to detect accidental changes to raw data.

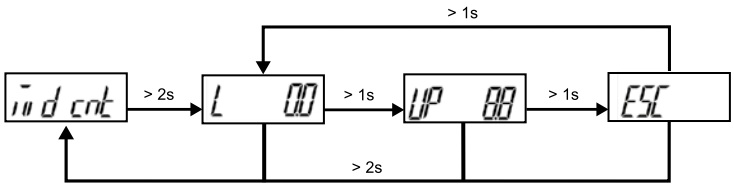


Screen 1 - Err s: shows Firmware CRC details – decimal value (0…3) of Bit 6 and 7
Screen 2 - Err d: shows Parameter CRC details – decimal value (0…7) of Bit 8, 9 and 10

Description of Check Sum Status register bits:

CODE	VALUE	DESCRIPTION
30400	0	No Error (OK)
	Bit 0	Error Parameter CRC
	Bit 1	Error Firmware CRC
	Bit 2	Error MID-lock
	Bit 6	Error Measurement module Check Sum
	Bit 7	Error Functional Software Check Sum
	Bit 8	Error Calibration Data Check Sum
	Bit 9	Error MID Setting Data Check Sum
	Bit 10	Error Setting Data Check Sum

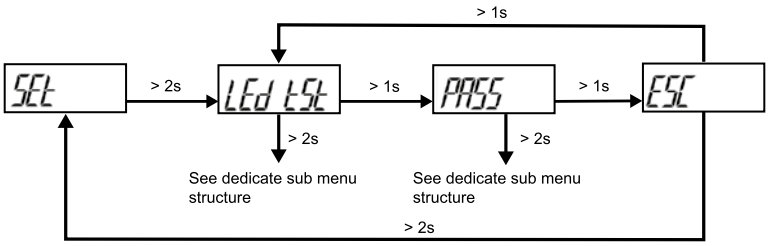
MID relevant counters:



Screen 1: MID unlock counter
Screen 2: FW upgrade counter (measuring mode)

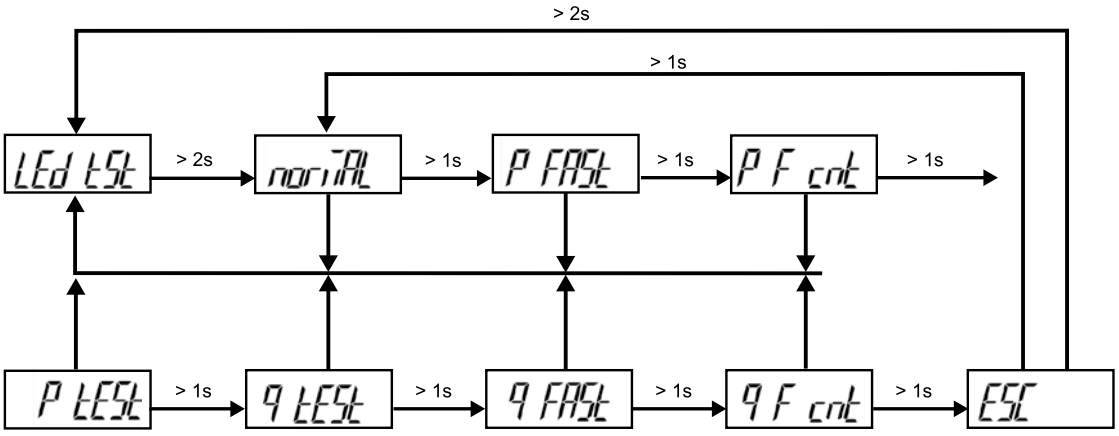
Digits check menu:

3.2.4.3 Set menu



3.2.4.3.1 Set sub-menus

Led test mode (Led tSt):

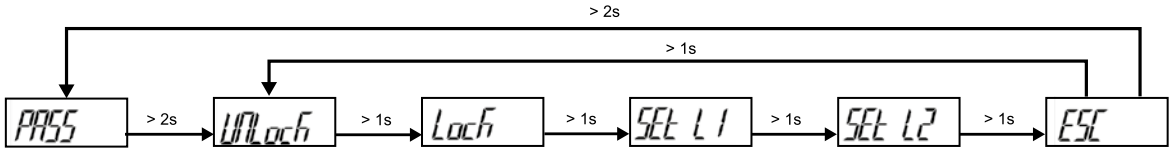


This function shall be used only for testing purposes during type testing and metrological verification of the meters.

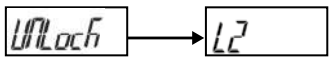
TEST MODES:

Normal	– 1000 imp/kWh, counter resolution 100 Wh/100 varh
P fast (Test mode P Fast)	– 100000 imp/kWh, counter resolution 1 Wh/1 varh
P F cnt (Test mode P Fast – counter only)	– 1000 imp/kWh, counter resolution 1 Wh/1 varh
P test (Test mode P)	– 1000 imp/kWh, counter resolution 100 Wh/100 varh
Q test (Test mode Q)	– 1000 imp/kvarh, counter resolution 100 Wh/100 varh
Q fast (Test mode Q fast)	– 100000 imp/kvarh, counter resolution 1 Wh/1 varh
Q F cnt (Test mode Q fast - counter only)	– 1000 imp/kvarh, counter resolution 1 Wh/1 varh

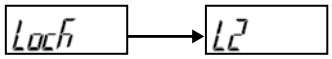
Menu Password (when in PASS menu, short touches move user through it):



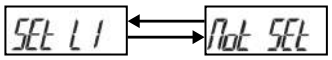
If you stop using short touches on a acertain screen, further menus start cycling automatically:



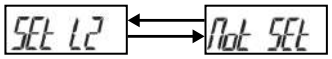
Unlock – shows the accessible level. With long touch password can be entered and the acces is unlocked.



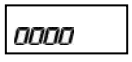
Lock – shows the accessible level. With long touch the acces is locked. In case no manual locking is done, the acces is locked automatically 5 minutes after last touch



With long touch you can enter the menu for setting Password Level 1. With long touch you can enter the menu for setting Password Level 1. Screen for entering the password for unlocking or setting the password:



When the character is blinking, one can scroll through different characters using short touches:

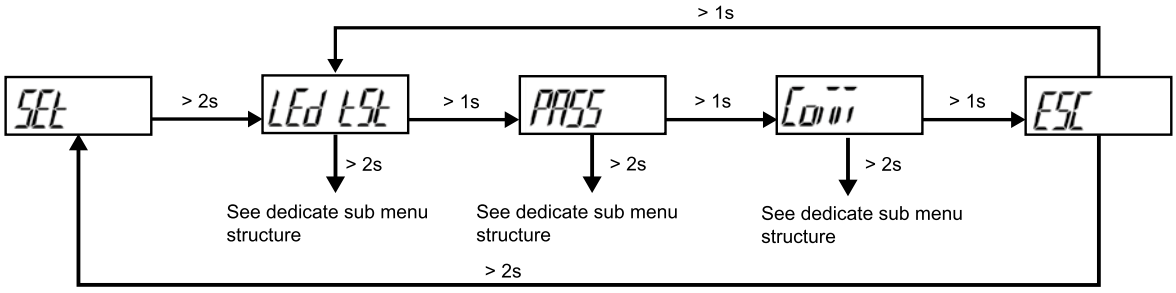


Usable characters are the following:

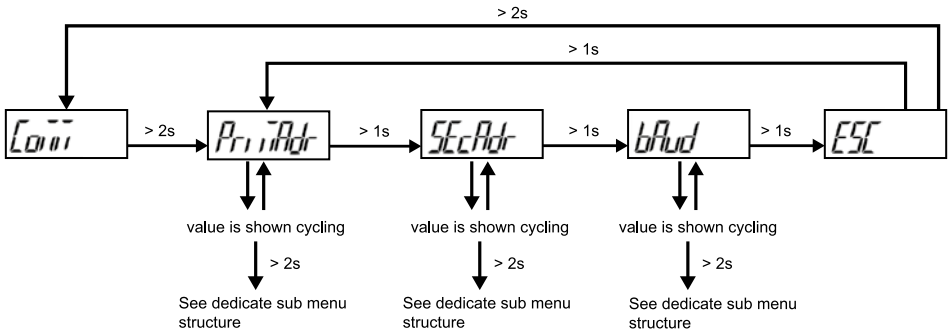
Communication menu (when in COMM menu, short touches move user through it):

Communication menu is available at M-bus and RS485 option and can be used for setting communication parameters (communication addresses, baud rate, parity and stop bits)

M-bus setting menu:

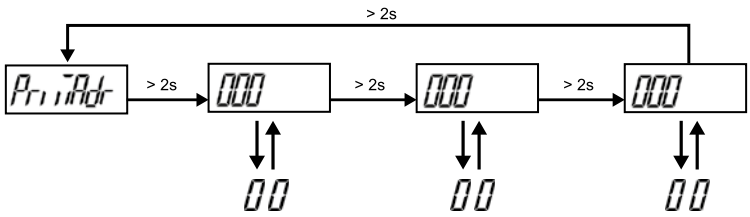


7M with MBus communication protocol must be configured using the submenu "COMM"



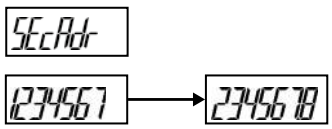
If you stop using short touches on a certain screen, the screen with the parameter value is shown and it starts cycling automatically. With long touch you can enter the setting mode:

Primary address:



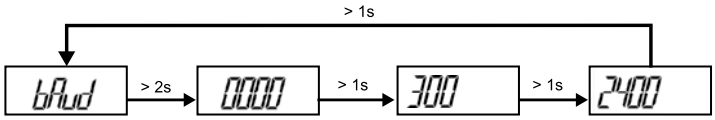
Secondary address:

When the character is blinking, one can scroll through numbers using short touches. The number can be confirmed by using the long touch

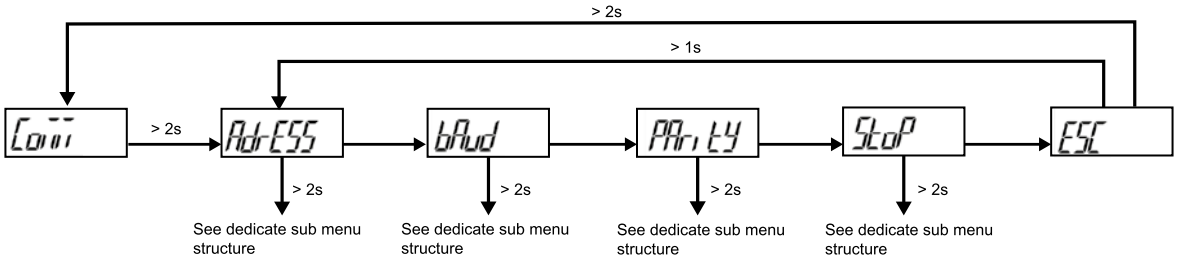


Two types of parameter values are scrolling automatically. Example above

Baud rate:



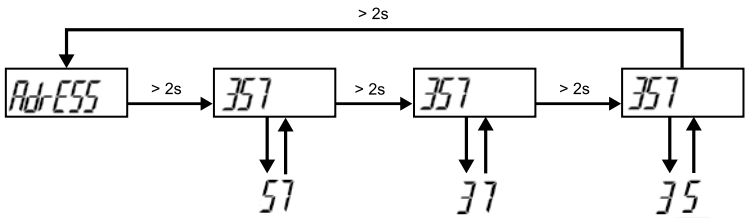
RS485 (Modbus) setting menu:



If you stop using short touches on a certain screen, the screen with the parameter value is shown and it starts cycling automatically. With long touch you can enter the setting mode.

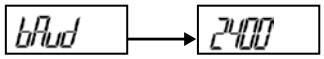
Address:

When the character is blinking, one can scroll through numbers using short touches. The number can be confirmed by using the long touch.



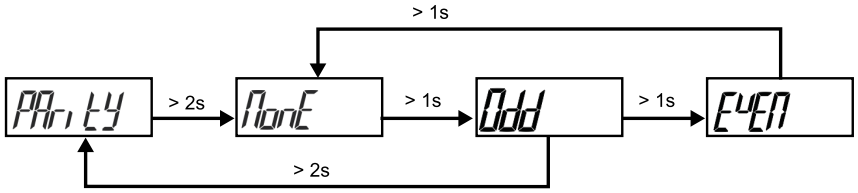
Baud rate:

You can choose between different values: 2400, 4800, 9600, 19200, 38400, 57600, 115200.



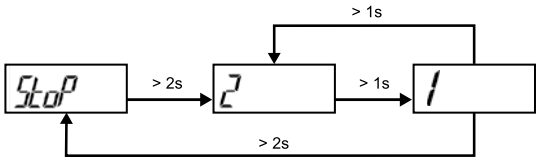
Parity:

You can choose between **even**, **odd** and **none**.



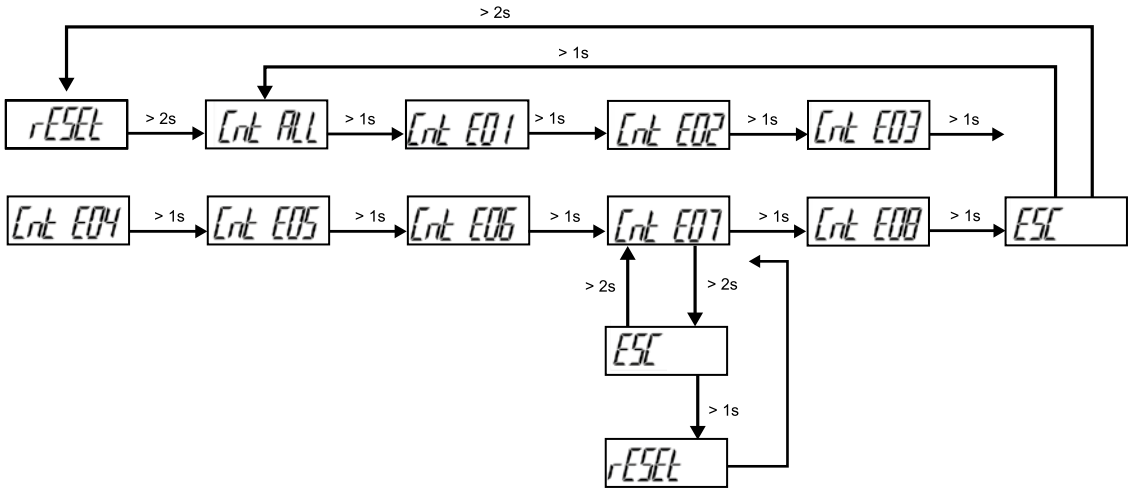
Stop bits:

You can choose between values: 1, 2.



3.2.4.3 Reset menu

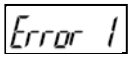
When in reset menu, short touches move user through it, allowing her/him to select a dedicated menu. With long touch, all counters or single counter can be chosen.



Above an example of how reset counter number 7, E07. For final execution, additional confirmation of reset is necessary.

3.2.4.3 Error display

In case the meter detects error in firmware or parameter check sum, the Error screen with the decimal value of the first three bits is displayed after each cycle of the displayed quantities. The details of the error is shown in Info menu. In case of the error, the manufacturer should be consulted or the meter.



4. TECHNICAL DATA

4.1 Accuracy

MEASURED VALUE	Accuracy Class
Active Energy	class 1 EN 62053-21
	class B EN 50470-3
	±1.5% from I_min to I_tr
	±1% from I_tr to I_max
Reactive Energy	class 2 EN 62053-23
	±2.5% from I_min to I_tr
	±2% from I_tr to I_max
Voltage	±1% of measured value
Current	±1% of I_ref from I_st to I_ref
	±1% of measured value from I_ref to I_max
Active Power	±1% of nominal power (U_n*I_ref) from I_st to I_ref
	±1% of measured value from I_ref to I_max
Reactive, Apparent power	±2% of measured value from I_st to I_ref
	±2% of measured value from I_ref to I_max
Frequency	±0.1% of measured value from

4.2 Mechanical characteristics of input

TERMINALI		
Main Input	Connection capacity flexible (rigid) cable	1.5 mm^2 ... 10mm^2 *Ferrule length should be12 mm. Wire stripped up to 14 mm
	Connection screw	M3.5
	Max Torque	0.8 Nm (PZ2)
	Length of removed isolation	10 mm
Communication Port	Contacts capacity	0.5 mm^2...1 (2.5) mm^2
	COnnection screws	M3
	Max Torque	0.6 Nm
	Length of removed isolation	8 mm

4.3 Electrical characteristics of input

ELECTRICAL FEATURES 7M.24	
Type (connection)	single phase (1b)
Reference current (I_{ref})	5 A
Maximum current (I_{max})	40 A
Minimum current (I_{min})	0.25 A
Transitional current (I_{tr})	0.5 A
Starting current (I_{st})	20 mA
Power consumption @ I_{ref}	< 0.1 VA
Nominal voltage (U_n)	230 V (–20 - +15)%
Power consumption @ U_n	10 VA
Nominal frequency (f_n)	50 Hz e 60 Hz
Minimum measuring time	10 s
Maximum peak current	1200 A/10 ms
Power consumption	0.5 W

Connections		
Pulse output (option)	Type	Optocoupler - open collector switch
	Pulse rate per kWh	1 imp/Wh - (1000 imp/kWh)
	Pulse duration	32 ms ± 2 ms
	Rated Voltage DC	27 V max
	Switched current	27 mA max
	Standard	EN 62053-31 (A&B)
M-Bus communication protocol (opzional)	Type	M-Bus
	Communication speed	300 bit/s ... 9600 bit/s (default 2400 bit/s)
	Protocol	M-Bus
	Primary address	0 – (default)
Modbus RS485 communication protocol (opzional)	Type	RS485
	Communication speed	1200 bit/s to 115200 bit/s (default 19200 bit/s)
	Frame	8, N, 2
	Protocol	MODBUS RTU
	Default primary address	33
IR communication port (opzional)	Type	IR
	Communication speed	19200 bit/s
	Frame	8, N, 2
	Protocol	MODBUS RTU
	Default primary address	33
	Remark	All settings are fixed
NFC (opzional)	Protocol	ISO/IEC 14443 Part 2 and 3 compliant
	Working frequency range	13.56 Mhz
	Baudrate	106 kbps
	Operating distance	Up to 15 mm from LCD (depending on user device)

4.4 Safety and ambient conditions

According to standards for indoor active energy meters.
Temperature and climatic condition according to EN 62052-11.

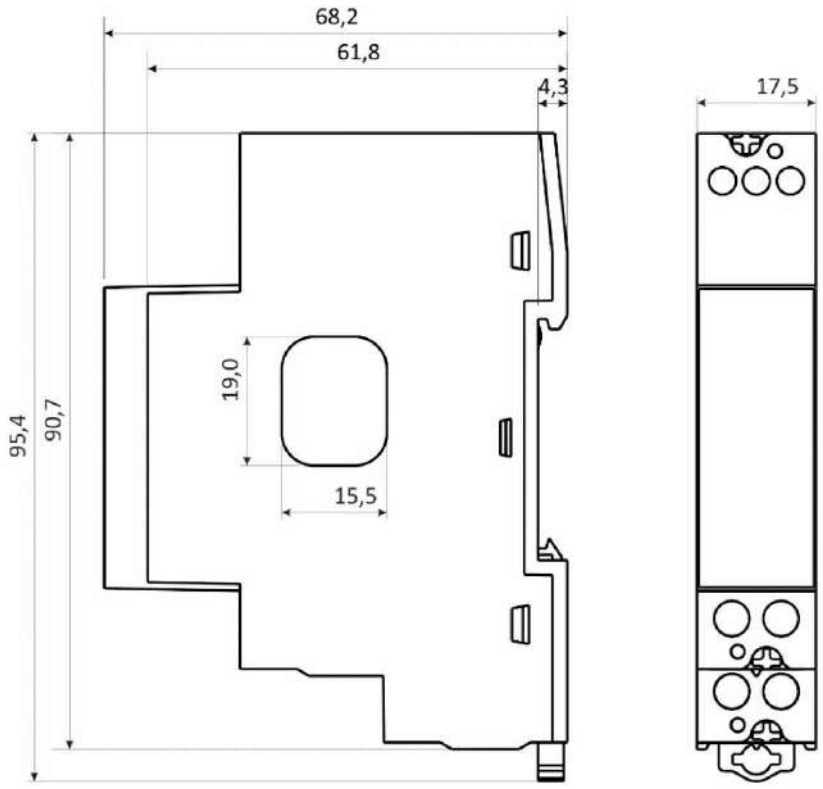
Dust/Water protection category	IP50 (For IP51 7M must be installed into appropriate cabinet)
Protection category - for touch by finger part	IP20
Operating temperature	–25 °C - +55 °C or (70°C for 7M.24 - 0210) (non condensing humidity)
Storage temperature	–40 °C - + 70 °C
Enclosure	Self extinguish, complying to UL94-V
Indoor meter	Yes
Pollution degree	2
Protection class	II
Installation category	300 Vrms cat.III
Standard	IEC 62052-31
Mechanical environment	M1
Electomagnetic environment	E2
Humidity	non condensing
Weight (with packaging):	150 g (170 g)
Installation	DIN Rail 35 mm
Dimensions (L x H x P)	17.5 mm x 90.7 mm x 68.2 mm
Dimensions of packaging (L x H x D)	30 mm x 112 mm x 80 mm
Colour	RAL 7035
Security seals	plastic wire material

4.5 Eu directives conformity

EU Directive on Measuring Instruments **2014/32/EU**
EU Directive on **EMC 2014/30/EU**
EU Directive on Low Voltage **2014/35/EU**
EC Directive **WEEE 2002/96/EC**
EU DIRECTIVE RED **2014/53/EU**

4.6 Dimensions

Dimensional drawing



5. APPENDICES

PLEASE NOTE

This chapter is a subject of change. Please download from **www.findernet.com** the dedicated guide for Modbus and M-Bus communication protocol

5.1 MODBUS communication protocol

Modbus protocol enables operation of device on Modbus networks. For 7M.24 with serial communication the Modbus protocol enables multi drop communication via RS485 communication. Modbus protocol is a widely supported open interconnect originally designed by Modicon.

The memory reference for input and holding registers is 30000 and 40000 respectively.
Communication operates on a master-slave basis where only one device (the master) can initiate transactions called 'Requests'. The other devices (slaves) respond by supplying the requested data to the master. This is called the 'Request - Response Cycle'.

The master could send the MODBUS request to the slaves in two modes:

- **Unicast mode**, where the master sends the request to an individual slave. It returns a replay to the master after the request is received and processed. A MODBUS transaction consists of two messages. Each slave should have an unique address.
- **Broadcast mode**, where the master sends a request to all slaves and an answer is never followed. All devices should accept the broadcast request function. The Modbus address 0 is reserved to identify the broadcast request.

Master to Slave Request

Device address	Function Code	nx8 bit data bytes	Error check

Slave to Master Response

Device address	Function Code	nx8 bit data bytes	Error check

Request

This Master to Slave transaction takes the form:

- Device address: master addressing a slave (Address 0 is used for the broadcast address, which all slave devices recognize.)
- Function code e.g. 03 asks the slave to read its registers and respond with their contents.
- Data bytes: tells the slave which register to start at and how many registers to read.

Response

This Slave to Master transaction takes the form:

- Device address: to let the master know which slave is responding.
- Function code: this is an echo of the request function code.
- Data bytes: contains the data collected from the slave.

Request frame

		Starting Register	Register Count	CRC
Slave Address	Function Code	HI LO	HI LO	LO HI
21	04	06 6B	00 02	

Response frame

			Register Data	CRC
Slave Address	Function Code	Byte Count	HI LO HI LO	LO HI
21	04	06 6B	FE 00 59 96	

Request-response cycle example

Address number of slave: 21
Function code: 04 --> 30000
Starting register HI…LO: $00…6B_{(16)}$ --> $107_{(10)}$ +$30000_{(10)}$ = **$30107_{(10)}$**
(Meaning that actual measurement is U1. For further informations see REGISTER TABLE FOR THE ACTUAL MEASUREMENTS.)
Register count HI…LO: $00…02_{(16)}$ --> $2_{(10)}$ (Two registers: 30107 and 30108)
Data type: T5 (Unsigned Measurement (32 bit) – see table of DATA types decoding)
Register data: FE 00 59 $74_{(16)}$ --> 22934 * 10^{-2} V = **229,34 V**

5.2 M-Bus

The M-Bus interface fully complies with M-Bus European standard EN13757-2. The entire communication is ensured with 8 Data Bits, Even Parity, 1 Stop Bit and a Baud Rate from 300 to 9600 Bauds.

Communication settings

Default communication settings are: 2400, 8, E, 1 primary address 0 and secondary address is set to serial number of device.

Initialize M-Bus (SNK_NKE)

This Short Telegram initializes the M-Bus 7M.24. The M-Bus 7M.24 confirms correct receipt by Single Character Acknowledgement (ACK = E5). If the telegram was not correctly received the 7M.24 will not send an acknowledgement.

Select 7M.24 M-BUS using Secondary Address (SND_UD)

This Telegram enables to select the 7M.24 M-Bus. The 7M.24 confirms the correct receipt by ACK. If the telegram has not been correctly received the 7M.24 M-Bus will not send an Acknowledgement. After issue of the Single Character Acknowledgement the 7M.24 M-Bus is ready to transmit the entire Read-out Data within 3 seconds from receiving the Telegram „Transmit Read-out Data". At the end of 3 seconds the M-Bus 7M.24 will switch back to normal mode.

Transmit Read-out Data via Primary/Secondary Address (REQ_UD2)

This Short Telegram enables to select the M-Bus 7M.24 and to command it to transmit the Read-out Data parameterized. The M-Bus 7M.24 confirms correct receipt by transmitting of the Read-out Data. If the Short Telegram has not been received correctly; no Data will be transmitted by the M-Bus 7M.24. The Read-out Data are sent within 35 ms – 75 ms from receipt of the Short Telegram by the M-Bus Meter (fom more infomations see section M-Bus telegrams).

Set Baud Rate via Primary/Secondary Address (SND_UD)

This telegram enables to set the desired Baud Rate. The M-Bus 7M.24 confirms the correct receipt by ACK. If the telegram was not received correctly the M-Bus 7M.24 does not send an Acknowledgement. The (ACK) is sent by the M-Bus 7M.24 in the Old Baud Rate. As soon as ACK is transmitted the M-Bus Meter switches to the baud rate newly parameterized. If the 7M.24 now does not receive a new Telegram under the new baud rate within a period of 30 seconds – 40 seconds, it automatically switches back to the old baud rate. This is apt to prevent that a faulty setting of the baud rate may interrupt communication.

Set Primary Address via Primary/Secondary Address (SND_UD)

This Telegram enables to set a new Primary Address. The M-Bus 7M.24 confirms the correct receipt by ACK. If the telegram has not been correctly received the M-Bus 7M.24 will not send an Acknowledgement.

Set Secondary Address via Primary/Secondary Address (SND_UD)

This Telegram enables to set a new Secondary Address. The M-Bus 7M.24(M) confirms the correct receipt by ACK. If the telegram has not been correctly received the M-Bus 7M.24 will not send an Acknowledgement.
Secondary Address (UD) consists of:

Identification Number:	00000000 – 99999999	8-digit Secondary Address number
Manufacturer's Code:	73 26	2 Byte Company Constant (ISS = "73 26")
Version Number:	01 – FF	1 Byte
Medium: 02		1 Byte Constant Electricit

Reset, Restart 7M.24 M-Bus via Primary/Secondary Address (SND_UD)

This Telegram reset/restarts the 7M.24 M-Bus. The 7M.24 M-Bus confirms correct receipt by ACK. If the telegram was not correctly received the 7M.24 will not send an Acknowledgement.

M-Bus Telegram

Total Energy counters 0, 1, 2, 3

Energy counters could represent: +/- active energy, +/-reactive energy or apparent energy and one of 4-th tariff.

	DIF	DIFE	DIFE	VIF	VIFE	VIFE	VIFE	DATA
								xx.xx.xx.xx
T0	04	none	none					
T1	84	10	none					
T2	84	20	none					
A+				05	none	none	none	$*10^{5-3}$ Wh
A-				85	3C	none	none	$*10^{5-3}$ Wh
R+				FB	82	75	none	$*10^{5-3}$ varh
R-				FB	82	F5	3C	$*10^{5-3}$ varh
App				FB	84	75	none	$*10^{5-3}$ VAh

Active Tariff number

Tariff number in progress (1 to 4)

	DIF	DIFE	DIFE	VIF	VIFE	VIFE	VIFE	DATA
	01			FF	01			xx

DATA: value represent as 8-bit integer

Active Power Total Pt (W)

Active power total in 32 bit x $10^{(2-3)}$ W

	DIF	DIFE	DIFE	VIF	VIFE	DATA
	04			2A		xx.xx.xx.xx

Reactive Power Total (kvar)

Reactive power total in 32bit x$10^{(2-3)}$ var

	DIF	DIFE	DIFE	VIF	VIFE	VIFE	VIFE	DATA
	04			FB	97	72		xx.xx.xx.xx

Instant Apparent Power Total (VA)

Apparent power total in 32 bit x $10^{(5-6)}$ VA

	DIF	DIFE	DIFE	VIF	VIFE	VIFE	VIFE	DATA
	04			FB	B4	75		xx.xx.xx.xx

n - 0…7

Power Factor: -: leading et +: lagging: PF

Power factor as 32-bit integer * 10^{-3}

	DIF	DIFE	DIFE	VIF	VIFE	VIFE	VIFE	DATA
	04			A8	B4	35		xx.xx.xx.xx

Unit : W/V/A

Current Total (A)

Total current as 32 bit x $10^{(9-12)}$ A

	DIF	DIFE	VIF	VIFE	VIFE	DATA
	04		FD	59		xx.xx.xx.xx

System frequency (Hz/1000)

Contains the line frequency 32-bit integer in mHz

	DIF	DIFE	DIFE	VIF	VIFE	VIFE	VIFE	DATA
	04			FB	2C			xx.xx.xx.xx

Voltages (V)

Voltage as 32 bit x $10^{(7-9)}$ V

	DIF	DIFE	VIF	VIFE	VIFE	VIFE	DATA
	04						xx.xx.xx.xx
U1			FD	C7	FC	01	

5.4 Obis code

OBIS code	Description
Active energy register	
1.8.0	Positive active energy (A+) total [kWh]
1.8.1	Positive active energy (A+) in tariff T1 [kWh]
1.8.2	Positive active energy (A+) in tariff T2 [kWh]
1.8.3	Positive active energy (A+) in tariff T3 [kWh]
1.8.4	Positive active energy (A+) in tariff T4 [kWh]
2.8.0	Negative active energy (A-) total [kWh]
2.8.1	Negative active energy (A-) in tariff T1 [kWh]
2.8.2	Negative active energy (A-) in tariff T2 [kWh]
2.8.3	Negative active energy (A-) in tariff T3 [kWh]
2.8.4	Negative active energy (A-) in tariff T4 [kWh]
15.8.0	Absolute active energy (A+) total [kWh]
15.8.1	Absolute active energy (A+) in tariff T1 [kWh]
15.8.2	Absolute active energy (A+) in tariff T2 [kWh]
15.8.3	Absolute active energy (A+) in tariff T3 [kWh]
15.8.4	Absolute active energy (A+) in tariff T4 [kWh]
16.8.1	Sum active energy without reverse blockade (A+ - A-) in tariff T1 [kWh]
16.8.2	Sum active energy without reverse blockade (A+ - A-) in tariff T2 [kWh]
16.8.3	Sum active energy without reverse blockade (A+ - A-) in tariff T3 [kWh]
16.8.4	Sum active energy without reverse blockade (A+ - A-) in tariff T4 [kWh]

Reactive energy register	
3.8.0	Positive reactive energy (Q+) total [kvarh]
3.8.1	Positive reactive energy (Q+) in tariff T1 [kvarh]
3.8.2	Positive reactive energy (Q+) in tariff T2 [kvarh]
3.8.3	Positive reactive energy (Q+) in tariff T3 [kvarh]
3.8.4	Positive reactive energy (Q+) in tariff T4 [kvarh]
4.8.0	Negative reactive energy (Q-) total [kvarh]
4.8.1	Negative reactive energy (Q-) in tariff T1 [kvarh]
4.8.2	Negative reactive energy (Q-) in tariff T2 [kvarh]
4.8.3	Negative reactive energy (Q-) in tariff T3 [kvarh]
4.8.4	Negative reactive energy (Q-) in tariff T4 [kvarh]
5.8.0	Imported inductive reactive energy in 1-st quadrant (Q1) total [kvarh]
5.8.1	Imported inductive reactive energy in 1-st quadrant (Q1) in tariff T1 [kvarh]
5.8.2	Imported inductive reactive energy in 1-st quadrant (Q1) in tariff T2 [kvarh]
5.8.3	Imported inductive reactive energy in 1-st quadrant (Q1) in tariff T3 [kvarh]
5.8.4	Imported inductive reactive energy in 1-st quadrant (Q1) in tariff T4 [kvarh]
6.8.0	Imported capacitive reactive energy in 2-nd quadrant (Q2) total [kvarh]
6.8.1	Imported capacitive reactive energy in 2-nd quadr. (Q2) in tariff T1 [kvarh]
6.8.2	Imported capacitive reactive energy in 2-nd quadr. (Q2) in tariff T2 [kvarh]
6.8.3	Imported capacitive reactive energy in 2-nd quadr. (Q2) in tariff T3 [kvarh]
6.8.4	Imported capacitive reactive energy in 2-nd quadr. (Q2) in tariff T4 [kvarh]
7.8.0	Exported inductive reactive energy in 3-rd quadrant (Q3) total [kvarh]
7.8.1	Exported inductive reactive energy in 3-rd quadrant (Q3) in tariff T1 [kvarh]
7.8.2	Exported inductive reactive energy in 3-rd quadrant (Q3) in tariff T2 [kvarh]
7.8.3	Exported inductive reactive energy in 3-rd quadrant (Q3) in tariff T3 [kvarh]
7.8.4	Exported inductive reactive energy in 3-rd quadrant (Q3) in tariff T4 [kvarh]
8.8.0	Exported capacitive reactive energy in 4-th quadrant (Q4) total [kvarh]
8.8.1	Exported capacitive reactive energy in 4-th quadr. (Q4) in tariff T1 [kvarh]
8.8.2	Exported capacitive reactive energy in 4-th quadr. (Q4) in tariff T2 [kvarh]
8.8.3	Exported capacitive reactive energy in 4-th quadr. (Q4) in tariff T3 [kvarh]
8.8.4	Exported capacitive reactive energy in 4-th quadr. (Q4) in tariff T4 [kvarh]
Apparent energy register	
9.8.0	Apparent energy (S+) total [kVAh]
9.8.1	Apparent energy (S+) in tariff T1 [kVAh]
9.8.2	Apparent energy (S+) in tariff T2 [kVAh]
9.8.3	Apparent energy (S+) in tariff T3 [kVAh]
9.8.4	Apparent energy (S+) in tariff T4 [kVAh]

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