
ENERGY METER

EV3

User Manual

EV3

User Manual

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1 General Information

1.1 Responsibility

The owner or provider is responsible for the proper use of the device. The installation, putting into operation and reinstallation of the meter is only allowed to be done by electrically skilled persons, which got knowledge about the contents of this user manual.

1.2 Common safety instructions

For installation, setting into operation and installation of the device the local requirements for safety requirements must be observed.

Danger



Inappropriate use of parts under high voltage may lead to grave injuries and accidents, which may be fatal even with 230V.

The conductors which are connected to the device must be disconnected to the mains during assembling and installation. It must be used a prevention for being switched on accidentally.

The device is not allowed to be used out of specifications.

1.3 Service and warranty instructions

Damaged devices can't be repaired by you. The warranty and liability will be terminated with opening the device. The same applies to damages caused by external influences.

For the device no servicing is required.

1.4 Disposal (product end of life information)



This meter was designed and built by ABB to provide many years of service and is backed by our commitment to provide high quality support. When it eventually reaches the end of its serviceable life, it should be disposed in accordance with local or national legislation.

1.5 Environment

This meter is designed for indoor or in a cabinet environment only (avoiding extreme weather conditions) in accordance with EN50470-1 and EN50470-3, with the terminal cover fitted.

1.6 Service and Warranty

This meter product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period ABB will at its option, either repair or replace products which prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by ABB. ABB does not warrant that the operation of the meter or firmware will be uninterrupted or error free.

Damaged devices can't be repaired by you. The warranty and liability will be terminated with opening the device. The same applies to damages caused by external influences.

For the device no servicing is required.

1.7 Cyber Security Disclaimer

EV meter is designed to be connected and to communicate information and data via a network interface, which should be connected to a secure network. It is your sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be) and to establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the meter, the network, its system and interfaces against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB S.p.A. and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Although ABB S.p.A. provides functionality testing on the products and updates that we release, you should institute your own testing program for any product updates or other major system updates (to include but not limited to code changes, configuration file changes, third party software updates or patches, hardware change out, etc.) to ensure that the security measures that you have implemented have not been compromised and system functionality in your environment is as expected.

1.8 Symbols

	<p>Danger through Electric Voltages</p> <p>The symbol indicates warnings, which may lead to personal injuries or death if it is ignored. Take all necessary precautions to avoid danger!</p>
---	---

	<p>Warning</p> <p>The symbol indicates warnings to a possible dangerous situation which may lead to personal injuries or damage to properties.</p> <p>Avoid dangerous situations!</p>
	<p>Attention!</p> <p>“Attention” indicates warnings, which may lead to damage of properties if not observed.</p>
	<p>Notice</p> <p>“Notice” indicates important information in the manual.</p>

2 Technical data

2.1 Abbreviations

+A	Import active energy (to customer)
-A	Export active energy (from customer)
EN	European Standard
Imp/kWh	Quantity of pulses each kWh
LCD	Liquid Crystal Display
LED	Light Emitting Diode
OBIS	Object Identification System
+P	Import active power
-P	Export active power

2.2 Technical specifications

Type	Three phase direct
Voltage	
Nominal voltage U_n	3x230/400 Vac
Voltage range	0.8 – 1.15 U_n
Frequency	
Nominal frequency f_n	50 Hz
Frequency range	0.98 – 1.02 f_n
Current	
Reference current $I_{ref} = I_b = 10 I_{tr}$	5 A
Maximum current I_{max}	65A
Minimum current I_{min}	0.25 A
Starting current I_{st}	$\leq 0.004 I_b$
Accuracy	
Cl. B	Class B in compliance with EN 50470-3
Measuring Active Energy	

Two Energy Directions	+A/-A
Meter constant	
LED-Output	1000 Imp/kWh
Display	
LCD	7 digits
Life cycle	> 12 years
RS485- Data Interface	
Connector	Three screws type
Parameter	9600/19200/38400 bps, 8E1/8N1/8O1
Communication protocol	Modbus RTU
Power Consumption	
Voltage circuit	< 0.7 W / 5.5 VA at U_n
Current circuit	< 0.015 VA at I_b
Temperature Range	
Typical Operation	-30°C to +70°C
Storage	-40°C to +85°C
EMC Properties	
Isolation	4 kV AC, 50 Hz, 1min
High Voltage	7kV, Impulse 0.1/2000 μ s
Housing	
Dimension	DIN-Rail 90x70x62 mm
Material	fiber-glass reinforced Polycarbonate (flame resistant EN 62053-21)
Class of protection	II
Degree of protection	IP21 (IP 51 in protective enclosure)
Weight	
Weight	appr. 0,26 kg
Environment	
Mechanical environment	Class M1 as per 2014/32/EU Directive.
Electromagnetic environment	Class E2 as per 2014/32/EU Directive.

Tab. 1: Technical Properties

2.2.1 Technical Standards

EN 50470-1: Electricity metering equipment (AC) -Part 1: General requirements, test and test conditions Metering equipment (class indexes A, B, and C);

EN 50470-3: Electricity metering equipment (AC) -Part 3: Particular requirement Static meters for active energy (class indexes A, B, and C);

EN 50022: Low voltage switchgear and control gear for industrial use; mounting rails, top hat rails, 35 mm wide, for snap-on mounting of equipment

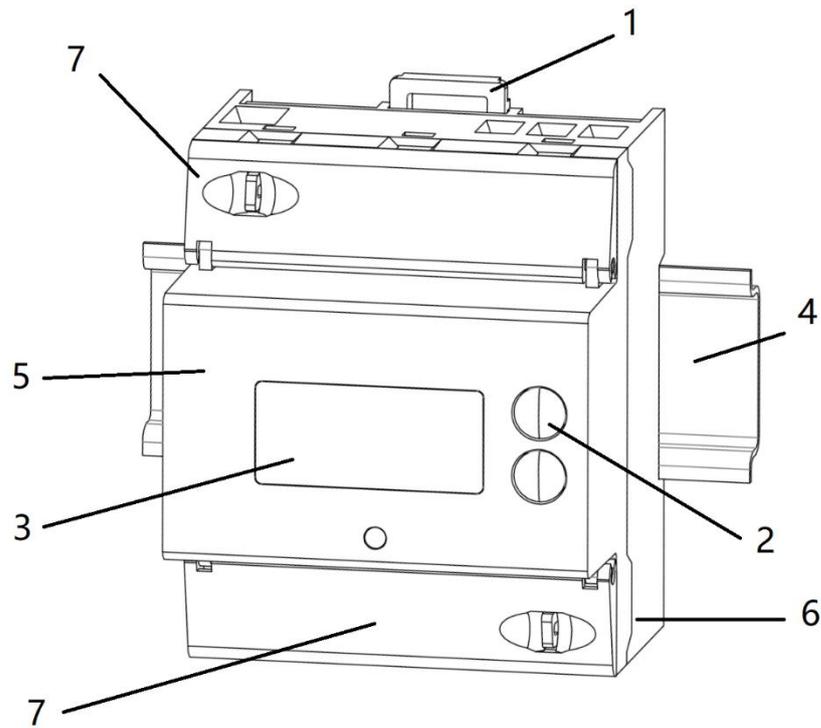
IEC 62053-21: Static meters for active energy (classes 1 and 2)

IEC 62052-11: Electricity metering equipment (AC)-General requirements, tests and test conditions –part 11: metering equipment

3 Dimension, Assembling and Installation EV3 012-100

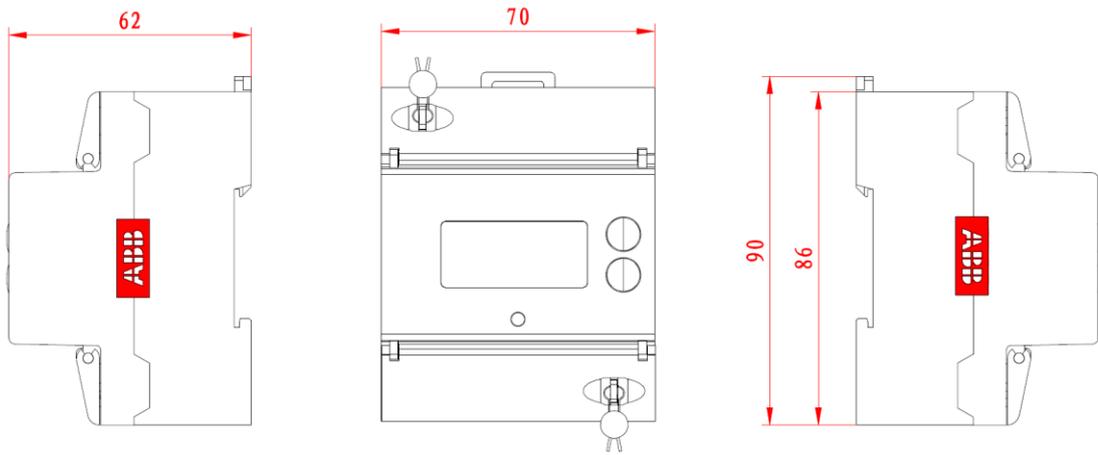
3.1 Assembling and dimensions

The meter constructed for assembling on DIN-rail TH 35-7.5 according to IEC 60715.

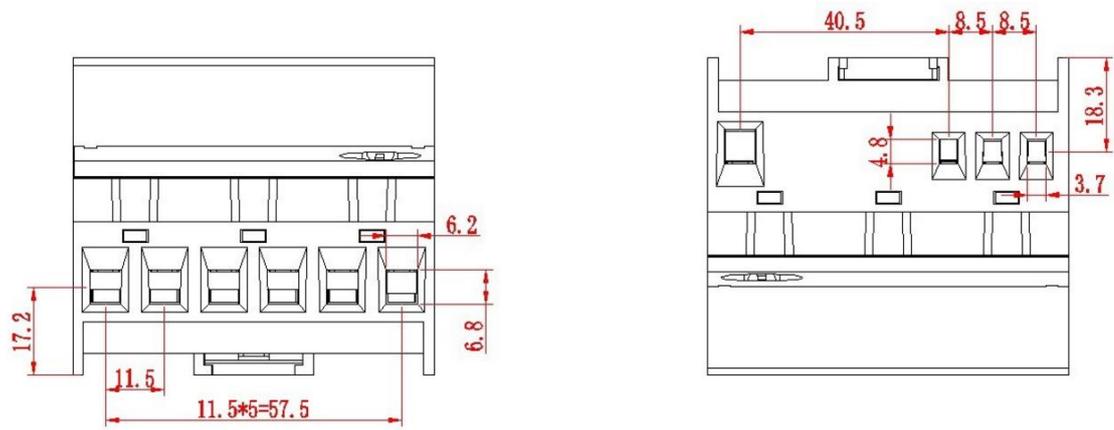


1. Housing EV3

Nr.	Element
1	Meter Hook
2	User Buttons
3	LCD
4	DIN Rail
5	Meter cover
6	Meter case
7	Terminal block with cover

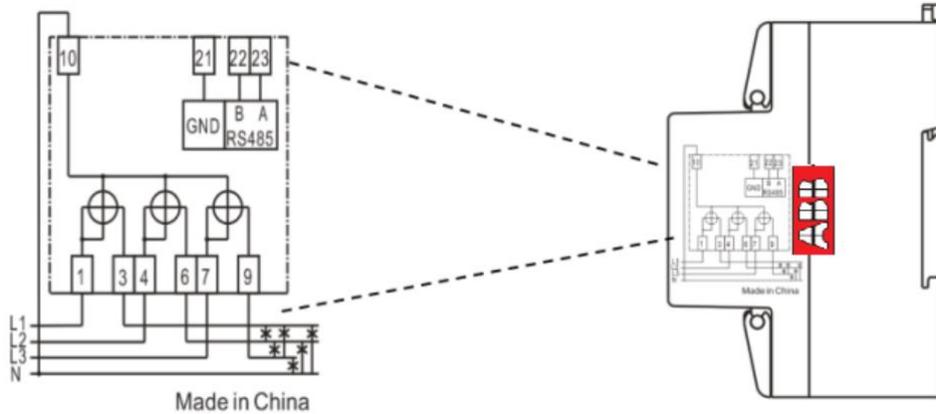


2. Housing EV3 dimension (mm)



3. Terminal block (mm)

3.2 Installation



4. Connection diagram EV3

The connection diagram printed on the housing needs to be considered connecting the meter to the mains power.

Terminal	Terminal Nr.	Terminal- [mm]	Terminal screw	Torque M [Nm]
Current In L1	1	6,3 x 5,6 (L x W)	M4 Pozidrive PZ1 Philips PH1	1,2 Nm < M < 1,5Nm
Current Out L1	3			
Current In L2	4			
Current Out L2	6			
Current In L3	7			
Current Out L3	9			
Voltage N	10			
RS485 Interface GND	21	5,0 x 3,2 (L x W)	M3 Pozidrive PZ1 Philips PH1	0,5 Nm < M < 0,7Nm
RS485 Interface B	22			
RS485 Interface A	23			



Warning

The requirements of the net provider need to be full filled.

Selective hedges have to be used according requirements of the net providers.

Attention

Damage of the terminals due to high torque



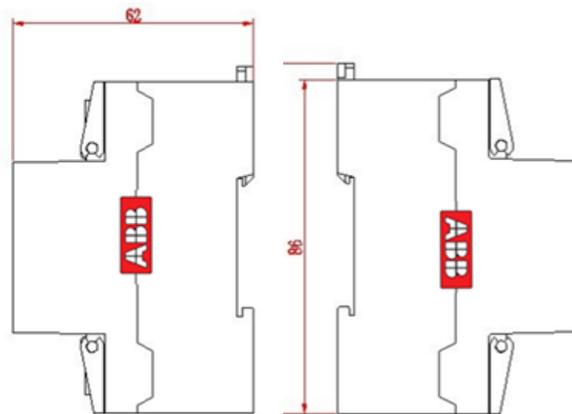
The specified maximum torques must not be exceeded!

Ensure that the connected lines are fixed with the needed torque compliant to EN 60999 for a safe connection. The needed torque depends on the type of used lines and the maximum current.

3.3 Protection Housing

As indicated in image 1 the cover of the terminal blocks can be sealed after installation.

The assembled meter base and meter cover will be protected against unauthorized opening with a manufacturer label (format 8x20 mm, corner radius 0.5 mm) on both sides of the housing.



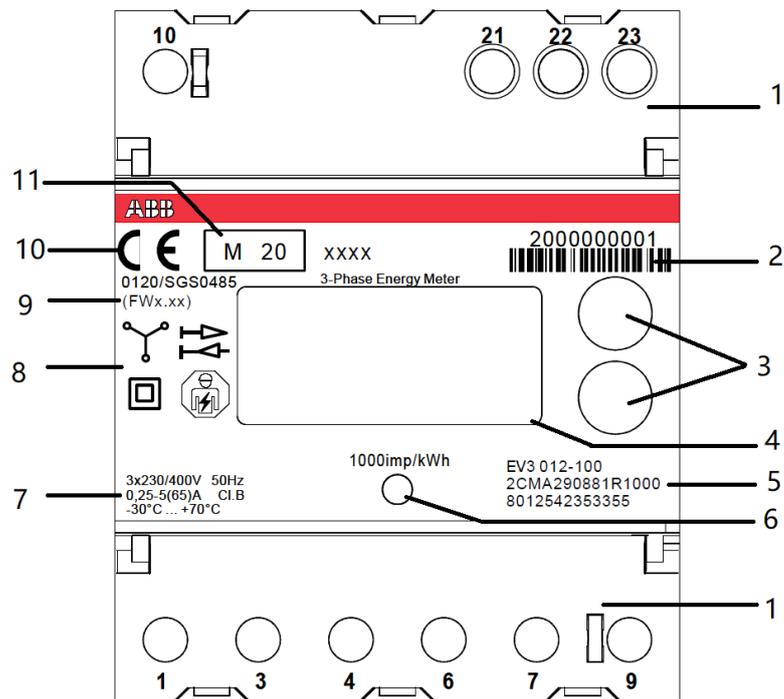
5. Sealing



Important

Warranty and accuracy are void if sealing labels are removed.

4 Nameplate



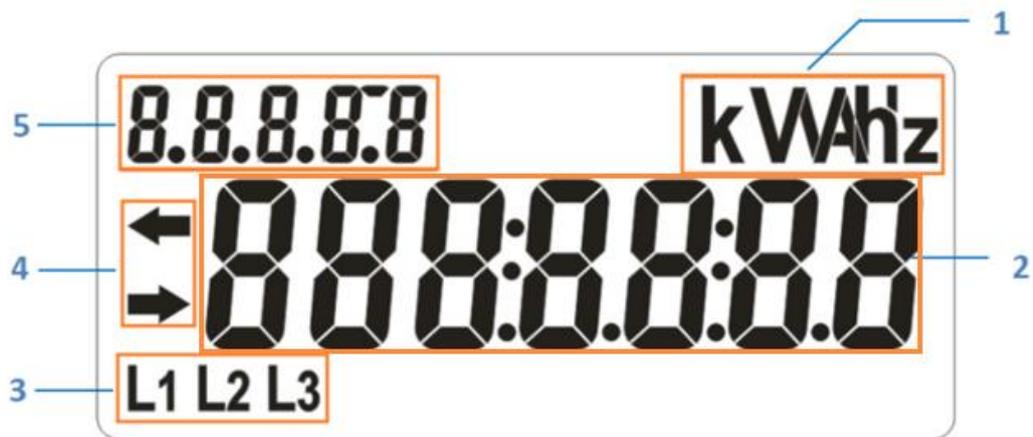
6. EV3 Nameplate

Nr.	Element	Function
1	Terminal block with cover	sealable terminal cover
2	Meter number	with barcode 128
3	User buttons	Information described in chapter 5
4	LCD	7 digits with additional symbols
5	Meter type	
6	LED	test LED 1000 Imp/kWh
7	Technical nominal data	
8	3 phase 4 Wire	
	Protection class	
	Two energy directions	 Import (+A) and Export (-A) energy measurement
	Security symbol	
9	Firmware version	Will be consistent with the actual certified version
10	Number approval document year of certification	CE sign, year of certification, named body for MID approval
11	Manufacture year	

5 LCD-Display

The LCD has the following format:

- LCD size: 37.5 mm × 17 mm
- Digit size: 3.38 mm × 1,53 mm



7. EV3 LCD

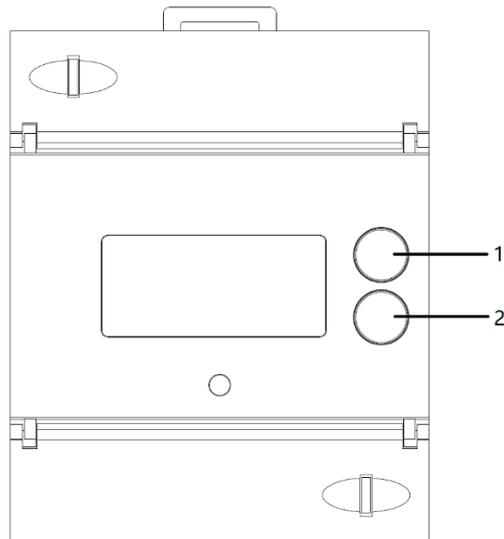
LCD-Display description:

Nr.	Element	Function
1	Unit	unit of the displayed value (kWh, W, V, A, Hz)
2	Values	according defined display list
3	Indication of phase voltages	Symbol off: loss of phase Symbol is flashing: reverse sequence, reverse polarity, $L_x > 1.15U_n$ or $L_x < 0.8U_n$.
4	Indication current direction	Export Import
5	OBIS Code	Identifier of the displayed value

Configurable display items:

Modbus Address	Register	Units	LCD displayed
5B14	Total active power	W	yes
5B16	Active power for L1	W	yes
5B18	Active power for L2	W	yes
5B1A	Active power for L3	W	yes
5B00	Voltage L1	V	yes
5B02	Voltage L2	V	yes
5B04	Voltage L3	V	yes
5B0C	Current L1	A	yes
5B0E	Current L2	A	yes
5B10	Current L3	A	yes
5B2C	Frequency	Hz	yes
5B3A	Power factor	-	yes
5B3B	Power factor for L1	-	yes
5B3C	Power factor for L2	-	yes
5B3D	Power factor for L3	-	yes
0402	Serial number	-	yes
8908	Firmware version	-	yes
8912	Check Sum	-	yes
5000	Current_Total-(Import kWh)	kWh	yes
5004	Current_Total-(Export kWh)	kWh	yes
5460	Current_L1-(Import kWh)	kWh	yes
5464	Current_L2-(Import kWh)	kWh	yes
5468	Current_L3-(Import kWh)	kWh	yes
546C	Current_L1-(Export kWh)	kWh	yes
5470	Current_L2-(Export kWh)	kWh	yes
5474	Current_L3-(Export kWh)	kWh	yes

6 User Buttons



8. EV3 User buttons

Nr.	Element	Function
1	Button „Up“	<ul style="list-style-type: none">- Switch backlight of the LCD ON- Scrolling the display items up- Enter display ALT Mode
2	Button „Down“	<ul style="list-style-type: none">- Switch backlight of the LCD ON- Scrolling the display items down- Enter display ALT Mode

Change COMM address can be enabled/disabled, if enabled, then we can change COMM address by buttons as following:

- Press both buttons more than 5s, LCD will show default address as delivery (e.g., 25);
- Short press up button, the first digit (2) will start scrolling from 2~;
- Short press down button, the second digit (5) will start scrolling from 5~;
- No pressed buttons more than 10s, the current displayed number will be used as new COMM address, LCD display back to Auto display.

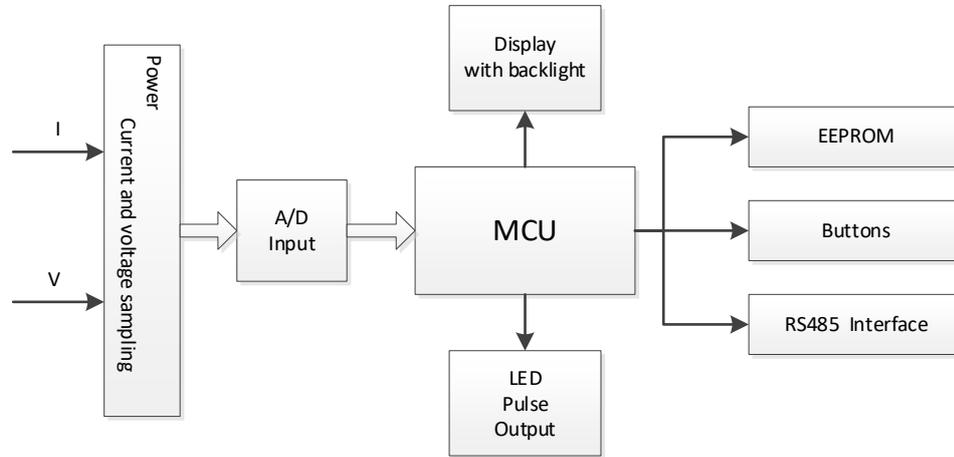
7 Test LED

The meter has one pulse LED for active energy with 1000 Imp/kWh.

The ON-time of a pulse is 40 ms.

8 Components

8.1 Block diagram



9. Block diagram

Current measuring:	Manganin shunt
Voltage measuring:	Resistor divider
A/D:	Analog to digital converter for the sampled voltage and current
MCU:	Micro Controller Unit
Communication interface:	RS485-Interface
Data storage EV3:	Nonvolatile storage for energy register +A/-A and meter parameter in EEPROM
Display EV3:	LCD with 7 digits
LED Pulse output:	Active energy +A and -A, 1000 Imp/kWh

9 Functionality

9.1 Measurement

The meter measures three phase active energy with accuracy class B.

The meter provides registers for total import, total export and net energy.

Additionally, each phase L1, L2 and L3 for import and export energy are measured.

The measurement of the energy is based on the measured power according the following calculations:

$$P_{\text{total}} = P_{L1} + P_{L2} + P_{L3}$$

$P_{\text{total}} > 0$: counting energy for +A

$P_{\text{total}} < 0$: counting energy for -A

9.1.1 Instantaneous parameter measurements

The instantaneous values can be read out via RS485 interface.

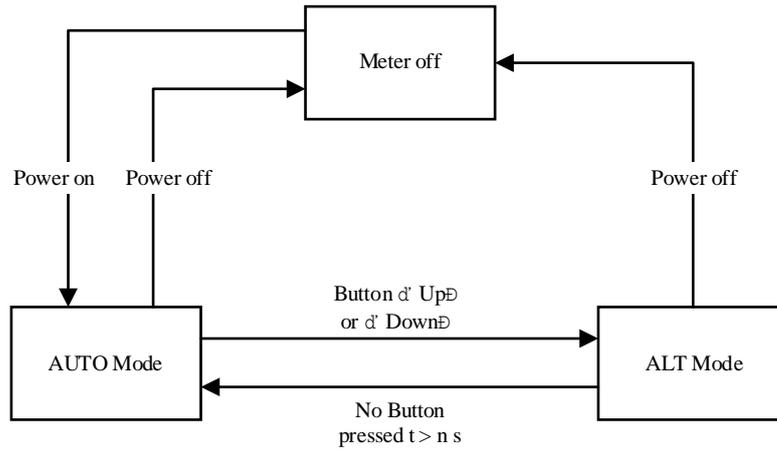
- Voltage and current
- Power factor
- Active power
- Frequency

9.2 Display Modes

The meter support two different display modes:

- AUTO Mode
- ALT Mode

9.2.1 Status Diagram



No Button pressed $t > n$ s: the parameter n is configurable via data interface

10. Status diagram display mode

After power on the meter shows for 2s self-check status and goes on to the AUTO-Mode. With the user buttons it can be changed between the different modes.

9.2.2 AUTO Mode and ALT Mode

In the AUTO Mode and ALT Mode all values which may be used for energy are displayed. This part of the display list can be changed by the user via RS485 interface.

The display lists can be expanded with additional values by the user via the RS485 interface and a parameter setting program. Each list can have 32 entries.

The different values are displayed with the following formats and units:

Type of value	Format	unit
Energy	x.x	kWh
Power	x.xx	W
Voltage	x.x	V
Current	x.xx	A
Power Factor	x.xx	---
Frequency	x.xx	---
Firmware Version		---
Checksum		---

In the AUTO Mode the next value of the defined list is displayed automatically with a settable time period (Configurable from 4 seconds to 20 seconds, and its default value is 5 seconds).

In the ALT Mode the next value is displayed after a user button was pressed or the device switched back to AUTO mode automatically after n seconds (n is configurable from 4 seconds to 20 seconds, and its default value is 5 seconds).

9.3 Fatal Error

The meter has implemented a self-monitoring system. If the meter recognizes improper operation so that billing relevant values may not be used anymore, it displays "--FF--". This status will be indicated with current display items flashing (1Hz).

9.4 Backlight

Backlight will be on after pressing button, it's useful to read meter through LCD when it in dark environment. Light on time is configurable from 5 seconds to 60 seconds. The default value is 20 seconds.

The back light will be turned off unconditionally if the voltage is less than $0.8U_n$.

10 RS485 Interface & Registers

Default Modbus settings:

Baud rate = 9600 (settable)

Device Address = 1 (settable)

Parity = Even

Stop bit, parity bit and data bit can be configured via Modbus as 8E1, 8N1 or 8O1.

Registers are listed in document 9AKK107991A9529