Averna ELEXIM

MeVOLT®

MEDIUM VOLTAGE SENSOR TARIFF METER

MID CERTIFIED

Up to 4 000 A

Up to 28 kV r.m.s.

Installation manual

mevolt.net

IMPORTANT NOTICE

MeVOLT® is the result of joint venture of Elexim, a.s. and Averna, a.s., hereinafter jointly referred to as the manufacturer or we.

The manufacturer applies a policy of ongoing development and reserves the right to change product without notice. The manufacturer does not accept any responsibility for loss or damage incurred as a result of acting or refraining from action based on information in this User Manual.

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REVISION	DATE	COMMENTS
0	03/2025	Initial revision
1	05/2025	Reference drawings update

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LIMITED WARRANTY

The manufacturer offers the customer a 24-month functional warranty on the instrument for faulty workmanship or parts from date of dispatch from the distributor. In all cases, this warranty is valid for 36 months from the date of production. This warranty is on a return to factory basis.

The manufacturer does not accept liability for any damage caused by instrument malfunction. The manufacturer accepts no responsibility for the suitability of the instrument to the application for which it was purchased.

Failure to install, set up or operate the instrument according to the instructions herein will void the warranty.

Only a duly authorized representative of the manufacturer may open your instrument. The unit should only be opened in a fully anti-static environment. Failure to do so may damage the electronic components and will void the warranty.

The greatest care has been taken to manufacture and calibrate your instrument. However, these instructions do not cover all possible contingencies that may arise during installation, operation or maintenance, and all details and variations of this equipment are not covered by these instructions.

For additional information regarding installation, operation or maintenance of this instrument, contact the manufacturer or your local representative or distributor.

WARNING

Read the instructions in this manual before performing installation, and take note of the following precautions:

- Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Failure to do so may result in serious or even fatal injury and/or equipment damage.
- Before connecting the instrument to the power source, check the labels on the back of the instrument to ensure that your instrument is equipped with the appropriate power supply voltage, input voltages and currents.
- Under no circumstances should the instrument be connected to a power source if it is damaged.
- To prevent a potential fire or shock hazard, do not expose the instrument to rain or moisture.
- The secondary of an external current transformer must never be allowed to be open circuit when the primary is energized. An open circuit can cause high voltages, possibly resulting in equipment damage, fire and even serious or fatal injury. Ensure that the current transformer wiring is secured using an external strain relief to reduce mechanical strain on the screw terminals, if necessary.
- Only qualified personnel familiar with the instrument and its associated electrical equipment must perform setup procedures.
- Do not open the instrument under any circumstances when it is connected to a power source.
- Do not use the instrument for primary protection functions where failure of the device can cause fire, injury or death. The instrument can only be used for secondary protection if needed.
- Read this manual thoroughly before connecting the device to the current carrying circuits. During operation of the device, hazardous voltages are present on input terminals. Failure to observe precautions can result in serious or even fatal injury or damage to equipment.

1. E²MEVOLT DESCRIPTION

The main advantage of *E²MeVOLT* is capability of measuring voltage & current using ABB KEVA/KECA medium voltage sensors.

The *E²MeVOLT* series is a group of state-of-art multi-microprocessor-based digital instruments that incorporate the capabilities of a power quality analyzer, energy meter, fault and data recorder and programmable controller, oriented for substation, industrial and commercial areas. These instruments provide three-phase measurements of electrical quantities in power distribution systems, monitoring external events, operating external equipment via relay contacts, fast and long-term on-board recording of measured quantities, transient voltages, harmonic analysis and disturbance recording.

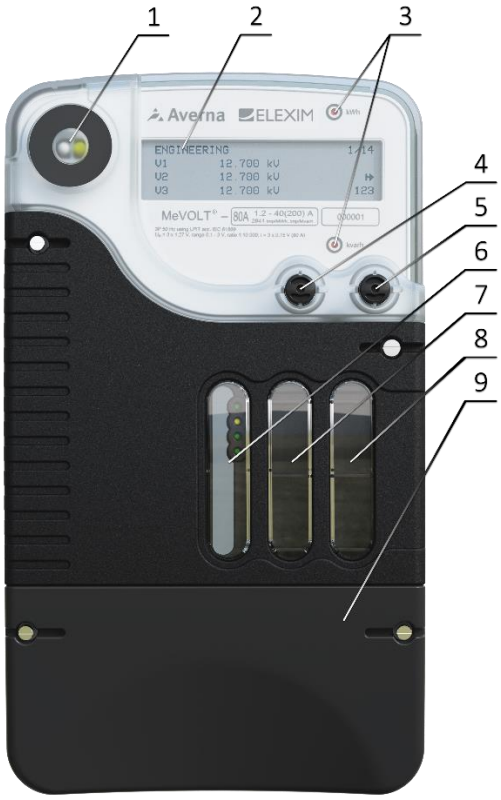


Figure 1 MeVOLT device

1 IR Communication port (COM1)
2 Graphical display
3 Energy pulse LED indicator
4 SCROLL Button
5 SELECT/ENTER Button
6 Power supply
7 Communication module
8 Available slot for optional module
9 Terminal cover

Separation of the terminal cover

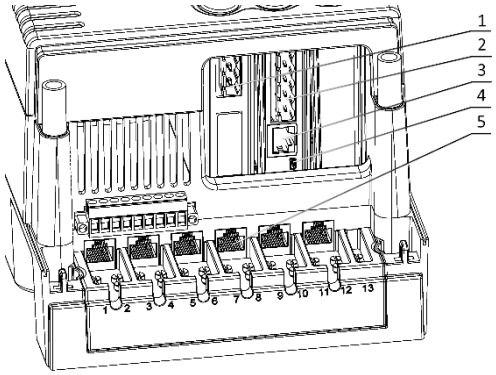


Figure 2 Connection side of the device

1 Power connector
2 Serial RS232/485
3 Ethernet RJ45
4 USB
5 Terminal block for KEVA/ KECA sensor connection

1.1 Block diagram of terminal block wiring

1.1.1 Connection schema of devices for 3 voltage LPIT sensors and 3 current LPIT sensors

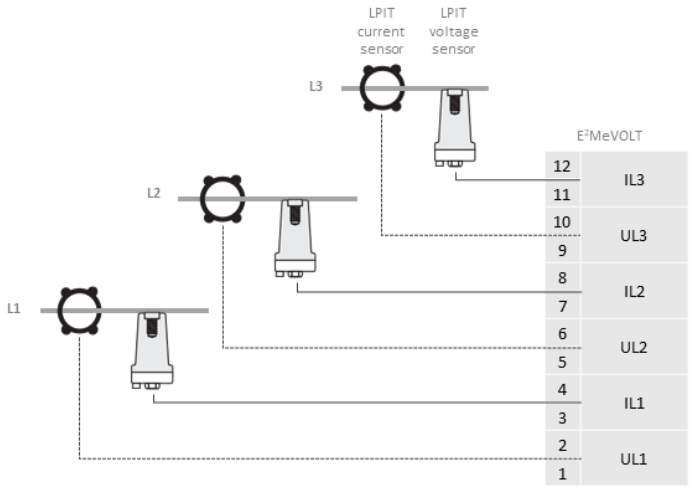


Figure 3 Connection with 3 voltage and 3 current LPIT sensors

1.1.2 Connection schema of devices for 3 combined LPIT sensors

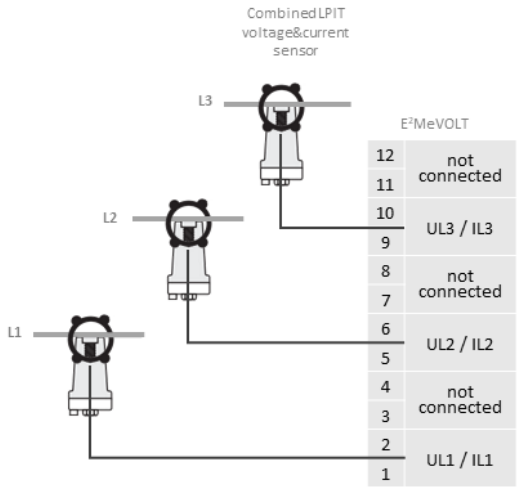


Figure 4 Connection with 3 combined LPIT sensors

1.1.3 Block diagram terminal block for connection sensors

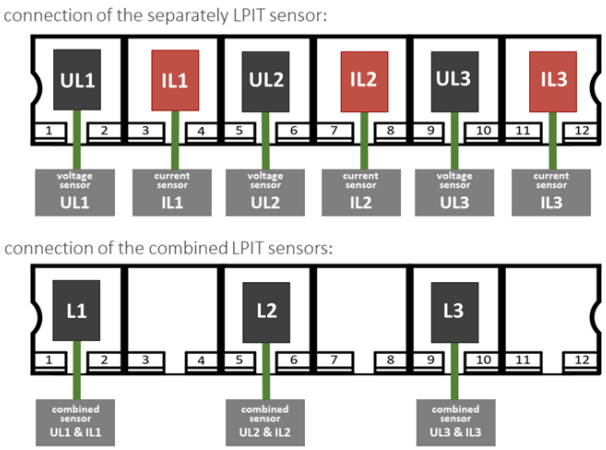


Figure 5 Block diagram terminal block for connection sensors

1.2 Features

The *E²MeVOLT* combines in a single enclosure:

- Precise Class B Active Energy and Power Demand Meter, Multiple Tariffs & Time-Of-Use (TOU, 16 Summary energy and demand registers for substation energy management, accumulation of energy pulses from external watt-meters, block and sliding demands), transformer and line losses, unique anti-tampering and self-test functions
- State of the art Power Quality Recorder (onboard PQ analyzer according to EN50160; programmable thresholds and hysteresis; ready-for-use reports; sags/swells, interruptions, frequency variations; flicker, temporary overvoltages, transient overvoltages, voltage unbalance, harmonic and interharmonics voltages)
- Digital Fault Recorder (onboard fault detector - programmable fault thresholds and hysteresis, zero-sequence currents and volts, current and volt unbalance; under-voltage, neutral current; ready-for-use fault reports - fault currents magnitude and duration, coincident volts magnitude, fault waveforms and RMS trace)
- Event Recorder for logging internal diagnostics events, control events and I/O operations
- Sixteen fast Data Recorders (from ½ cycle RMS to 2-hour RMS envelopes; up to 20 pre-fault cycles; programmable data logs on a periodic basis and on any internal and external trigger)
- Programmable Controller (32 control setpoints, OR/AND logic, extensive triggers, programmable thresholds and delays, relay control, event-driven data recording)
- High-Class 3-phase Power meter (true RMS of volts and amps, powers, power factors)
- Demand Meter (amps, volts, harmonic demands)
- Harmonic Analyzer (25 voltage harmonics)
- 16 programmable timers from ½ cycle to 24 hours for periodic recording and triggering operations on a time basis
- One slot for hot swap field installable option modules
- Graphic LCD display

1.3 AC Measurement Inputs

- Three AC low voltage inputs for measurement of voltage using ABB KEVA medium voltage sensors (RJ45 connector)
- Three AC low voltage inputs for measurement of current using ABB KECA current sensors for medium voltage (RJ45 connector)

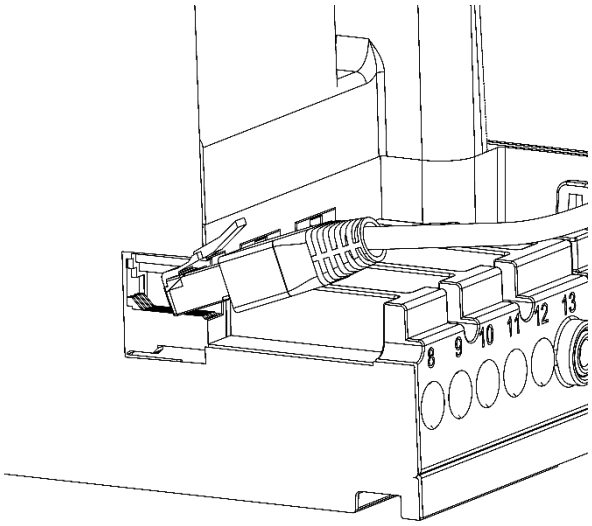
1.3.1 Connecting the sensors to the meter

Connection procedure:

1. at an angle slide in the sensor connector into the RJ45 socket
2. push the connector down so that the end of the connector is flush with the edge of the terminal block
3. slide in the connector into the socket

Disconnection procedure:

1. unblocks connector lock (use a screwdriver to help) and proceed in reverse order
2. pull the connector towards you
3. at an angle pull out



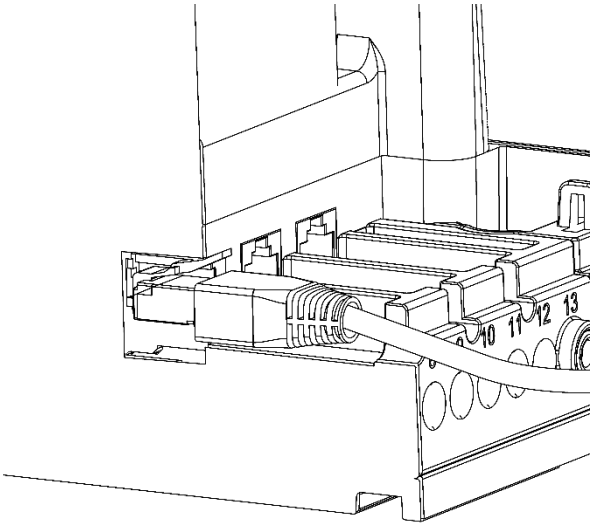


Figure 6 and Figure 7 - Connecting the sensors

Detail of connected inputs:

Figure 7 Detail of connected sensors

2. MECHANICAL INSTALLATION

2.1 Enclosure:

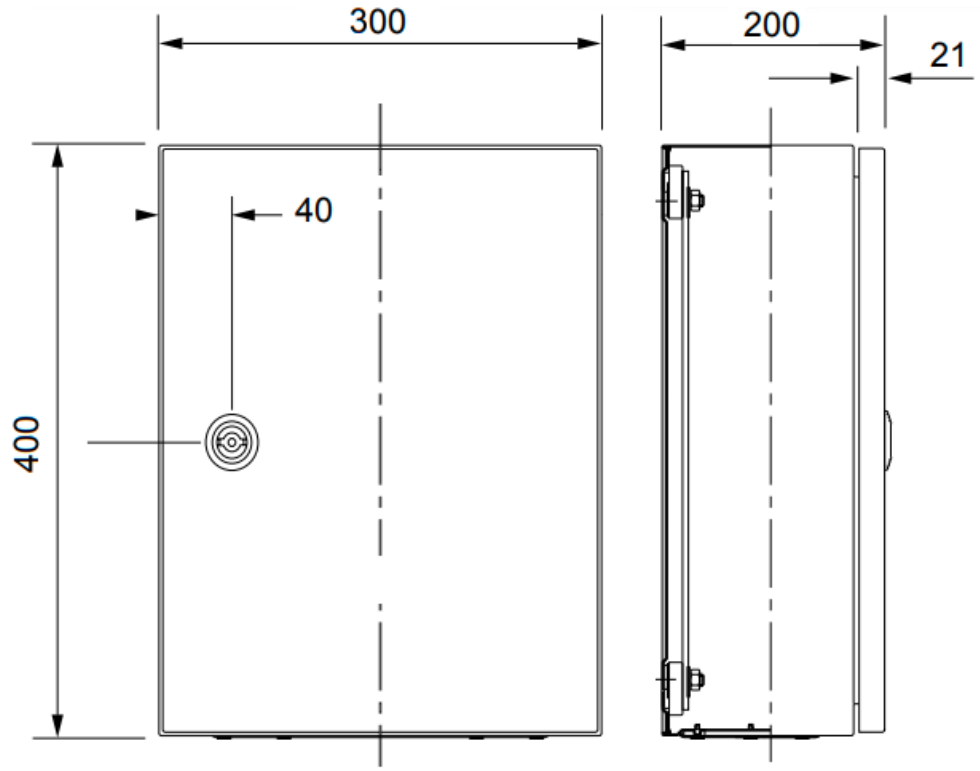


Figure 8 Dimensions enclosure

2.2 E²MeVOLT device:

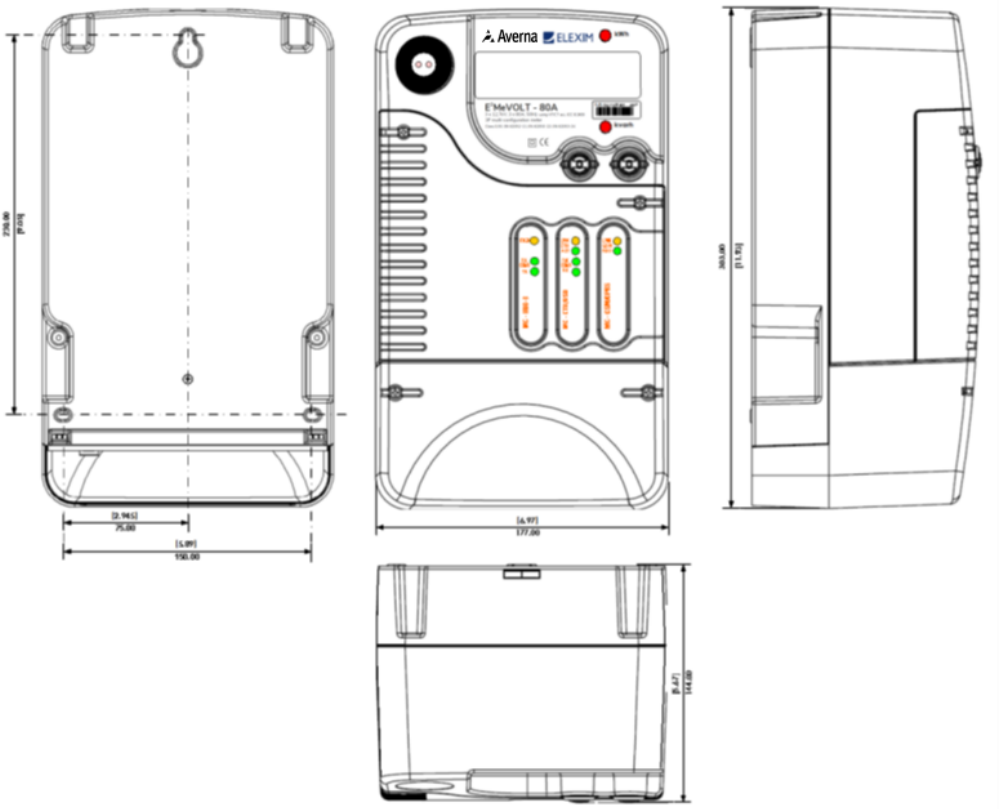


Figure 9 Dimensions device

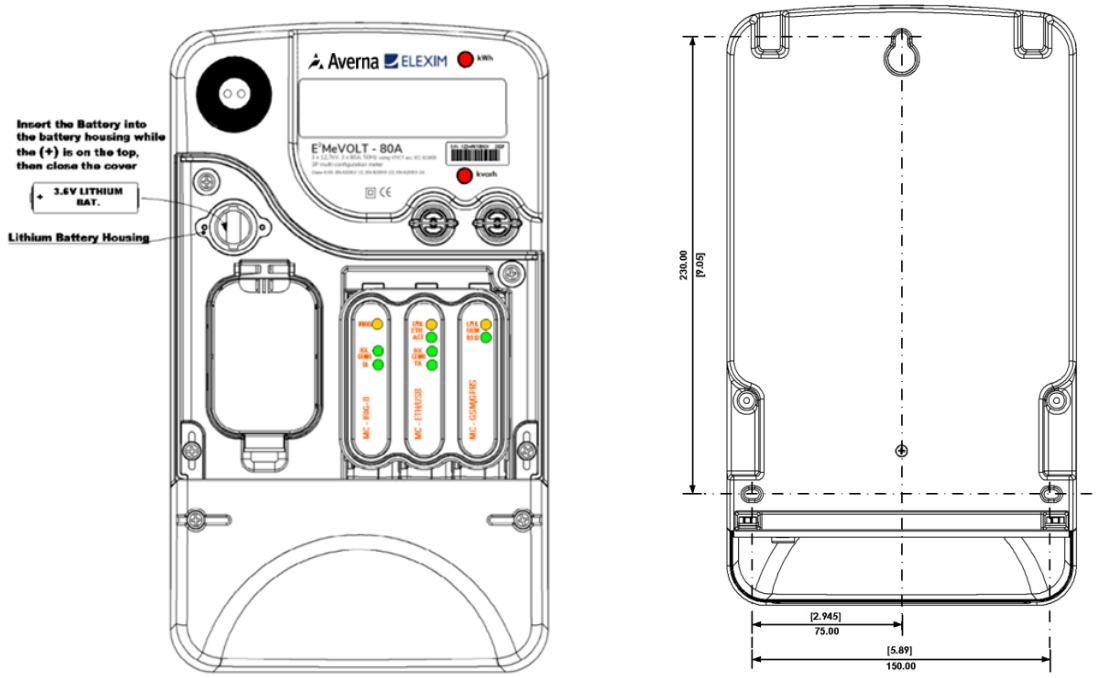


Figure 10 Device E²MeVOLT and wall mount dimensions

Figure 11 Real installation of device E²MeVOLT

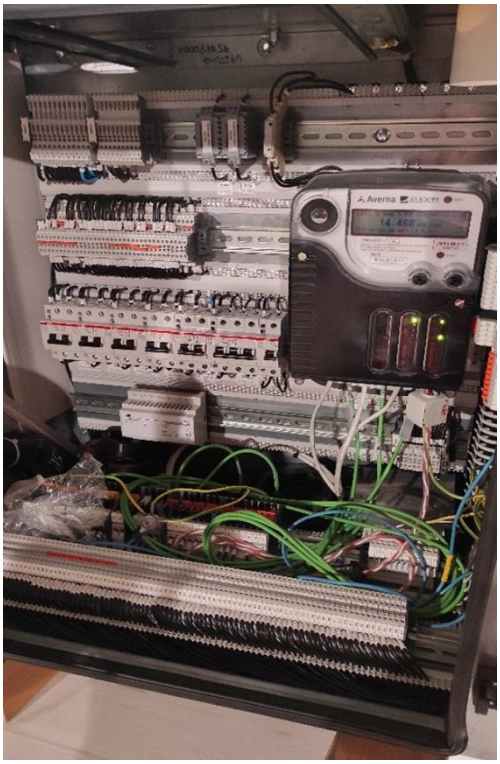


Figure 12 Real installation on medium voltage switchgear ABB

3. CONTROL AND INDICATORS

3.1 Push Buttons

The E²MeVOLT provides two sealable push buttons that do not have labels. They allow you to scroll through the multi-page display screens for local meter reading, to inspect or change meter setup parameters, and to control display operations.

3.2 Graphical display indicators

The E²MeVOLT graphical display is used both for displaying billing and instrumentation data, and for indication of the present tariff rate and important diagnostic information.

3.3 Energy Pulse LED Indicators

The E²MeVOLT is provided with two red LED indicators labeled as “kWh” and “kvarh” that flash when a load is applied to the meter. The LED pulse rate in NORMAL mode is indicated on the meter nameplate. The standard LED pulse rates are listed in the following table. All indicated rates are in secondary units.

Type device	LED indication of active energy	LED indication of reactive energy
E2MeVOLT 80	2830,6 imp/MWh	2830,6 imp/Mvarh
E2MeVOLT 800	283061,6 imp/GWh	283061,6 imp/ Gvarh
E2MeVOLT 1600	141531 imp/ GWh	141531 imp/ Gvarh

3.4 TEST mode

The E²MeVOLT can run in NORMAL or in TEST mode.

TEST mode is intended for testing the device energy measurement accuracy without affecting the billing energy and demand data. All instrumentation data is still available in TEST mode.

The front pulse LED indicators flash at a programmable rate in TEST mode, and the billing data display shows separate test kWh and kvarh energy readings with an extended 0.001 kWh resolution.

See Device Options and Mode Control in the next chapter on how to put your meter in TEST mode and to change the test LED pulse rate. See TEST Mode Data Display for more information on the TEST mode display.

NOTE: In TEST mode the following features are not operational:
- setpoints
- power quality recorder
- fault recorder
- relay outputs
- instrument transformer correction
- transformer/line loss compensation

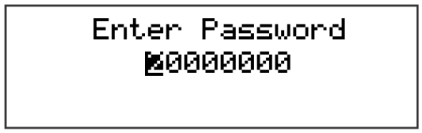
3.5 Device Diagnostics

Device diagnostic messages may appear as a result of the E²MeVOLT built-in diagnostic tests performed during start-up and device operation. A blinking diagnostics indicator is shown on the display whenever there are diagnostic messages. See in next chapter.

3.6 Meter security

The E²MeVOLT provides 3-level password security for protecting meter setups and accumulated data from unauthorized changes. Meter readings are not software protected. Access to setup and control

items is granted depending on the security level of the password you entered. The passwords can be 1 to 8 digits long.



The following table shows the meter security levels and user access rights.

Password	Security Level	Access Rights
Password 1	Low	Reset of billing and engineering maximum demands, and device diagnostics. Meter clock update. Display setup.
Password 2	Medium	TEST mode. Reset of meter and battery operation time, counters, failure counters and pulse counters. Communications setup. I/O operation setup and control. Memory and recorders setup. Billing/TOU system setup.
Password 3	High (Administration level)	Meter passwords setup. Basic device setup. Device energy and power options setup. Reset of conventional log files.

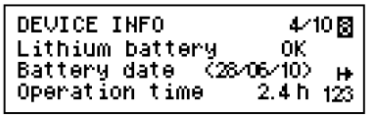
3.7 Meter Clock and Time Synchronization

Time synchronization provides a common time basis for the meter billing and tariff system, and for the power quality and fault recorders so that events and disturbances can be compared to one another.

The E^{2}MeVOLT can receive time synchronization signal either from a GPS satellite clock that has an IRIG-B time code output, or from another device that can provide minute aligned time synchronization pulses through relay contacts. The E^{2}MeVOLT IRIG-B port uses unmodulated (pulse-width coded) time code signal (unbalanced 5V level). The red IRIGB LED is blinking when the IRIG-B port receives a GPS clock signal.

3.8 Monitoring Meter Battery

The E^{2}MeVOLT is provided with a backup lithium battery that keeps the meter clock. You can monitor the status of batteries from the front display on the Device Info pages.



3.9 Instrument Transformer Correction

Ratio and phase angle error correction can be applied to external CTs and PTs to achieve overall metering installation accuracy or be used in any metering installation to optimize the accuracy of the metering data.

The user can program up to 8 test points for both ratio correction and phase angle error curves covering the typical transformer operating range.

The E^{2}MeVOLT is able to calculate the transformer errors dynamically based on the transformer performance characteristics and the actual CT current and PT voltage signals appearing at the meter,

to interpolate to the actual measured operating point and to apply the interpolated error corrections to the meter calculations. See Instrument Transformer Correction Setup on how to program the ratio correction factors and phase angle errors for external CTs and PTs and enable correction in the meter.

3.10 Power Transformer/Line Loss Compensation

Loss compensation allows accounting for losses in power transformers and/or power line in the event the billing and metering points are located at different sides of the power transformer or at different sides of the power line.

The calculated compensation values for kW and kvar losses are added to the measured power quantities and energies. The compensation values will be either positive, or negative depending on whether losses are calculated at the supply side or at the load side of the power transformer. They will be positive if the meter is located at the load side while the billing point is on the supply side, and negative in the opposite direction.

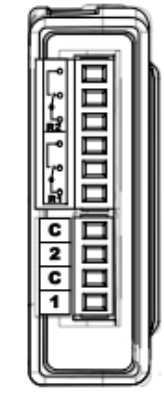
The instantaneous kW and kvar losses for iron and copper can be read and inspected via communications.

3.11 Operating digital inputs

The E^{2}MeVOLT can monitor a total of 8 digital inputs including four fast internal digital inputs and one replaceable two-channel 2DI/2DO modules. See the E^{2}MeVOLT Installation Manual for digital input ratings and connection diagrams. The 2DI/2DO module is provided with four indication LEDs that show the status of the digital inputs and relay outputs:

LED	Color	Status	Description
IN1, IN2	Yellow	Lights	The digital input terminals are shorted
OUT1, OUT2	Green	Lights	The normally open relay contacts are closed

Fast internal digital inputs are sampled at a 1-ms rate, and expansion inputs are sampled at a 1/2-cycle rate. Digital inputs functionality is programmable in the E^{2}MeVOLT and any digital input can perform multiple metering and control functions at the same time:



2DI/2DO MODULE

- Receiving energy pulses from external watt meters (sub metering) – link a digital input to a Billing/TOU register and provide a required multiplication factor
- Counting pulses from external pulse sources – link a digital input to a pulse counter
- Triggering a setpoint – put a digital input into a setpoint trigger list
- Triggering the Fault Recorder – link a digital input to the Fault Recorder and enable external triggers in the Fault Recorder setup
- External synchronization of power demand intervals –select a digital input as an external power demand sync source
- External synchronization of the meter clock – select a digital input as a time synchronization input and provide minute-aligned pulses from the external master clock source.

All digital inputs have a user-programmable debounce time from one to 100 milliseconds.

3.12 Operating relay outputs

Two relay outputs can be provided in your E²MeVOLT with expansion 2-channel 2DI/2DO replaceable modules. See the E²MeVOLT Installation Manual for available relay output ratings and connections. See Section Operating Digital Inputs above for the relay terminals location and relay status LED indicators. Relay outputs are updated at a half-cycle rate.

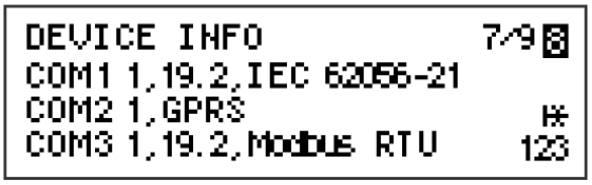
Each relay is independently programmable in the E²MeVOLT and can operate in latched, unlatched, pulse or KYZ mode. Relay operations can be inverted so that the relay is energized in its non-active state and de-energized when it is operated. This mode, known as “failsafe” mode, may be used for signaling purposes to send alarms when the device is not operational either due to a fault or due to loss of power.

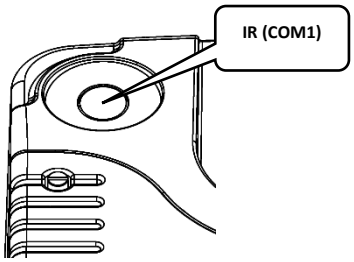
3.13 Communicating with E²MeVOLT

Communication with the E²MeVOLT is provided either via the embedded optical IR port, or via the replaceable communication ports.

3.13.1 Infrared Port

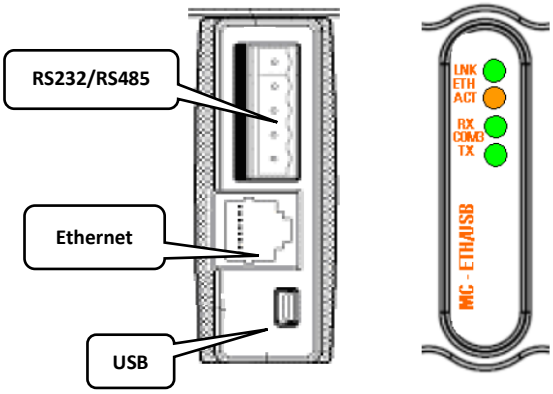
The E²MeVOLT has an optical infrared port for local meter reading via a hand-held unit or a portable PC. The IR port can be equipped with an IEC- or ANSI-compatible optical head on your selection. The IR port is identified in the E²MeVOLT as port COM1. It is factory preset to 19200 bps, 8-bits/No-parity data format, and is pre-programmed for the IEC 62056-21 protocol.





3.13.2 Communication module

The communication module has a serial port, an Ethernet port and a USB port.



3.13.2.1 Serial communication

Serial port is easily configurable for either RS-232, or RS-485 serial communications. Serial port is identified as port COM3. The COM3 port is provided with two green RX and TX LEDs that blink when the port receives or transmits data.

The port is factory preset to 19200 bps, 8-bits/No-parity data format, and is pre-programmed for the Modbus RTU protocol.

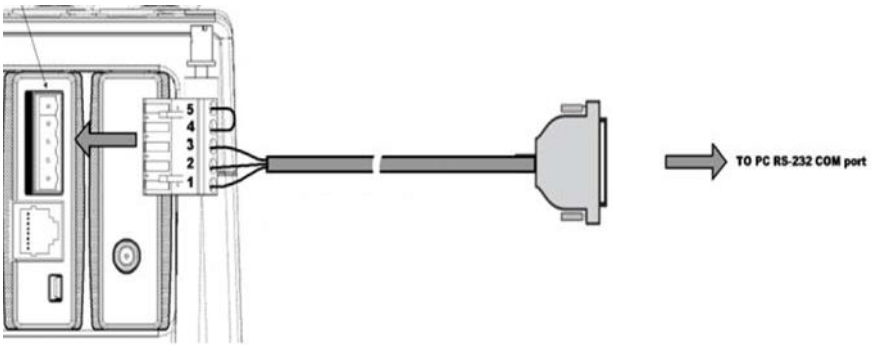


Figure 13 Serial communication RS232/RS485

Pin number	Signal RS485	Signal RS232
1	X-	TXD
2	X+	RXD
3	GND	GND
4	NOT CONNECTED	Connect to PIN5
5	NOT CONNECTED	Connect to PIN5

DB9 pin number	signal
2	TXD
3	RXD
5	GND

3.13.2.2 Ethernet connection

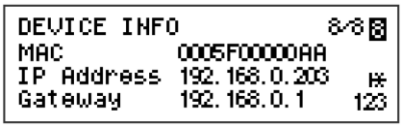
An optional 10/100Base-T Ethernet/USB module provides a direct connection of the E²MeVOLT to the Ethernet. The port has two indication LEDs that operate as follows:

LED	Color	Status	Description
LINK	Green	Lights	The good link is detected (slightly blinks when the port receives or transmits data)
ACT	Red	Blinks	Activity on the port - the port receives or transmits data

The E²MeVOLT provides two TCP servers configured for the Modbus/TCP (on port 502) and DNP3.0/TCP (on port 20000) communications. The TCP servers support 5 simultaneous Internet connections with client applications. Connection through the Ethernet port does not require device identification. The meter responds to any device address and returns the received address in the response message.

Default network settings

IP: 192.168.0.203
GW: 192.168.0.1
MASK: 255.255.255.0



3.13.2.3 USB communication

Ethernet/USB module provides a full speed 12-Mbit USB 1.1 port for local communications with the support PAS software. The USB module can be installed in the expansion slot 1 or 2. USB communications does not require any settings. Just connect your PC to the E²MeVOLT USB port using the supplied USB cable with a mini-USB connector and install the USB driver.

To prevent potential differences between the PC USB port and the E²MeVOLT USB device port, it is recommended to use a galvanically isolated USB adaptor before connecting the E²MeVOLT USB port to a PC, or to use a battery powered PC.

3.13.3 DC/DC Power supply module

The module can be installed into any expansion slot. The 24VDC supply module has two indication LEDs that operate as follows:

LED	Color	Status	Description
VIN	Green	Lights	External DC voltage is applied to the input terminals
VOUT	Green	Lights	The module supplies the power

4. USING FRONT DISPLAY

1 SCROLL
2 SELECT/ENTER

Figure 14 Display and device control

4.1 Display operations

The E²MeVOLT has a high-contrast graphical LCD display with backlight for local data read outs, meter setup and servicing. The display operates in two modes:

- Multi-page data display mode with Auto-Scroll feature allows you to scroll through display screens and pages to view various billing, instrumentation and status data.
- Programming mode allows you to enter menu-driven device setups for inspecting and changing factory set meter parameters, or resetting maximum demands, counters and device diagnostics messages.

The display is normally updated once per second except of the clock display where the update rate changes to twice per second.

4.2 Navigation button

The E²MeVOLT is provided with two sealable navigation buttons that do not have labels. See the picture above for button locations and their functionality.

You can perform three types of actions with each button:

- Short press, or “press and release”
- Long press, or “press and hold for 1 to 2 seconds”
- Extended press, or ”press and hold for 5 seconds or longer ”

The function of each button changes depending on what operating mode the display is in.

The **SCROLL** button operates once it’s briefly pressed. It has two functions:

- In data display mode, it scrolls through the display pages.
- In programming mode, it scrolls through the menu items and allows changing a selected digit when entering numbers.

The **SELECT/ENTER** button normally operates once it’s released. The button function changes depending on the time the button is pressed:

- In data display mode, when pressed briefly and released, it scrolls through the display views; a long press for more than 5 seconds switches to programming mode.
- In programming mode, when pressed briefly and released, it moves from one menu item to another; a long press for one second selects a highlighted menu item allowing to enter a submenu or to store a changed item.

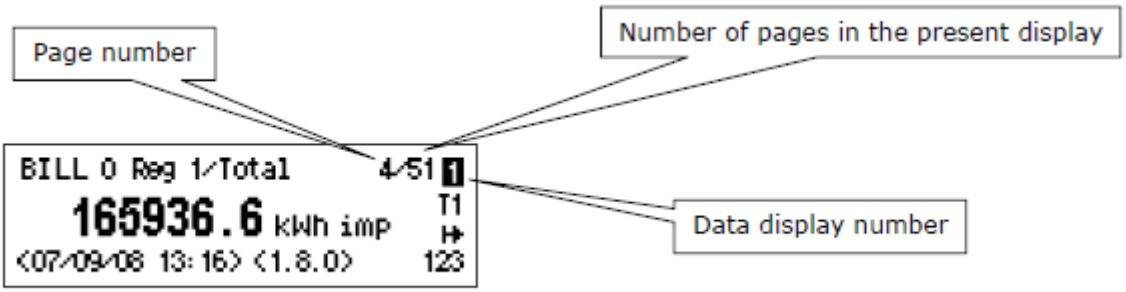
In data display mode, when the **SCROLL** and **SELECT/ENTER** buttons are briefly pressed together and then released, the current display returns to the start page; in some pages, an extended press for more than 5 seconds is used as a “shortcut” for immediate entering a specific programming menu.

4.3 Navigating in Data Display Mode

The following table gives a summary of the button operations in data display mode.

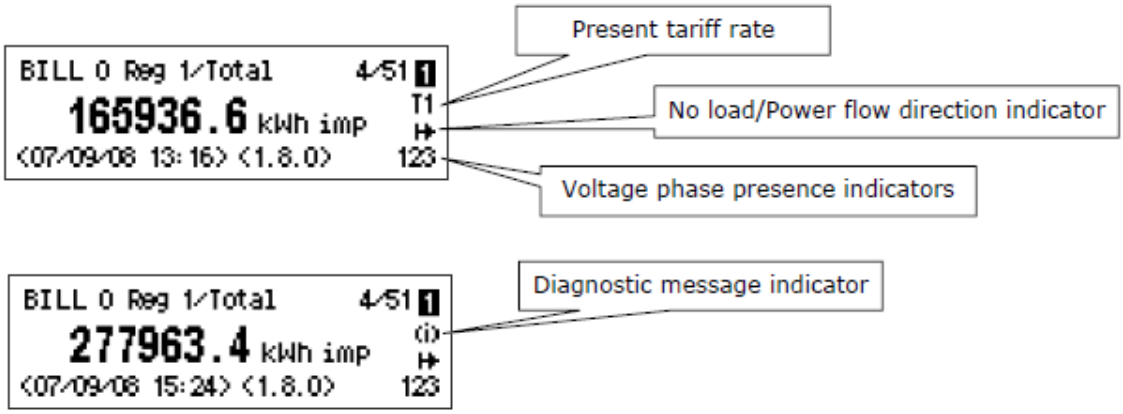
Button	Press	operations
SCROLL	Short press	Scroll through pages
SELECT/ENTER	Short press	Scroll through displays
SCROLL + SELECT/ENTER	Short press	Return to the start page within a present display
SCROLL + SELECT/ENTER in the clock page	Short press	Enter to/Return from the test display
SCROLL + SELECT/ENTER in selected pages	Extended press	Shortcut for entering a specific menu in programming mode
SELECT/ENTER	Extended press	Enter programming mode

The E²MeVOLT provides 9 different multi-page data displays. Your present location is indicated by three numbers at upper right of the display as shown in the following picture. Use a short press on the SELECT/ENTER button to scroll through displays. Use a short press on the SCROLL button to scroll through the pages.



4.4 Status Indicators

Graphical icons on the right give immediate meter status indication and show the present tariff rate.



4.4.1 Tariff Rate Indicator

The tariff rate indicator (T1 through T8) is only shown on the billing data displays. It indicates the currently active tariff rate. Whenever there is an important diagnostic message, the tariff rate indicator alternates with a blinking diagnostic indicator (see below).

4.4.2 Diagnostic Indicators

The diagnostic indicators listed in the following table are displayed as blinking icons. If there are a number of diagnostic events, a higher priority event is indicated first.

Indicator Icon	Event Priority	Description
	High	Low lithium battery indicator with auto-reset. Indicates that the battery voltage is below its operational limit. The battery should be checked and replaced. See the meter installation manual for the battery replacement procedure. The icon is automatically shut down after the battery voltage returns to its normal value.
	Medium	Electromagnetic field indicator with auto-reset. Indicates presence of a high electromagnetic field that can affect accuracy of energy measurements. The electromagnetic interference event start and end time are recorded in the meter event log. The icon is automatically shut down after the electromagnetic field disappears.
	Low	General diagnostic message indicator: indicates that there are diagnostic messages you can inspect via the DIAGNOSTICS display. The icon is shut down after you explicitly reset diagnostics messages either from the display or via communications. You can disable diagnostic message indicator via the Display Setup menu.

4.4.3 No Load/Power Flow Direction Indicator

The power flow indicator gives information on the load presence and shows the direction of active power.

Indicator Icon	Description
	No load.
	Direct active power flow – imported (delivered) active energy.
	Reversed active power flow – exported (received) active energy.

4.4.4 Phase Presence Indicators

Phase presence indicators “123” show the status of either V1-V2-V3 phase-to-neutral voltages in line-to-neutral wiring modes, or V12-V23-V31 phase-to-phase voltages in line-to-line wiring modes.

Indicator Icon	Description
	All voltages are present and above the voltage dip threshold.
	Blinking phase indicator – the phase voltage is below the defined voltage dip threshold. Possibly indicates an incorrect meter nominal voltage setting.
	Dashed phase indicator - the phase voltage is either missing or below the voltage interruption threshold.

If the phase voltage is below the defined voltage dip threshold, its corresponding phase indicator is blinking. If the phase voltage is either missing or below the voltage interruption threshold, the phase indicator is replaced with a dash.

5. DISPLAY FEATURES

The E²MeVOLT display has a number of programmable features that can be disabled, enabled and adjusted via the meter Display Setup.

5.1.1 Backlight

A short press on any button while the display backlight is off switches the backlight on. The backlight stays on as long as you selected in the display setup and then dims to conserve power. The backlight time is factory set to 1 minute and can be programmed from 1 to 10 minutes. You can temporarily set the backlight to continuous operation if you need to work in dark for more time. The backlight is not operational if voltages are missing on meter terminals while the meter is powered from the battery.

5.1.2 Auto-Return

If the Auto-Return feature is enabled and no button is pressed for the programmable Auto-Return interval (1 to 30 minutes for data displays; fixed at 5 minutes for setup menus), the display automatically returns to the default page from any other data display or a setup menu. If the Auto-Scroll feature is enabled, the display immediately enters the auto scroll sequence.

5.1.3 Auto-Scroll

If the Auto-Scroll feature is enabled, the data display automatically scrolls through all pages of all data displays that are included into the programmable auto-scroll sequence. The scroll interval is adjustable in the range of 2 to 30 seconds. The scroll sequence may include all or only selected displays.

The display automatically enters auto scrolling if no button is pressed for the Auto-Return interval when the Auto-Return feature is enabled, or in 1 minute if this feature is disabled. In the last case, the scroll sequence is restored from the point where it was interrupted. To stop auto scrolling, press briefly any button if the backlight is on; else press briefly any button twice since the first press only sets the backlight on and does not affect auto scrolling.

Auto-Scroll is not operational in TEST mode.

6. MEASUREMENT UNITS

The following table shows the display resolution for common displayed quantities. All measured data is displayed in primary units.

Measured Quantity	Voltage Connection	Units and Display Resolution
Energy		kWh, kvarh, kVAh with one decimal place. The number of digits is programmable
Power	For sensors (PT = 1.0)	kW, kvar, kVA with three decimal places
	Transformer (PT>1.0)	MW, Mvar, MVA with three decimal places
Voltage	Direct (PT = 1.0)	Volts with one decimal place
	Transformer (PT>1.0)	Kilovolts with three decimal places
Current		Amperes with two decimal places

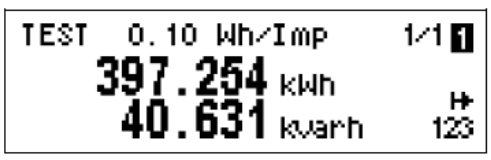
6.1 Data Displays

The E²MeVOLT has 9 multi-page data displays listed in the following table.

Display Number	Display Label	Display Contents
1	BILL 0	Present (0) billing period data
2	BILL 1	Last (-1) billing period data
3	BILL 2	Second previous (-2) billing period data
4	BILL 3	Third previous (-3) billing period data
5	MAX. DEMAND	Engineering maximum demands
6	ENGINEERING	Instrumentation data
7	SETUP	Basic meter setup data
8	DEVICE INFO	Device service data
9	DIAGNOSTICS	Device diagnostics messages

6.2 TEST Mode Data Display

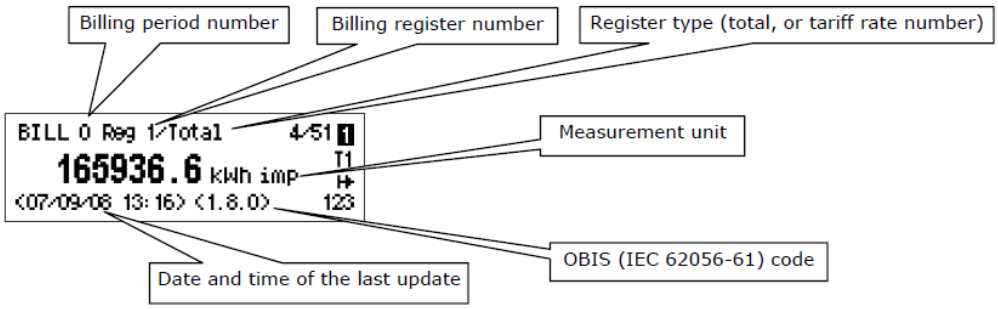
The TEST data display is shown in TEST mode in place of the billing period data displays.



TEST mode display: test LED pulse rate in secondary Wh/imp, test kWh and kvarh energy registers readings in primary units with an extended 0.001 kWh resolution. Extended press SCROLL +SELECT/ENTER is a shortcut for immediate entering the TEST mode setup menu.

6.3 Billing Period Data Displays

The E²MeVOLT provides four billing data displays: one for the present billing period and others – for three previous billing periods. All displays have a layout shown in the following picture. See OBIS Identification Codes.



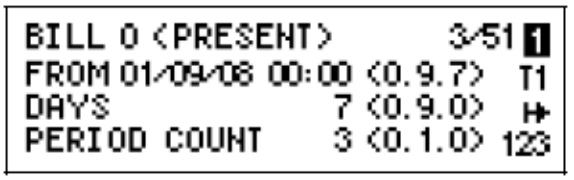
Each billing period display lists all total and tariff energy, maximum demand and cumulative maximum demand registers for all configured billing registers and all active tariffs. The E²MeVOLT automatically arranges pages in each display. Only registers you selected in the billing/TOU register setup and tariff rates listed in the TOU daily profiles are included.

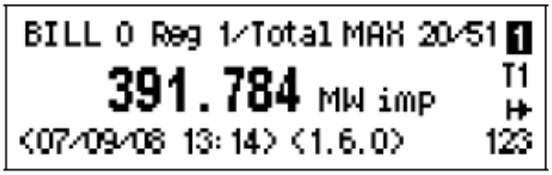
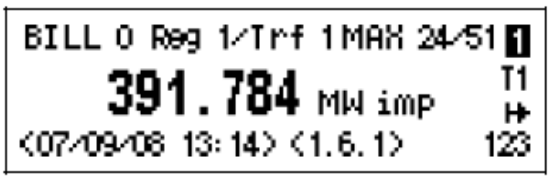
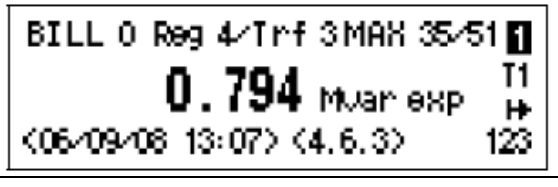
The order of pages is shown in the following table.

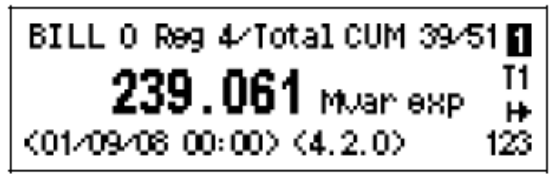
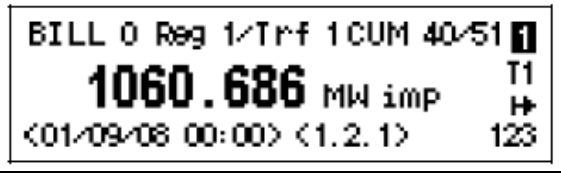
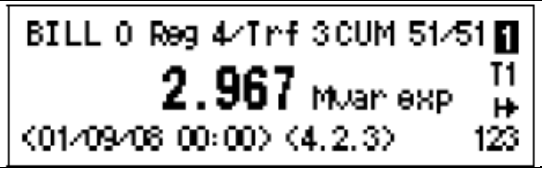
Number of Pages	Display Contents
1-10	Register 1…10 total energy readings
1-8	Register 1 tariff 1…8 energy readings
1-8	Register 2 tariff 1…8 energy readings
…	…
1-8	Register 10 tariff 1… 8 energy readings
1-10	Register 1…10 total maximum demand
1-8	Register 1 tariff 1…8 maximum demand
1-8	Register 2 tariff 1…8 maximum demand
…	…
1-8	Register 10 tariff 1…8 maximum demand
1-10	Register 1…10 total cumulative maximum demand
1-8	Register 1 tariff 1…8 cumulative maximum demand
1-8	Register 2 tariff 1…8 cumulative maximum demand
…	…
1-8	Register 10 tariff 1…8 cumulative maximum demand

6.4 Present Billing Period Data

The following example demonstrates the present billing period displays for four configured billing registers (kWh imported and exported, kvarh imported and exported) and for three active tariff rates. The actual register contents in your installation may be different depending on your selection of register sources.

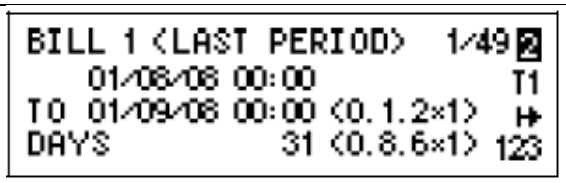
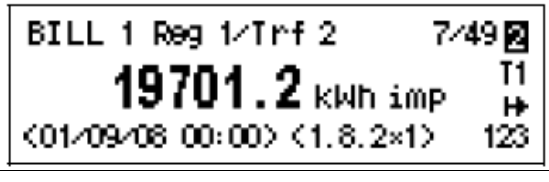
	Clock display. Indicates present time and date. The date order can be changed via the Local Settings setup menu. Short press SCROLL + SELECT/ENTER moves to the test pattern display page. Extended press SCROLL + SELECT/ENTER is a shortcut for immediate entering the clock setup menu.
	Test pattern display you can enter from the lock page by short press SCROLL + SELECT/ENTER. All pixels are lit up. The second short press SCROLL + SELECT/ENTER returns to the clock page.
	Present billing period data - general page: period start date and time, period duration in days, and the billing period count (number of maximum demand resets). Extended press SCROLL + SELECT/ENTER is a shortcut for immediate entering the billing maximum demand reset/end of billing period menu
	Total energy reading of register 1 – imported kWh.

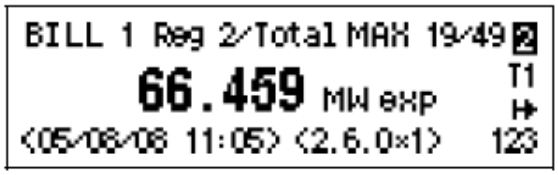
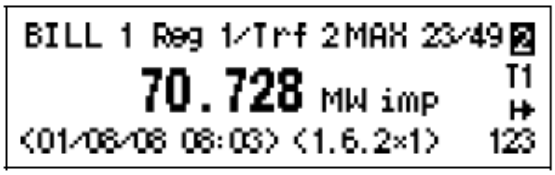
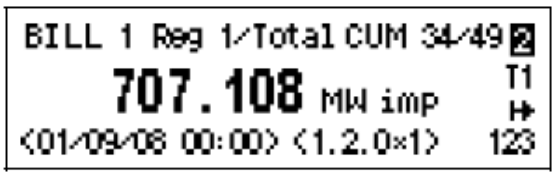
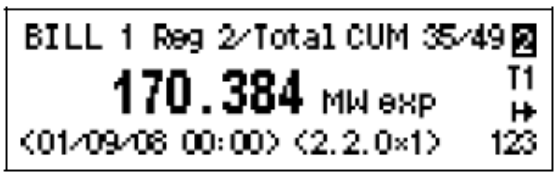
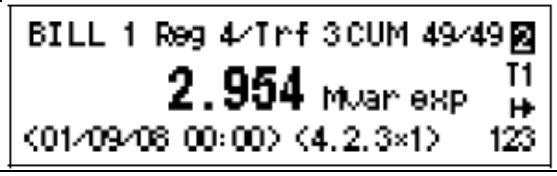
	Total energy reading of register 2 – exported kWh.
	Total energy reading of register 3 – imported (inductive) kvarh.
	Total energy reading of register 4 – exported (capacitive) kvarh.
	Tariff 1 energy reading of register 1 – imported kWh.
	Tariff 2 energy reading of register 1 – imported kWh.
…	…
	Tariff 3 energy reading of register 4 – exported kvarh
	Total maximum demand reading of register 1 – imported kW.
…	…
	Total maximum demand reading of register 4 – exported kvar.
	Tariff 1 maximum demand reading of register 1 – imported kW.
…	…
	Tariff 3 maximum demand reading of register 4 – exported kvar.

	Total cumulative maximum demand reading of register 1 – imported kW.
…	…
	Total cumulative maximum demand reading of register 4 – exported kvar.
	Tariff 1 cumulative maximum demand reading of register 1 – imported kW.
…	…
	Tariff 3 cumulative maximum demand reading of register 4 – exported kvar.

6.5 Previous Billing Period Data

The following example demonstrates billing displays for the three previous billing periods. Displays for the last billing period (BILL 1) and for two preceding billing periods (BILL 2) and (BILL 3) look the same.

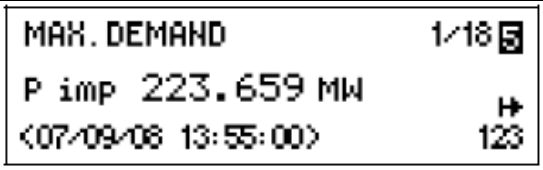
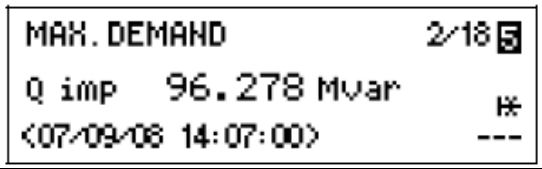
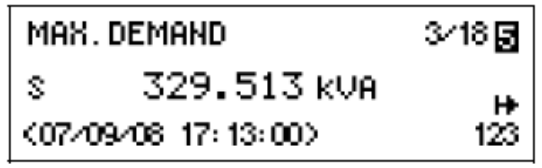
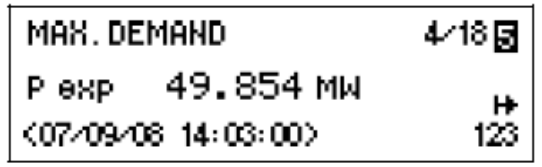
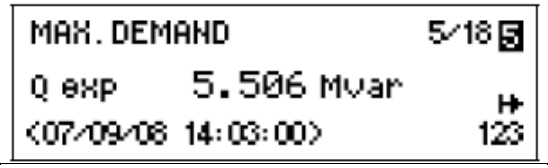
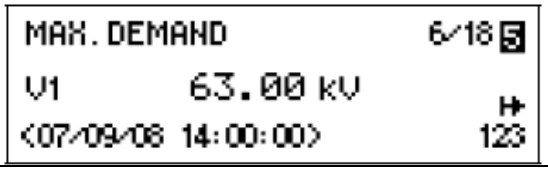
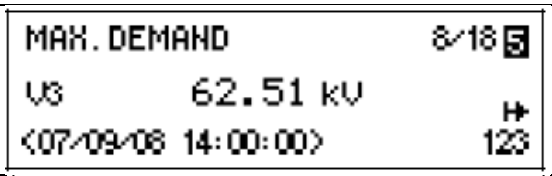
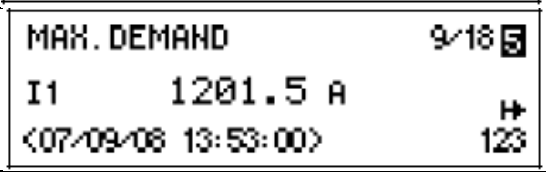
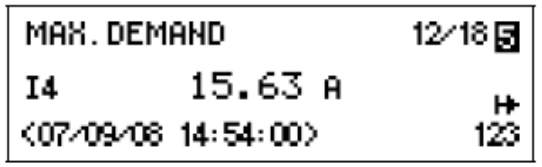
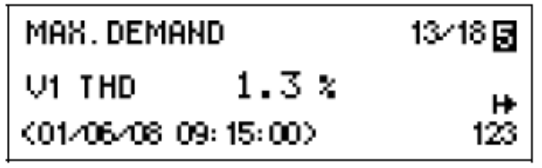
	Previous billing period data - general page: period start date and time, period end date and time, and period duration in days.
	Total energy reading of register 1 – imported kWh.
	Total energy reading of register 2 – exported kWh.
	Tariff 1 energy reading of register 1 –imported kWh.
	Tariff 2 energy reading of register 1 – imported kWh.

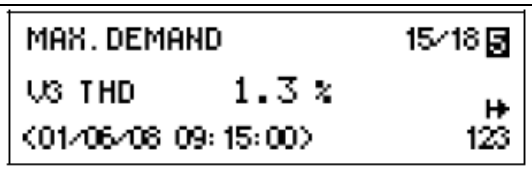
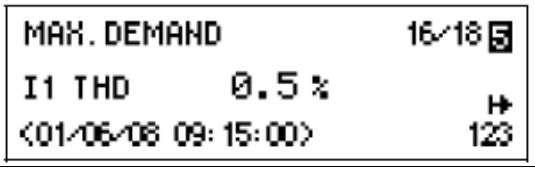
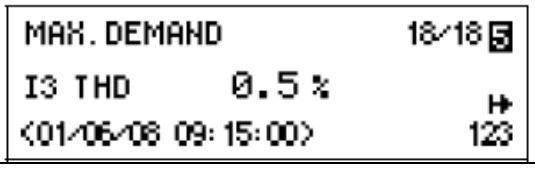
	Total maximum demand reading of register 1 – imported kW.
	Total maximum demand reading of register 1 – exported kW.
	Tariff 1 maximum demand reading of register 1 – imported kW.
	Tariff 2 maximum demand reading of register 1 – imported kW.
…	…
	Total cumulative maximum demand reading of register 1 – imported kW.
	Total cumulative maximum demand reading of register 1 – exported kW.
	Tariff 1 cumulative maximum demand reading of register 1 – imported kW.
	Tariff 3 cumulative maximum demand reading of register 4 – exported kvar.

6.6 Engineering Maximum Demand Data Display

Maximum demand displays show engineering maximum demands (not billing maximum demands) for powers, voltages, currents and total harmonics. Each quantity is displayed with the date and time of the last update.

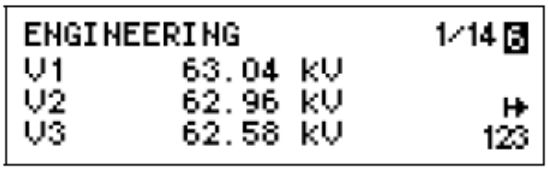
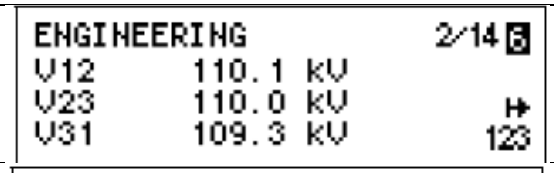
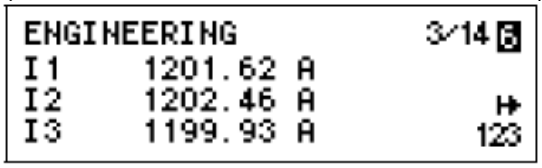
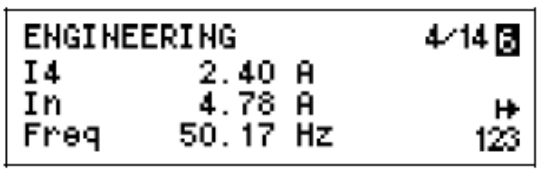
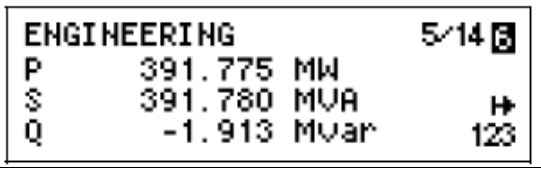
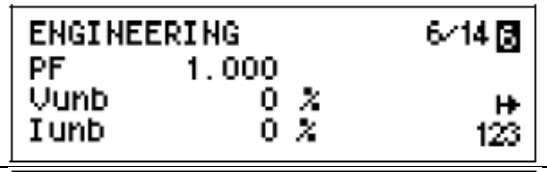
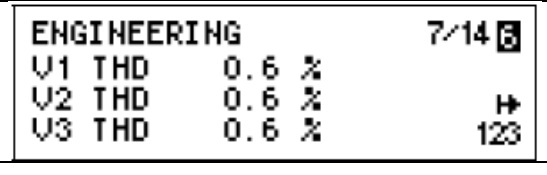
From any maximum demand display, you can use an extended press SCROLL + SELECT/ENTER as a shortcut for immediate entering the corresponding maximum demand reset menu.

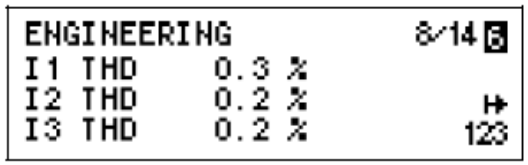
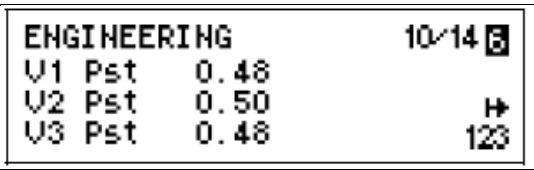
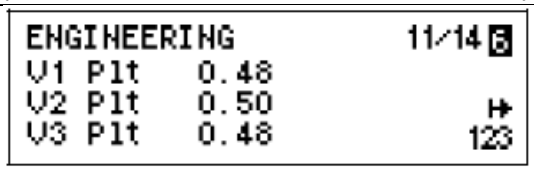
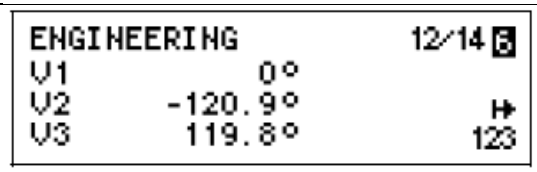
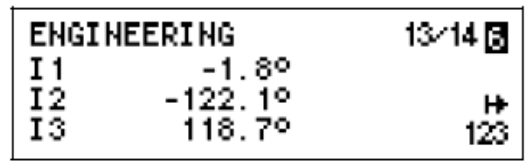
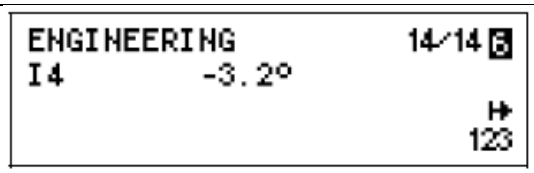
	kW import maximum demand
	kvar import (inductive) maximum demand
	kVA maximum demand
	kW export maximum demand
	kvar export (capacitive) maximum demand
	V1 maximum demand Indicate V12 voltage in line-to-line configurations.
…	…
	V3 maximum demand Indicate V31 voltage in line-to-line configurations
	I1 maximum demand
…	…
	I4 maximum demand
	V1 THD maximum demand

	V3 THD maximum demand
	I1 THD maximum demand
	I3 THD maximum demand

6.7 Engineering Data Display

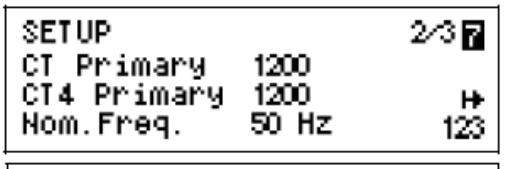
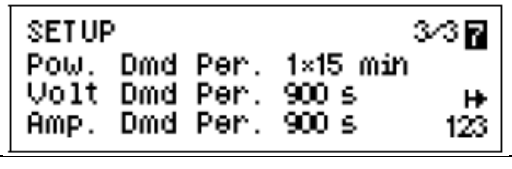
Engineering data represents general instrumentation data you can use while installation and inspecting the meter. Use phase angles displays to check the order of phases when connecting wires to the meter terminals.

	Phase-to-neutral voltages. Only displayed in 4-wire configurations with a neutral.
	Phase-to-phase voltages
	Phase currents
	Auxiliary current Neutral current Frequency
	Total powers
	Total power factor Voltage unbalance, % Current unbalance, %
	Phase voltage THD Indicate phase-to-phase voltage THD in line-to-line configurations

	Phase current THD
	Short-term flicker
	Long-term flicker
	Voltage phase angles (relative to V1 voltage). Indicate phase-to-phase voltage angles in line-to-line configurations.
	Phase current phase angles (relative to V1 voltage)
	Auxiliary current phase angle (relative to V1 voltage)

6.8 Setup Data Display

The setup data display shows basic device settings that can be required for immediate inspecting while meter testing and at the time of installation.

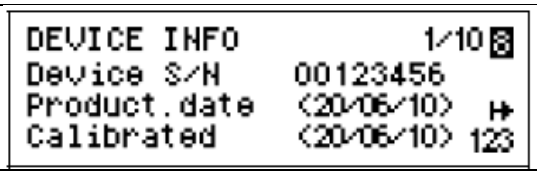
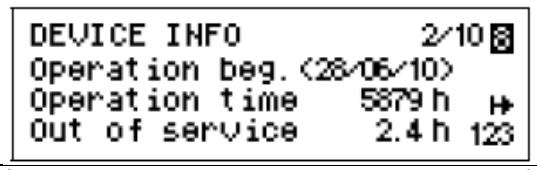
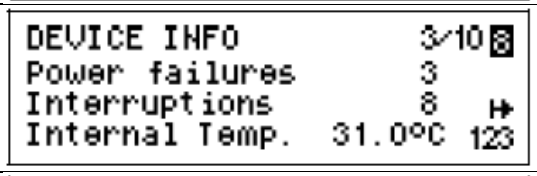
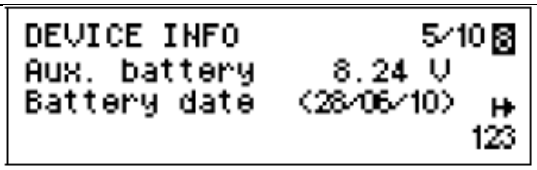
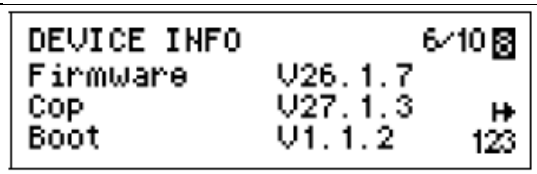
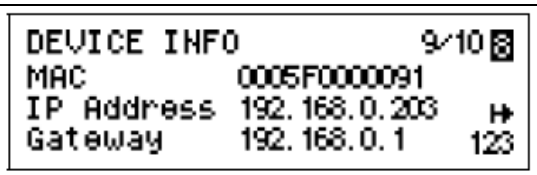
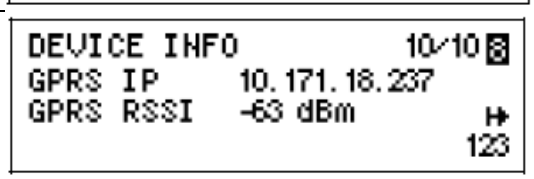
	Device wiring mode (see Basic Meter Setup for full list of wiring modes), external potential transformer ratio and the nominal device voltage.
	Primary ratings of the external current transformers (main and auxiliary current inputs) and the nominal device frequency.
	Power demand period (number of blocks x block demand period), and voltage and ampere demand periods.

6.9 Device Info Display

The device info display provides different service information that may be required for meter identification and inspection, like product and firmware information, batteries status, operation time, communication settings, and so on.

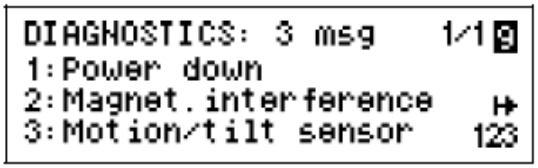
NOTE

Always clear the meter operation time and fault counters before putting the meter into operation. Clear the battery operation time counters after replacing a battery.

	Meter identification info: serial number, production date and calibration date
	Meter operation time counters (since start of operation): Start of operation date Total operation time in hours Out of service time in hours
	Power failure counters (since start of operation): Total number of power failures Total number of 3-phase voltage interruptions Internal meter temperature
	Lithium battery status and operation time: Battery status Battery replacement date Total operation time
	Auxiliary battery status and operation time: Battery status and voltage Battery replacement date
	Meter firmware information: Host processor firmware version Fast transient coprocessor firmware version Host boot loader firmware version
	Memory information: Program flash memory size Data flash memory size
	Serial communication ports info: network address, baud rate and communication protocol.
	Ethernet network info: Device MAC address Network IP address Default gateway IP address
	Wireless GPRS network info: Network IP address Receive signal strength indicator (RSSI), dBm

6.10 Device Diagnostics Display

The diagnostics display shows device diagnostic messages recorded as a result of the meter self-test diagnostics during start-up and operation.

	If there are more pages, use a short press on the SCROLL button to scroll through the entire list of messages. Extended press SCROLL + SELECT/ENTER is a shortcut for immediate entering the diagnostics reset menu.

If there are diagnostic messages, the (i) diagnostic icon on the right on the display flashes until you clear the device diagnostics. Some of the diagnostics events are cleared automatically as the event source disappears.

The diagnostic icon can be disabled or enabled via the Display Setup menu.

7. PROGRAMMING MODE

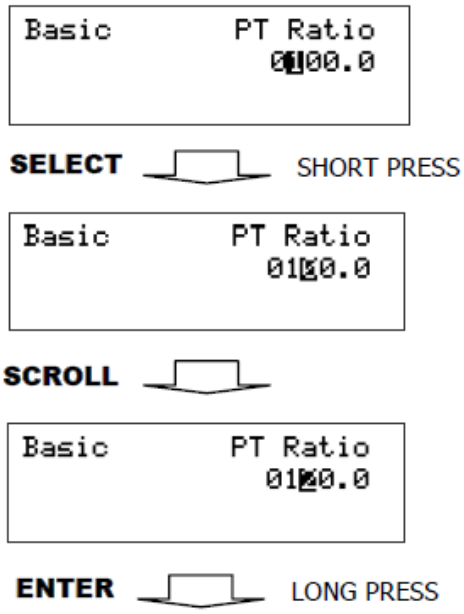
To enter programming mode from the data display, press and hold the SELECT/ENTER button for more than 5 seconds.

7.1 Navigation Buttons

The following table gives a summary of the button operations in programming mode.

Button	Press	Operations
SCROLL	Short press	Scroll through a menu item list in a highlighted window or increment a highlighted digit in a numeric field
SELECT/ENTER	Short press (less than 1 second) = SELECT	Highlight a menu window or a digit in a numeric field
SELECT/ENTER	Long press (1 to 2 seconds) = ENTER	Store the changed item or perform an action indicated in a highlighted window

7.2 Entering Numeric Values

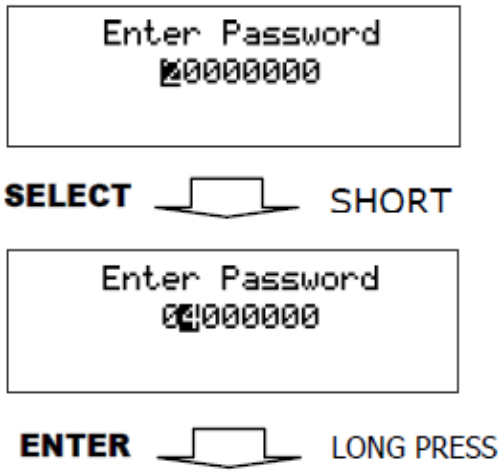


Whenever a numeric value is to be changed, use a short press on the SELECT/ENTER button to highlight a desired digit, and then use the SCROLL button to change the value of the highlighted digit. A highlighted digit appears in inversed color. If you missed a digit, just continue moving through the rest of digits until you reach the desired place.

Once the number is set to the desired value, press and hold the SELECT/ENTER button for 1-2 seconds to save your new setting.

To reject your changes and restore the previous value, use a short press on the SELECT/ENTER button to return to the higher-level window.

7.3 Password Security



The setup menus are secured by 8-digit user passwords. Every time you enter programming mode, you are prompted for a correct password. The meter is primarily shipped with all passwords preset to 9 at the factory.

It is recommended that you change the factory set passwords as soon as possible to protect your setups and accumulated data from unauthorized changes.

Enter the password as you enter numeric values. As you move to the next place, the digit entered is saved and then zeroed. If you missed a digit, you should re-type all preceding digits before you reach the missed place again. Once the password is set to the desired value, press and hold the SELECT/ENTER button for more than 1 second. If the password you entered is correct, you move to the main device menu, otherwise you return back to the data display.

7.4 Setup Menus and Access Rights

The E^{2}MeVOLT setup is menu-driven. The meter provides 12 menus that allow local access to a limited number of meter setups and control functions listed in the following table. Access to menus is granted depending on the security level of the password you entered.

Menu Label	Menu Function	Security Level	
		View	Change
Reset	Reset of billing and engineering maximum demands, device diagnostics, meter and battery operation time counters and failure counters	Low	See Table below
RTC	RTC clock setup	Low	Low
Display	Display setup	Low	Low
Test	TEST/NORMAL mode switching and LED pulse rate setup for TEST mode	Low	Medium
Basic	Basic device setup	Low	High
Options	Device options setup	Low	High
COM1	COM1 serial port setup	Low	Medium
COM2	COM2 serial port setup	Low	Medium
COM3	COM3 serial port setup	Low	Medium
Net	Ethernet network setup	Low	Medium
Local	Local settings	Low	Medium
Access	Meter passwords setup	High	High
Loader	Launches flash download via a local serial port	Medium	Medium

Access to the RESET menu entries is allowed depending on your security level.

If your security level does not allow access to a menu, it will not be listed in the main menu list, and you will not be able to highlight menu items that you are not allowed to change, but you can still view their present settings.

7.5 Viewing and Changing Setup Options

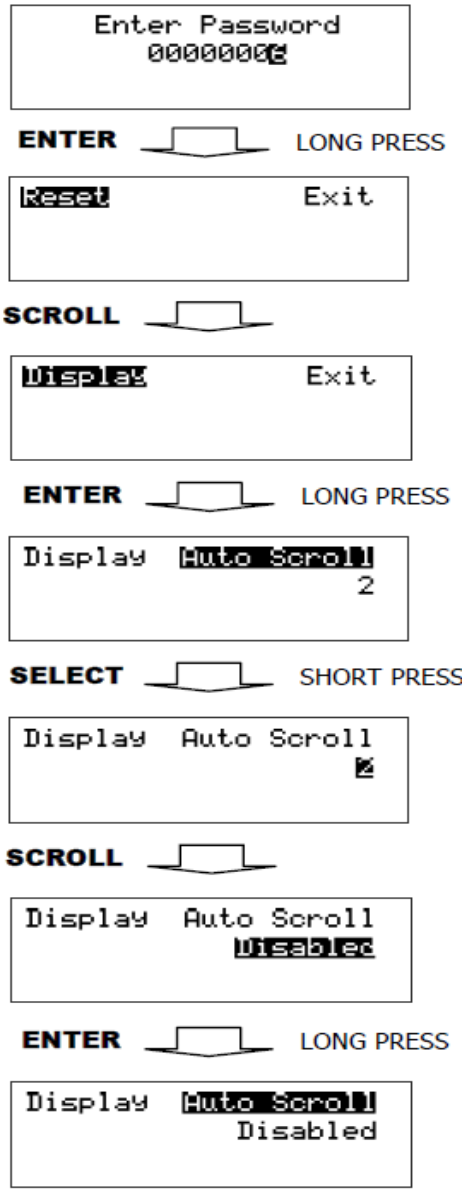
Once you entered a correct password you are moved to the main meter menu.

The main menu has two windows: the left window displays a submenu list, while the right window is an assisting Exit window that allows easy returning back to the data display. A currently active menu item is highlighted by inversed color.

To select a desired menu entry from the menu list:

1. If the left window is not highlighted yet, highlight it by briefly pressing the SELECT/ENTER button.
2. Use the SCROLL button to scroll through the menu list until the desired menu entry appears.
3. Press the SELECT/ENTER button for more than 1 second to enter the selected submenu.

Once entered the submenu, the left window is still showing the menu name, while the upper-right window represents a submenu options list, and the lower-right window indicates the present option value.



To select an option you want to view or change:
Use the SCROLL button to scroll through the option list until the desired option's name appears in the window.

- To change the selected option's value:

Press the SELECT/ENTER button briefly to highlight the lower-right window.

- If an option is represented by a list of values, use the SCROLL button to scroll through the list until a desired value appears in the window. It an option is represented by a numeric value, use the SCROLL button to adjust each digit to the desired value, and use a short press on the SELECT/ENTER button to move through digits.
- Once the desired value is selected, press the SELECT/ENTER button for more than 1 second to save your new setting. You return to the upper-right window and can continue scrolling through the rest of options or can return to the main menu.

If you wish to leave the option value unchanged, use a short press on the SELECT/ENTER button to return to the upperright window.

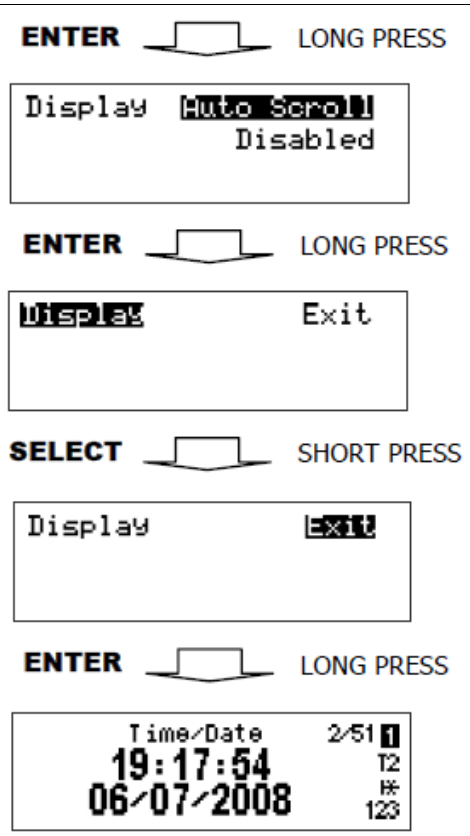
To exit the submenu and return to the main menu:

- If the upper-right window is not highlighted yet, highlight it by briefly pressing the SELECT/ENTER button.
- Press the SELECT/ENTER button for more than 1 second. You will return to the main menu.

To exit the main menu and return to the data display:

- Press briefly the SELECT/ENTER button to highlight the right-upper Exit window.
- Press the SELECT/ENTER button for more than 1 second. You will return back to the data display.

7.6 Input/Outputs Options



The *E²MeVOLT* is equipped with four fast digital inputs (DI), in the basic instrument, two digital inputs (DI) and two digital outputs in optional plug-in module (2DI/2DO module):

- DI (basic) – 4 Digital inputs – optically isolated input; dry contact, programmable de-bounce time from 1 ms to 1 sec; free linkage to Sequence-of-Events Recorder, Fault Recorder, control setpoints, pulse counters and Energy/TOU subsystem)
- DI (module) – 2 Digital inputs – optically isolated input; dry contact, programmable sampling rate from ½ cycle to 1 sec; control setpoints, pulse counters and Energy/TOU subsystem)
- DO – 2 Relay outputs – mechanic or solid-state relay, unlatched, latched and pulse operations, failsafe operation for alarm notifications; programmable pulse width; direct remote relay control through communications

7.7 Communications Options

The *E²MeVOLT* has extensive communications capabilities:

- Infrared port (Modbus RTU/ASCII and DNP3.0 protocols)
- Versatile RS-232/485 universal serial communications port (up to 115,200 bps, Modbus RTU/ASCII and DNP3.0 protocols)
- Ethernet 10/100 Base-T port (Modbus/TCP or DNP3.0/TCP protocols, up to five non-intrusive simultaneous connections, Telnet service port)
- USB 1.1 full speed device port (Modbus RTU protocol, 12 Mbps) for fast local communications and data retrieving
- Cellular GPRS modem (Modbus/TCP or DNP3.0/TCP protocols)
- 1-ms satellite-synchronized clock - IRIG-B format time-code input

7.8 Upgradeable Firmware

The *E²MeVOLT* uses flash memory for storing device firmware that allows future upgrading of the device without replacing any hardware component. The new features can be easily added to your device by simply replacing the firmware through a local RS-232/RS-485, USB port or Ethernet port.