Multiple input PQ monitor MEg37

User manual

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INTRODUCTION

The multiple input PQ monitor MEg37 measures four voltages and the total of 36 currents at the LV level. It provides the functions of measuring and evaluation of voltage quality, recording of time courses of electrical quantities and the function of electric power measurement. The mentioned functions are performed simultaneously. In the function of measuring and evaluation of voltage quality, it evaluates the set voltage quality parameters for three measured voltages and three measured currents according to EN 61000-4-30:2009 with the precision of Class S using methods meeting the requirements of EN 62586 for Class A. At events specified in the voltage quality standard as well as events initiated by overcurrents, it records courses of RMS ½ values with an optional pre-trigger and post-trigger in addition to the stated parameters.

In the recording function of all the measured quantities, the monitor calculates an average value for individual user-defined recording intervals from ten-period values and evaluates the maximum and minimum ten-period value. It records time lines of these values and the values of active and reactive energies with the distinction of flow direction, derived from all current channels to non-destructive data memory.

In the function of electric power measurement, it accumulates ten-period values of active and reactive energies for individual record intervals to six registers for active, reactive inductive and reactive capacitive energy with flow direction distinction. It also saves the time line in individual record intervals of accumulated values of six energy registers for all the current channels in the non-destructive data memory.

The monitor includes an uninterruptible power supply with an internal accumulator and supply from all of the four measured voltages. It uses flexible current sensors with electronic switching of measurement ranges at measurement parametrization to measure currents.

The GPS signal can be used for time synchronization.

Local measurement parametrization and check of correct connection is carried out via the serial USB 2.0 interface. Remote transmission of measured data and remote parametrization can be carried out via a GSM network with GPRS/EDGE, LTE and UMTS/HSPA+ services. The monitor has the ETH communication interface.

It is designed in an all-plastic waterproof case and it has increased insulation and is in overvoltage category CAT IV 300 V.

INFORMATION ON SW

The multiple input PQ monitor MEg37 package includes a CD with user programs. Parametrization of measurements, reading of measured data, displaying of direct measurements, including an oscillographic recording, are carried out by the **PQ_MEg** program. Unified program **Data Viewer** ensures displaying of measured data in graphic and tabular form of a data file, export of measured data and printing tasks. Functions of the individual programs are specified in separate user manuals [1], [2].

The database based program **WebDatOr**, supplied separately, is ready to take care of work with data files from one or more measurement instruments, even of different types [3].

DESCRIPTION OF MONITOR FUNCTIONS

The PQ monitor MEg37 unit measures phase voltages at the LV level through inputs **U1**, **U2**, **U3** against the common conductor at the input **N**. Delta voltages U12, U23 and U31 are calculated from measured phase voltages. Voltage brought to input **U4** can be phase voltage of a different voltage system with the identical common conductor or voltage between ground and the common conductor N. Current inputs are divided to three inputs **I1**–**I3**, input **I4** and eight triples of inputs marked **A** through **H**. To measure currents, flexible current sensors, model AMOSm, are used with software-adjustable rated value of 30 A, 100 A, 300 A, 1000 A and 3000 A. Three current sensors 3AMOSm/37 are connected to inputs I1–I3 and a separate current sensor AMOSm/37 is connected to input I4. Both the aforementioned sensors are marked with an identical serial number as the PQ monitor MEg37 unit. To achieve higher measurement precision, they are calibrated together with the monitor unit, therefore non-interchangeable. Three sensors marked AH AMOSm/37 which are calibrated separately are connected to current inputs A through H. They can therefore be installed to any input A through H of the monitor with the identical serial number. Sensors 3AMOSm/37 should measure phase currents corresponding to voltages connected to inputs U1 through U3. A sensor AMOSm/37 usually measures the current of the central conductor or the phase current of a different voltage system. Up to eight triples of AH AMOSm/37 sensors are usually used for measuring phase currents of individual LV output feeders and currents I0 of corresponding LV output feeders are evaluated by calculation.

Voltage quality according to EN 61000-4-30:2009 is measured and evaluated from voltages connected to voltage inputs U1, U2 and U3 and associated currents I1, I2 and I3 connected to inputs I1–I3. They also record courses of RMS ½ values with a programmable pre-trigger, the longest record time and a post-trigger for voltage phenomena defined in EN 50160:2010/Cor.:2010-12 as well as events derived from the set thresholds

of voltages U4 and thresholds of overcurrents I1 through I3 in addition to parameters of channels U1 through U4 and I1 through I4 stipulated by the standard.

In the recorder function, true RMS values for ten periods are evaluated for all the measured quantities, including currents I0 calculated from three-phase currents of inputs A through H. Average values are calculated and extreme ten-period values are evaluated in the program-selectable record interval from 1 sec to 15 minutes from the measured quantities. Harmonic and interharmonic components of the 60th order are calculated for the measured voltages and currents at inputs I1–I3, I4 and A through H. Active and reactive energies as well as outputs derived from the harmonics analysis are calculated from currents I1, I2, I3 and triplets of currents at inputs A through H and corresponding voltages U1, U2 and U3.

In the function of electric power measurement, ten-period values of active and reactive energy are calculated for each of three-phase currents I1, I2, I3 and the triplets of currents at inputs A through H and from corresponding voltages U1, U2 and U3. They are accumulated for the selected record interval in assigned six registers (active supply, active consumption, reactive inductive supply, reactive inductive consumption, active capacitive supply, active capacitive consumption). Time-distributed values of six registers of individual three-phase output feeders are calculated from time series of six registers corresponding to individual phases.

The monitor MEg37 can synchronize time by the GPS signal. The galvanically separated communication via USB2.0 with the communication speed of 5.4 Mbit/sec is used for local communication. The LTE function of the GSM network with communication speeds up to 100 MBit/sec towards the monitor and up to 50 MBit/sec for data transmission from the monitor is ready for remote data transmission from the monitor MEg37 and remote measurement parametrization.

On the upper side of the monitor there is the ETH interface which enables efficient remote transmission of measured data via the Ethernet network with the speed up to 10/100 MBit/sec according to IEEE802.3. The MEg37 unit has also a connector for connecting two-state input and two-state output signal and a thermometer on the upper side.

RUN LED, U1, U2, U3, U4, I1-I3, I4, A through H, (wireless communication), (wire communication) signaling statuses of individual blocks of the monitor.

RUN signalization has the following statuses:

- Briefly interrupted illumination – the monitor measures according to the programmed parametrization.
- Repeated short flashing – the monitor is programmed, it does not measure now. The pre-set time of the start of measurement has not occurred, or the supply has not switched on during programming of measurement with postponed start.

U1, **U2**, **U3** and **U4** signalization:

- Permanent illumination – the voltage is in the pre-set tolerance band ($0.9\,U_n$ to $1.1\,U_n$)
- One flash – the voltage is in the pre-set interruption band.
- Two flashes – the voltage is in the pre-set dip band.
- Three flashes – the voltage is in the pre-set swell band.

I1–I3, **I4**, **A** through **H** signalization:

- The illumination signals connection of the current sensor to the monitor. Potential change of installed elements is not checked.

Signalization of wireless communication :

- Not illuminated – data transmission via the GSM network and monitor synchronization by the GPS signal are inactive.
- Short repeated flashing – monitor synchronization by the GPS signal.
- Short repeated interruption of illumination – data package transmission via the GSM network.
- Alternating illumination 1 : 1 – monitor synchronization by the GPS signal and data package transmission via the GSM network.

Signalization of wire communication :

- The illumination signals data package transmission via the Ethernet.

DESIGN OF THE MEg37 SET

The multiple input PQ monitor MEg37 set consists of the monitor MEg37 unit with the built-in uninterrubtible power source and the synchronization GPS and the communication GPRS / EDGE, LTE, UMTS / HSPA+ module and independent components: current sensors 3AMOSm/37, AMOSm/37 and AH AMOSm/37, an antenna AGPS, AGPRS, voltage extensions, contact elements and adapters.

The monitor MEg37 unit is supplied in Class S, see Fig. 1. Unremovable power supply cords U1 through U4 and N with the length of two meters, double insulation and flexible even at frost serve for connecting the MEg37 unit to measured voltage. Voltage cords U1 through U4 are red and the N cord is black.

Three sensors 3AMOSm/37 connected to the connector I1–I3 of the MEg37 unit is designed for measuring phase currents of the LV transformer, see Fig. 2. A separate sensor AMOSm/37, see Fig. 3, connected to the connector I4 of the MEg37 unit is designed for measuring the current of e.g. the central conductor or other current in the transformer station. Triplets of sensors AH AMOSm/37, see Fig. 4, are connected to connectors A through H of the MEg37 unit and they are designed for three-phase measurement of currents of individual LV outlet feeders of the transformer station. Sensing parts of sensors 3AMOSm/37 and AMOSm/37 are red and sensing parts of triples of sensors AH AMOSm/37 are green. Cables of flexible sensors are two meter long with increased insulation.

Signal reception of the GPS system by means of the AGPS antenna enables time synchronization required at devices for measuring voltage quality of Class A. However, it is also useful for precise identification of time information about events at the voltage in monitors Class S, see Fig. 5. It is connected to the GPS connector of the monitor unit. The AGPS antenna forms part of the winding-up mechanism of the 10 m long coaxial cable. The first two meters of the coaxial cable at the connector through which the antenna is connected to the MEg37 unit are equipped with a red increased insulation to achieve the necessary safety.

The monitor MEg37 unit has the USB 2.0 communication interface for operating the monitor at the place of installation, i.e. measurement parametrization, checking the correct connection and reading out the measured data. The communication cable USB-mini / EMC with the length of 3 m with increased resistance against interfering ambient effects serves for connecting to PC.

An AGPRS antenna is connected to the GPRS connector, see Fig. 6, with a 3 m supply cable. The dipole of the antenna and the supply cable are equipped with additional increased insulation so that the antenna can also be installed in a LV case.

The cable with a connector, which has to be waterproof for automatic operation, is connected to the ETH connector of the MEg37 unit, see Table 3. A waterproof cable must also be connected to the I/O connector during automatic operation.

The MEg37 unit is placed in the all-insulated plastic cabinet with connectors and it is waterproof. On the rear side of the cabinet, next to the stated parameters of the monitor MEg37, there is a basic installation diagram of the multiple input PQ monitor MEg37 set in a transformer station.

Crocodile clips are contained in the basic monitor set. Optionally, magnetic contacts or grips with fuses and „open eye" contacts can also be delivered in the set. Protected voltage extensions made of frost-resistant conductors with doubled insulation, see Fig. 7, which can have free ends or be equipped with banana plug endings, serve for the connection of the monitor to voltage in large cabinets. A LV adapter, see Fig. 8, is used for single-phase connection of the U1 voltage of the monitor to a LV socket.

Fig. 1: PQ monitor MEg37, basic dimensions and user elements

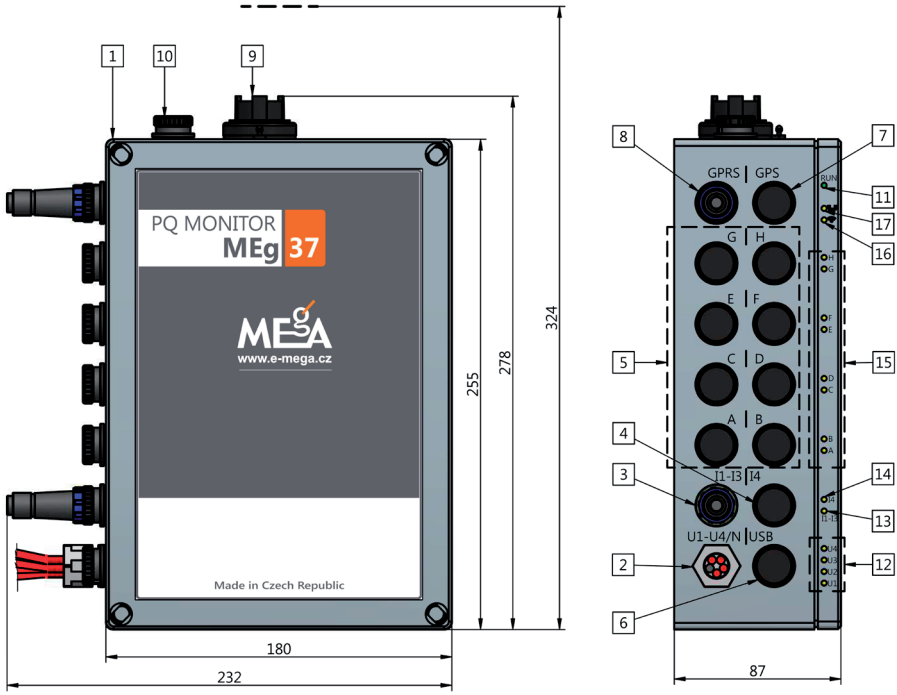


Fig. 2: Three flexible sensors of current 3AMOSm/37

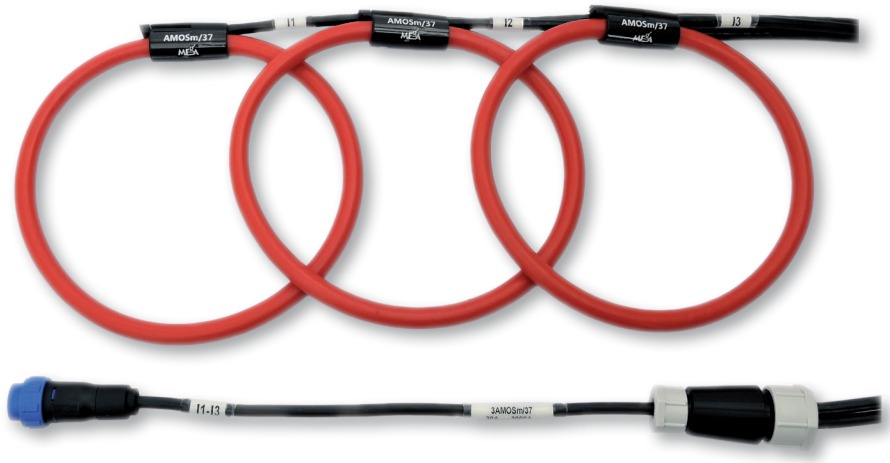


Fig. 3: Flexible sensor AMOSm/37

Fig. 4: Three flexible sensors of current AH AMOSm/37

Fig. 5: AGPS antenna

Fig. 6: AGPRS antenna

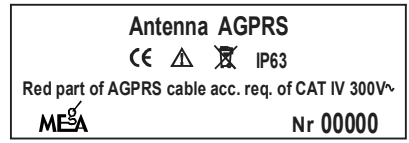


Fig. 7: Voltage extensions 3PB and 3PV

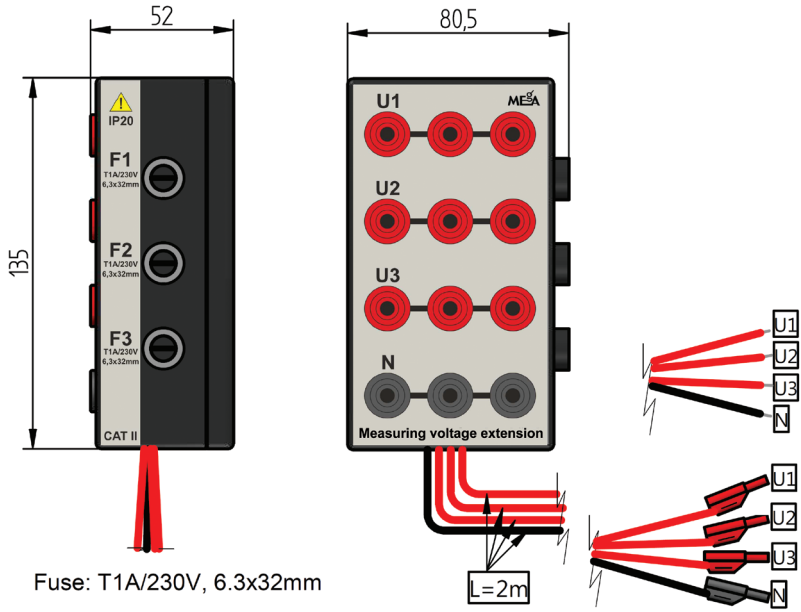
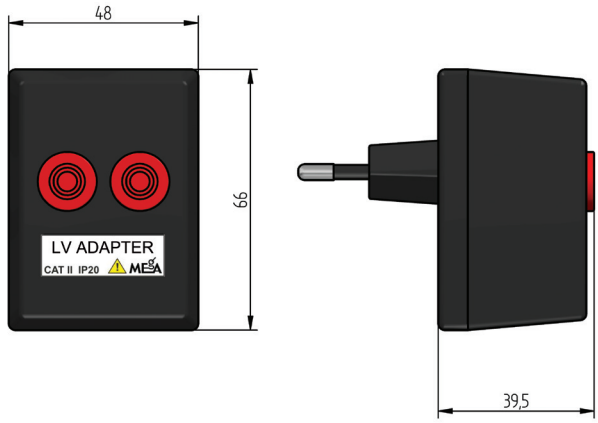


Fig. 8: LV adapter



⚠⚠ SAFETY INFORMATION

- **Maximum attention must be paid to this information.**
- Warnings draw attention to the facts presenting safety risks to the operator.
- Cautions indicate conditions and facts that may cause damage to the monitor.

⚠ Warning

- **Be careful, the operator performing the installation of current sensors on a live part must be equipped with personal protective equipment and additional safety devices and use them during the installation.**
- **When the PQ monitor MEg37 is used in a different way than it is specified by the manufacturer, the protection provided by the PQ monitor MEg37 can be impaired.**

- The operator performing installation and disassembly of the components of the PQ monitor MEg37 set must be qualified for work on or near to dangerous voltages. The operator must also be trained in providing the first aid.
- The monitor may only be operated by skilled personnel equipped with personal protective equipment against electrical injury.
- It is not permitted to connect voltage measuring cords to phase voltages higher than 450 V_{AC} and delta voltages higher than 780 V_{AC}, otherwise there is a risk of electric shock.
- It is not permitted to connect the monitor to phase voltages higher than 300 V_{AC} in LV networks between MV / LV transformers and customer electricity meters characterized by **CAT IV** overvoltage categories, otherwise there is a risk of electrical injury.
- In case of a mechanical damage even to the top layer of the insulation of the sensing part of the flexible sensor, which can manifest in a contrast change in colour of the sensing part surface, or in case of damage to the monitor or its accessories, the damaged part must be immediately dismounted and consequently sent for repair.
- Maintenance and repairs of monitors may only be carried out by the manufacturer or service organizations authorized by the manufacturer.
- The monitor unit must not be opened due to the loss of water-tightness and resistance against the effect of humidity.

- Current sensors and antennas, properly tightened, must be connected to connectors, or connectors must be covered with housings due to the loss of water-tightness and resistance against the effect of humidity.
- During local parametrization or reading of data the operator shall protect the monitor from water.
- Voltage extensions 3PB and 3PV and the LV adapter may only be used in covered areas without the effect of water and humidity.
- It is not permitted to use other accessories than those included in the monitor set delivery.
- Current sensors, adapters and voltage extensions are first connected to the monitor and only then to the measured circuits.
- Current sensors of AMOSm/37 types may only be installed on insulated parts of conductors. When current sensors are installed on non-insulated parts, they can only be installed to circuits of the overvoltage category according to Table 1, which will be switched off during the installation. When installing current sensors to the environment with dangerous voltage, personal protective equipment must be used and safety requirements valid for the respective network must be met
- When installing the monitor with the attached AGPS antenna to a LV cabinet with the overvoltage category of CAT IV, its cable with an increased insulation can only be placed in the cabinet.

Caution

Explanation of symbols used in the user manual and in the specifications of components of the PQ monitor MEg37 set:

	Note in documentation / Danger, risk of danger
	Danger, risk of electric shock
	Do not install around non-insulated hazardous live conductors which can cause electrical shock, burning or arc discharge.
CAT IV	Overvoltage category, characterizing the state of the transient overvoltage. General LV distribution network from a transformer station to fuses at the electricity meter.
CAT III	Overvoltage category, characterizing the state of the transient overvoltage. General LV installations in buildings behind fuses at the electricity meter.
	Safety class II, double or increased insulation
	Ground, grounding terminal
IP code	Degree of protection provided by enclosure
	The product is intended for recycling and collection points.
CE	Declaration of Conformity – European Community

Maximum voltage against common conductor may be 450 V_{AC} and the maximum delta voltage is 780 V, otherwise there is a danger of monitor failure.

In the CAT IV 300 V environment, the maximum voltage against common conductor can be 300 V_{AC}, otherwise there is a danger of monitor failure.

The monitor unit must not be opened due to the loss of water-tightness and resistance against the effect of humidity.

Either corresponding components (current sensors, antennas) must be connected to connectors of the monitor, or connectors must be covered with housings due to the loss of water-tightness and resistance against the effect of humidity.

During parametrization or reading of data the operator shall protect the monitor from the effect of water.

Tab. 1: Overvoltage categories of components of the MEg37 set

Current sensors and contact elements	**Field of application**
Flexible sensor AMOSm/37, 3AMOSm/37, AH 3AMOSm/37	CAT IV / 300 V
AGPS antenna	CAT II, 2 m of a red cable of the CAT IV / 300 V
AGPRS antenna	CAT IV
Crocodile clamps	CAT II / 1000 V
„Open eye“ contacts	CAT II / 1000 V
Grips with fuses	CAT III / 1000 V
Magnetic contacts	CAT III / 1000 V
LV adapters	CAT II / 600 V
Voltage extension with banana plugs	CAT II / 600 V

Tab. 2: Water-tightness of components of the MEg37 set

Name	**Protection**
MEg37 unit	IP 65
Flexible current sensors, type AMOSm/37	IP 65
AGPS antenna	IP 23
AGPRS antenna	IP 63
LV adapter	IP 20
Voltage extensions with banana plugs	IP 20
Crocodile clamps, grips and magnetic contacts	IP 20

Tab. 3: Basic set and optional accesories of the monitor set

Basic set and optional accessories of the monitor set	**Identification**
PQ monitor MEg37 unit, Class S	S/37
Communication cable with USBmini / EMC / 2 m	USB/37
LV adapter for measuring in a LV socket	NN/37
Set of crocodile clamps (3 pcs red, 1 pc blue, 1 pc black)	K/37
Set of 5 pcs of open eyes (3 pcs red, 1 pc black, 1 pc blue) with the inner diameter of 8.2 mm	XKS-A
Set of 5 pcs of open eyes (3 pcs red, 1 pc black, 1 pc blue) with the inner diameter of 4.1 mm	XKS-4
Leather cloth transport case	T/37
CD with user manuals to the monitor, descriptions of the PQ_MEg user software and the Data Viewer user software, a calibration sheet	CD/37

Components of optional accessories	**Identification**
GPRS/LTE function with the AGPRS antenna to the PQ monitor MEg37, Class S	AGPRS
GPS function with the AGPS antenna to the PQ monitor MEg37, Class S	AGPS
Three flexible current sensors 3AMOSm/37, I1–I2–I3, 40 cm (30 A, 100 A, 300 A, 1 000 A, 3 000 A)	3AMOSm/37
Flexible current sensor AMOSm/37, I4, 40 cm (30 A, 100 A, 300 A, 1 000 A, 3 000 A)	AMOSm/37
Three flexible current sensors of outlet feeder AH AMOSm/37, IA–IH, 40 cm (30 A, 100 A, 300 A, 1 000 A, 3 000 A)	AH AMOSm/37
Communication cable RJ45 Ethernet with the length of 5 m, waterproof at one side	PX0837 / 5M
Communication cable RJ45 Ethernet with the length of 5 m, waterproof at both sides	PX0838 / 5M

Components of optional accessories	Identification
Cable for the connection of the input, outputs and the thermometer with free ends	IO/37
Set of grips with fuses CATIII (3 pcs red, 2 pcs black)	G/37
Set of magnetic contacts ø 7 mm, L 10 mm, (3 pcs red, 1 pc blue, 1 pc black)	M7/37
Set of magnetic contacts ø 11 mm, L 35 mm, (3 pcs red, 1 pc blue, 1 pc black)	M11/37
Three-phase voltage extension with banana plugs, (2 m)	3PB/37
Three-phase voltage extension with free ends, (2 m)	3PV/37
Transport leather cloth case for optional accessories	T/37

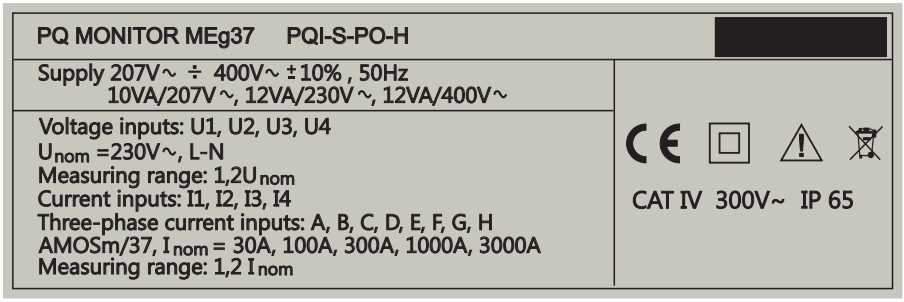
Tab. 4: User elements

Item	Name	Description
1	PQ monitor MEg37	Multiple input PQ monitor MEg37, see Fig. 1, waterproof with all-insulated surface, CAT IV 300 V, self-powered
2	Voltage inputs with supply	Fixedly connected measuring cords U1, U2, U3, U4 and N with the length of 2 m ending with banana plugs CAT IV 300 V which are also the supply cords. Maximum voltage between the N cord and U1, U2, U3, U4 cords is 450 V_{AC}.
3	Connector of current inputs I1, I2, I3	The connector for connecting three current sensors I1, I2, I3. Current sensors are flexible 3AMOSm/37, see Fig. 2. Automatic identification of the connected type of sensors during parametrization of the measurement. An identical value of the rated current can only be set on current inputs I1, I2, I3 by the program: 3AMOSm/37 (30 A, 100 A, 300 A, 1000 A, 3000 A). The set nominal value of current of sensors at inputs I1, I2 and I3 need not be identical with the rated value of the current set at input I4.

Item	Name	Description
4	Connector of current input I4	The connector for connecting the current sensor I4 is type AMOSm/37, see Fig. 3. Automatic identification of the connected type of sensor during parametrization of the measurement. The software can set the following values of the rated current: AMOSm/37 (30 A, 100 A, 300 A, 1000 A, 3000 A) The set rated value of current of the sensor at input I4 need not be identical with the rated value of currents of three sensors at inputs I1, I2, I3.
5	Connectors of current inputs A, B, C, D, E, F, G, H	Connectors for connecting the triplets of flexible current sensors of outlet feeders, type AH AMOSm/37, see Fig. 4. Automatic identification of the connected type of sensors during parametrization of the measurement. An identical value of the rated current can only be set on current inputs A-H by the program: AH AMOSm/37 (30 A, 100 A, 300 A, 1 000 A, 3 000 A).
6	Connector mini USB	Connector of galvanically separated communication USB 2.0 / 5,4 Mbit/sec.
7	Connector of the AGPS antenna	The connector for connecting the AGPS antenna, see Fig. 5, which enables time signal synchronization using the method and preciseness of Class A monitors.
8	AGPRS antenna connector	The connector for connecting the AGPRS antenna, see Fig. 6, which enables remote transmission of measured data and remote measurement parametrization by the GPRS / EDGE, LTE, AGPRS and UMTS / HSPA+ function.
9	ETH interface connector	The connector for the connection of remote data transmission via Ethernet at the speed up to 10 / 100 MBit/sec according to IEEE802.3, the PX0837/5M or PX0838/5M power supply cable.
10	Connector of I/O signals	Galvanically separated group of the input and output signal and the thermometer with the common conductor, the power supply cable IO/37.

Item	Name	Description
11	RUN LED	Briefly interrupted illumination – the monitor measures according to the programmed parametrization. Repeated short flashing – the monitor is programmed but does not measure now as the pre-set time from the start of measurement has not occurred, or the supply has not switched on during programming of measurement with postponed start.
12	LEDs U1, U2, U3, U4	Signalization of voltage status at inputs U1, U2, U3 and U4: Permanent illumination – the voltage is in the pre-set band (0.9 U_n to 1.1 U_n) One flash – the voltage is in the pre-set interruption band Two flashes – the voltage is in the pre-set dip band Three flashes – the voltage is in the pre-set swell band.
13	LEDs I1–I3	They are turned on when current sensors are connected.
14	LED I4	It is turned on when current sensor is connected.
15	LEDs A, B, C, D, E, F, G, H	They are turned on when current sensors are connected.
16	LED	Wireless communication: Not illuminated – data transmission via the GSM network and monitor synchronization by the GPS signal are inactive. Short repeated flashing – monitor synchronization by the GPS signal. Short repeated interruption of illumination – data package transmission via the GSM network. Alternating illumination – monitor synchronization by the GPS signal and data package transmission via the GSM network.
17	LED	Wire communication: The illumination signals data package transmission via the Ethernet.

Fig. 9: Rating plate of the PQ monitor MEg37 Class S



Legend to the rating plate

The rating plate of the monitor, see Fig. 9, is situated on the rear side of the monitor. In addition to manufacturer's identification data and monitor designation, there is a specification of the range of alternating supply voltage from 207 V_{AC} to 400 V_{AC} ± 10 % with the frequency of 50 Hz and the consumption for limit values of supply voltage.

Voltage inputs:

At the LV level, the voltage U1, U2, U3 and U4 is measured against input N, the rated value is 230 V_{AC}. Measured voltages are at the same time supply voltages. The maximum voltage at inputs U1, U2, U3 and U4 against N is 1.2 U_n.

Flexible **current sensors** AMOSm/37 with selected rated value from the series of 30 A, 100 A, 300 A, 1 000 A and 3 000 A are connected to current inputs I1, I2, I3 and I4 and three phase current inputs A through H in LV networks.

Current sensors of AMOSm/37 types may only be installed on insulated parts of conductors. When the aforementioned current sensors are installed on non-insulated parts, they can only be installed to circuits of the overvoltage category according to Table 1, which will be switched off during the installation. When installing current sensors to the environment with dangerous voltage, personal protective equipment must be used and safety requirements valid for the respective network must be met. The measuring range of current sensors is up to 1.2 I_n.

Voltage up to the value of 300 V_{AC} can only be measured in the environment of networks with overvoltage category CAT IV.

IP65 protection of the monitor is ensured with properly tightened housings of the USB connector, connectors I1–I3, connector I4, connectors A through H, GPS connector, GPRS connector, ETH connector and I/O connector.

When AGPS and AGPRS antennas, voltage extensions 3PB and 3PV and the LV adapter intended only for installation in covered areas are used, the operator of the monitor shall ensure resistance to the effect of water in a different manner.

During local parametrization of measurement and reading of measured data via a communication cable with USBmini / EMC the operator shall also ensure resistance to the effect of water on the connector in a different manner.

The PQ monitor MEg37 set is calibrated with current sensors of the identical serial number. The measurement preciseness specified in technical conditions is only ensured in this set.

⚠ CHARACTERISTICS OF MONITOR DESIGN

The monitor unit of safety class II with the shape of a flat block which can be put upright, crosswise as well as laid flat with indication elements and connectors on the front and upper side enables positioning of the multiple input PQ monitor MEg37 in all three axes.

A plastic insulation and flame-retardant case of the monitor unit and non-conductive surface of components of the set.

Water-proof and dust-proof design of the case of the unit with water-proof current and antenna connectors when current sensors are installed, or covered with fixed housings.

Voltage cords with double insulation with the length of 2 m, well flexible even at below-zero temperatures, colour-coded (U1, U2, U3 and U4 are red, N is black), ended with safe banana plugs CAT IV 300 V.

The measurement of currents I1, I2, I3, current I4 and three-phase currents of LV outlet feeders A through H by AMOSm/37 sensors approved for the installation in LV cabinets with supply cables with the total length of 2 m, well flexible even at below-zero temperatures.

Defining of measurement precision of the monitor set using the components of the marked serial numbers.

Extension of the monitor set by adapters, voltage extensions and contact elements which enable the use of the monitor in various operating conditions.

The source with a long term of uninterrupted supply, supplied via measuring cords U1, U2, U3 and U4 with alternating as well as direct-current voltage of wide range.

GPS synchronization of internal clock and two-directional data transmission by the LTE service of the GSM network. Both the antennas are modified for safe installation in LV cabinets.

CONNECTION FOR MEASUREMENT

When the monitor is installed in LV networks, voltage is measured directly and currents indirectly by means of flexible sensors AMOSm/37.

During three-phase measurement of voltage, voltages U1, U2 and U3 must be connected in the counter-clockwise direction at which the device is calibrated.

During single-phase measurement, the reference input U1 must always be connected to the measured voltage.

Unconnected voltage inputs U2, U3 and U4 can also be connected to measured voltage U1 and then they participate in the supply to the monitor, or they can be connected to the middle N or PEN conductor and then they display the defined zero voltage. If the unused voltage inputs are left unconnected, their voltage is not defined due to their high input resistance and connection of voltage channels.

The monitor is supplied from measured voltages brought to any of the inputs U1, U2, U3 and U4.

Fig. 10: An example of MEg37 connection at three-phase measurement at the LV side of the transformer and outlet feeders in the transformer station

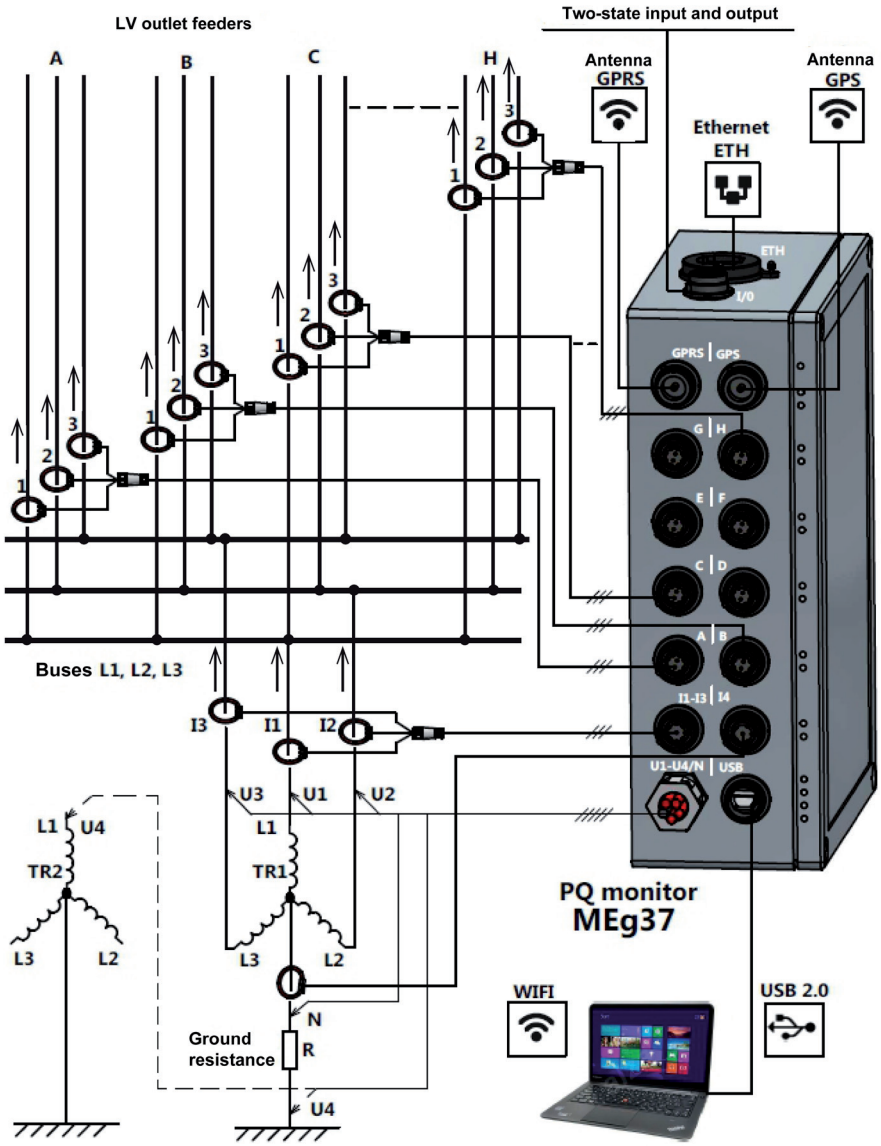
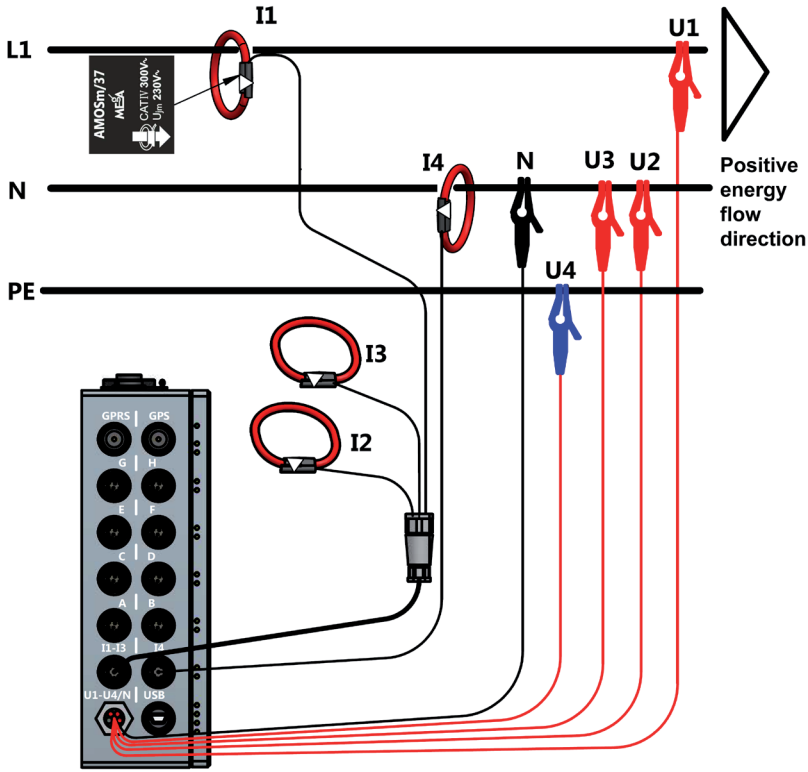


Fig. 11: Single-phase measurement of voltage and current and measurement of voltage of the middle conductor against ground and current of the middle conductor in the LV network



Note: Voltage inputs U2 and U3 can be connected to the phase voltage L1 and then they participate in the supply to the device, or they can be connected to the PE or N conductor.

Fig. 12: Measurement of three-phase voltage and three-phase current by 3AMOSm/37 sensors in the LV network

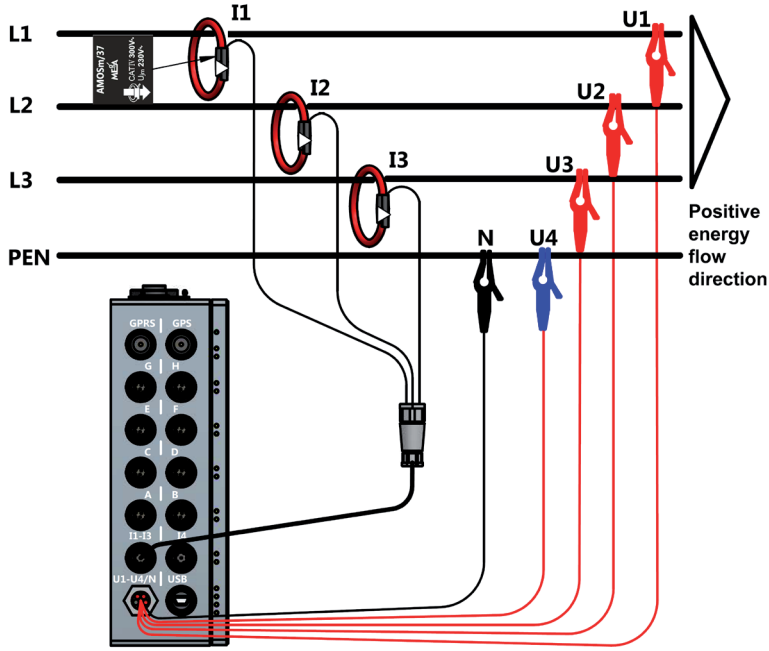
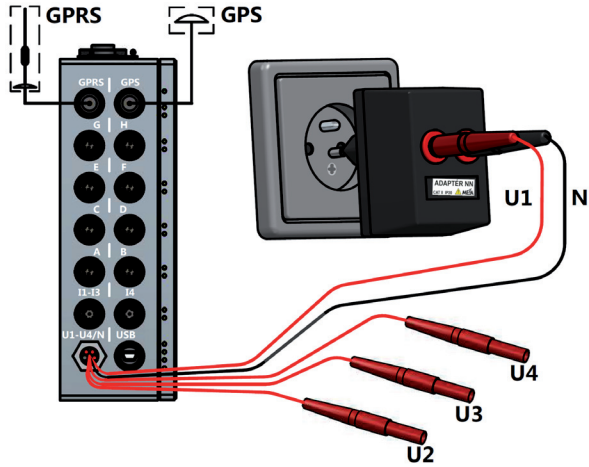


Fig. 13: One-phase measurement of voltage in a LV socket with GPS synchronization and GPRS remote data transmission



MEASURED DATA

The range of measured data depends on connection for measurement and measurement parametrization. Measured data are divided into data of continuous phenomena of voltage quality, data at voltage events and events initiated by voltage U4, and overcurrents, recorder data and data of electric power measurement.

Data of continuous phenomena of voltage quality (aggregation interval 10 minutes):

- Time of evaluation
- Voltage unbalance
- Frequency
- Voltage
- Voltage deviations U_{over}, U_{under}
- Flicker P_{st} and P_{lt}
- THD_U
- DC component, fundamental up to 60^{th} harmonic of voltage
- Centered groups of interharmonic voltages up to the order of 60
- Level of voltage signals (HDO)
- Flagged data
- Currents
- THD_I
- Basic to 60^{th} harmonics of currents
- Centered groups of interharmonic currents up to the order of 60.

Data at voltage phenomena and events initiated by voltage U4 and overcurrents:

- Time of event
- Event duration
- Moments when the limits for interruption, dip and swell of voltage and current are exceeded
- Residual and maximum values of voltage and current
- Curves of voltages $U_{RMS1/2}$ and currents $I_{RMS1/2}$ before, during and after an event.

Recorder data (aggregation interval from 1 sec to ¼ h pursuant to measuring parametrization):

- Time of evaluation
- Voltage
- Currents
- Active powers
- Reactive powers
- Apparent powers
- PF
- Active and reactive energies – four quadrants, 6 registers for each phase
- Distortion powers
- Unbalance power
- Active powers of the 1st harmonic
- Reactive powers of the 1st harmonic
- Apparent powers of the 1st harmonic
- Cos φ
- Active and reactive energies of the 1st harmonic – four quadrants, 6 registers for each phase
- THD_U
- THD_I
- Harmonic components of voltages up to the order of 60
- Harmonic components of currents up to the order of 60.

The above stated data of continuous phenomena of voltage quality are stipulated for the voltages U1, U2, U3 and currents I1, I2, I3.

The above stated recorded data of voltage events and single events starting from exceeding of defined limits for voltages U1 to U4 and for currents I1 to I3 are recorded for all the stated values, including I4.

The above stated recorder data apply to voltages U1 to U4, currents I1 to I4 and currents of inputs A through H.

ASSEMBLY OF THE MONITOR SET, PREPARATION FOR MEASUREMENT

Warning

- The maximum connected voltages can be at the value of 450 V_{AC}, the maximum connected delta voltages are at the value of 780 V_{AC}.
- In the CAT IV 300 V environment, the maximum voltage against common conductor can be 300 V_{AC}.
- Accessories included in the monitor set can only be used for the assembly of the monitor before measurement according to the approved overvoltage category which has to be in compliance with the overvoltage category in the measured point.
- Before connecting to measured voltages all components of the set must be mutually connected and housings shall be installed on free connectors of the monitor unit.
- It is recommended not to unnecessarily expose the monitor MEg37 and current sensors AMOSm/37 to the effect of water and humidity.
- Due to the protection against electrical shock injury voltage cords must be fitted with contact elements stated in Table 1 or inserted to safe slots of adapters, or extensions before their connection to voltage. Magnetic contact can only be installed to switched-off voltage circuits with zero voltage.
- The cable the AGPS antenna with increased insulation can only be placed in LV cabinets with the danger of contact.

Caution

- The PQ monitor MEg37 set is calibrated with current sensors marked with an identical serial number. The measurement preciseness specified in technical conditions is only ensured in this set.

- During measurement of voltage by means of an adapter or voltage extension voltage cords U1 through U4 and of N monitor are inserted to the marked safety slots. In other cases, either crocodile clamps or grips with fuses or magnetic contacts are installed on voltage cords.
- When connecting AGPS and AGPRS antennas which have the same design of the connector the attention must be paid to their correct connection. Unless antennas are used, housings must be properly screwed on antenna connectors to ensure watertightness.

- During parametrization of measurement and reading of measured data via a communication cable with USBmini / EMC the operator shall also ensure protection against the effect of water on the connector in a different manner.

Unless sensors are connected to current connectors, connector housings must be screwed on all the current connectors.

Flexible current sensors AMOSm/37 with the rated value of 30 A, 100 A, 300 A, 1000 A and 3000 A are connected to current inputs I1–I3, I4 and A through H.

A communication cable with USBmini/EMC is connected to the communication connector USB of the monitor, the other end of which is connected to the USB connected of PC with the started PQ MEg parametrization software according to the under manual in its user description [1].

Corresponding antennas according to Fig. 13 can be connected to GPRS and GPS connectors on the PQ monitor MEg37 of Class S. Be careful not to confuse antennas!

INSTALLATION OF MEASUREMENT AND INSPECTION OF THE CORRECT CONNECTION OF THE MEASURING SET

Warning **Caution**

- It is not permitted to connect voltage measuring cords to phase voltages higher than 450 V_{AC}, otherwise there is a risk of electric shock.
- It is not permitted to connect monitor to delta voltages higher than 780 V_{AC}, otherwise there is a risk of electric shock.
- It is not permitted to connect the monitor to phase voltages higher than 300 V_{AC} in LV networks between MV / LV transformers and customer electricity meters characterized by CAT IV overvoltage categories, otherwise there is a risk of electrical injury.
- The monitor shall only be operated by skilled personnel equipped with personal protective equipment against electrical injury.
- The voltage extension and the LV adapter must not be exposed to the effect of water.
- Operating range of voltage is up to 440 V_{AC}.
- In case of a mechanical damage to the monitor or its measuring cords, the monitor must be immediately dismounted and then sent for repair.

- Current sensors AMOSm/37 may only be installed in circuits with the maximum overvoltage category given in Table 1.
- In case of a mechanical damage even to the top layer of the insulation of the sensing part of the flexible sensor AMOSm/37, which can manifest in a contrast change in colour of the sensing part surface, the sensor must be immediately dismounted and sent for repair.
- Current sensors are only intended for installation on insulated live parts.
- If current sensors are installed in areas with dangerous voltage, the operator must be equipped with personal protective equipment against electric shock injury.
- If current sensors need to be installed on live parts or in areas with dangerous voltage, they have to be installed at the voltage-free status and safety requirements and regulations valid in the respective distribution network must be adhered to.
- Unless currents are measured, unused current connectors are properly covered with connected connector housings
- AGPS and AGPRS antennas are preferably installed outside the LV case. Be careful not to confuse AGPS and AGPRS antennas when connecting them to the monitor unit.
- The AGPRS antenna and the red part of the AGPS cable with increased insulation can be placed in a LV case with CAT IV 300 V.
- Connectors of monitors equipped with antenna connectors must be covered with housings unless antennas are connected to them.

1. Voltage cords **N** and then **U1**, and potentially **U4**, are connected to the measured voltages according to the measuring connection as in Fig. 10 through Fig. 13. If needed, crocodile clamps, open eyes, magnetic contacts, adapters or voltage extensions are used.
2. During measurement the measuring cord **U1** of the reference channel of the monitor must always be connected to the measured voltage.
3. **RUN** LED turns on according to the programmed measuring mode, see Table 4.
4. LEDs **U1**, **U2**, **U3** and **U4** turn on according to the amount of voltage and are lit as described in Table 4.
5. Current sensors are installed on conductors with the measured current so that their arrows show directions of current flows to load. Conductors with measured current

must be without voltage when installed. The connection of the connector of sensors to the monitor unit is signaled by turning on of the corresponding LED.

A flexible element of the loop closure of the flexible sensor AMOSm/37 is deviated from the axis which inclines the free end of the loop closure. It is wound around the conductor with the measured current and the free end is inserted back to the sleeve. If needed the position of the flexible sensor on the measured conductor is fixed by means of reversible plastic fastening tape. The part of sensing loop opposite to the closure of the flexible sensor in which the sensor is calibrated is preferably attached to the measured conductor.

6. The AGPS cable is unwound to the necessary length (max. 10 m) and the antenna is placed on a level platform with visibility to the sky. The red part of the cable with increased insulation can only be placed in the case.

7. The cable of the AGPRS antenna in the basic design with the length of 3 m is unwound to the necessary length; the remaining part of the cable is wound up and fixed with a Velcro tape. The antenna is placed to the space with sufficient GSM signal intensity in the vertical position. When installed in an all-metal case, the antenna must be installed outside the shielded area of the case, e.g. in a plastic inlet tube.

8. A pictogram of connection of communication with the monitor, FW version and the monitor serial number are shown on the PC with the started **PQ MEg** software which is connected to the monitor via USBmini / EMC cable, on the last right tab of the window, see Fig. 14. Captions of all window tabs are in bold.

   In case of the started **PQ MEg** software and unconnected or incorrectly connected monitor, a window with an empty field is shown on the PC, which informs about the status without communication, and tab captions are tuned down, see Fig. 15.

9. The bold **Settings MEg** tab is opened and depending on the measuring connection a single-phase or three-phase measurement is selected as well as rated values of measured currents including other measurement parameters.

   An example of three-phase measurement parametrization at the LV level with flexible sensors AMOSm/MEg37 on currents I1 through I4 is shown in Fig. 16.

10. By pressing the **Start of measurement** push-button the previously measured data are deleted in the monitor and the measurement according to the newly selected parametrization is started. By activating the **Measurement** menu push-button and selecting the **RMS** menu, the PC shows amounts of measured voltages and currents, their time course and power phase diagram. An example is in Fig. 17.

    Values of measured quantities and the correct direction of current sensor installation are checked.

11. By activating the **Measurement** menu push-button and selecting the **Samples** menu, harmonic components of measured voltages and currents, oscillographic courses and the phase diagram showing orientations of current directions compared to voltage directions are shown. An example is in Fig. 18.

12. Pictograms of GPRS and GPS are shown in the main window of the **PQ MEg** software, see Fig. 19.

    Meaning of pictograms and working with them:

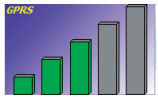
    The device supports the function of data transmissions of the GSM network and GPS synchronization but there is no sufficient signal.

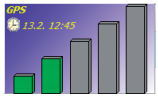
    The device supports the function of data transmissions of the GSM network and GPS synchronization, there is a sufficient signal for data communication of the GSM network.

    The device supports the function of data transmissions of the GSM network and GPS synchronization, there is a sufficient signal from satellites of the GPS system.

    In case of sufficient signal intensity of the GSM network with the function of data transmissions, the signal intensity at the given point is shown after pressing its pictogram (a push-button) in a bar chart. The weakest signal is marked with the shortest bar. The shown example shows the signal intensity at the third degree.

    In case of a sufficient GPS signal for synchronizing the time of the monitor, the signal intensity at the given point is shown after pressing its pictogram (a push-button) in a bar chart. The weakest signal is marked with the shortest bar. The shown example shows the signal intensity at the second degree. The date and time below the GPS title shows the time when the time of the monitor with the GPS signal was synchronized for the last time.

13. In case that a GPS signal of sufficient intensity is not present at the place of installation, it is possible to transfer the monitor supplied from the internal battery with the connected AGPS antenna to areas with sufficient signal and have the internal clock of the monitor synchronized. Unless time synchronization occurs during the uninterrupted supply for the term of 1 minute, the power supply to the monitor must be ensured. After synchronization the monitor supplied from its own back-up source is returned to the measuring point and connected to measured voltages and currents. In this way the time of internal clock is synchronized at least at the beginning of measurement.

Fig. 14: Main window of the PQ SW when the communication with MEg37 is established

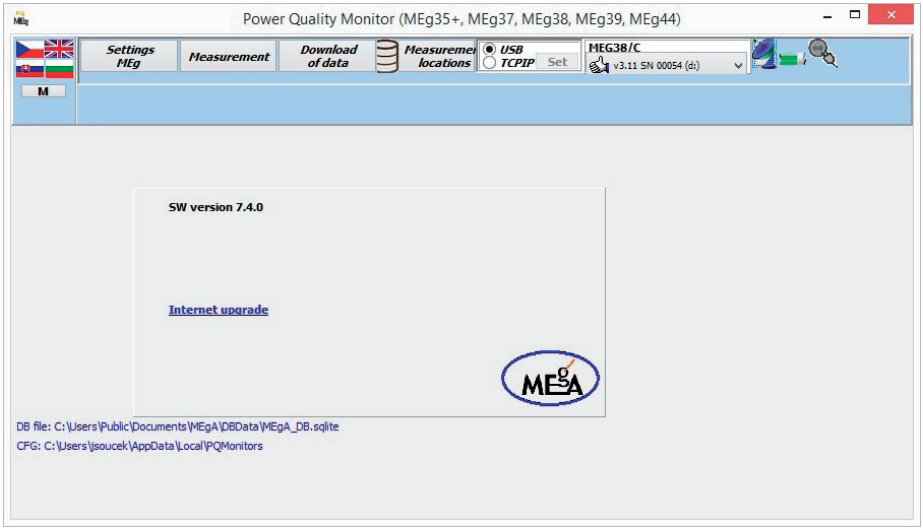


Fig. 15: Main window of the PQ SW when the communication with MEg37 is not established

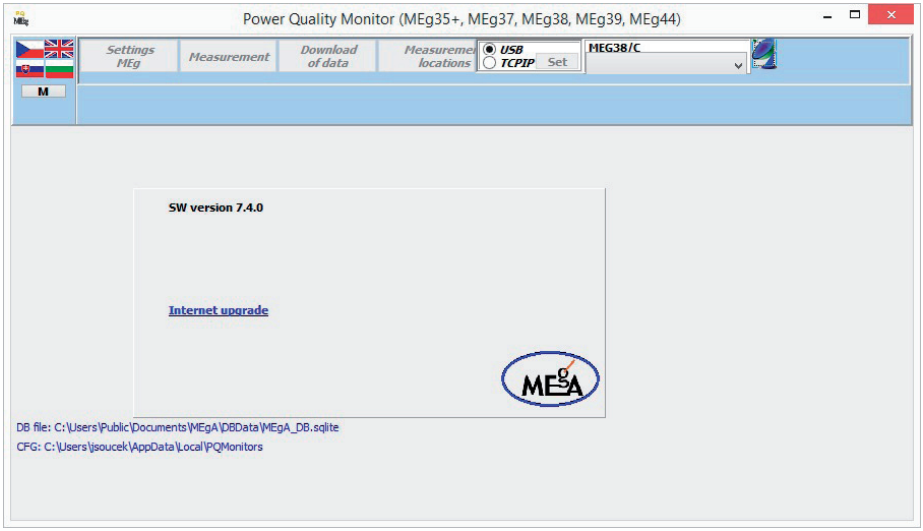


Fig. 16: Parametrization of a three-phase measurement in a LV network with flexible sensors 3AMOSm/37, AMOSm/37 and AH AMOSm/37

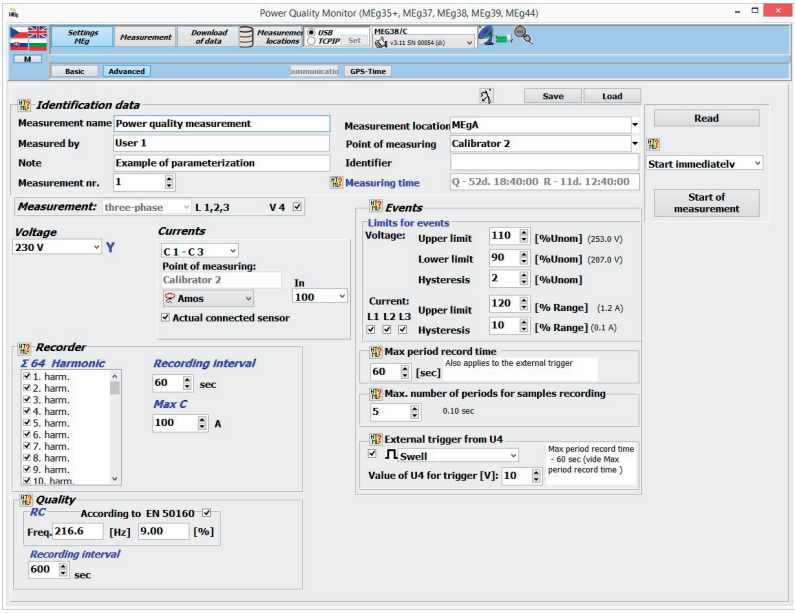


Fig. 17: Measuring and check of connected quantities, the course of RMS values

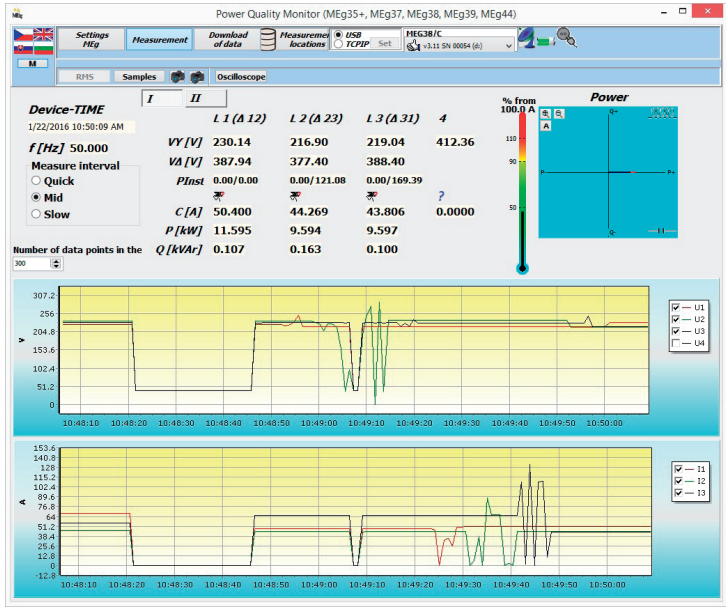


Fig. 18: Measuring and check of connected quantities, oscillographic courses and FFT

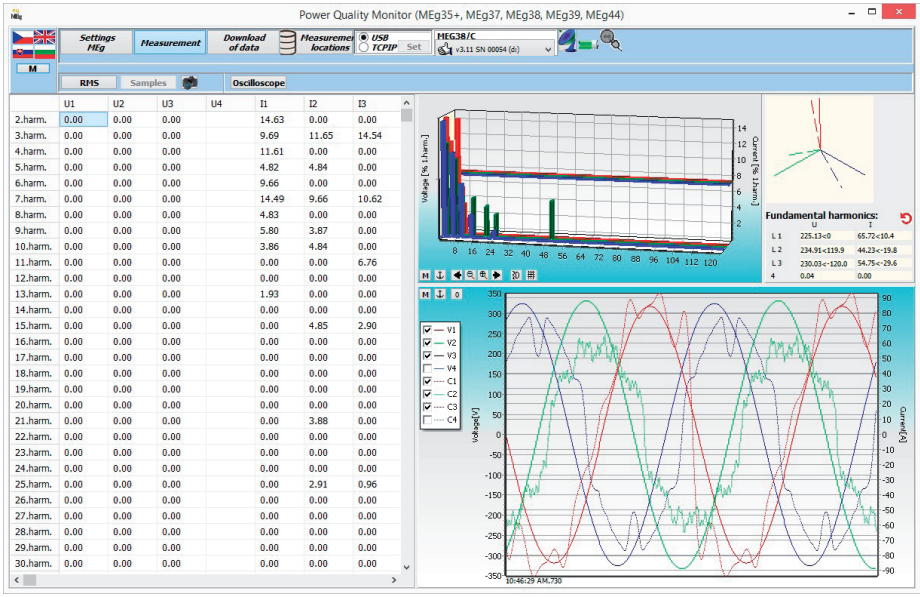
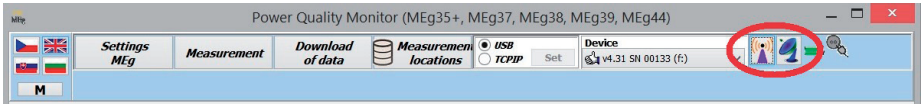


Fig. 19: An example of a main window with the information about GPS and GSM network signal intensities



MAINTENANCE

⚠ Caution

- The repairs of the monitor during the warranty period may only be carried out by the manufacturer's skilled and trained personnel or by the manufacturer's service organizations. The contact to the manufacturer's service is indicated on the website www.e-mega.cz.
- The monitor may not be exposed to chemicals.
- The monitor must only be transported in original transport cases supplied by the manufacturer.
- Re-calibration of PQ monitors MEg37 Class S is recommended always after the expiry of 3 years after the sale or the previous calibration.

The monitor does not require any special maintenance if properly used in compliance with this user manual. When polluted, the device shall be carefully cleaned with a damp cloth without using cleaning agents.

BATTERIES

The following batteries are used in the monitor:

- Lithium battery type CR2032 for the clock circuit
- Ni-MH accumulator, type 8×1000mAH, to ensure measurement at power supply failure.

The accumulator is charged when the monitor is connected to any measured voltage U1 through U4.

The term of full charge of completely discharged accumulator when charged from single voltage with the rated value and above-zero temperatures is shorter than 12 hours.

The fully charged monitor ensures at least ten consequent one-minute supply intervals at above-zero temperatures.

In the full range of operating temperatures the fully charged monitor ensures at least two one-minute supply intervals when the supply is interrupted.

The completely discharged accumulator must be charged at least for 20 minutes at above-zero temperatures to ensure a one-minute supply interval of the monitor.

When the monitor is started with the fully charged accumulator after a long-term switch-off of the monitor and the ambient temperature of -25°C, the monitor remains in operation after a short-term supply voltage recovery at least for 10 seconds.

DISPOSAL

After the end of use of the monitor, the monitor must be recycled in waste disposal sites according to rules for electronic waste disposal following from Act No. 185/2001 Coll. as amended.

WARRANTY

The monitor and its accessories are covered by a 24-month warranty from the date of purchase, however not longer than 30 months from the date of release from the manufacturer's warehouse. Defects originating during this period as a demonstrable result of defective design, manufacturing or using improper material will be repaired free of charge by the manufacturer or his service organization.

The warranty becomes invalid even during the warranty period if the user carries out unauthorized modifications or changes on the monitor MEg37, if he connects the device incorrectly or in case of rough handling or operation contrary to technical conditions stated.

Defects on the monitor and its accessories originated during the warranty period shall be claimed by the user to the manufacturer or to the service organization authorized by the manufacturer.

For warranty as well as post-warranty failure it is recommended to hand over a description of failure manifestations together with the device.

TECHNICAL PARAMETERS

General information

Measurement uncertainties apply to the reference conditions.

The development and production of the monitor is in compliance with ISO 9001:2009 and ISO 14001:2005.

Reference conditions

Temperature of environment:	23 °C ± 2 K
Relative humidity:	40 % to 60 % RH
Frequency:	50 Hz ± 2 %
Voltage unbalance:	≤ 0.1 %
Time course of signals:	sinusoidal

There is a counter-clockwise three-phase voltage system at voltage inputs U1, U2 and U3.

Supply – via input U4 by the voltage higher than calibrated voltages at inputs U1, U2 and U3.

Measuring characteristics

A/D converter:	16 bit
Sampling frequency:	128 samples per period for U1–U4, I1–I4, A–H
Anti-aliasing filter:	digital filter, type FIR
Phase-lock loop:	controlled by the passage of voltage of the basic harmonics U1 through zero
Aggregation intervals:	quality function – according to EN 61000-4-30:2009 recorder function and electricity meter – from 1 sec to 1/4 hour
Synchronization of aggregation:	according to EN 61000-4-30:2009

Time basis of:
- – GPS synchronization: ± 10 ms
- – without GPS synchronization: ±1 sec per 24 hours at 23 °C ± 2 K

Communication

USB 2.0, communication speed 5.4 Mbit/sec.

GSM, communication speeds up to 100 MBit/sec towards the monitor and up to 50 MBit/sec for data transmission from the monitor.

ETH, Ethernet with the speed up to 10/100 MBit/sec according to IEEE802.3.

Data memory

Capacity:	512 MB, NAND
Memory organization:	circular

Design data

Dimensions:	190 × 277 × 87 mm, with connectors 232 × 324 × 87 mm
Weight:	2.2 kg
Length of voltage supply cables:	2 m

All-insulation surface, made of polycarbonate, resistant to UV radiation, non-flammable.

Protection:	IP65 according to EN 60 529
Overvoltage category:	CAT IV / 300 V, CAT III / 600 V according to EN 61010-2-030:2010
Safety class:	II, reinforced insulation
Testing voltage:	5.4 kV, 50 Hz, 1 minute

Power supply

Supply voltage:	207 V_{AC} to 400 V_{AC} ±10 %, 50 Hz
Consumption without GPS and GPRS:	12 VA / 230 V_{AC}
Consumption with GPS and GPRS:	16 VA / 230 V_{AC}
Uninterrupted power supply period:	1 minute (SW set-up), even for multiple repetition
Type of fuses:	FSK 00.1 / 500 mA-T, fuses can only be replaced by the manufacturer or service organisations trained by it

EMC

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use – EMC requirements Part 1: General requirements

It also includes EN 61 000-6-2:2005, EN 61 000-4-2:2009, EN 61 000-4-3:2006, EN 61 000-4-4:2012, EN 61 000-4-5:2006, EN 61 000-3-3:2013, EN 61 000-3-2:2006.

Voltage on network terminals

EN 55011:2009
Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement

Interference electromagnetic radiation

EN 55011:2009
Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement

Radiated high-frequency electromagnetic field

EN 61000-4-3:2006
Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test

Operating conditions

Operating temperature:	-25 °C to +55 °C
Stabilization period:	10 minutes after start-up
Relative humidity:	5 % to 95 %, without long-term condensation
Pollution degree:	2
External magnetic field:	0.5 mT, 50 Hz
Altitude:	up to 2,000 m above sea level
Operating position:	arbitrary

Operation in indoor environments only.

Storage

Storage temperature:	-30 °C to +60 °C

Protection against the effect of water and chemicals.

Protection against long-term effect of UV radiation.

Voltage inputs U1, U2, U3 and U4

SW set-up of the voltage level:	LV
Rated phase voltages U_n P-N:	230 V_{AC}
Rated delta voltages U_n P-P:	400 V_{AC}
Measuring range of phase voltages P-N:	440 V_{AC}
Maximum output voltage P-N:	450 V_{AC}
Voltage measurement uncertainty with f=50 Hz:	0.05 % of M.V. ± 0.025 % U_n
Frequency range:	up to 3.15 kHz
Input resistance:	1.68 MΩ
Temperature coefficient:	0.05 % / 10 K
Measurement:	direct

Current inputs with flexible sensors AMOSm/37

	Inputs I1–I4	Inputs A–H
SW set-up of the rated value:	Yes	Yes
Rated value of current I_n:	30 A, 100 A, 300 A, 1 000 A, 3 000 A	
Measuring range of current:	5 % I_n to 120 % I_n	
Frequency range:	40 Hz to 3.15 kHz	
Current measurement uncertainty (45 Hz to 60 Hz) [1) 2) 3) 4)]		
I_n = 30 A:	1.0 % of M.V. ± 0.1 % I_n	1.0 % of M.V. ± 0.5 % I_n
I_n = 100 A, 300 A, 1000 A, 3000 A:	0.5 % of M.V. ± 0.1 % I_n	1.0 % of M.V. ± 0.5 % I_n
Change of the data with position:	± 1.0 % of M.V.	± 1.5 % of M.V.

Change of the data by the effect of ext. fields: ± 1.0 % of M.V. ± 0.2 % I_n
(external field caused by the conductor with 0.3 I_n / 50 Hz at the distance of 35 mm from the enclosure)

Harmonics measurement uncertainties to the order of 50 [1) 2) 3)]:

I_n = 100 A, 300 A, 1 000 A:	± 5 % I_{harm} at 10 % $I_n \geq I_{harm} \geq$ 3 % I_n and ± 0.15 % I_n at I_{harm} < 3 % I_n
I_n = 30 A and 3000 A:	± 10 % I_{harm} at 10 % $I_n \geq I_{harm} \geq$ 3 % I_n and ± 0.3 % I_n at I_{harm} < 3 % I_n

Operating temperature:	-20 °C to +55 °C	
Temperature coefficient:	0.2 % / 10 K	
Relative humidity:	≤ 95 % RH	
Degree of protection provided by enclosure:	IP42	
Measuring category:	CATIV / 300 V	
Safety class:	II	
Loop length:	40 cm (red)	40 cm (green)
Loop diameter:	8 mm	
Enclosure free end diameter:	10 mm	
Permitted radius of loop bent:	> 20 mm	

[1] In the range of 5 % I_n – 120 % I_n
[2] At the correct position of the enclosure
[3] Up to the order of 25 the maximum peak factor 2
[4] M.V. – measured value

Function of measuring the power quality

Classification of the PQ monitor MEg37 according to IEC 62586-1

PQ monitor MEg37 Class S has the classification of **PQI-S-PO-H**, f = 50 Hz, CAT III / 300 V according to EN 61010-2-030:2010.

Table of functions of the PQ monitor MEg37 according to EN 61000-4-30:2009 including EN 61000-4-15:2011 and EN 61000-4-7:2002.

Function and measured data	MEg37, Class S	
	Method of measurement	Measurement uncertainty, measurement range
Frequency 10 s data	Class A	Class S
Magnitude of supply voltage 150 periods, 10 minutes, 2 hours	Class A	Class S
Flicker 10 minutes P_{st}, 2 hours P_{lt}	Class A	Class S
Voltage dips and swells residual and maximum U, T duration	Class A	Class S
Supply voltage interruption residual and maximum U, T duration	Class A	Class S
Voltage unbalance 150 periods, 10 minutes, 2 hours	Class A	Class S
Harmonic voltages 150 periods, 10 minutes, 2 hours	Class A	Class S
Interharmonic voltages 150 periods, 10 minutes, 2 hours	Class A	Class S
Mains signaling voltage 150 periods	Class A	Class S
Underdeviation and overdeviation 150 periods, 10 minutes, 2 hours	Class A	Class S

Note: According to EN 61557-12 the PQ monitor MEg37 is a self-powered performance measuring and monitoring device.
It combines the functions of recording, measuring the electric power and measuring the quality of voltage.

Measurement uncertainties and measuring ranges of voltage quality parameters of PQ monitors MEg37 Class S at testing statuses 1, 2 and 3 according to EN 61000-4-30:2009

LV level, f = 50 Hz

Parameter	Class	Measurement uncertainty	Measuring range
Frequency	S	± 10 mHz	42,5 Hz – 57,5 Hz
Voltage	S	± 0.2 % U_n	10 % U_n – 150 % U_n
Flicker P_{st}, P_{lt}	S	7.5 % P_{st}, P_{lt} IEC 61000-4-15, ed. 2	P_{st}, P_{lt} (0.4 – 4.0) 1 – 4000 changes/min
Flicker $P_{inst, max}$	S	8 % $P_{inst, max}$	$P_{inst, max}$ (0 – 10) sine, rectangular
Voltage events	S	Amplitude: ± 0.5 % U_n Duration: ± 1 period	5 % U_n – 150 % U_n 0.02 sec – 60 sec
Interruptions	S	Duration: ± 1 period	0.02 sec – 60 sec
Unbalance	S	± 0.2 %	1.0 % u_2 – 5 % u_2 1.0 % u_0 – 5 % u_0
Harmonic voltages	S	± 5 % U_{harm}, $U_{harm} \geq 3$ % U_n ± 0.15 % U_n, $U_{harm} < 3$ % U_n	10 % – 100 % class 3 IEC 61000-2-4
Interharmonic voltages	S	± 5 % U_{harm}, $U_{harm} \geq 3$ % U_n ± 0.15 % U_n, $U_{harm} < 3$ % U_n	10 % – 100 % class 3 IEC 61000-2-4
Mains signalling voltage	S	± 10 % U_{sig} for 3 % $U_n \leq U_{sig} \leq 15$ % U_n, ± 0.3 % U_n for 1 % $U_n \leq U_{sig} \leq 3$ % U_n	1.0 % U_n – 15 % U_n
Underdeviation and overdeviation	S	± 0.2 % U_n	10 % U_n – 120 % U_n
Time base [5)]	S	± 1 sec per 24 hours	–
Time base [6)]	A	± 10 msec	–

[5)] Without GPS signal synchronization
[6)] With GPS signal synchronization

Function Recorder and electric power measurement

Power Factor (PF, cos φ)

Measurement precision: 1 % of M.V.

Measuring range: 0.5 inductive to 0.8 capacitive

Voltage range: from 0,8 U_n to U_{max}

Current range: ftom 10 % I_n to I_{max}

Active power and active energy, MEg37 with sensors

Voltage range: from 80 % to 120 % U_n

Current range: from 2 % to 120 % $I_n = I_{max}$

Measurement uncertainties in % of the measured value:

Current value	cos φ	Inputs I1–I4 with AMOSm/37	Inputs A–H with AMOSm/37
Class [7)]		2.0	3.0
$2\,\%\,I_n \le I < 5\,\%\,I_n$	1	3.0 %	3.5 %
$5\,\%\,I_n \le I \le I_{max}$	1	2.0 %	2.5 %
$5\,\%\,I_n \le I < 10\,\%\,I_n$	0.5 L, 0.8 C	3.0 %	3.5 %
$10\,\%\,I_n \le I \le I_{max}$	0.5 L, 0.8 C	2.0 %	2.5 %

Reactive power and reactive energy, MEg37 with sensors

Voltage range: from 80 % to 120 % U_n

Current range: from 2 % to 120 % $I_n = I_{max}$

Measurement uncertainties in % of the measured value:

Current value	sin φ C or L	Inputs I1–I4 with AMOSm/37	Inputs A–H with AMOSm/37
Class [7]		3.0	3.0
$2\,\% I_n \le I < 5\,\% I_n$	1.0	3.0 %	3.5 %
$5\,\% I_n \le I \le I_{max}$	1.0	2.5 %	2.5 %
$5\,\% I_n \le I < 10\,\% I_n$	0.5	3.0 %	3.5 %
$10\,\% I_n \le I \le I_{max}$	0.5	2.5 %	2.5 %
$10\,\% I_n \le I \le I_{max}$	0.25	3.0 %	3.5 %

Apparent power, MEg37 with sensors

Voltage range: from 80 % to 120 % U_n

Current range: from 2 % to 120 % $I_n = I_{max}$

Measurement uncertainties in % of the measured value:

Current value	Inputs I1–I4 with AMOSm/37	Inputs A–H with AMOSm/37
Class [7]	2.0	3.0
$2\,\% I_n \le I < 5\,\% I_n$	2.5 %	3.5 %
$5\,\% I_n \le I \le I_{max}$	2.0 %	2.5 %

[7] Function performance class according to EN 61557-12

Measurement of powers and energies, MEg37 unit without sensors

Voltage range: from 80 % to 120 % U_n

Current range: from 2 % to 120 % $I_n = I_{max}$

Measured quantity	Voltage	Current	PF	Uncertainty
Active power	up to 1.2 U_n	up to 1.2 I_n	> 0.5	± 0.5 % P_n
Reactive power	up to 1.2 U_n	up to 1.2 I_n	< 0.85	± 0,5 % Q_n
Active energy	0.8 U_n to 1.2 U_n	0.05 I_n to 1.2 I_n	0.5 L 0.8 C	Class B
Reactive energy	0.8 U_n to 1.2 U_n	0.05 I_n to 1.2 I_n	< 0.707	± 1 % of M.V.
Power factor	0.8 U_n to 1.2 U_n	0.05 I_n to 1.2 I_n	–	± 0.5 % of M.V.

Summary of evaluated quantities in the function Recorder

Quantity	Symbol	For each phase	Fourth channel	Three-phase value	For interval[8]	200 ms minimum in interval	200 ms maximum in interval
RMS voltage	U_{ef}	PN+PP	PN+PP		PN+PP		
Harmonic voltages – 1. to 64. harmonic	$U_{1.h}$ to $U_{64.h}$	PN+PP	PN+PP		PN+PP		
Total harmonic voltage distortion	THD_U	PN+PP	PN+PP		PN+PP		
RMS current	I_{ef}	PN+PP	PN+PP		PN+PP		
Harmonic currents – 1. to 64. harmonic	$I_{1.h}$ to $I_{64.h}$	PN+PP	PN+PP		PN+PP		
Total harmonic current distortion	THD_I	PN+PP	PN+PP		PN+PP		
cosφ	cosφ	PN		PN+PP	PN+PP		
Power Factor	PF	PN		PN+PP	PN+PP		
Active power	P	PN		PN+PP	PN+PP	PN+PP	PN+PP
Reactive power	Q	PN		PN+PP	PN+PP	PN+PP	PN+PP
Apparent power	S	PN		PN+PP	PN+PP	PN+PP	PN+PP
Distortion power	D	PN		PN	PN	PN	PN
Unbalance power[9]	N			PN+PP	PN+PP	PN+PP	PN+PP

Quantity	Symbol	For each phase	Fourth channel	Three-phase value	For interval[8)]	200 ms minimum in interval	200 ms maximum in interval
Active power (1. harmonic)	$P_{1.h}$	PN		PN+PP	PN+PP	PN+PP	PN+PP
Reactive power (1. harmonic)	$Q_{1.h}$	PN		PN+PP	PN+PP	PN+PP	PN+PP
Apparent power (1. harm.)	$S_{1.h}$	PN		PN+PP	PN+PP	PN+PP	PN+PP
Unbalance power (1. harm.)	$N_{1.h}$			PN+PP	PN+PP	PN+PP	PN+PP
Active energy – consumption	EP+	PN		PN+PP	PN+PP		
Active energy – supply	EP-	PN		PN+PP	PN+PP		
Inductive reactive energy during active consumption	EQL/EP+	PN		PN+PP	PN+PP		
Capacitive reactive energy during active consumption	EQC/EP+	PN		PN+PP	PN+PP		
Inductive reactive energy during active supply	EQL/EP-	PN		PN+PP	PN+PP		
Capacitive reactive energy during active supply	EQC/EP-	PN		PN+PP	PN+PP		
Active energy – consumption (1. harmonic)	$EP+_{1.h}$	PN		PN+PP	PN+PP		
Active energy – supply (1. harmonic)	$EP-_{1.h}$	PN		PN+PP	PN+PP		
Inductive reactive energy during active consumption (1. harm.)	$EQL/EP+_{1.h}$	PN		PN+PP	PN+PP		
Capacitive reactive energy during active consumption (1. harm.)	$EQC/EP+_{1.h}$	PN		PN+PP	PN+PP		

Quantity	Symbol	For each phase	Fourth channel	Three-phase value	For interval[8]	200 ms minimum in interval	200 ms maximum in interval
Inductive reactive energy during active supply (1. harm.)	EQL/ $EP-_{1.h}$	PN		PN+PP	PN+PP		
Capacitive reactive energy during active supply (1. harm.)	EQC/ $EP-_{1.h}$	PN		PN+PP	PN+PP		

[8] Recording interval is selectable from 1 sec to 15 minutes. For energy measurement it is a summary value for interval, for other quantities it is a mean value for interval.

[9] In the phase-to-phase measurement mode the unbalance power includes also distor tion component.

Legend:

PN values evaluated in the phase-to-neutral measurement mode

PN+PP values evaluated in both phase-to-neutral and phase-to-phase measurement modes

Note:

PQ monitor MEg37 measures phase-to-neutral voltages by default.

AGPS antenna

Dimensions:	ø = 135 mm, v = 55 mm
Weight:	0.45 kg
Coaxial cable length:	10 m
Safety class:	II
Overvoltage category:	CATIV / 300 V **only the first 2 m of the cable with an increased red insulation**
Degree of protection provided by enclosure:	IP23
Frequency band:	1575.42 MHz
Frequency band width:	10 MHz
Gain:	22.5 dBi typ.
Operating temperature:	-20 °C to 60 °C

AGPRS antenna

Dimensions:	v = 320 mm, base ø = 50 mm, rod ø = 13 mm,
Weight:	0.175 kg
Attachment:	magnetic
Coaxial cable length:	3 m
Safety class:	II
Overvoltage category:	CATIV / 300 V
Degree of protection provided by enclosure:	IP63
Frequency band of GPRS/EDGE:	900 / 1800 MHz
Frequency band of LTE:	800/1800 MHz
Frequency band of UMTS/HSPA+:	850/900 MHz
Polarisation:	vertical
Gain:	5 dB
Working temperature:	-20 °C to 60 °C

LITERATURE

[1] User specification of the PQ MEg programme, www.e-mega.cz

[2] User specification of the Data viewer programme, www.e-mega.cz

[3] User specification of the WebDatOr programme, www.e-mega.cz

MANUFACTURER

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Multiple input PQ monitor MEg37
User manual

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Edition: 02/2016