PQ monitor MEg38/C

User manual

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1/ INTRODUCTION

The MEg38/C PQ monitor measures four voltage and four current values at LV, MV and HV levels. It provides the functions of recording, voltage quality analysis and the function of electric power measurement, including quick measurements of active energy, all performed simultaneously. In the recording function, the MEg38/C PQ monitor, hereinafter referred to as „monitor", processes all measured values, evaluates power, energy and harmonics up to the order of 63. In the voltage quality analysis function, the MEg38/C monitor is supplied in Class A or S according to the EN 61000-4-30 standard, ed. 3. Both variants perform measurements using the methods stipulated for Class A, and they differ in measurement accuracy and recommended time for recalibrations. It measures three voltages and three current values without interruptions and gaps. It analyses harmonics and centred groups of interharmonics up to the order 125. Rapid voltage changes RVC are measured and evaluated according to the standard from voltage $U_{RMS1/2}$ and from average voltage values for 10 periods U_{RMS10}. When recording events, the monitor, aside from recording the course of $U_{RMS1/2}$ and $I_{RMS1/2}$, makes an oscillographic record of all four values of voltage and current. The user SW working above the recording function evaluates the values of loop impedance and compensation capacity battery, and determines the circuit-breaker value. It measures characteristics of appliances in connection with the three-phase and single-phase load adapter. The monitor can operate as an oscillograph with the function of recording of the voltage values U1 to U4 and the current values of I1 to I4 into data memory, and an oscillographic record can also be triggered by voltage U4. In addition to the standard function of four-quadrant power measurement with a differentiation of reactive energy according to the flow of active energy, the MEg38/C monitor offers the function of "dynamic measurement of active energy" for measurement of active energy during rapid changes of its flow direction.

The MEg38/C monitor includes an uninterruptible power supply permanently connected to all four voltage measuring inputs, with which it is subjected to safety tests. During parametrization and data loading, it can also supply power via a USB interface from connected PC.

For current measurement, it uses flexible sensors, clamp-on transformers or toroid sensors that it identifies automatically. It has SW for changeover of ranges. For time synchronisation prescribed in Class A, there is a possibility of connection to GPS, which can be performed in Class S as well. Time synchronization is also possible using the NTP protocol. It enables remote transmission of measured data as well as remote measurement parametrization using the LTE/ GPRS service of the GSM network. It is designed in an

all-plastic case of minimum dimensions with magnetic attachment, it is waterproof and has safety class II with reinforced insulation and measuring category CAT IV / 300 V.

The MEg38/C PQ monitor utilizes a dual-core processor, in which the DSP core ensures the above stated measuring functions and the ARM core ensures the communication functions, including static and dynamic directing, the firewall function and the virtual private network (VPN) functions with the support of IPsec protocol and remote setting management.

2/ INFORMATION ON SW

PQ monitor MEg38/C package includes a CD with user programs. Local and remote parametrization of measurements, reading of measured data, displaying of direct measurements, including oscillographic recording, are carried out by the PQ_MEg program. Data Viewer DVMEg is a shared program ensuring the 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].

The issue of secure remote transmission of data and remote parametrization of measurement is described in the user description of remote communication functions of the MEg38/C monitor [4]. The function of secure remote transmission of data is performed in the ARM core of the Texas Instruments dual-core processor. It includes static directing of TCP/IP and the support of dynamic directing, the Firewall function with status packets and remote management of setting rules, virtual private network – VPN with the IPsec protocol and remote setting management.

3/ 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 of single voltage and current events and events initiated by voltage U4, and recorder data.

Data of continuous voltage quality phenomena (pre-set aggregation interval of 10 minutes, data of continuous voltage quality phenomena are stipulated for voltages U1, U2, U3 and for currents I1, I2, I3):

- Time of evaluation
- Frequency, average, maximum and minimum;
- Voltage; average, maximum and minimum (time domain, frequency domain)
- Voltage deviations U_{over}, U_{under}
- Voltage unbalance
- Flicker P_{st} and P_{lt}
- Voltage distortion factor THD_U
- DC component, fundamental to 125th harmonic voltage
- Centred groups of interharmonic volteges up to the order of 125
- Level of voltage signals
- Rapid voltage changes
- Value marking, flagging
- Currents; average, maximum
- Current distortion factor THD_I
- Basic to 125th harmonics of currents
- Centred groups of interharmonic currents up to the order of 125
- Active power; average, maximum and minimum
- Three-phase active power
- PF
- Reactive power; average, maximum and minimum
- Three-phase reactive power.

Data during voltage phenomena at U1 to U3 and during exceeding of the limit at currents I1 to I3 and voltage U4 are recorded for all the stated variables:

- 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 voltage $U_{RMS1/2}$ and currents $I_{RMS1/2}$ with optional pre-trigger and post-trigger

- Oscillogram of voltage and current curves during an event with optional pre-trigger and post-trigger
- Harmonic voltages and currents during event

Recorder data for voltages U1 to U4 and currents I1 to I4 (aggregation interval from 1 s to ¼ h according to measurement parametrization):

- Time of evaluation
- Voltage; average, maximum and minimum
- Currents; average, maximum
- Active power; average, maximum and minimum
- Reactive power; average, maximum and minimum
- Apparent power; average, maximum and minimum
- PF
- Active and reactive energies – four quadrants, 6 registers for each phase
- Active and reactive energies of the 1st harmonic – four quadrants, 6 registers for each phase
- Deformation power; average, maximum
- Asymmetric power; average, maximum
- Active power of the 1st harmonic; average, maximum and minimum
- Reactive power of the 1st harmonic; average, maximum and minimum
- Apparent power of the 1st harmonic; average, maximum and minimum
- Asymmetric power of the 1st harmonic; average, maximum and minimum
- Cos φ
- Factor THD_U
- Factor THD_I
- Harmonic voltages to the 63rd order including the DC component
- Harmonic components of currents up to the order of 63.
- HDO voltage curve

HDO telegram data:

- HDO telegram transmission start time
- Phase with HDO telegram
- Address and command part of the HDO telegram
- Minimum and maximum voltage of HDO telegram marks
- HDO telegram carrier frequency

Data of rapid voltage changes RVC:

- RVC start time
- Phase, three-phase RVC
- Time of RVC duration in half-periods and in ms
- Average voltage difference before and after RVC
- Half-period minimum and maximum voltage
- Ten-period minimum and maximum voltage

The MEg38/C PQ monitor records rapid voltage changes (RVC) according to the standard IEC 61000-4-30 ed3. The algorithm is based on floating measurement of 100 values of $U_{RMS1/2}$ in each phase. The user defines a threshold value of voltage change for starting recording, and a hysteresis value after the rapid change and return to the balanced state. Rapid changes are characterized by the time of beginning, the duration, the difference in voltage between balanced states before a rapid change and after it (ΔU_{DC}) and the maximum difference between voltage $U_{RMS1/2}$ during a rapid change and balanced state voltage before the start of a rapid change (ΔU_{max}). A record of rapid changes can be extended in user SW by a record of the entire course of $U_{RMS1/2}$ values. Also considered is the curve of sliding ten-period values of $U_{10RMS1/2}$. When a voltage event limit is exceeded, the record of rapid change is cancelled and the given voltage phenomenon is evaluated and saved as a voltage-related event.

Dynamic measurement of active energy:

- Total positive energy (consumption)
- Total negative energy (supply)
- Time of aggregation interval end
- Time of aggregation interval
- Positive and negative energy of the aggregation interval of L1 to L3 phases.

The function of dynamic measurement of active energy enables exact recording of active energy even during rapid changes in the direction of its flow. Common instruments for measurement of power and energy work with a basic measuring interval in the order of tens of basic frequency periods. It can, in the case of rapid changes in the flow direction, e.g., at the places of connection of power supplies in a distribution grid, result in inaccurate recording and evaluation of energy overflows. The basic evaluating interval in the dynamic measurement of active energy function is a half-period of the basic frequency (10 ms at the frequency of 50 Hz), and, also thanks to this, even such short overflows are reliably recorded in the corresponding register. According to settings, it is possible to record all half-period values, or to set an interval for saving in seconds and minutes, into which the half-period values are aggregated. Higher SW enables displaying power and energy into a table or graph, or exporting to a .csv file.

4/ BASIC INFORMATION ABOUT THE MEg38/C SET

The MEg38/C PQ monitor set consists of a MEg38/C monitor unit, current sensors, antennas, voltage extensions, contact elements and adapters.

The MEg38/C monitor unit is supplied in Class A or S, refer to Fig. 1, and it contains an uninterruptible power supply and, depending on selected options, a built-in module with the GPS and GPRS/LTE functions of the GSM network. Three sensors are intended for measuring phase currents and an independent sensor is intended for measuring the current, e.g. of the neutral conductor. There are three designs of current sensors.

Flexible AMOSm/standard/38 sensors with the standard length of the sensing part of 400 mm and the clearance of 120 mm, refer to Fig. 2, or the AMOSm/long/38 model with the length of the sensing part extended to 600 mm and with the clearance of 180 mm, refer to Fig. 3, are designed for measurements on the LV level.

Clamp-on transformers with nominal currents of 1 A and 5 A are delivered in two designs, see Fig. 4 and Fig. 5. Clamp-on transformers MT0.5/38 provide current measurement preciseness of 0.5 % I_n and CAT IV, and, therefore, they can be used for measurements on conductors of LV transformer stations as well as power grids. Clamp-on transformers MT1.0/38 with the accuracy of 1.0 % I_n and CAT III can only be used for measurements in LV circuits of buildings or for indirect measurements of in secondary circuits of instrument current transformers; they have smaller dimensions.

Toroid sensors with a higher preciseness of even low currents, power and energy need to be switched off when installed and dismounted and consequently the measured circuits need to be disconnected. They are also supplied in two design modifications, see Fig. 6 and Fig. 7. Toroids TORv/38 with nominal currents of 10 A and 50 A and CAT IV / 300 V are suitable for measurements on LV grid conductors with a diameter up to 15 mm. Toroids TORm/38 with nominal currents of 1 A and 5 A and with CAT IV / 300 V can be used for direct measurements of current in LV grid conductors with a diameter up 6 mm as well as for indirect measurements in secondary circuits of instrument current transformers.

K alligator clips and are included in the basic monitor set. The basic set of Class A monitor includes an antenna for receiving GPS signal of the AGPS/2.5 m design with the length of the coiled coaxial cable of 2.5 m, refer to Fig. 9, or in the AGPS/10m design with the length of reeled coaxial cable of 10 m, refer to Fig. 8. The AGPS antennas enable the required time synchronization of the monitor using the GPS signal. An AGSM antenna, refer to Fig. 10, can be optionally ordered for both variants, and it enables a remote parametrization of measurements and a transmission of measured data. The AGSM antenna has a coaxial cable with a length of 2.5 m with reinforced insulation and a removable magnetic holder.

A single-phase load adapter Z and a three-phase load adapter 3Z, see Fig. 11 and Fig. 12, are intended for measurements on instruments.

Fig. 13 shows NPV or NPB voltage extensions with 2 m measuring cables for connection of the monitor to voltage in larger electric cabinets. The cables can have free ends or ends provided with contact plugs. LV adapter is used to connect the monitor to a single-phase socket of a LV installation.

The contact elements for connection of a portable PQ monitor to voltage are displayed in Fig. 14. They are the MK7 or MK11 magnetic contacts, G grips with fuses or the O8 and O4 open eye contacts.

Fig. 1: PQ monitor MEg38/C, basic dimensions and user elements

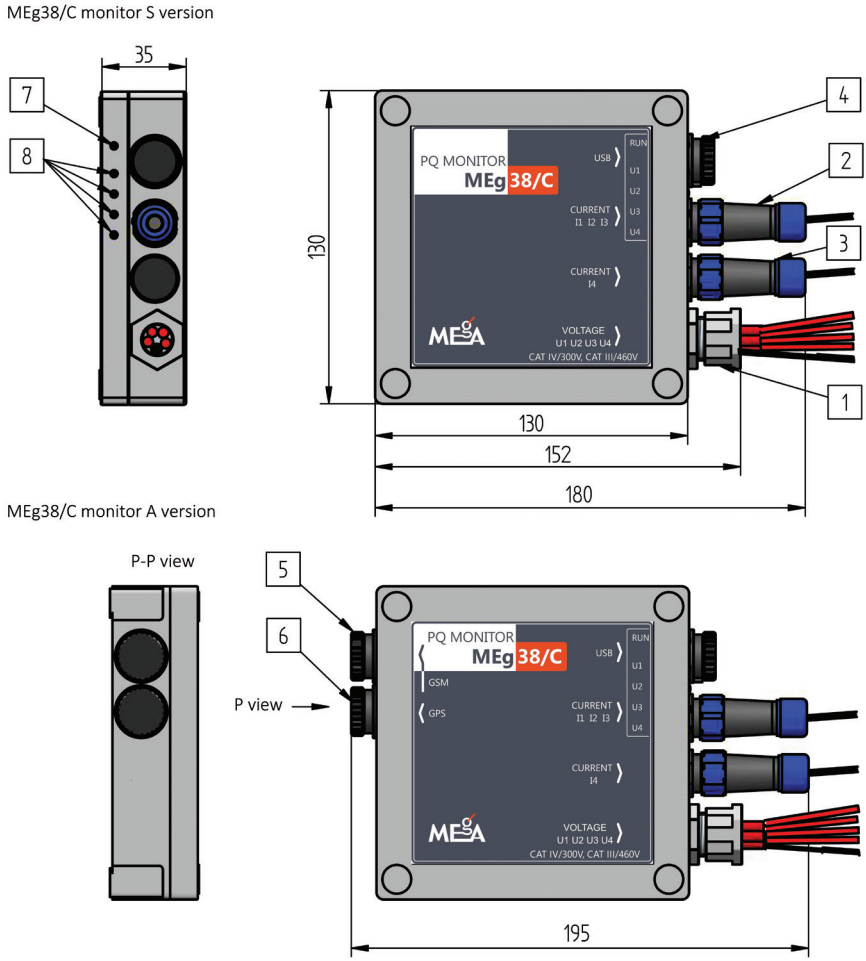


Fig. 2: Three flexible 3AMOSm/standard/38 current sensors, sensing section clearance 120 mm

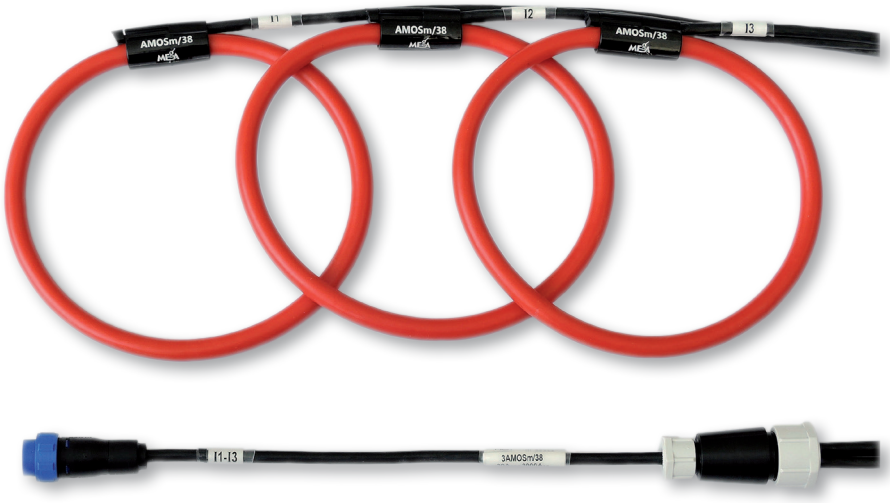


Fig. 3: Flexible AMOSm/long/38 current sensor, sensing section clearance 180 mm

Fig. 4: Three clamp-on transformers 3MT0.5/38

Fig. 5: Clamp-on transformer MT1.0/38

Fig. 6: Three toroid sensors 3TORv/38

Fig. 7: Three toroid sensors 3TORm/38

Fig. 8: Antenna AGPS/10m

Fig. 9: Antenna AGPS/2.5 m

Fig. 10: AGSM antenna

Antenna AGSM
CAT IV 300V~
CE ⚠ IP63
MEGA Nr 00000

Fig. 11: Single-phase load adapter Z

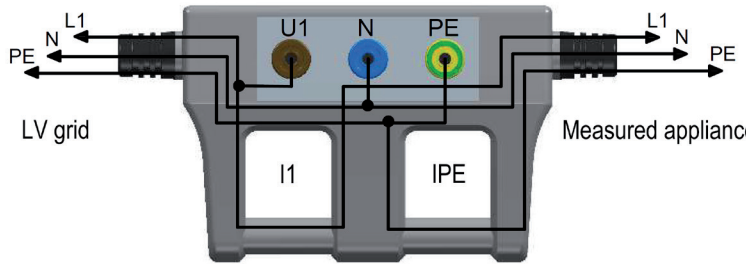


Fig. 12: Three-phase load adapter 3Z

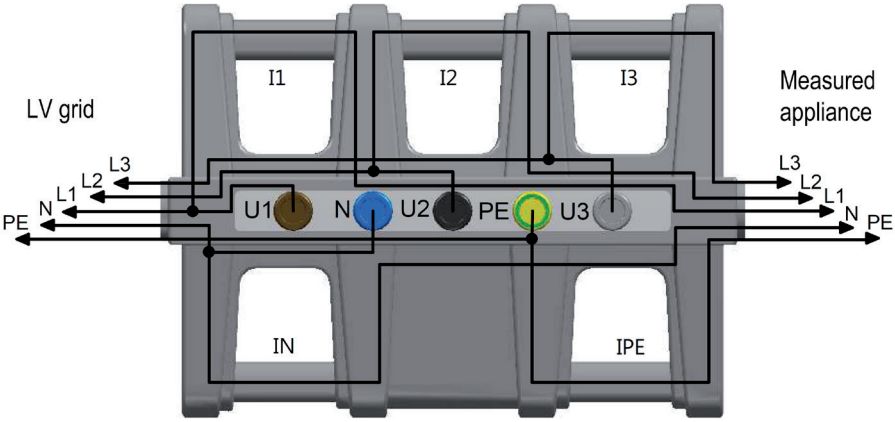


Fig. 13: Voltage extensions with NPV free ends and with NPB contact plugs, LV adapter

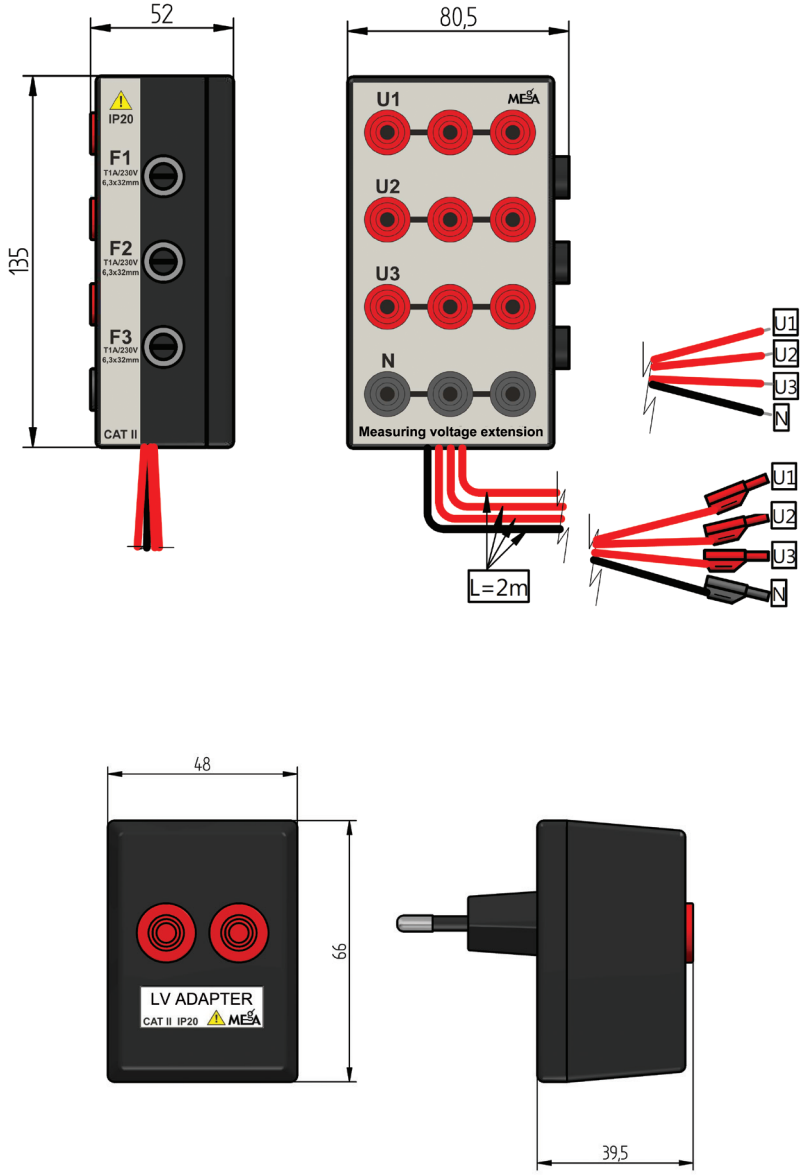
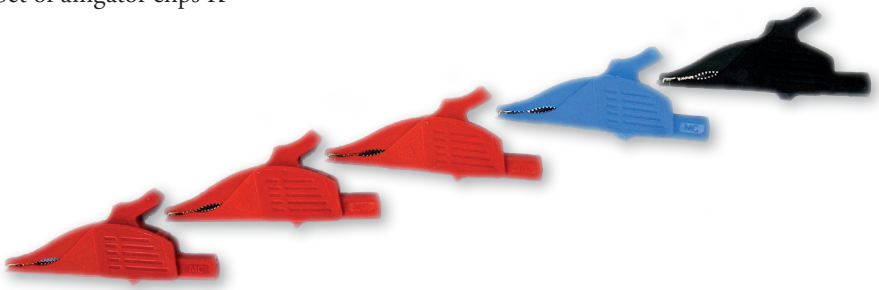
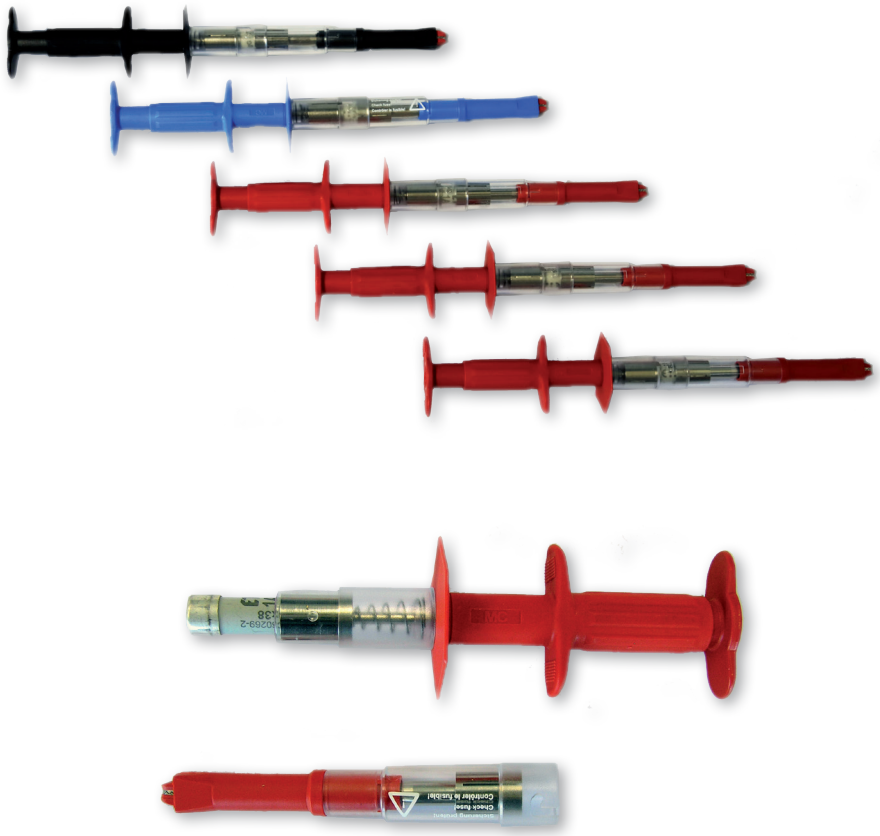


Fig. 14: Contact elements of PQ monitors

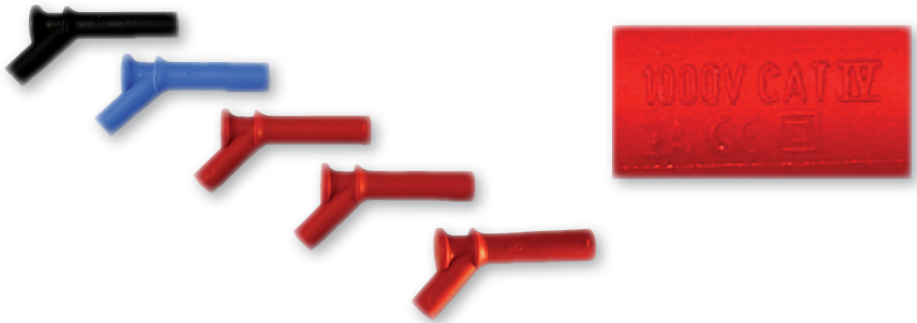
Set of alligator clips K



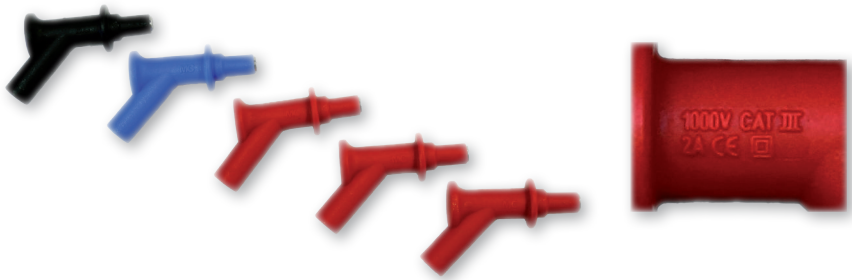
Set of grips G with fuses 10 × 38 gG, 1 A, 500 V_{AC}



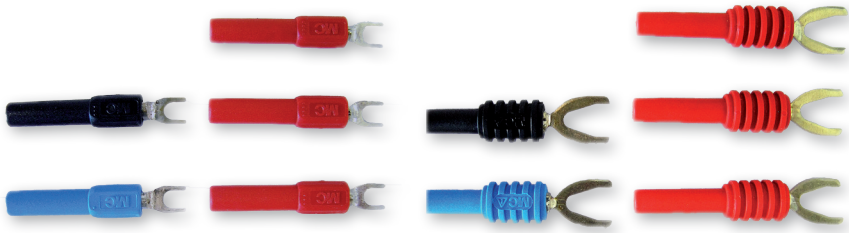
Set of magnetic contacts MK11



Set of magnetic contacts MK7



Set of open-eye contacts O4 a O8



5/ DESCRIPTION OF MEg38/C PQ MONITOR SET

Characteristics of monitor design

The MEg38/C PQ monitor unit of square shape, safety class II with indication elements and connectors on the narrow sides, in the complete set with connected connectors forms an optimal narrow profile rectangular format for space saving installation in electric cabinets.

The plastic, insulating and self-extinguishing case of the monitor unit has a magnetic holder and non-conductive surface. The surface of the set components is also non-conductive.

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

Voltage cords with double insulation with the length of 1 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 the I1, I2, I3 currents by three separated sensors and the I4 current by a separate sensor, which are of the AMOSm/38, MT/38 and TOR/38 types approved for the installation in LV cases with supply cables with the total length of 2 m, well flexible even at below-zero temperatures.

Measurement of secondary I1, I2, I3 currents of instrument transformers by three sensors and the I4 current by a separate sensor, which are of the MT1.0/38 and TORm/38 types in confined spatial conditions.

Purposely distinguished, mutually non-confusable, software-identifiable types of current sensors in the flexible design, designed as a clamp-on transformer and as a toroid sensor with SW changeover of the measuring range:

- A flexible design of AMOSm/38 sensors of safety class II for the installation on the LV level is all-insulation, water-proof, with overvoltage category CAT IV / 300 V with the standard size sensing part of 40 cm and the long size of 60 cm, the range of rated currents from 30 A to 3,000 A, and with the closure of the sensing part which enables opening with one hand. The length of the freeze-resistant supply cable is 1.8 m.
- Clamp-on transformers MT0.5/38, overvoltage category CAT IV / 300 V, for measuring in covered areas with the precision class of 0.5 for direct as well as indirect measurements of currents with the rated value of 1 A and 5 A at the LV, MV and HV levels. Clamp-on MT1.0/38 transformers, overvoltage category CAT III / 300 V,

with the precision class of 1.0 for direct as well as indirect measurements of currents with the rated value of 1 A and 5 A on insulated conductors on the LV, MV and HV levels.

- Toroid sensors TORv/38, measurement category CAT IV / 300 V for direct measurements of currents with the rated value of 10 A or 50 A in covered areas at the LV level. Toroid sensors TORm/38 with the measurement category of CAT IV / 300 V for direct as well as indirect measurements of currents in covered areas with the rated value of 1 A and 5 A on the MV and HV levels.

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

Extension of the monitor set by Z, 3Z and LV adapters, NPV and NPB voltage extensions, and K, G, O4, O8, MK7, MK11 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.

MEg38/C can be also supplied power via a USB connector. It enables loading of data and parametrization of the monitor using a computer even when the monitor is not connected to power supply.

GPS synchronisation of internal clock by means of two-directional data transmission through the LTE/GPRS service of the GSM network in the basic Class A monitor set, and optionally also in the Class S monitor. Both antennas are provided with an insulating cover and have enhanced insulation of a part of the cable.

Computing and memory space reserved for updating of measuring functions with development of voltage quality standards.

Tab. 1: Basic set and optional accessories of the MEg38/C monitor, Class A or S version

The **Class S monitor** without optional extension has the connectors and indication elements situated on one side. The **Class A monitor** is fitted on its rear side with connectors for AGPS and AGSM antennas, refer to Fig. 1.

Components of the basic set	**Identification**
PQ monitor MEg38/C unit, Class A (the basic set includes the GPS and GPRS/LTE functions and the AGPS/2.5 m/5 dB antenna)	MEg38/C cl. A
PQ monitor MEg38/C unit, Class S [1)]	MEg38/C cl. S
Communication cable USBmini/EMC / 2 m [2)]	USB/2m
LV adapter for measuring in a LV socket	NN
Set of alligator clips (3 pcs red, 1 pc blue, 1 pc black)	K
Transport case with lining	B/38
CD with a user manual, descriptions of the PQ_MEg user software and the Data Viewer DVMEg user software, the calibration certificate	CD/38

Components of optional accessories	**Identification**
GPS and GPRS/LTE functions [3)]	FGP/38
Antenna AGPS/10 m	AGPS/10m
Antenna AGPS/2.5 m [4)]	AGPS/2,5m
Antenna AGSM/2.5 m/5 dB [4)]	AGSM/5dB
Antenna AGSM/2.5 m/9 dB [4)]	AGSM/9dB
Three flexible current sensors 3AMOSm/standard/38, I1-I2-I3, sensor length 40 cm, clearance 12 cm (30 A, 100 A, 300 A, 1 000 A, 3 000 A)	3AMOSm/ standard/38
Flexible current sensor AMOSm/standard/38, I4, sensor length 40 cm, clearance 12 cm (30 A, 100 A, 300 A, 1 000 A, 3 000 A)	AMOSm/standard/38
Three flexible current sensors 3AMOSm/long/38, I1-I2-I3, sensor length 60 cm, clearance 18 cm (1 000 A, 3 000 A)	3AMOSm/ long/38
Flexible current sensor AMOSm/long/38, I4, sensor length 60 cm, clearance 18 cm (1 000 A, 3 000 A)	AMOSm/ long/38

Components of optional accessories	Identification
Three clamp-on current transformers 3MT0.5/38, I1-I2-I3, precision class 0.5 (1 A, 5 A)	3MT0,5/38
Clamp-on current transformer MT0.5/38, I4, precision class 0.5 (1 A, 5 A)	MT0,5/38
Three clamp-on current transformers 3MT1.0/38, I1-I2-I3, precision class 1.0 (1 A, 5 A)	3MT1,0/38
Clamp-on current transformer MT1.0/38, I4, precision class 1.0 (1 A, 5 A)	MT1,0/38
Three toroid sensors 3TORv/38, I1-I2-I3 (10 A, 50 A) [4]	3TORv/38
Toroid sensor TORv/38, I4 (10 A, 50 A) [4]	TORv/38
Three toroid sensors 3TORm/38, I1-I2-I3 (1 A, 5 A) [4]	3TORm/38
Toroid sensor TORm/38, I4 (1 A, 5 A) [4]	TORm/38
Single-phase load adapter Z	Z
Three-phase load adapter 3Z	3Z
Set of CATIII grips with fuses (3 pcs red, 1 pc blue, 1 pc černý)	G
Set of magnetic contacts ø 7 mm, L 10 mm, (3 pcs red, 1 pc blue, 1 pc black)	MK7
Set of magnetic contacts ø 11 mm, L 35 mm, (3 pcs red, 1 pc blue, 1 pc black)	MK11
Set of open-eye contacts, ø 8 mm, (3 pcs red, 1 pc blue, 1 pc black)	O8
Set of open-eye contacts, ø 4 mm, (3 pcs red, 1 pc blue, 1 pc black)	O4
Three-phase voltage 2 m extension with banana plugs [4]	NPB
Three-phase voltage 2 m extension with free ends [4]	NPV
Electrical assembly SW (a circuit breaker value, a compensation capacity value)	EMSW/38
Leather transport case	T/38

[1] GPS and GPRS/LTE functions can be ordered as options
[2] The cable can be ordered with a length up to 5 m
[3] GPS and GPRS/LTE functions in the GSM network require the use of corresponding antennas
[4] It can be ordered with a cable up to 10 m long.

Tab. 2: Overvoltage categories of components of the MEg38/C set

Current sensors and contact elements	**Field of application**
Clamp-on transformer MT0.5/38	CAT IV / 300 V
Clamp-on transformer MT1.0/38	CAT III / 300 V
Flexible sensor AMOSm/standard/38	CAT IV / 300 V
Flexible sensor AMOSm/long/38	CAT IV / 300 V
Toroid sensor TORv/38	CAT IV / 300 V
Toroid sensor TORm/38	CAT IV / 300 V
Antenna AGPS/10 m	CAT II, first 2 m of red antenna cable CAT IV / 300 V
Antenna AGPS/2.5 m	CATII, 2.5 m of a red cable of the antenna CAT IV / 300 V
Antenna AGSM/2.5 m/5 dB	CAT IV / 300 V
Antenna AGSM/2.5 m/9 dB	CAT IV / 300 V
Alligator clips K	CAT II / 1000 V
Open-eye contacts O8, O4	CAT II / 1000 V
Grips with fuses G	CAT III / 1000 V
Magnetic contacts MK7, MK11	CAT III / 1000 V
Load adapter Z	CAT II / 250 V
Load adapter 3Z	CAT II / 415 V
LV adapter	CAT II / 600 V
NPB and NPV voltage extensions	CAT II / 600 V

Tab. 3: Water-tightness of components of the MEg38/C set

Name	**Protection**
MEg38/C unit cl.A and cl.S	IP 65
Flexible current sensors of the type AMOSm/standard/38, AMOSm/long/38	IP 65
Clamp-on transformers of the MT/0.5/38, MT/1.0/38 type	IP 40 closed jaws IP 30 open jaws
TORv/38, TORm/38 toroid sensors	IP 40
Antennas AGPS/10 m, AGPS/2.5 m	IP 23
Antennas AGSM/2.5 m/5 dB and AGSM/2.5 m/9 dB	IP 63
Load adapters type Z, 3Z	IP 20
LV adapter	IP 20
Voltage extensions with NPB, NPV banana plugs	IP 20
Alligator clips K, grips G and magnetic contacts MK7, MK11	IP 20

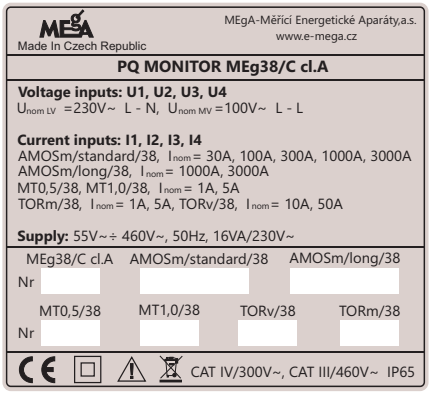
Tab. 4: User elements, refer to Fig. 1

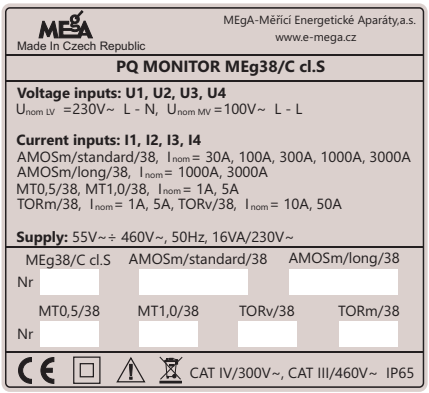
Item	Name	Description
1	Voltage inputs with supply	Fixedly connected measuring cords U1, U2, U3, U4 and N with the length of 1 m ending with banana plugs CAT IV / 300 V which are also the supply cords. Maximum voltage between the N and U1, U2, U3, U4 supply cords is 460 V_{AC}
2	Connector of current inputs I1, I2, I3	The connector for connecting three current sensors I1, I2, I3. Current sensors can be flexible 3AMOSm/standard/38 and 3AMOSm/long/38, refer to Fig. 2 and Fig. 3, or clamp-on transformers 3MT0.5/38 and 3MT1.0/38, refer to Fig. 4 and Fig. 5, or toroid sensors 3TORv/38 and 3TORm/38, refer to Fig. 6 and Fig. 7. Automatic identification of the connected type of sensors during parametrisation of the measurement. An identical type of sensors (SW check distinguishes between 3AMOSm/standard/38, 3AMOSm/long/38, MT0.5/38, MT1.0/38, TORv/38 and TORm/38) must be used on current inputs I1, I2, I3 and I4 of the monitor. An identical value of the rated current can only be set on current inputs I1, I2, I3 by the programme: (30 A, 100 A, 300 A, 1000 A, 3000 A) for AMOSm/standard/38, (1000 A, 3000 A) for AMOSm/long/38, (10 A, 50 A) for TORv/38, (1 A, 5 A) × current transformer ratio for TORm/38, (1 A, 5 A) × current transformer ratio for MT0,5/38 and MT1,0/38. The set nominal value of current of sensors on inputs I1, I2 and I3 must be identical with the rated value of the current set on input I4.

Item	Name	Description
3	Connector of I4 current input	Connector for connecting I4 current sensor The current sensor can be flexible AMOSm/standard/38 and AMOSm/long/38, or clamp-on transformer MT0.5/38 or MT1.0/38, or toroid sensor TORv/38 or TORm/38. Automatic identification of the connected type of sensor during parametrisation of the measurement. An identical type of sensors (SW check distinguishes between AMOSm/standard/38, AMOSm/long/38, MT0.5/38, MT1.0/38, TORv/38 and TORm/38) must be used on current inputs I1, I2, I3 and I4. The software can set the following values of the rated current: (30 A, 100 A, 300 A, 1000 A, 3000 A) for AMOSm/standard/38, (1000 A, 3000 A) for AMOSm/long/38, (10 A, 50 A) for TORv/38, (1 A, 5 A) × current transformer ratio for TORm/38, (1 A, 5 A) × current transformer ratio for MT0,5/38 and MT1,0/38. The set rated value of current of the sensor at input I4 need not be identical with the rated value of currents of sensors at inputs I1, I2, I3.
4	Mini USB connector	Connector of galvanically separated communication USB 2.0 / 3 Mbit/s
5	Connector of the AGPS antenna	Connector for connecting the AGPS antenna/2.5 m or AGPS/10 m enabling time signal synchronisation of Class A monitors. In the case of Class S monitors, the function of time synchronization by GPS signal is optional.
6	Connector of the AGSM antenna	A connector for connecting the AGSM antenna enabling remote transfer of measured data and remote parametrisation of measurements of Class A monitors. In the case of Class S monitors, the function of remote data transmission and parametrization of measurements is optional.

Item	Name	Description
7	Status of the RUN LED	Briefly interrupted illumination – the monitor measures according to the programmed parametrisation 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. Alternating lighting 1 : 1 – oscillographic record.
8	Status of LEDs U1, U2, U3, U4	Signalisation of voltage status on inputs U1, U2, U3 and U4 by lighting LEDs during the measurement at the LV level (star connection) or voltage differences U1-U2, U2-U3, U3-U1 during the measurement at the MV level (delta connection). Lighting: permanent illumination – the voltage is in the pre-set tolerance band (0.9 U_n to 1.1 U_n), repeated one flash – voltage is in a preset interruption band repeated two flashes – voltage is in a preset drop band repeated three flashes – voltage is in a preset increase band.

Fig. 15: Performance labels of the PQ monitor MEg38/C Class A and Class S





Legend to the rating plate

The rating plate of the monitor, see Fig. 15, is situated on the rear side of the monitor. In addition to manufacturer's identification data and monitor marking it contains basic information on voltage and current inputs.

Voltage inputs:

On the LV level, voltage U1, U2, U3 and U4 is measured against input N, the rated value is 230 V_{AC}.

At the MV level, delta voltages U1-U2, U2-U3 a U3-U1 with the rated value of 100 V are measured, voltage U4 is measured against input N with the rated value of 100/√3 V.

Measurement at the LV or MV level is selected during parametrisation of the measurement.

Measured voltages are at the same time supply voltages. The maximum voltage value at inputs U1, U2, U3 and U4 against N is 460 V_{AC}.

Current inputs:

Flexible current sensors AMOSm/standard/38 with the rated value of 30 A, 100 A, 300 A, 1,000 A and 3,000 A or AMOSm/long/38 with rated values of 1,000 A and 3,000 A, or toroid sensors TORv/38 with the rated value of 10 A, 50 A or toroid sensors TORm/38 with the rated value of 1 A, 5 A are usually connected to current inputs I1, I2, I3 a I4 in LV networks. It is also possible to use clamp-on transformers MT0.5/38 or MT1.0/38 (CATIII) with the rated values of 1 A or 5 A.

Clamp-on transformers MT1.0/38 or more precise MT0.5/38 are intended for measurement of currents in secondary circuits of instrument transformers with the ratio and rated value of 1 A and 5 A. Toroid sensors TORm/38 can be used.

Connecting cables of AGPS and AGSM antennas are marked close to the connectors with a serial number of the MEg38/C unit with which they have been completed.

6/ CONNECTION FOR MEASUREMENT

When the monitor is installed in LV networks, voltage is measured directly and currents can be measured directly or indirectly via the sensors.

In MV and HV grids, voltage and current is measured indirectly through instrument measuring transformers with defined ratios.

If unused voltage inputs are left unconnected, their voltage is not defined due to their high input resistance and to the connection of the monitor voltage channels.

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 zero voltage.

The monitor is supplied from the measured voltages. If the instrument voltage transformer has the output higher or equal to 30 VA, the measurement is not influenced due to its loading.

During measurement at the MV level and unused voltage input U4 it is recommended to lead supply alternating voltage of 230 V_{AC} or supply direct-current voltage of 220 V_{DC} or 110 V_{DC} to this input.

During measurement at the LV level the monitor set includes the single-phase Z and three-phase 3Z load adapter, which can be used for measuring the parameters of a single-phase or a three-phase device including harmonic and oscillographic records at switching on/off. The LV adapter can also be used for measuring phase voltage at a LV single-phase socket.

SW automatically identifies types of sensors AMOSm/standard/MEg38, AMOSm/long/MEg38, MT0,5/38, MT1,0/38, TORv/38 and TORm/38 . The identification is carried out at the start of measurement and at the recovery of measuring after a failure of supply, therefore types of installed sensors must not be changed during measurement.

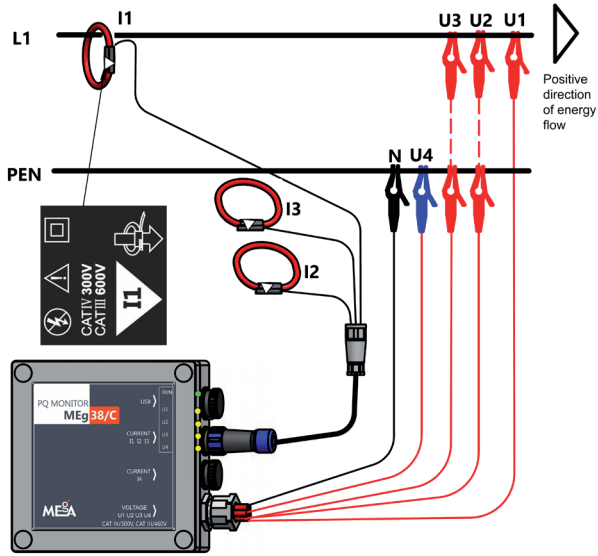
To measure currents I1, I2, I3 and the current I4, current sensors of the same type can be used, see Table 5. All types of current sensors can be used for measurement on the LV level, while the clamp-on MT1.0/38 transformers can be used in the CAT III / 300 V environment only.

Sensors MT0.5/38, MT1.0/38 and TORm/38 are intended for the MV level and indirect measuring in secondary circuits of current transformers as well as for the LV level.

Tab. 5: Permitted connections of types of sensors

Connections of types of sensors		Input I1, I2 , I3					
		AMOSm /standard/38	AMOSm /long/38	MT 0,5/38	MT 1,0/38	TORv /38	TORm /38
Input I4	AMOSm /standard/38	YES	NO	NO	NO	NO	NO
	AMOSm /long/38	NO	YES	NO	NO	NO	NO
	MT0,5/38	NO	NO	YES	NO	NO	NO
	MT1,0/ MEg38	NO	NO	NO	YES	NO	NO
	TORv/38	NO	NO	NO	NO	YES	NO
	TORm/38	NO	NO	NO	NO	NO	YES

Fig. 16: Single-phase measurement of voltage and current by a 3AMOSm/38 type sensor in LV grid



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 PEN conductor and then they measure the zero voltage.

Fig. 17: Single-phase measurement of voltage and direct measurement of current by 3MT/38 type clamp-on transformer in LV grid. (The 3MT1.0/38 clamp-on transformer can only be used in the CATIII/300V environment).

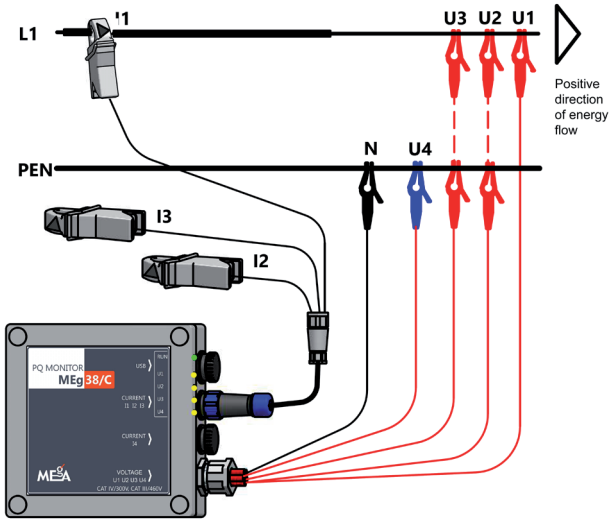


Fig. 18: Single-phase measurement of voltage and direct measurement of current by TOR/38 toroid sensor in LV grid

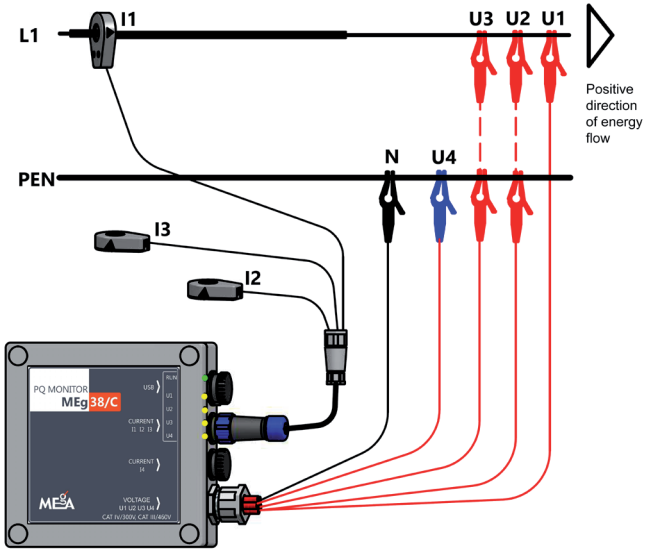


Fig. 19: Single-phase measurement of voltage and current and measurement of voltage of the middle conductor against ground and current of the middle conductor in the LV network

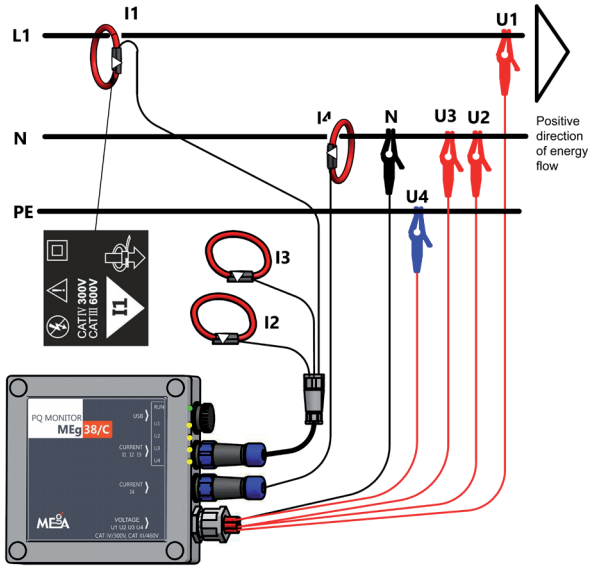


Fig. 20: Measurement of three-phase voltage and three-phase current by 3AMOSm/38 sensors in LV grid

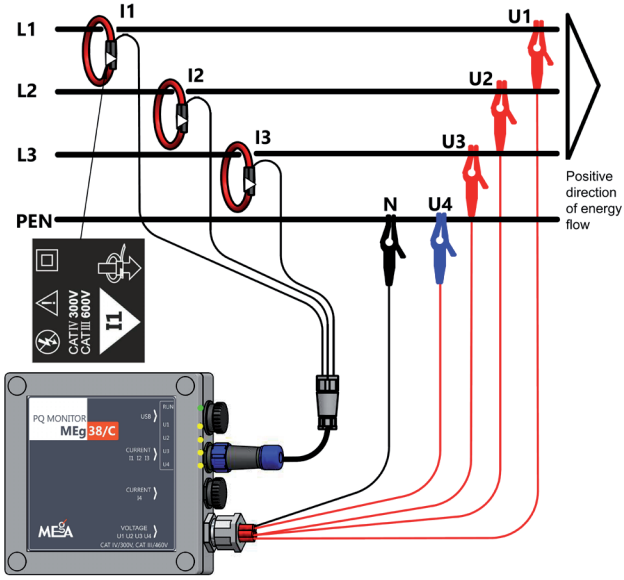


Fig. 21: Measurement of three-phase voltage and voltage between the middle conductor and the ground, measurement of three-phase currents and the current of the middle conductor by 3AMOSm/38 type sensors LV grid

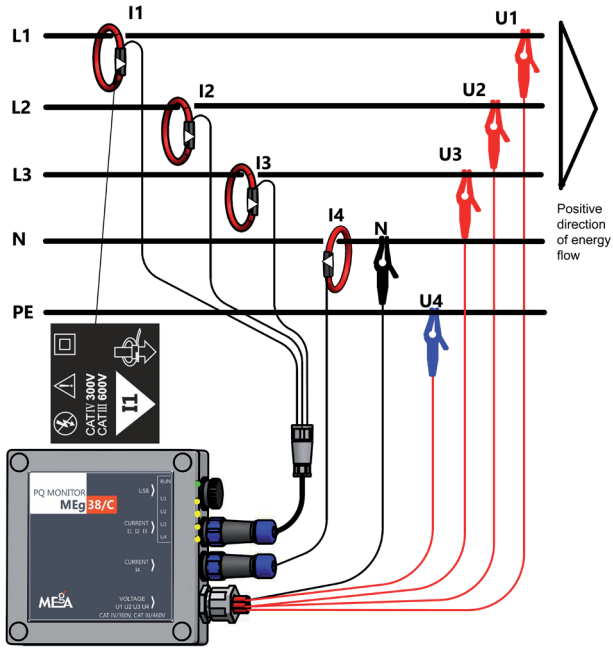


Fig. 22: Measurement of three-phase voltage and direct measurement of three-phase current by 3MT/38 clamp-on transformers in LV grid

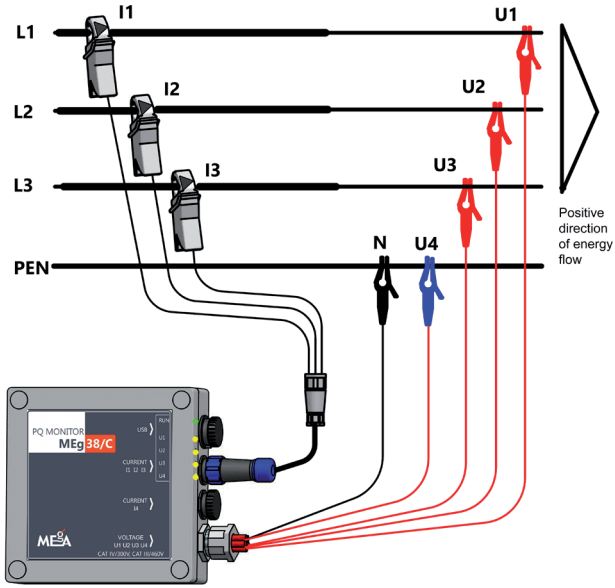


Fig. 23: Measurement of three-phase voltage and direct measurement of three-phase current by 3TOR/38 toroid sensors in LV grid

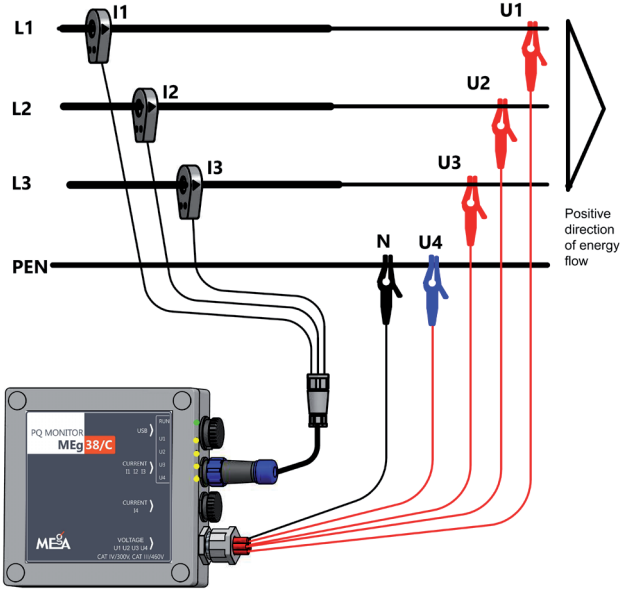


Fig. 24: Single-phase measurement of voltage in a LV socket

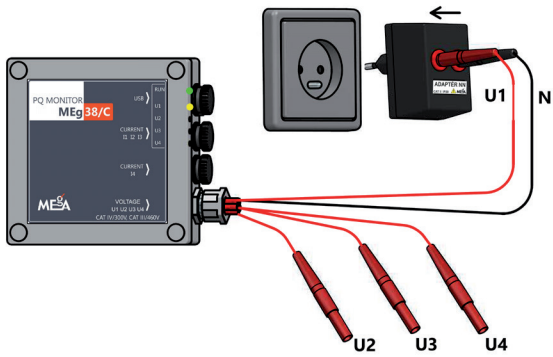


Fig. 25: Measurement of phase voltage, middle conductor voltage against ground and phase current of a single-phase appliance in LV grid by single-phase load adapter Z with clamp-on transformers MT0.5/ 38 and MT1.0/38

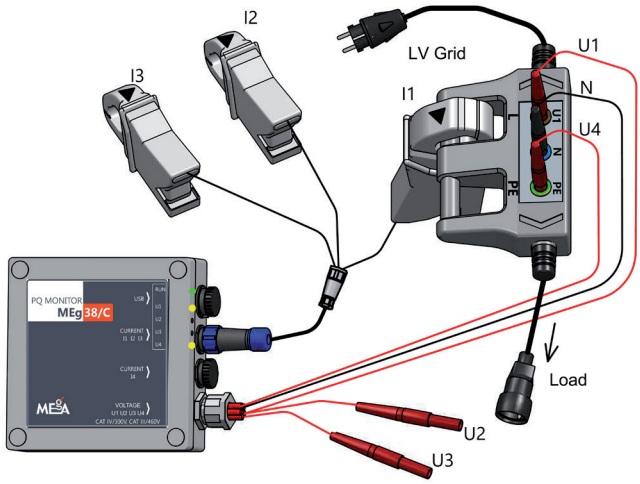


Fig. 26: Measurement of phase voltages, middle conductor voltage against ground and measurement of phase currents of a three-phase appliance in LV grid by three-phase load adapter 3Z with flexible sensors of the 3AMOSm/38 and AMOSm/38 type

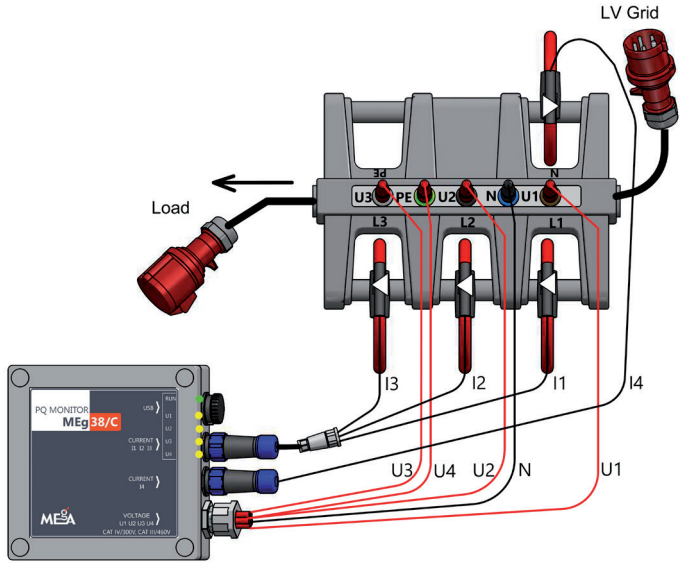


Fig. 27: Three-phase measurement of delta voltages and phase currents by clamp-on transformers 3MT0.5/38 or 3MT1.0/38 in MV and HV networks with the grounded centre

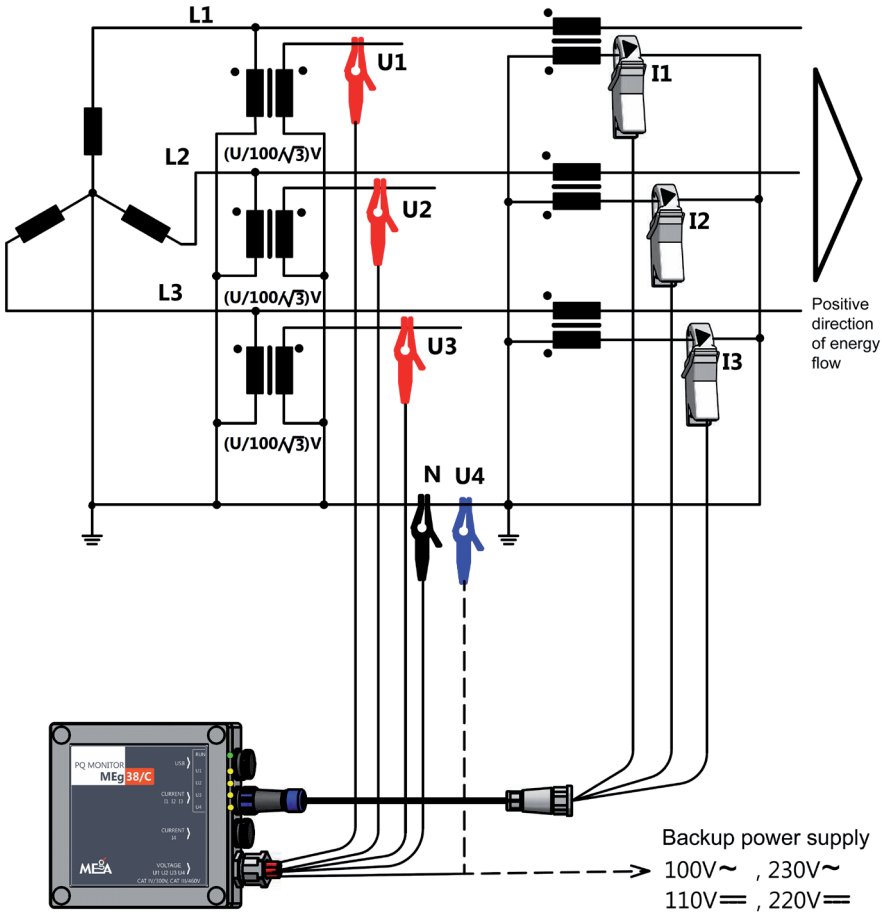


Fig. 28: Three-phase measurement of delta voltages and phase currents by toroid sensors 3TORm/38 in MV and HV networks with the grounded centre

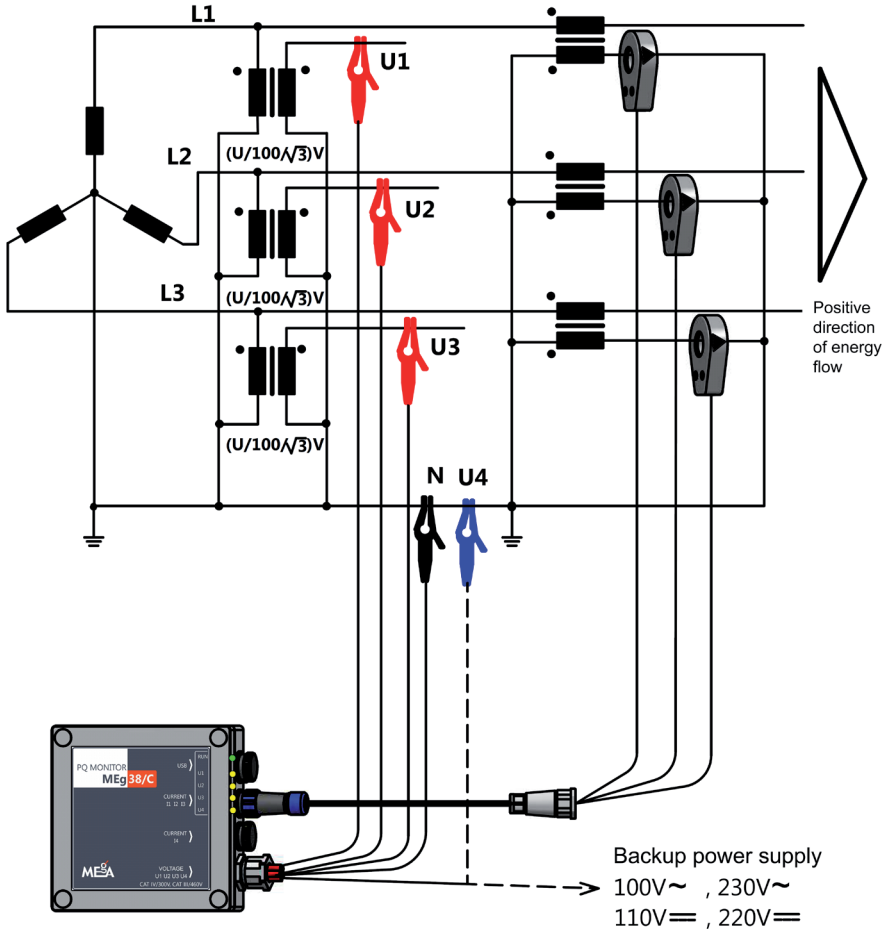


Fig. 29: Measurement of delta voltages, voltage U0, phase currents by clamp-on transformers 3MT0.5/38 or 3MT1.0/38 and current I0 by clamp-on transformers MT0.5/38 or MT1.0/38 in compensated MV grid

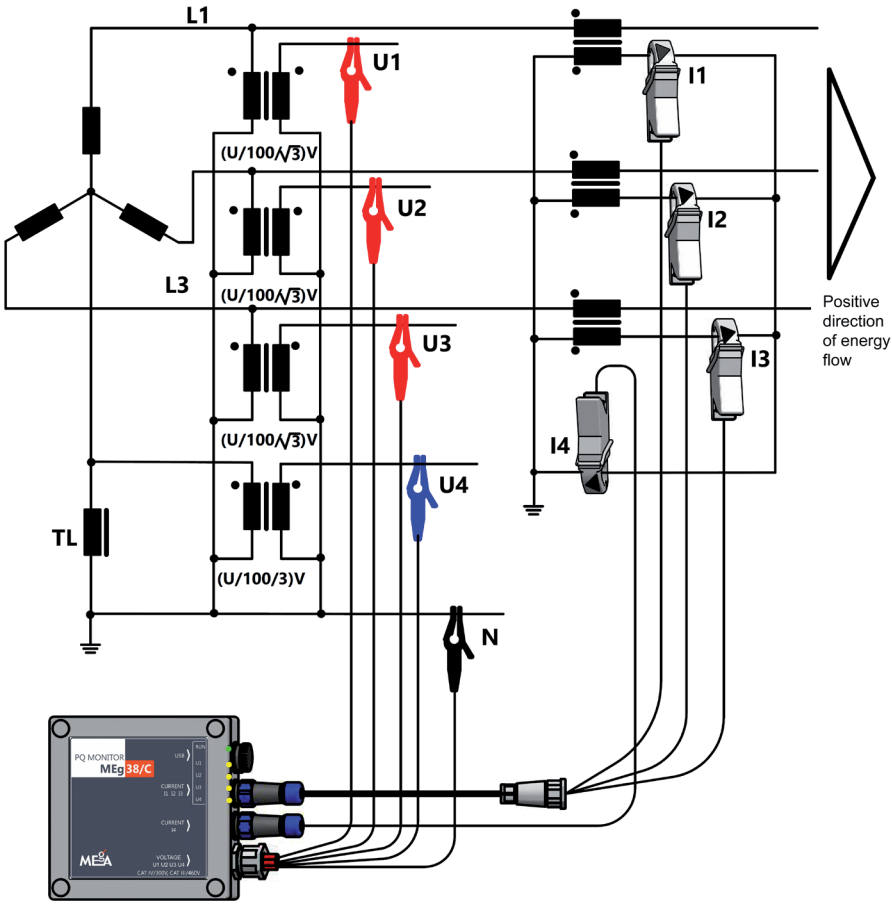
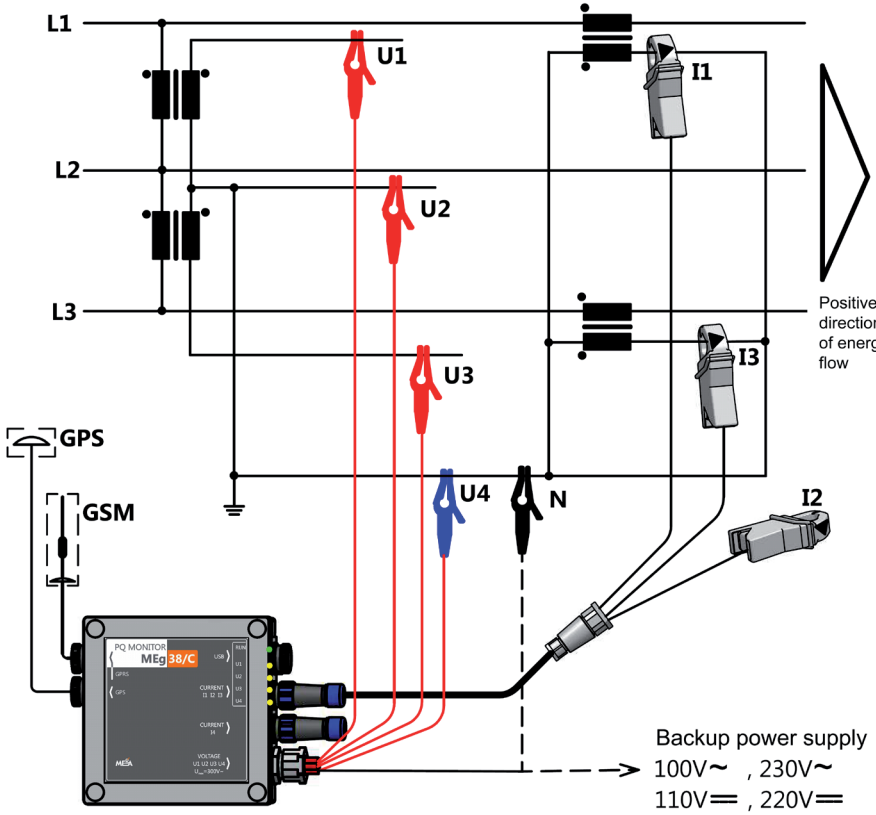


Fig. 30: Measurement in Aron connection by the MEg38/C monitor on the MV level with connected GPRS/LTE communication through GPRS network and GPS time synchronisation



7/ SAFETY INFORMATION

- **Pay utmost attention 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

- **Warning, the operator installing current sensors on live parts must be equipped with personal protective equipment and additional safety devices and use them during the installation.**
- **When the PQ monitor MEg38/C is used in a different way than it is specified by the manufacturer, the protection provided by the PQ monitor MEg38/C can be impaired.**
- The operator performing installation and disassembly of the components of the PQ monitor set must be qualified for work on or near to dangerous voltages. The operator must also be trained in providing 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 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.
- During local parametrisation or reading of data the operator shall protect the monitor from water.

- 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.
- Load adapters, voltage extensions and LV adapter may only be used in covered areas without the effect of water and condensing 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 measured circuits.
- Current sensor of AMOSm/38, MT/38 and TOR/38 types may only be installed on insulated parts of conductors.
- Current sensors may only be installed in circuits with overvoltage category prescribed in Table 2.
- When installing the monitor with the attached AGPS antenna to a LV case with the overvoltage category of CAT IV, only its cable with doubled red insulation with the length of 2 m can be placed in the case.

⚠ **Caution**

- 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 loading of data through a USB communication cable, the operator shall protect the monitor against the effect of water.

Explanation of symbols used in the user manual and in the specifications of components of the PQ monitor MEg38/C 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 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 low-voltage 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 the enclosure


The product is intended for recycling and collection points


Declaration of Conformity – European Community

8/ ASSEMBLY OF THE MONITOR SET, PREPARATION FOR MEASUREMENT

- The PQ monitor MEg38/C set is calibrated with current sensors whose serial numbers are specified on the performance label situated on the rear side of the device. The measurement preciseness specified in technical conditions is only ensured in this set.
- 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
- It is recommended not to unnecessarily expose the monitor and current sensors AMOSm/38 to the effect of water and condensing humidity
- When clamp-on current transformers MT0.5/38 and MT1.0/38 as well as toroid sensors TORv/38 and TORm/38, NPV and NBV voltage extensions and AGPS and AGSM antennas, load adapters Z and 3Z and LV adapter are used, the operator of the monitor shall take other measures to ensure protection against the effect of water on the mentioned sensing parts
- Unless currents are measured, unused current connectors are properly covered with connected connector housings
- 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 contacts MK7 and MK11 can only be installed to switched-off voltage circuits with zero voltage
- During measurement of voltage by means of adapters or voltage extensions voltage cords U1 through U4 and of N monitor are inserted to the marked safety slots. In other cases, either alligator clips or grips with fuses or magnetic contacts are installed on voltage cords and connected to the earthing system
- To measure currents, identical types of current sensors are connected to the current connector I1, I2, I3 and/or to the current connector I4, namely either flexible sensors AMOSm/standard/38 or AMOSm/long/38 or clamp-on transformers MT0.5/38 or MT1.0/38 or toroid sensors TORv/38 or TORm/ 38, refer to Table 5. Nuts of connectors or housings shall be properly tightened.
- Flexible current sensors of the AMOSm/standard/38 type with the rated value of 30 A, 100 A, 300 A, 1,000 A and 3,000 A or the AMOSm/long/38 type with the rated values of 1,000 A and 3,000 A, or clamp-on transformers MT0.5/38 or MT1.0/38 with the rated value of 1 A and 5 A, or toroids TORv/38 with the rated value of 10 A and 50 A or toroids TORm/38 with the rated value of 1 A and 5 A are usually

connected to current inputs I1, I2, I3 and I4 in LV grids. The clamp-on MT1.0/38 transformers can only be used in buildings.

- During parametrisation of measurement and reading of measured data via a communication cable with USBmini/EMC the operator shall also ensure protection against to the effect of water on the connector in a different manner.
- A communication cable with USBmini/EMC is connected to the open communication connector USB of the monitor, the other end of which is connected to the USB connected of PC with the started PQ MEg parametrisation software according to the under manual in its user description [1].
- When connecting AGPS and AGSM 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 water-tightness.
- Corresponding antennas according to Fig. 30 are connected to GSM and GPS connectors on the Class A PQ monitor MEg38/C and the extended Class S PQ monitor MEg38/C. Be careful not to confuse antennas!
- AGPS and AGSM antennas are preferably installed outside the LV case. Be careful not to confuse AGPS and AGSM antennas when connecting them to the monitor unit.
- The AGSM S antenna and the red part of the AGPS cable 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.

Warning!

- In case of a mechanical damage to the monitor or its measuring cords, the monitor must be immediately dismounted and sent for repair
- In case of a mechanical damage even to the top layer of the insulation of the sensing part of the flexible sensor AMOSm/38, which can manifest in a contrast change in colour of the sensing part surface, the sensor must be immediately dismounted and sent for repair

.

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

The operating voltage range at least on a single input is from 52 V_{AC} to 460 V_{AC}.

1. Voltage cords N and then U1, and potentially U4, are connected to the measured voltages according to the measuring connection as in Fig. 16 through Fig. 30. Alligator clips, magnetic contacts, open-eye contacts, adapters or voltage extensions are used as necessary.
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 the measured current must be free of voltage during installation.

   a) A flexible element of the loop closure of flexible sensor AMOSm/standard/38 or AMOSm/long/38 is deflected away from the sensor axis, resulting in releasing the free end of the loop closure from the socket, and the loop is then coiled around the conductor with measured current, and the free end is inserted back into the socket. 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.

   b) Clamp-on transformers MT0.5/38 and MT1.0/38 are opened by pressing the marked end behind the safety barrier and slid on the conductor with measured current

   c) When toroid sensors TORv/38 and TORm/38 are installed, the circuit with measured current is disconnected from voltage first and then opened at the place of measurement. A toroid sensor is slid on the free conductor, and the circuit is closed and then connected to voltage.

   Warning! Before disconnecting the secondary circuit of the instrument measuring transformer the terminals of the measuring transformer must be short circuited first.

6. The AGPS/10 m antenna and/or AGPS/2.5 m antenna is extended to its required length (max. 10 m) and positioned onto a horizontal surface with direct visibility of the sky. Only a part of the red marked cable can be placed in the LV case.

7. The cable of the AGSM antenna in the basic configuration with the length of 2.5 m is unwound to the necessary length; the remaining part of the cable is wound up and fixed with a Velcro. The antenna is placed to the space with sufficient GSM signal intensity in the vertical position. When installation is made in an all-metal case, the antenna should be installed outside of the case, e.g. in a plastic inlet tube. In this case, it is possible to remove the magnetic base from the antenna and fix the antenna vertically by binding strips.

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 a USBmini/EMC cable, on the last right tab of the window, refer to Fig. 31. Captions of all window tabs are in bold.

   In case of the started **SW PQ** software and unconnected or incorrectly connected monitor, a window with an empty field is shown on the PC, which confirms the communication and tab.

9. 9. The bold "**MEg Set-up**" tab is opened and depending on the measuring connection a single-phase or three-phase measurement, a voltage level, the type of current sensors and rated values are selected and/or also the conversion ratio of current sensors including other measurement parameters.

   An example of single-phase measurement parametrization on LV level with flexible sensors AMOSm/MEg38 is shown in Fig. 33.

   An example of three-phase measurement parametrization on LV level with a clamp-on transformer MT0.5/38 is shown in Fig. 34.

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 parametrisation 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. 35.

    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. 36.

    Warning! When measuring delta voltages and phase currents at the MV level, there is a phase shift of about 30° between voltage and current. The same need not apply to current I4.

12. The GSM and GPS pictograms are displayed in the main window of the PQ_MEg program, refer to Fig. 37.

    Meaning of pictograms and working with them:

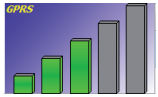
    The device does not support the functions of GSM network data transmission and GPS synchronization.

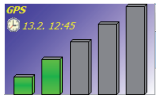
    The device supports the function of GSM network data transmission, but it does not support the function of GPS synchronization.

    The device does not support the function of GSM network data transmission, but it supports the function of GPS synchronization.

    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 pictured 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 MEG38/C monitor supplied from the internal battery with the connected AGPS antenna to areas with sufficient GPS signal and have the internal clock of the monitor synchronized. If time synchronization does not occur in a preset interval (1, 2 or 3 minutes), it is necessary to ensure the monitor power supply either from PC via USB or from the power grid. After time synchronization, the MEg38/C monitor supplied power 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 synchronised at least at the beginning of measurement.

Fig. 31: Main window of the PQ_MEg program when the communication with MEg38/C is established

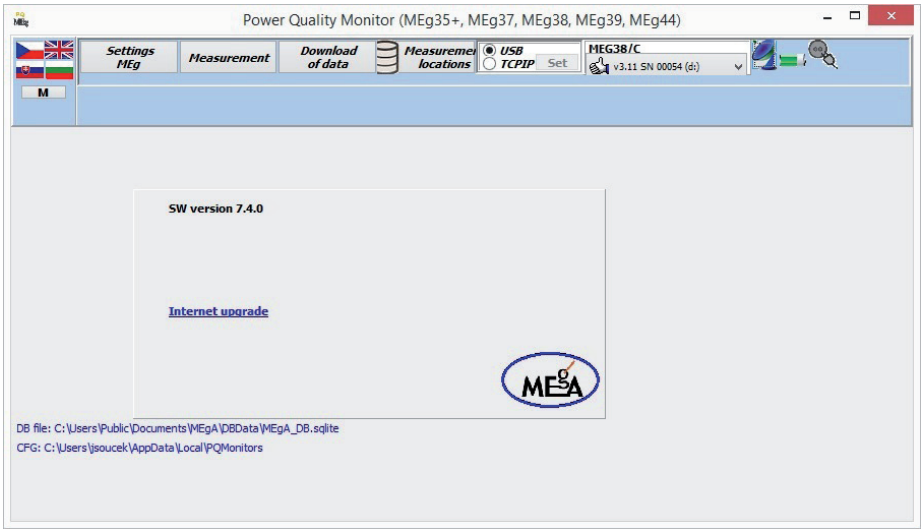


Fig. 32: Main window of the PQ_MEg program when the communication with MEg38/C is not established

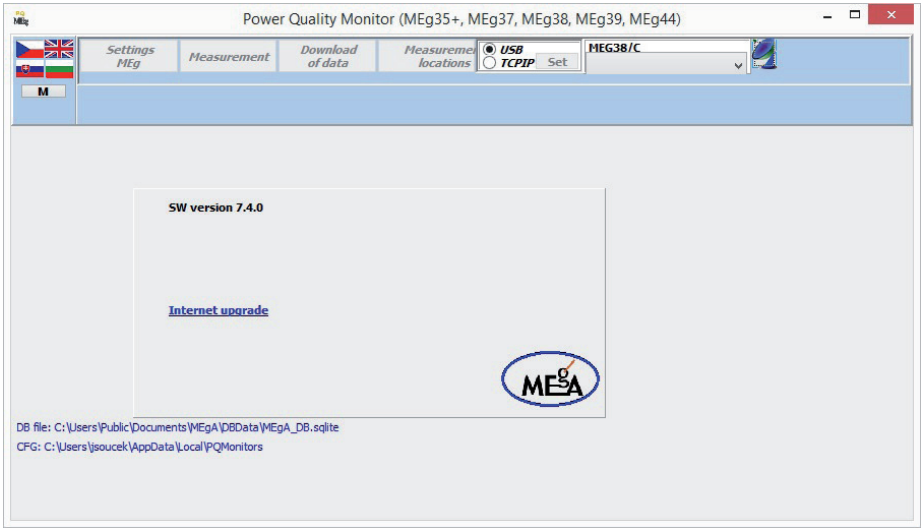


Fig. 33: Parametrisation of a single-phase measurement in LV grid with flexible sensors AMOSm/standard/38

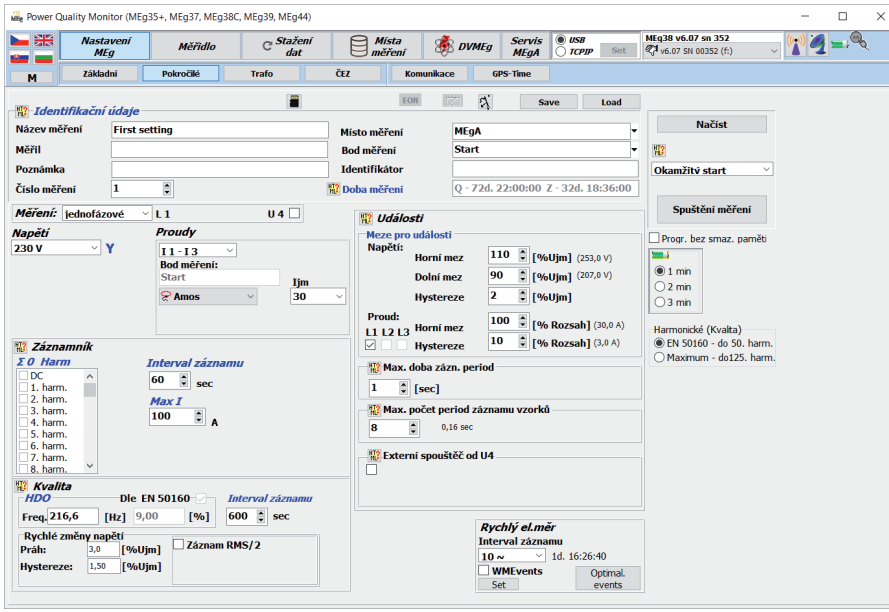


Fig. 34: Parametrisation of a three-phase measurement in LV grid clamp-on transformers MT/0.5/38

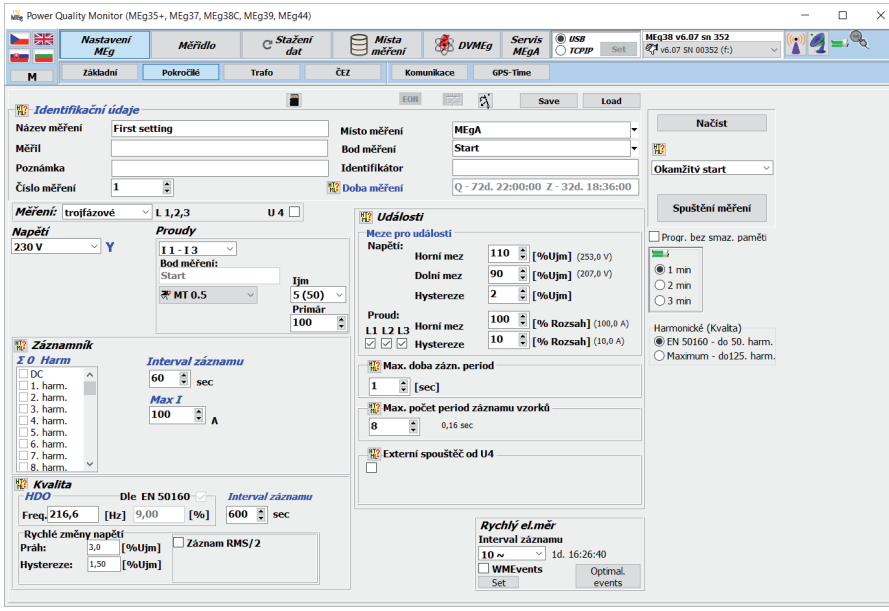
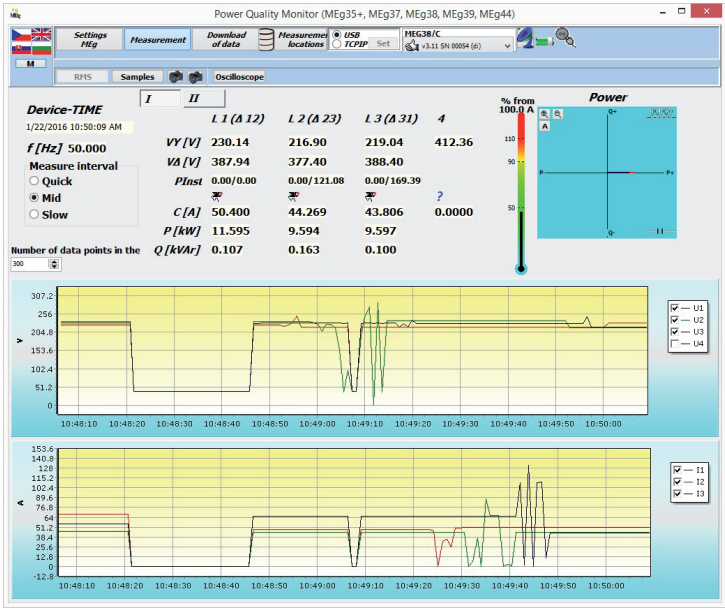


Fig. 35: Measuring and check of connected quantities, the course of efficient values



Obr. 36: Measuring and check of connected quantities, oscillographic courses and FFT

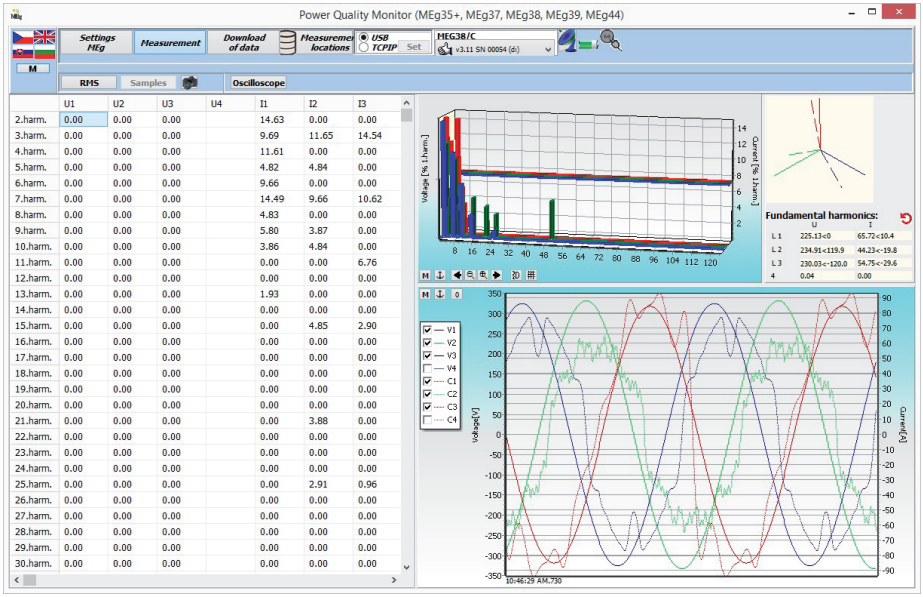


Fig. 37: Example of a main window with the information about GPS and GSM signal intensities

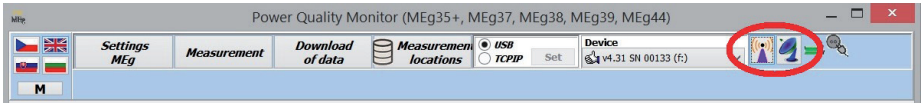
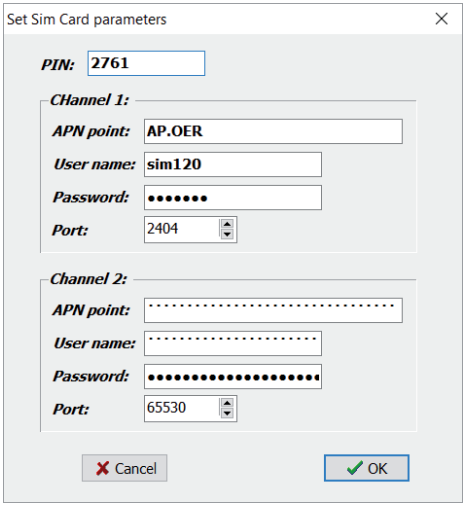
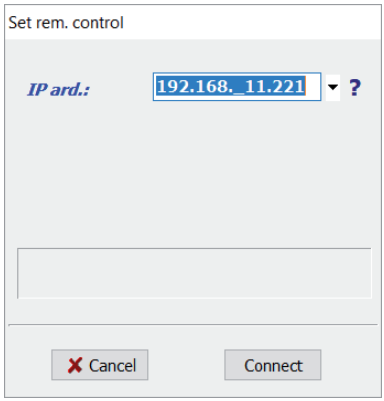


Fig. 38: Setting the sim card parameters SetSimKarty and setting for remote communication





10/ MAINTENANCE

⚠ Caution

- Repairs of the MEg38/C PQ 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. Contact information of the manufacturer's service is provided at www.e-mega.cz
- The monitor may not be exposed to chemicals.
- The monitor must only be transported in original transport bags and cases supplied by the manufacturer.
- Recalibration of Class A MEg38/C PQ monitors shall be conducted after every 2 years and Class S MEg38/C PQ monitors after every 3 years from the date of sale or the latest 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.

11/ BATTERIES

The following batteries are used in the monitor:

- type CR2032 lithium battery for the clock circuit
- Ni-Mh battery, type 8×V200H, to ensure measurement at power supply failure

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

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

12/ DISPOSAL

Po ukončení užívání monitoru je nutné nechat monitor recyklovat ve sběrnách odpadu dle pravidel nakládání s elektronickým odpadem.

13/ WARRANTY

The MEg38/C PQ 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 its service organization.

The warranty becomes invalid even during the warranty period if the user carries out unauthorized modifications or changes on the MEg38/C monitor, 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.

14/ TECHNICAL PARAMETERS

General information

Measurement uncertainties apply to the reference conditions,

The development and production of the monitor is in compliance with standards ISO 9001:2001 and ISO 14001:2005, OHSAS 18001:2008, ISO/IEC 27001:2014.

Reference conditions

Temperature of environment:	23 °C ± 2 K
Relative humidity:	40 % – 60 % RH
Frequency:	50 Hz ± 2 %
Voltage asymmetry:	≤ 0.1 %
External magnetic field:	≤ 40 A_{DC} / m ≤ 3 A_{SS}, 50Hz / m
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.

Operating conditions

Operating temperature:	-20 °C to +55 °C
Stabilisation period:	10 minutes after start-up
Relative humidity:	5 % to 95 %, non-condensing
Pollution degree:	2
Altitude:	up to 2000 m above sea level

Device is designed for indoor use.

Storage

Storage temperature:	-30 °C to +70 °C

Protection against the effect of water and chemicals.

Protection against long-term effect of UV radiation.

Design data

Dimensions – with GPS a GSM: 167 × 130 × 35 mm, with connectors 195 × 130 × 35 mm
– without GPS a GSM: 152 × 130 × 35 mm, with connectors 180 × 130 × 35 mm

Weight: 0.7 kg without GPS and GSM, 0.8 kg with GPS and GSM

Length of voltage supply cables: 1 m

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

Protection: IP65 according to EN 60 529

Mechanical protection: IK06

Overvoltage category: CAT IV / 300 V,
CAT III / 460 V according to EN 61010-2-030

Safety class: II, reinforced insulation

Magnetic fixing of MEg38/C unit.

Function of remote communication through GSM network

Sim card communication interface.

Remote communication through mobile GSM network using the GPRS, 3G, 4G(LTE) modes.

The lowest supported mode of communication through mobile network GPRS mode is in Class B. Other supported modes include 3G and 4G (LTE).

The code scheme is CS1 to CS4.

Also, time synchronization from a superior system using the NTP protocol is supported in both variants of MEg38/C, Class S and Class A.

The MEg38/C monitor features automatic restart of the communication unit in the case of a loss of communication with the superior system. A loss of communication with a superior system is defined as a communication outage for a preset period ranging from 1 minute to 1 day and with the resolution of 1 s. Remote GSM communication supports static routing of TCP/IPv4 as well as dynamic routing protocols.

The Firewall function utilizes status packets and remote management of rules and settings.

VPN supports the secured IPsec protocol on the network layer and secured remote management of VPN setting by means of SSH.

Safety

EN 61010-1 ed.2 Safety requirements for electrical equipment for measurement, control, and laboratory use

EN 61010-2-030 Safety requirements for electrical equipment for measurement, control, and laboratory use - Particular requirements for equipment having testing or measuring circuits

EN 55011 ed.3 Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement

EN 55022, ed.3 Information technology equipment – Radio disturbance characteristics – Limits and methods of disturbance measurement – Limits and methods of measurement

EMC

EN 61326-1:2006 ed.2:2013 Electrical equipment for measurement, control and laboratory – use EMC requirements – Part 1.

General requirements and related standards:

EN 61000-3-2 ed. 4:2015, EN 61000-3-3 ed. 3:2014,
EN 61000-6-2 ed. 3:2016, EN 61000-4-2 ed. 2:2009,
EN 61000-4-3 ed. 3:2006, EN 61000-4-4 ed. 3:2013,
EN 61000-4-5 ed. 3:2015, EN 61000-4-6 ed.4:2014
EN 61000-4-8 ed. 2:2010, EN 61000-4-11 ed. 2:2005,
EN 61000-4-19, TNI CLC/TR 50579

EN 55011 ed. 3:2010 Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement

EN 55022 ed.3:2011 Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement

Resistance against:

- external magnetic induction at relative frequency (50 Hz) of any direction - 0.5 mT according to IEC1036,
- external electric AC 50 Hz field of any direction – 10 kV/m
- electrostatic discharges - 10 kV according to EN 61000-4-2 ed.2:2009
- electromagnetic hf field (80 MHz – 1000 MHz) – 10 V/m according to EN 61000-4-3 ed. 3:2006
- rapid transient phenomena ≥ 6 kV according to EN 50470-1:2007
- surge pulses ≥ 6 kV according to EN 50470-1:2007
- transient overvoltage ≥ 4 kV according to EN 61000-4-5 ed.3:2015

- symmetrical interference propagated by power lines in the frequency range from 2 kHz to 150 kHz according to TNI CLC/TR 50579, EN 50470-1:2007, EN 50470-3

Permanent resistance of voltage circuits ≥460 V

Equipment for measurement of electric energy (AC)≥ 6 kV according to EN 50470-1:2007.

Power supply

Supply voltage: 57,7 V_{AC} to 300 V_{AC} +15 %, -10 %, 50 Hz
80 V_{DC} to 300 V_{DC} ±10 %

Consumption: 16 VA / 230 V_{AC}

Uninterrupted power supply period: 1 minute (SW set-up), even for multiple repetition

Data memory

Capacity: 128 MB, NAND

Data memory organization: circular

An example of the scope of record in a three-phase network
(20 % quality, 8 % recorder, 52 % events, 20 % reserve):

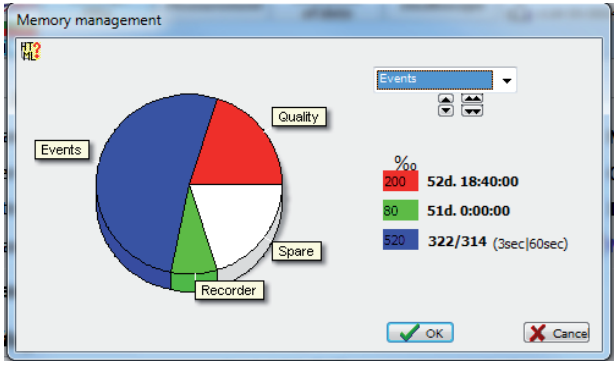
quality – 52 days 18 hours

events – at least 322, with duration of 3 s

voltage $U_{RMS1/2}$, current $I_{RMS1/2}$, record duration 10 s

oscillographic record of voltages and currents, record duration 1 s

recorder – 51 days 0 hours



Note: It applies to the data of quality U1, U2, U3 and I1, I2, I3, for the data of the recorder U1, U2, U3, U4 and I1, I2, I3, I4.

Functions use the reserve part of the memory after they exhaust their earmarked space.

Measuring characteristics

A/D converter:	16 bit
Sampling frequency:	256 samples per period
Anti-aliasing filter:	digital filter, type FIR
Phase lock loop:	controlled by the passage of voltage of the basic harmonic U1 through zero
Aggregation intervals:	quality function – according to EN 61000-4-30, ed. 2 recorder function – from 1 sec to ¼ hour
Synchronization of aggregation:	according to EN 61000-4-30, ed. 3
Time base of:	
– GPS synchronisation:	± 10 ms
– NTP synchronisation:	± 1 s
– without GPS synchronisation:	±1 sec per 24 hours at 23 °C ± 2 K

Voltage inputs U1, U2, U3 and U4

SW set-up of the voltage level:	LV	MV and HV
Rated phase voltages U_nP-N:	230 V_{AC}	100/√3V_{AC}
Rated delta voltages U_nP-P:	400 V_{AC}	100 V_{AC}
Measuring range of voltages P-P:	460 V_{AC}	250 V_{AC}
Voltage measurement uncertainty with f = 50 Hz:	0.05 % M.V. ± 0.025 % U_n	
Frequency range:	up to 7,2 kHz	
Input resistance:	1.68 MΩ	
Temperature coefficient:	0.05 % / 10 K	
Measuring:	direct	indirect
Max. transfer of voltage transformer:	none	999 kV / 100 V (optional SW PQ)

Current inputs with flexible sensors AMOSm/standard/38 and AMOSm/long/38

SW setting of the rated value

Rated value of current I_n	
– AMOSm/standard/38:	30 A, 100 A, 300 A, 1,000 A, 3,000 A
– AMOSm/long/38:	1,000 A, 3,000 A
Measuring range of current:	5 % I_n to 120 % I_n
Frequency range:	40 Hz to 7.2 kHz
Current measurement uncertainty [1) 2)]	
I_n = 30 A:	1.0 % M.V. ± 0.1 % I_n (45 Hz to 60 Hz)
I_n = 100 A, 300 A, 1,000 A, 3,000 A:	0.5 % M.V. ± 0.1 % I_n (45 Hz to 60 Hz)
Change of value with position:	± 1.0 % M.V.
Change of value due to external fields: (external field of a conductor with 0.3 I_n / 50 Hz positioned 35 mm from the closure)	± 1.0 % M.H. ± 0.2 % I_n
Uncertainty of measurement of harmonics up to the order of 50 [1) 2) 3) 4)]:	
I_n = 100 A, 300 A, 1,000 A:	± 5 % I_{harm} at 3 % $I_n \le I_{harm} \le$ 10 % I_n and ± 0.15 % I_n at I_{harm} < 3 % I_n
I_n = 30 A and 3,000 A:	± 10 % I_{harm} at 3 % $I_n \le I_{harm} \le$ 10 % I_n and ± 0.3 % I_n at I_{harm} < 3 % I_n
Phase error, (45 Hz to 60 Hz) [1) 2)]	2.0 °
Working temperature:	- 20 °C to + 55 °C
Temperature coefficient:	0.2 % I_n / 10 K
Relative humidity:	≤ 95 % RH
Ingress protection:	IP65
Measuring category:	CAT IV / 300 V
Safety class:	II
Loop length:	40 cm (standard), 60 cm (long)
Coil diameter:	8 mm
Enclosure free end diameter:	10 mm
Permissible loop bending radius:	> 20 mm

[1)] In the range of 5 % I_n to 120 % I_n [2)] At the correct position of the enclosure
[3)] Up to the order of 25 the maximum peak factor 2
[4)] Class 1 according to EN 61000-4-7, ed. 2

Current inputs with clamp-on transformers MT0.5/38 or MT1.0/38

	MT0.5/38	MT1.0/38
Rated current I_n:	1 A, 5 A	
Measuring range:	5 % to 120 % I_n	
Measurement error [1] at f = 50 Hz:	0.5 % of the range	1.0 % of the range
Harmonics measurement uncertainty up to the order of 50 [1) 3) 4)]:	± 5 % I_{harm} at $I_{harm} \geq 3$ % I_n and ± 0.15 % I_n at $I_{harm} < 3$ % I_n	± 10 % I_{harm} at $I_{harm} \geq 3$ % I_n and ± 0.3 % I_n at $I_{harm} < 3$ % I_n
Measuring category:	CAT IV / 300 V, CAT III / 600 V	CAT III / 300 V
Degree of protection provided by enclosure:	IP40 with closed jaws IP30 with opened jaws	
Operating temperature:	-10 °C to +55 °C	0 °C to +50 °C
Temperature coefficient:	0.2 % / 10 K	
Relative humidity:	≤ 85 % RH	
Dimensions:	135 × 51 × 35 mm	100 × 60 × 26 mm
Max. diameter of measured conductor:	20 mm	24 mm
Weight:	0.2 kg	0.16 kg

[1)] In the range of 5 % I_n to 120 % I_n
[2)] At the correct position of the enclosure
[3)] Up to the order of 25 the maximum peak factor 2
[4)] Class 1 according to EN 61000-4-7, ed. 2

Current inputs with toroid sensors TORv/38 and TORm/38

	TORv/38	TORm/38
Rated current I_n:	10 A, 50 A	1 A, 5 A
Measuring range:	5 % to 120 % I_n	
Measurement error [1] at f = 50 Hz:	0.5 % of the range	
Harmonics measurement uncertainty up to the order of 50 [1) 3) 4)]:	± 5 % I_{harm} at $I_{harm} \geq 3\,\% I_n$ and ± 0.15 % I_n at $I_{harm} < 3\,\% I_n$	± 10 % I_{harm} at $I_{harm} \geq 3\,\% I_n$ and ± 0.3 % I_n at $I_{harm} < 3\,\% I_n$
Measuring category:	CAT IV / 300 V	
Safety class:	II	
Ingress protection:	IP40	
Operating temperature:	-10 °C to +55 °C	
Temperature coefficient:	0.2 % / 10 K	
Relative humidity:	≤ 85 % RH	
Dimensions:	40 × 15 × 55 (80) mm	30 × 16 × 45 (70) mm
Max. diameter of measured conductor:	15 mm	6 mm
Weight:	0.1 kg	0.1 kg

[1] In the range of 5 % I_n to 120 % I_n
[2] At the correct position of the enclosure
[3] Up to the order of 25 the maximum peak factor 2
[4] Class 1 according to EN 61000-4-7, ed. 2

Communication

USB 2.0, communication speed 5.4 Mbit/s.

GSM, GPRS/LTE function

Antenna AGPS/10 m, AGPS/2,5 m

	AGPS/10 m	**AGPS/2,5 m**
Dimensions:	ø = 135 mm, h = 55 mm	64 (78 terminal) × 58 × 59 mm
Weight:	0.45 kg	0.20 kg
Coaxial cable length:	10 m	2.5 m
Coaxial cable type:	RG 174 (diameter 2.8 mm)	
Connector type:	MCX, for IP 65 PX0415/1	
Overvoltage category:	CAT IV / 300 V, **only first red 2 m of cable**	
Safety class:	II	
Ingress protection:	IP23	
Magnetic attachment		
Frequency band:	1575.42 MHz	
Frequency band width:	10 MHz	
Gain:	30 dBi typ.	
Impedance:	50 Ω	
VSWR:	< 2 : 1	
HPBW:	H - 360°, minimum V - 30°	
Polarisation:	R.H.C.P.	
Maximum input power:	10 W	
Operating temperature:	- 30 °C to 90 °C	

Antenna AGSM / 5 dB, AGSM / 9 dB

Dimensions:	5 dBi:	l = 320 mm, base ø = 50 mm, rod ø = 13 mm
	9 dBi:	l = 500 mm, base ø = 60 mm, rod ø = 15 mm
Weight 5 dBi / 9 dBi:		0.175 / 0.225 kg
Design:		all-insulated design
Coaxial cable length:		3.0 m
Overvoltage category:		CAT IV / 300 V
Safety class:		II
Ingress protection:		IP63
Coaxial cable type:		RG 174 / U (diameter 2.8 mm)
Connector type:		SMA(m), for IP 65 PX0415/1
Frequency band:		700 / 800 / 900 / 1700 / 1800 / 1900 / 2100 / 2600 MHz
Polarisation:		vertical
Impedance:		50 Ω
Gain:		5 dBi
VSWR:		< 2 : 1
HPBW:		H - 360°, minimum V - 30°
Technology:		GSM / UMTS / LTE
Maximum input power:		10 W
Operating temperature:		- 40 °C to 85 °C

Removable base for magnetic attachment

Function of measuring the power quality

Classification of the PQ monitor MEg38/C according to IEC 62586-1

PQ monitor MEg38/C Class A has the classification of PQI-A-PO, f = 50 Hz, CAT IV / 300 V, CAT III / 460 V according to EN 61010-2-030.

PQ monitor MEg38/C Class S has the classification of PQI-S-PO, f = 50 Hz, CAT IV / 300 V, CAT III / 460 V according to EN EN 61010-2-030.

Methods of measurement of voltage quality of the MEg38/C cl. A monitor and the MEg38/C cl. S monitor meet the requirements for Class A according to EN 61000-4-30, ed.3 and the tests according to EN 62586-1 and EN 62586-2.

Table of functions of the PQ monitor MEg38/C according to IEC 61000-4-30, ed. 3 including EN 61000-4-15, ed. 2 and EN 61000-4-7, ed. 2.

Function and measured data	PQI-A-PO		PQI-S-PO	
	Method of measurement	Measurement uncertainty and range	Method of measurement	Measurement uncertainty and range
Grid frequency 10 s data	Class A	Class A	Class A	Class S
Supply voltage value 150 periods, 10 min., 2 hours	Class A	Class A	Class A	Class S
Flicker 10 minutes P_{st}, 2 hours P_{lt}	Class A	Class A	Class A	Class S
Voltage dips and swells, residual and maximum U, T duration	Class A	Class A	Class A	Class S
Supply voltage interruption residual U, T duration	Class A	Class A	Class A	Class S
Voltage asymmetry 150 periods, 10 min., 2 hours	Class A	Class A	Class A	Class S
Harmonic voltages 150 periods, 10 min., 2 hours	Class A	Class A	Class A	Class S
Interharmonic voltages 150 periods, 10 min., 2 hours	Class A	Class A	Class A	Class S
Voltage of signals in supply voltage Measured voltage data	Class A	Class A	Class A	Class S

Function and measured data	PQI-A-PO		PQI-S-PO	
	Method of measurement	Measurement uncertainty and range	Method of measurement	Measurement uncertainty and range
Positive and negative voltage deviations 150 periods, 10 min., 2 hours	Class A	Class A	Class A	Class S
Rapid voltage changes	Class A	Class A	Class A	Class S

Note.: According to ČSN EN 61557-12, the PQ monitor MEg38/C 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

According to EN 61000-4-30, ed. 3, Article 5.11, it measures and evaluates rapid voltage changes RVC.

Measurement uncertainties and measuring ranges of voltage quality parameters of PQ monitors MEg38/C Class A and Class S at testing statuses 1, 2 and 3 according to EN 61000-4-30, ed. 3

LV and MV level, f = 50 Hz

Parameter	**Class**	**Measurement uncertainty**	**Measuring range**
Frequency	A	± 2 mHz	42.5 Hz – 57.5 Hz
	S	± 10 mHz	42.5 Hz – 57.5 Hz
Voltage	A	± 0.1 % U_n	10 % U_n – 150 % U_n
		± 0.2 % U_n	10 % U_n – 150 % U_n
Flicker P_{st}, P_{lt}	A	5 % P_{st}, P_{lt} IEC 61000-4-15, ed. 2	P_{st}, P_{lt} (0.2 – 10.0) 1 – 4000 changes/min
	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 $P_{inst, max}$	A	8 % $P_{inst, max}$	$P_{inst, max}$ (0 – 20) sine, rectangular
	S	8 % $P_{inst, max}$	$P_{inst, max}$ (0 – 10) sine, rectangular

Parameter	Class	Measurement uncertainty	Measuring range
Voltage events	A	Amplitude: ± 0.2 % U_n Duration: ± 1 period	5 % U_n – 200 % U_n 0.02 sec – 60 sec
	S	Amplitude: ± 0.5 % U_n Duration: ± 1 period	5 % U_n – 150 % U_n 0.02 sec – 60 sec
Interruptions	A	Duration: ± 1 period	0.02 sec – 180 sec
	S	Duration: ± 1 period	0.02 sec – 60 sec
Asymmetry	A	± 0.1 %	0.5 % u_2 – 5 % u_2 0.5 % u_0 – 5 % u_0
	S	± 0.2 %	1.0 % u_2 – 5 % u_2 1.0 % u_0 – 5 % u_0
Harmonic voltages to the 50th order including the DC component	A	± 5 % U_{harm}, $U_{harm} \geq 1$ % U_n ± 0.05 % U_n, $U_{harm} < 1$ % U_n	10 % – 200 % class 3 IEC 61000-2-4
	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	A	± 5 % U_{harm}, $U_{harm} \geq 1$ % U_n ± 0.05 % U_n, $U_{harm} < 1$ % U_n	10 % – 200 % class 3 IEC 61000-2-4
	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
Signals in voltage	A	± 5 % U_{sig} for 3 % $U_n \leq U_{sig} \leq 15$ % U_n, ± 0.15 % U_n for 1 % $U_n \leq U_{sig} \leq 3$ % U_n	0 % U_n – 15 % U_n
	S	± 10 % U_{sig} for 3 % $U_n \leq U_{sig} \leq 15$ % U_n, ± 0.3 % U_n pro 1 % $U_n \leq U_{sig} \leq 3$ % U_n	0 % U_n – 15 % U_n
Deviations of voltage	A	± 0.1 % U_n	10 % U_n – 150 % U_n
	S	± 0.2 % U_n	10 % U_n – 120 % U_n
Time base [1)]	A	± 10 msec	–
Time base [2)]	S	± 1 sec per 24 hours	–

[1)] with GPS signal synchronization

[2)] without 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 0,5 U_n to U_{max}

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

Active power and active energy

Voltage range: from 80 % U_n to 120 % U_n

Current range: from 10 % I_n to 120 % $I_n = I_{max}$

Measurement uncertainties in % of the measured value:

Current value	Power factor	AMOSm/38 [4]	MT0.5/38	MT1.0/38	TORv/38 TORm/38
Class [3]		2.0	1.0	2.0	1.0
2 % $I_n \le I < 5$ % I_n	1	3.0 %	1.5 %	2.0 %	1.5 %
5 % $I_n \le I \le I_{max}$	1	2.0 %	1.0 %	1.5 %	1.0 %
5 % $I_n \le I < 10$ % I_n	0.5 L, 0.8 C	3.0 %	1.5 %	2.0 %	1.5 %
10 % $I_n \le I \le I_{max}$	0.5 L, 0.8 C	2.0 %	1.0 %	1.5 %	1.0 %

Reactive power Q_v and reactive energy E_{rv}

Voltage range: from 80 % U_n to 120 % U_n

Current range: from 10 % I_n to 120 % $I_n = I_{max}$

Measurement uncertainties in % of the measured value:

Current value	sin φ C or L	AMOSm/38 [4]	MT0.5/38	MT1.0/38	TORv/38 TORm/38
Class [3]		3.0	2.0	2.0	2.0
2 % $I_n \le I < 5$ % I_n	1.0	3.0 %	2.0 %	2.5 %	2.0 %
5 % $I_n \le I \le I_{max}$	1.0	2.5 %	1.5 %	2.0 %	1.5 %
5 % $I_n \le I < 10$ % I_n	0.5	3.0 %	2.0 %	2.5 %	2.0 %
10 % $I_n \le I \le I_{max}$	0.5	2.5 %	1.5 %	2.0 %	1.5 %
10 % $I_n \le I \le I_{max}$	0.25	3.0 %	2.0 %	2.5 %	2.0 %

Apparent power

Voltage range: from 80 % U_n to 120 % U_n

Current range: from 10 % I_n to 120 % $I_n = I_{max}$

Measurement uncertainties in % of M.V.:

Current value	AMOSm/38 [4]	MT0.5/38	MT1.0/38	TORv/38 TORm/38
Class [3]	2.0	1.0	2.0	1.0
2 % $I_n \le I < 5$ % I_n	2.5 %	1.5 %	2.0 %	1.5 %
5 % $I_n \le I \le I_{max}$	2.0 %	1.0 %	1.5 %	1.0 %

[3] Class of functional power according to EN 61557-12

[4] For both versions of the AMOSm/standard/38 and AMOSm/long/38 sensor

Overview of evaluated quantities in the function Recorder

Quantity	Mark	For each phase	Fourth channel	For three-phase terminal	Behind interval[5]	200 ms minimum in interval	200 ms maximum in interval
Effective voltage	U_{ef}	F+S	F+S		F+S		
Voltage harmonics – 0 to 63th harmonic order	$U_{0.h}$ to $U_{63.h}$	F+S	F+S		F+S		
Overall harmonic distortion of voltage	THD_U	F+S	F+S		F+S		
Effective current	I_{ef}	F+S	F+S		F+S		
Current harmonics – 0 to 63th harmonic order	$I_{0.h}$ to $I_{63.h}$	F+S	F+S		F+S		
Overall harmonic distortion of current	THD_I	F+S	F+S		F+S		
Power factor	$\cos\varphi$	F		F+S	F+S		
Power factor	PF	F		F+S	F+S		
Active power	P	F		F+S	F+S	F+S	F+S
Reactive power	Q	F		F+S	F+S	F+S	F+S
Apparent power	S	F		F+S	F+S	F+S	F+S
Deformed power	D	F		F	F	F	F
Asymmetric power[6]	N			F+S	F+S	F+S	F+S

Quantity	Mark	For each phase	Fourth channel	For three-phase terminal	Behind interval[5)]	200 ms minimum in interval	200 ms maximum in interval
Active power (1st harmonic)	$P_{1.h}$	F		F+S	F+S	F+S	F+S
Reactive power (1st harmonic)	$Q_{1.h}$	F		F+S	F+S	F+S	F+S
Apparent power (1st harm.)	$S_{1.h}$	F		F+S	F+S	F+S	F+S
Asymmetric power (1st harm.)	$N_{1.h}$			F+S	F+S	F+S	F+S
Active energy - consumption	EP+	F		F+S	F+S		
Active energy - supply	EP-	F		F+S	F+S		
Reactive inductive energy during active consumption	EQL/EP+	F		F+S	F+S		
Reactive capacitive energy during active consumption	EQC/EP+	F		F+S	F+S		
Reactive inductive energy during active supply	EQL/EP-	F		F+S	F+S		
Reactive capacitive energy during active supply	EQC/EP-	F		F+S	F+S		
Active energy – consumption (1st harmonic)	$EP+_{1.h}$	F		F+S	F+S		
Active energy – supply (1st harmonic)	$EP-_{1.h}$	F		F+S	F+S		
Reactive inductive energy during active consumption (1st harmonic)	EQL/ $EP+_{1.h}$	F		F+S	F+S		
Reactive capacitive energy during active consumption (1st harmonic)	EQC/ $EP+_{1.h}$	F		F+S	F+S		

Quantity	Mark	For each phase	Fourth channel	For three-phase terminal	Behind interval[5]	200 ms minimum in interval	200 ms maximum in interval
Reactive inductive energy during active supply (1st harm.)	EQL/ $EP_{-1.h}$	F		F+S	F+S		
Reactive capacitive energy during active supply (1st harm.)	EQC/ $EP_{-1.h}$	F		F+S	F+S		

[5] Record interval adjustable from 1 s to 15 minutes. Energy represented by total value per interval, other quantities are average values per interval..

[6] In the delta voltage measuring mode, the power asymmetry contains even deformation influences.

Legend:

F values evaluated in the phase voltage measuring mode

F+S values evaluated in the phase voltage measuring mode and in the delta voltage measuring mode

Note:

As standard, the MEg38/C PQ monitor in the LV measuring mode measures phase voltages, and in the MV and HV measuring mode it measures delta voltages.

15/ LITERATURE

[1] Uživatelský popis programu PQ_MEg, www.e-mega.cz
[2] Uživatelský popis programu Data viewer, www.e-mega.cz
[3] Uživatelský popis programu WebDatOr, www.e-mega.cz
[4] Uživatelský popis funkcí dálkové komunikace monitoru MEg38/C, www.e-mega.cz

16/ MANUFACTURER

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