



PQ monitor MEg38/C

User manual



PQ monitor MEg38/C

INTRODUCTION

The PQ monitor MEg38/C measures four voltages and four currents on the LV, MV and HV level. It realizes a recording function and a voltage quality analysis function that are performed simultaneously. In the recording function, the PQ monitor MEg38/C, hereinafter monitor, processes all of the measured quantities, evaluates powers, energies and harmonics up to order 64. In the voltage quality analysis function of class A, it evaluates all parameters specified by the standard for the measured three voltages and three currents. It evaluates harmonics and centred groups of interharmonics up to order 125. While recording events, it records not only the course of U_{RMSU2} and I_{RMSU2} but it makes also an oscillographic recording of all four voltages and currents. The user SW working above the recording function can evaluate the size of the capacitive compensation battery and specifies the circuit-breaker value. It measures characteristics of appliances in connection with the three-phase and single-phase load adapter. The monitor can work as an oscillograph recording the voltages U1–U4 and the currents I1–I4 into the data memory; the oscillographic recording can be started by the voltage U4.

The monitor includes an uninterruptible power supply supplied from all of the four measured voltage inputs. For the current measurement, it uses flexible sensors or current clamps that it identifies automatically. Its ranges are changed by SW. For time synchronisation which is required in class A it is possible to connect GPS. Monitor allows remote transfer of measured data and remote parameterisation using GPRS service of GSM network.

Monitor is designed in an all-plastic case with minimum dimensions, it is waterproof, it has increased insulation and CATIV.

INFORMATION ABOUT SW

The PQ monitor MEg38/C includes CD with user software. The program **SW PQ** is used for parameterization of measurement, download of measured data and it displays the direct measurement including the oscillographic record. For displaying and evaluation of the measured data in graphical and tabular form in a single data file, export of measured data and the print task is the unified software **Data Viewer**. Functions of the individual programs are specified in separate user manuals [1], [2].

To analyse more data files of one or more instruments even of various types, the program **WebDatOr** is prepared that is delivered separately [3].

BASIC INFORMATION ABOUT THE SET MEg38/C

The PQ monitor MEg38/C set includes the MEg38/C monitor unit in Fig. 1 with uninterruptible power supply and current sensors in three versions. The flexible sensors AMOSm/MEg38 in Fig. 2 are intended for LV measurements. Clamp-on transformers are delivered in two precisions of measurement. MT0,5/MEg38 in Fig. 3a has precision of current measurement $0.5\% I_n$ and are intended for measurement in secondary circuits of instrument transformers and also for LV measurement in category CATIV. MT1.0/MEg38 in Fig. 3b has precision $1.0\% I_n$ and can be used for measurements in secondary circuits of instrument transformers and for LV measurements in category CATIII. MT1.0/MEg38 has smaller outer dimensions with bigger inner diameter for easier installation to measured circuit.

The single-phase and three-phase load adapter can be used for testing of electrical appliances; see Fig. 4 and 5.

For connection of monitor to voltages in large switchgears are intended voltage extensions and the LV adapter for a single-phase socket Fig. 6 and 7.

Optional accessories in the set are also: magnetic contacts, voltage extensions, grips with fuses and an adapter for voltage measurements in a single-phase LV plug socket.

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

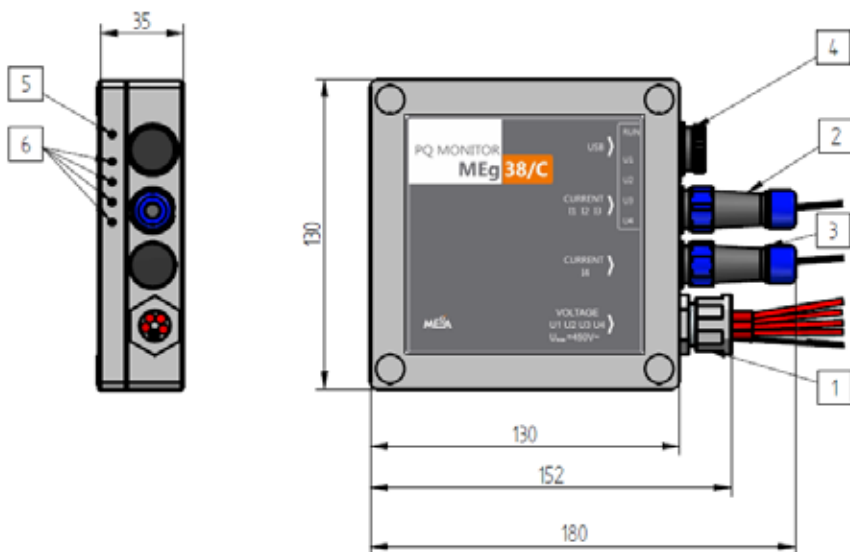


Fig. 2: Triple of flexible current sensors 3AMOSm/MEg38



Fig. 3a: Triple of clamp-on current transformers 3MT0,5/MEg38



Fig. 3b: Triple of clamp-on current transformers 3MT1,0/MEg38



Fig. 4: Three-phase load adapter 3Z/MEg38

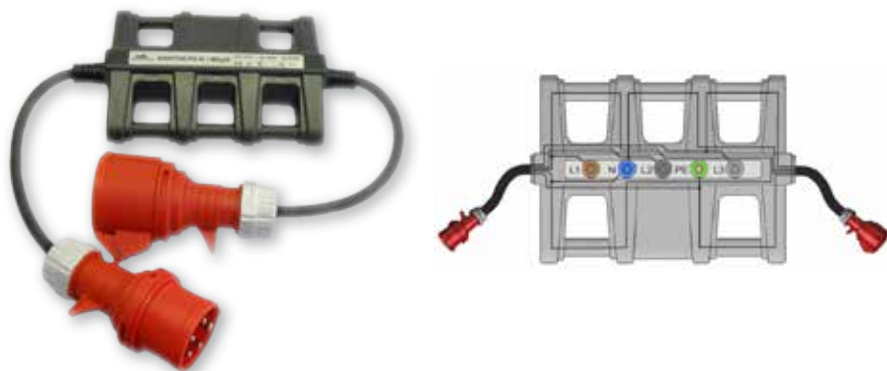


Fig. 5: Single-phase load adapter Z/MEg38



Fig. 6: Voltage extensions

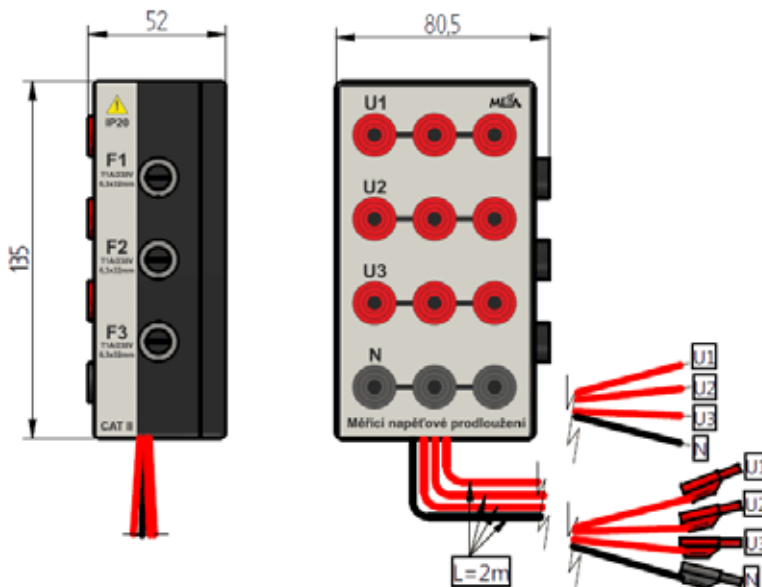
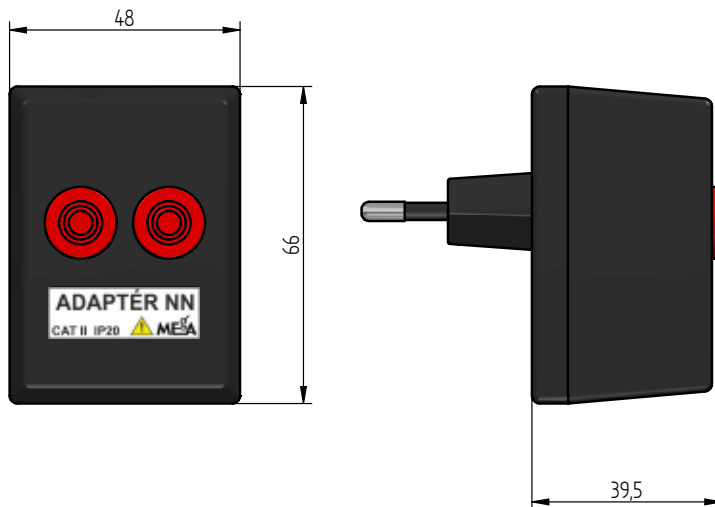


Fig. 7: LV adapter



 **SAFETY INFORMATION**

- **It is necessary to pay close attention to these information.**
- The warning points out facts, which represent safety risks for the operator.
- The cautions specify conditions and facts, which can damage the monitor.

Warning

- **Watch out! The operator installing the current sensors on live parts must be equipped with protective and other safety equipment and must 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 operators installing and removing components of the PQ monitor set must be qualified for live-line working and working near dangerous voltages. They must be as well trained for the first aid treatment.
- The monitor may be operated only by qualified persons provided with protective equipment against electric shock.
- It is not allowed to connect voltage measuring cords to phase voltages higher than $450 V_{AC}$ and line to line voltages higher than $780 V_{AC}$; otherwise there is a risk of electric shock.
- In LV networks between MV/LV transformers and energy meters of customers characterized by the overvoltage category **CATIV**, it is not allowed to connect the monitor to phase voltages higher than $300 V_{AC}$; otherwise there is a risk of electric shock.
- When the top insulation layer of the sensing part of the flexible sensor alone is mechanically damaged, which can prove with a contrast change of the surface colour of the sensing part, or when the monitor or its accessories are damaged, the damaged part must be immediately removed and sent for repair.
- Only the manufacturer or service firms trained by the manufacturer may service and repair the monitors.
- Because of loss of waterproofness and moisture resistance, the monitor unit must not be opened.

- Because of loss of waterproofness and moisture resistance, properly tightened current sensors and antennas must be connected to the connectors or the connectors must be covered with caps.
- The operator must ensure the protection of monitor against water during the local parameterization or download of measured data.
- The load adapters, voltage extensions and the LV adapter may be used only in covered rooms not exposed to water and moisture.
- Other accessories than included in the monitor set delivery are not allowed to be used.
- The current sensors, adapters and voltage extensions are to be connected to the monitor first and only then to the measured circuits.

Tab. 1: Overvoltage category of components of the set MEg38/C

Current sensors and contact elements	Application area
Clamp-on transformer MT0,5/MEg38	CATIV / 300 V
Clamp-on transformer MT1,0/MEg38	CATIII / 300 V
Flexible sensor AMOSm/MEg38	CATIV / 300 V
Crocodile clips	CATII / 1000 V
Grips with fuses	CATIII / 1000 V
Magnetic contacts	CATIII / 1000 V
Load adapter Z/MEg38	CATII / 250 V
Load adapter 3Z/MEg38	CATII / 415 V
LV adapter	CATII / 600 V
Voltage extensions with banana plugs	CATII / 600 V

- The current sensors AMOSm/MEg38 and MT/MEg38 may be installed only on insulated parts of conductors. When the current sensors are to be installed on an uninsulated part, they may be installed only into circuits of the overvoltage category according to Tab. 1 that are off during the installation. When the sensors are installed into environment with dangerous voltages, it is necessary to use protective equipment and meet safety requirements applicable for the given network.

Tab. 2: Waterproofness of components of the set MEg38/C

Name	Protection
Unit MEg38/C	IP 65
Flexible current sensors AMOSm/MEg38	IP 65
Clamp-on current transformers MT/MEg38	IP 20
Load adapters Z/MEg38	IP 20
LV adapter	IP 20
Voltage extensions with banana plugs	IP 20
Crocodile clips, grips and magnetic contacts	IP 20

Caution

The meaning of symbols used in the user manual and in descriptions of components of the PQ monitor MEg38/C set:



Note in the documentation / Warning, risk of danger



Warning, risk of electric shock



Do not attach around uninsulated dangerous live wires that can cause electric shock, burns or arc discharge



Attaching around uninsulated hazardous live conductors allowed

CAT IV

Overvoltage category characterizing a transient overvoltage condition. Generally, a LV network from the transformer station to fuses at the electricity meter

CAT III

Overvoltage category characterizing a transient overvoltage condition. Generally, a LV installation in buildings behind fuses of the electricity meter



Safety class II, double or increased insulation



GND, grounding terminal

IP code



Ingress protection rating



The product is designated for recycling and for collection points



Declaration of conformity – European Community

  The maximum voltage to the common wire may be $450 V_{AC}$ and the maximum line to line voltage is 780 V; otherwise there is a risk of a monitor fault.

In the CATIV/300 V environments, the maximum voltage to the common wire may be $300 V_{AC}$; otherwise there is a risk of a monitor fault.

Because of loss of waterproofness and moisture resistance, the monitor unit must not be opened.

Because of loss of waterproofness and moisture resistance, there must be connected appropriate components (current sensors, antennas) or the connectors must be covered with caps.

The operator must ensure the protection against water during local parameterization or data download.

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

Components of the basic set	Identification
PQ monitor unit MEg38/C, class A	A/38
PQ monitor unit MEg38/C, class S	S/38
Communication USBmini/EMC cable	USB/38
LV adapter for measuring in a LV plug socket	NN/38
Set of crocodile clips (3 red, 1 blue, 1 black)	K/38
Transport bag with filling	B/38
CD with user manuals for the monitor, user program SW MEg38, user program Data Viewer and the calibration certificate	CD/38

Components of the optional accessories	Identification
GPS and GPRS functionality for PQ monitor Meg38/C, class S	
Triple of flexible current sensors 3AMOSm/MEg38, I1-I2-I3, 40 cm (100 A, 300 A, 1 000 A, 3 000 A)	3AMOSm/38
Flexible current sensor AMOSm/MEg38, I4, 40 cm (100 A, 300 A, 1 000 A, 3 000 A)	AMOSm/38
Triple of clamp-on current transformers 3MT0,5/MEg38, I1-I2-I3, accuracy class 0.5 (1 A, 5 A)	3MT0,5/38
Clamp-on current transformer MT0,5/MEg38, I4, accuracy class 0.5 (1 A, 5 A)	MT0,5/38
Triple of clamp-on current transformers 3MT1,0/MEg38, I1-I2-I3, accuracy class 0.5 (1 A, 5 A)	3MT1,0/38
Clamp-on current transformer MT1,0/MEg38, I4, accuracy class 0.5 (1 A, 5 A)	MT1,0/38
Single-phase load adapter Z/MEg38	Z/38
Three-phase load adapter 3Z/MEg38	3Z/38
Set of grips with fuses CAT III (3 red, 2 black)	G/38
Set of magnetic contacts $\varnothing 7$ mm, L 10 mm, (3 red, 1 blue, 1 black)	M7/38
Set of magnetic contacts $\varnothing 11$ mm, L 35 mm, (3 red, 1 blue, 1 black)	M11/38
Three-phase voltage extension with banana plugs, (2 m)	3PB/38
Three-phase voltage extension with free ends, (2 m)	3PV/38
SW for electric installation (circuit-breaker value, compensation capacity value)	EMSW/38
Transport leatherette case	T/MEg38

Monitor class S has connectors and indication elements located on one side; see Fig. 1.

Monitor class A uses for connection of GPS and GSM antennas connectors located on the other side of unit.

Tab. 4: User elements

Item	Name	Description
1	Voltage inputs with power supply	<p>Connected measuring cords U1, U2, U3, U4 and N, long 1 m and ended with banana plugs CATIV, which are power cords as well.</p> <p>The maximum voltage between the cord N and the cords U1, U2, U3, U4 is $450 V_{AC}$.</p>
2	Connector of current inputs I1, I2, I3	<p>Connector for connecting the triple of current sensors I1, I2, I3.</p> <p>The current sensors can be the flexible 3AMOSm/MEg38, see Fig. 2, or the current clamps 3MT/MEg38, see Fig. 3.</p> <p>The connected sensor type is identified automatically when the measurement is parameterized.</p> <p>Only identical sensor types may be used on the current input I1, I2, I3 and I4 of the monitor (SW check distinguishes AMOSm/MEg38, MT0,5/MEg38 and MT1,0/MEg38).</p> <p>Only identical nominal current values may be set by the program on the current input I1, I2, I3. Nominal current value on input I1, I2, I3 can be different than nominal current value on I4 input.</p> <p>SW settings of the nominal current values:</p> <ul style="list-style-type: none"> – 3AMOSm/MEg38 (100 A, 300 A, 1 000 A, 3 000 A) – 3MT0,5/MEg38 (1 A, 5 A), 3MT1,0/MEg38 (1 A, 5 A)
3	Connector of current input I4	<p>Connector for connecting the current sensor I4</p> <p>The current sensor can be the flexible sensor AMOSm/MEg38 or the clamp-on transformer MT/MEg38</p> <p>The connected sensor type is identified automatically when the measurement is parameterized.</p> <p>Only identical sensor types may be used on the current input I4 and the input I1, I2, I3 (SW check distinguishes AMOSm/MEg38, MT0,5/MEg38 and MT1,0/MEg38).</p> <p>The nominal current value on the input I4 may differ from the nominal current value on the input I1, I2, I3</p> <p>SW settings of the nominal value:</p> <ul style="list-style-type: none"> – AMOSm/MEg38 (100 A, 300 A, 1 000 A, 3 000 A) – MT0,5/MEg38 (1 A, 5 A), MT1,0/MEg38 (1 A, 5 A)







Item	Name	Description
4	Mini USB connector	Connector of the galvanically isolated communication USB 2.0/3 Mbit/s.
5	RUN LED condition	<p>Shortly intermittent lighting – the monitor measures according to the programmed parametrization.</p> <p>Repeated short flashing – the monitor is programmed but it does not measure because the preset time of the measurement start has not occurred yet, or the power supply has not been turned on because the measurement was programmed with a postponed start.</p> <p>Alternate lighting 1:1 – oscillographic recording.</p>
	Condition of measured voltages U1, U2, U3, U4	<p>Indication of voltage conditions on the inputs U1, U2, U3 and U4 during the LV measurement (star-connection) or U1-U2, U2-U3, U3-U1 during the MV measurement (triangle-connection).</p> <p>Lighting:</p> <p>continuous – the voltage is in the predefined tolerance zone ($0.9 U_n$ to $1.1 U_n$)</p> <p>one flashing – the voltage is in the predefined interruption zone</p> <p>two flashings – the voltage is in the predefined dip zone</p> <p>three flashings – the voltage is in the predefined increase zone</p>

Fig. 8: Rating plate of the PQ monitor MEg38/C

 Made in Czech Republic		MEgA-Měřicí Energetické Aparáty, s.s. www.e-mega.cz	
PQ MONITOR MEg38/C			
SUPPLY		57.7V~ ÷ 400V~ ±10%, 50Hz 5VA/52V~, 8VA/230V~, 12VA/440V~,	
Voltage inputs: U1, U2, U3, U4 $U_{nom LV} = 230V \sim L - N$, $U_{nom MV} = 100V \sim L - L$ Measuring range: 440V~ Current inputs: I1, I2, I3, I4 AMOSm/MEg38, $I_{nom} = 100A, 300A, 1000A, 3000A$ MT0.5/MEg38, $I_{nom} = 1A, 5A$ MT1.0/MEg38, $I_{nom} = 1A, 5A$ Measuring range: 1.2 I_{nom}			
			 CAT IV 300V~ IP 65
MEg38/C		AMOSm/MEg38	MT0.5/MEg38
Nr	<input type="text"/>	<input type="text"/>	<input type="text"/>

Explanatory notes to the rating plate

The rating plate of the monitor, see Fig. 8, is placed on the monitor back side. In addition to the identification data of the manufacturer and of the monitor, it specifies the AC supply voltage range from 52 V to 440 V with the frequency 50 Hz and the consumption for the nominal and limit values of the supply voltage.

Voltage inputs:

The voltages U1, U2, U3 and U4 are measured to the input N on the LV level; the nominal value is $230 V_{AC}$.

The line to line voltages U1-U2, U2-U3 and U3-U1 with the nominal value 100 V are measured on the MV level; the voltage U4 is measured to the input N with the nominal value $100/\sqrt{3} V$.

The LV or MV measurement is selected when the measurement is parameterized. The measured voltages are supply voltages as well. The maximum voltage on the voltage inputs U1, U2, U3 and U4 towards N is $450 V_{AC}$.

The flexible current sensors AMOSm/MEg38 with the nominal value 100A, 300A, 1000A and 3000A are connected to the current inputs I1, I2, I3 and I4 usually in LV networks.

For measurement of currents with nominal value 1 A and 5 A usually in secondary circuits of instrument current transformers but also for measurement in LV circuits are designated current clamps MT0,5/MEg38. Current clamps MT1,0/MEg38 are designated for measurement of current with nominal value 1 A, 5 A in secondary circuits of instrument transformers or LV circuits of measurement category CAT III.



The current sensors AMOSm/MEg38 and MT/MEg38 may be installed only on insulated parts of conductors. When the current sensors are to be installed on an uninsulated part, they may be installed only into circuits of the overvoltage category according to Tab.1 that are off during the installation. When the sensors are installed into environments with dangerous voltages, it is necessary to use protective equipment and meet safety requirements applicable for the given network.

The measuring range of the current sensors is up to $1.2I_n$.



In the network environment with the overvoltage category CAT IV, the voltage can be measured only up to $300V_{AC}$.

The IP65 protection of the monitor is ensured when the caps of the USB connector, connector I1, I2, I3, connector I4 and with A version also antenna connectors are properly tightened or the current sensors and antennas are properly tightened.

When using current sensors MT/MEg38, voltage extensions, load adapters and the LV adapter designated for installation only in covered rooms, the operator of the monitor must ensure the protection against water in a different manner.

Also during local parameterization of measurement and download of data using communication cable USBmini/EMC, the operator must ensure the protection against water on the connector in a different manner.

The PQ monitor MEg38/C set is calibrated with the current sensors whose serial numbers are stated in the bottom part of the rating plate. The measurement accuracy specified in the technical specification is guaranteed only in this set.



CHARACTERISTICS OF THE MONITOR DESIGN

The square shape monitor unit of the safety class II with indication elements and connectors on the narrow front side is designed with an optimum rectangular format in the completed assembly for uncluttered installation into energetics switchgears.

Plastic, insulating and self-extinguishing case of the monitor unit and non-conducting surface of components of the set.

The waterproof and dustproof design of the monitor case with waterproof current connectors when current sensors are installed or covered by the attached caps.

Voltage cords with double insulation long 1 m, good flexible also under negative temperatures, with colour coding (U1, U2, U3 and U4 are red, N is black), ended with safe banana plugs CATIV/300V.

Measurement of the currents I1, I2, I3 with separate sensor triplet and the current I4 with a standalone sensor, all approved for installation into LV switchgears, with 2 m cables with good flexibility also under negative temperatures.

Purpose differentiated, mutually not interchangeable, automatically identified current sensors with SW switching of measuring ranges, in flexible version and in clamp-on transformer version:

- Flexible sensors AMOSm/MEG38 of the safety class II for installation on the LV level is all-insulating, waterproof; overvoltage category CATIV/300V with the sensing part long 40 cm; range of measured currents from 100 A to 3000 A; sensing part closure allows opening with just one hand.
- Clamp-on transformers MT0,5/MEG38 with overvoltage category CATIV/300V for measurements in covered environments, with accuracy class 0.5 for direct and also indirect measurements of currents with nominal value 1 A and 5 A on the LV, MV and HV level or clamp-on transformers MT1,0/MEG38 with overvoltage category CATIII/300 V for measurement in covered environments, with accuracy class 1.0 of current with nominal value 1 A and 5 A indirectly on MV or HV voltage level or directly on LV level with overvoltage category CATIII.

Definition of measurement accuracy of the monitor set when using components with the identified serial numbers.

Extension of monitor set using adapters, voltage extensions and contact elements allowing that the monitor can be used in various operating conditions.

Uninterruptible long-time secured power supply unit supplied through measuring cords U1, U2, U3 and U4 by AC or DC voltage of a wide range.

GPS time synchronization of internal clock and bidirectional remote transfer of data using GPRS service with class A monitor in basic configuration and optionally with class S monitor. Both antennas are with insulation cover and has increased insulation of part of cable.

MEASURING CONNECTION

With the monitor in LV networks, the voltages are measured directly and currents can be measured directly or indirectly.

The measurement in MV and HV networks is indirect through instrument measuring transformers.

For the three-phase voltage measurement, the voltages U1, U2 and U3 must be connected in the left-rotating direction, at which the instrument is calibrated.

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

Not connected voltage inputs U2, U3 and U4 can be also connected to the measured voltage and then they participate in the monitor power supply or can be connected to the central wire N or PEN; then they show the defined zero voltage. When the unused voltage inputs are left unconnected, then their voltage is not defined due to their high input resistance and the voltage channel connection.

The monitor is supplied from the measured voltages. When the power of the instrument transformer is higher than or equals 30 VA, then the measurement is not influenced due to its loading.

During measurement on the MV level and the voltage input U4 is not used, it is recommended to connect the AC supply voltage $230 V_{AC}$ or the DC supply voltage $220 V_{DC}$ or eventually $110 V_{DC}$ to this input.

For measurement on the LV level, the monitor set includes load adapters, which can be used for measuring parameters of single-phase or three-phase appliances including harmonics and oscillographic recordings during the turning on and off. For the phase voltage measurement in a LV single-phase plug socket, the LV adapter can be used.

Versions of the sensors AMOSm/MEg38 a MT/MEg38 cannot be confused during the installation and the sensor types AMOSm/MEg38, MT0,5/MEg38 and MT1,0/MEg38 are automatically identified by SW. The identification is executed when the measurement is started and when the measurement is restored after a power outage, and therefore it is not allowed to change the types of installed sensors in the course of the measurement.

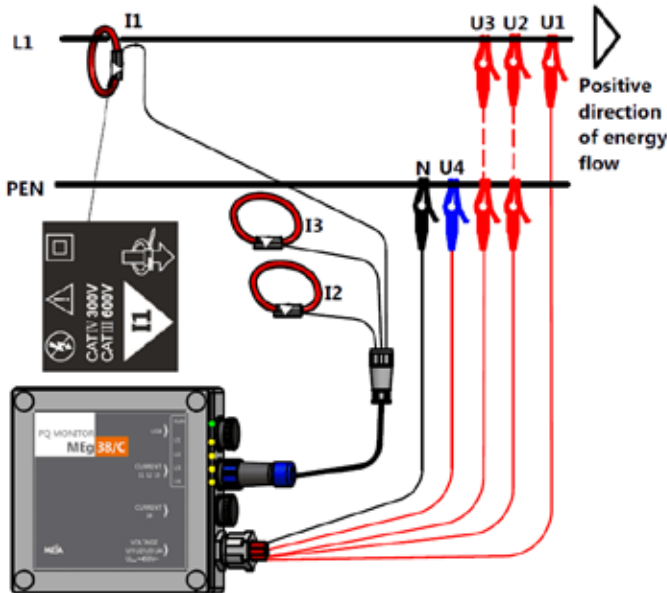
For measurement of the currents I1, I2, I3 and the current I4, it is allowed to use only current sensors of the same type; see Tab. 5.

The flexible current sensors AMOSm/MEg38 are intended for measurement on LV level. The clamp-on transformers MT/MEg38 are made in two accuracy classes. For measurements in LV, MV or HV level are intended sensors MT0,5/MEg38 CAT IV / 300 V and mainly for MV or HV level and measurement in secondary circuits are intended sensors MT1,0/MEg38 CATIII / 300 V.

Tab. 5: Permissible connections of the sensor types

Connections of the sensor types		Input I1, I2 , I3		
		AMOSm/MEg38	MT0,5/MEg38	MT1,0/MEg38
Input I4	AMOSm/MEg38	YES	NO	NO
	MT0,5/MEg38	NO	YES	NO
	MT1,0/MEg38	NO	NO	YES

Fig. 9: Single-phase voltage and current measurement with the sensor 3AMOSm/MEg38



Note: Note: voltage inputs U2 and U3 can be connected to phase voltage L1, then they participate on power supplying of device or they can be connected to PEN conductor and measure zero voltage.

Fig. 10: Single-phase voltage measurement and direct current measurement with the clamp-on transformer 3MT0,5/MEg38

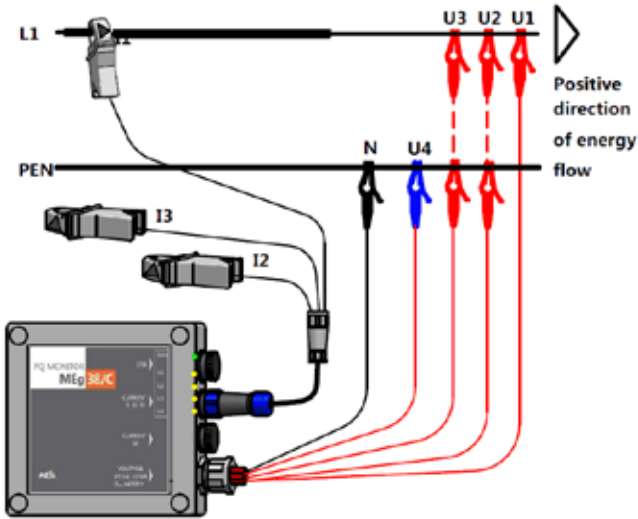


Fig. 11: Single-phase voltage and current measurement and neutral conductor voltage measurement to ground and neutral conductor current measurement

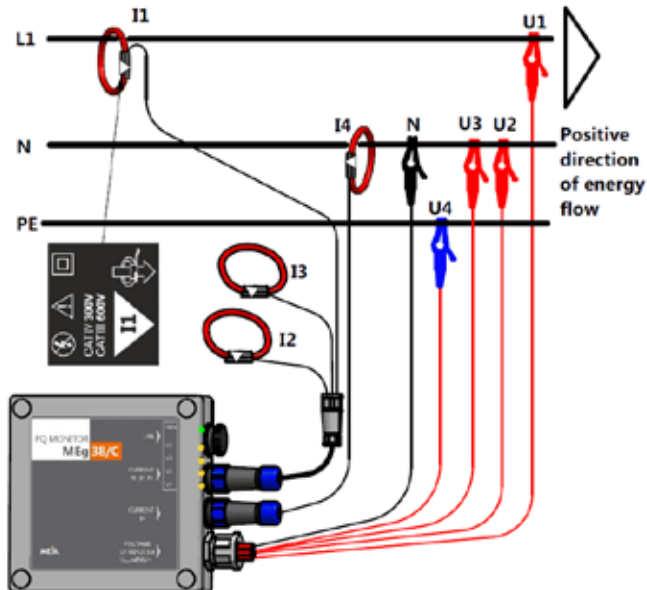


Fig. 12: Three-phase voltage and three-phase current measurement with the sensors 3AMOSm/MEg38

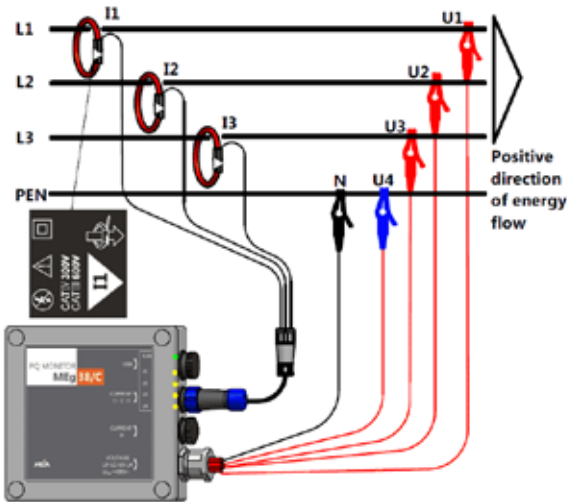


Fig. 13: Three-phase voltage measurement and measurement of the voltage between the neutral conductor and ground, three-phase current measurement and measurement of neutral conductor current with sensors 3AMOSm/MEg38 and AMOSm/MEg38

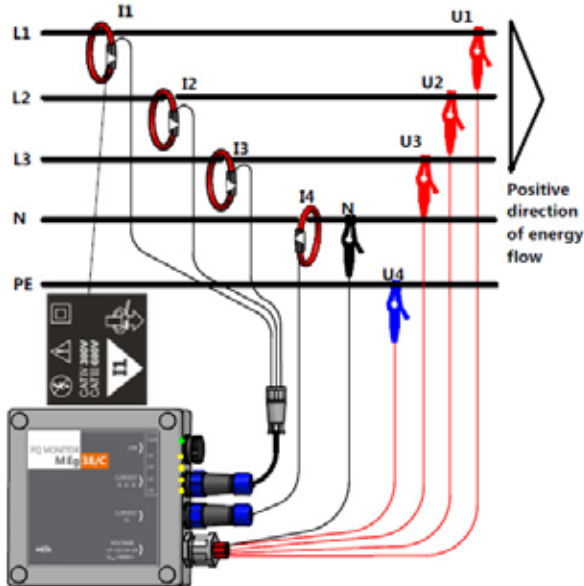


Fig. 14: Three-phase voltage measurement and direct three-phase current measurement with the sensors 3MT0,5/MEg38

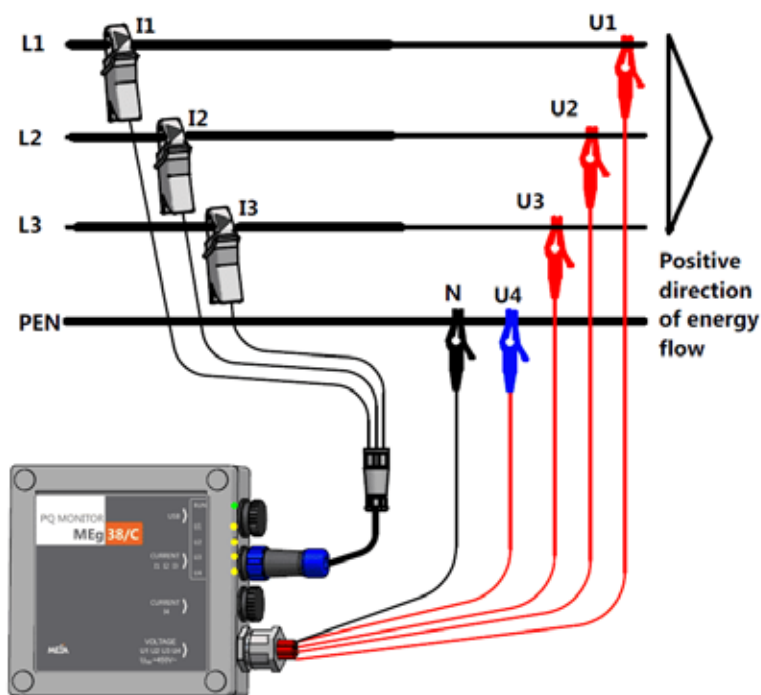


Fig. 15: Single-phase voltage measurement in a LV plug socket

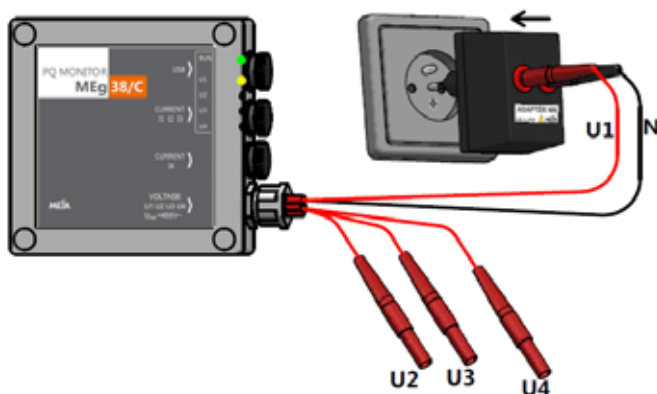


Fig. 16: Measurement of phase voltages and current and voltages between the neutral conductor and ground with the single-phase load adapter Z/MEg38

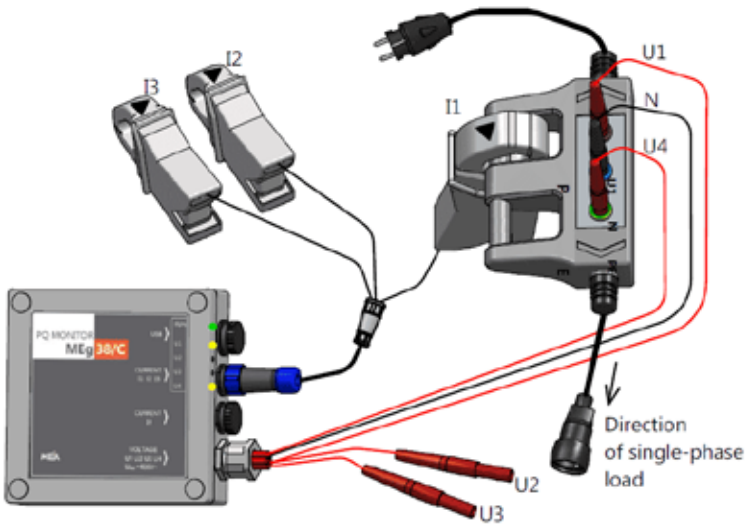


Fig. 17: Measurement of phase voltages, measurement of neutral conductor voltage to ground and measurement of phase currents of an appliance with the three-phase load adapter 3Z/MEg38

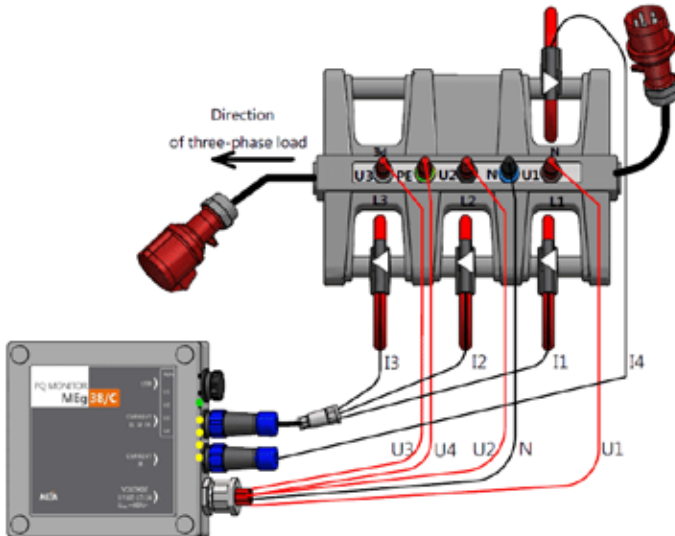


Fig. 18: Three-phase measurement of line to line voltages and phase currents with the sensors 3MT1,0/MEg38, in MV and HV networks with grounded neutral point.

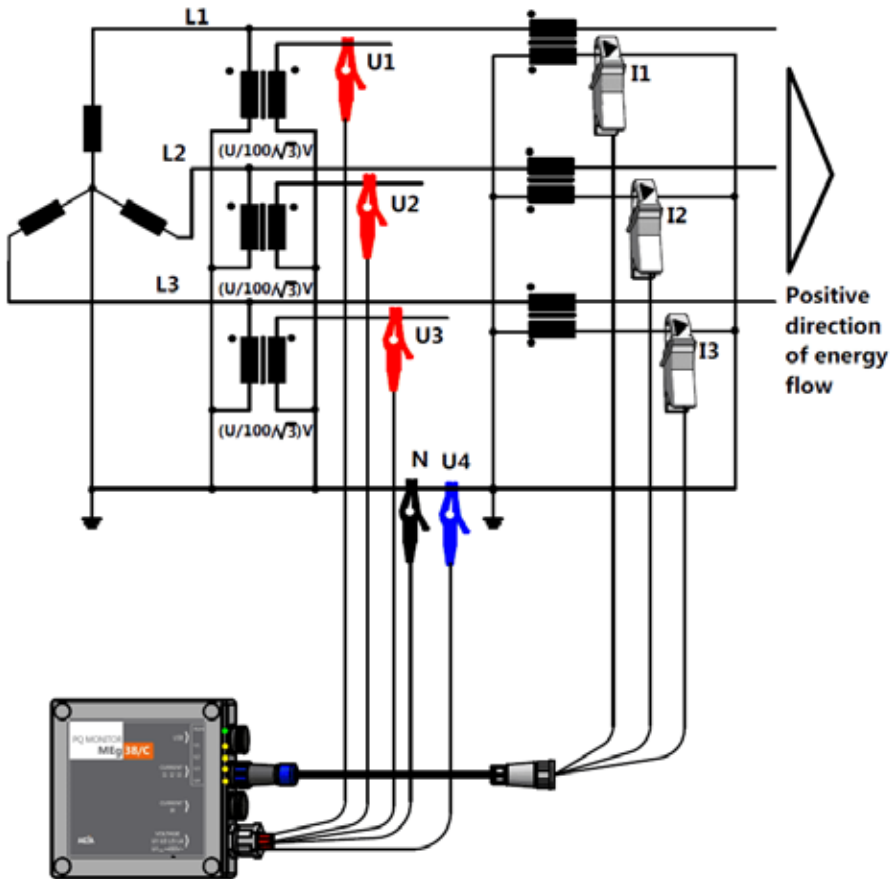


Fig. 19: Measurement of line to line voltages, U0 voltage and phase currents with the sensors 3MT0,5/MEg38 in a compensated MV network

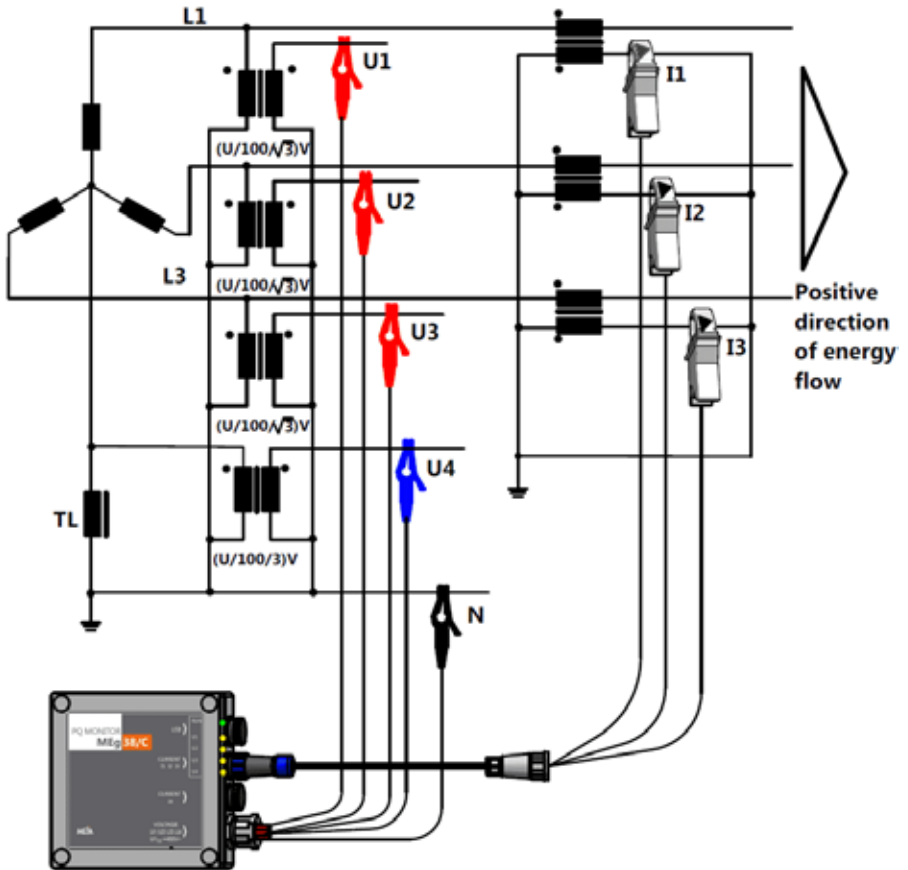
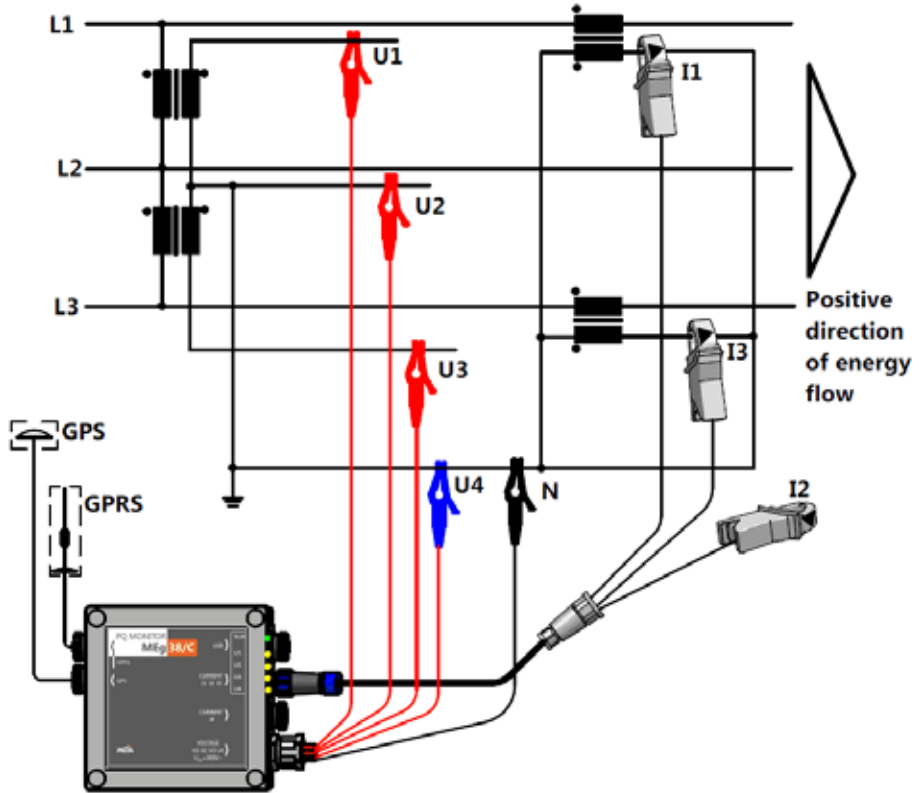


Fig. 20: Measurement in the Aron connection on the MV level with connected GPRS communication and GPS time synchronization



MEASURED DATA

The amount of measured data depends on the measuring connection and parameterization of the measurement. The measured data are divided into data of continuous voltage quality phenomena, data of one-time voltage events and recorder data.

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

- Time period of evaluation
- Voltage unbalance
- Frequency
- Voltage
- Voltage deviations U_{over} , U_{under}
- Flicker P_{st} and P_{lt} ,
- THD_U
- DC component, basic up to 125th voltage harmonic
- Centred groups of interharmonic voltages up to order 125
- Voltage signals level
- Identification of flagged values
- Currents
- Basic up to 125th current harmonic
- Centred groups of interharmonic currents up to order 125

Data of one-time voltage events:

- Event occurrence time
- Event duration time
- Times when limits of interruption, voltage and current dips and swells were exceeded
- Residual and maximum voltages and currents
- Time courses of voltage values $U_{\text{RMS1/2}}$ and current values $I_{\text{RMS1/2}}$
- Oscillogram of voltage and current waveforms during the event
- Voltage and current harmonics during the event

Recorder data (aggregation interval from 1 sec to ¼ hour according to the measurement parameterization):

- Time period of evaluation
- Voltages
- 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 1st harmonics
- Reactive powers of 1st harmonics
- Apparent powers of 1st harmonics
- Cos φ
- Active and reactive energies of 1st harmonic – 4 quadrants, 6 registers fo each phase
- THD_U
- THD_I
- Voltage harmonics up to order 64
- Current harmonics up to order 64
- Active and reactive energy (6 registers for a phase)

The above mentioned data of the continuous voltage quality phenomenons are specified for the voltages U1, U2, U3 and the currents I1, I2, I3.

The above mentioned data of the recording of one-time events started from the time when the defined limits for U1 – U4 and currents I1 – I3 were exceeded, are recorded for all given quantities.

The above mentioned recorder data are for the voltages U1 – U4 and the currents I1 – I4.

COMPLETION OF THE MONITOR SET, PREPARATION OF THE MEASUREMENT



Warning

- The maximum connected phase voltages may be $450 V_{AC}$, the maximum connected deltaline to line voltages are $780 V_{AC}$.
- In the CATIV / 300 V environments, the maximum voltage to the common wire may be $300 V_{AC}$.
- For completion of the monitor before the measurement, only accessories included in the monitor set according to the approved overvoltage category in accordance with the overvoltage category in the measured point are allowed to be used.
- It is necessary to interconnect all of the components of the set before connecting to the measured voltages.
- It is recommended not to expose the monitor and the current sensors AMOSm/MEg38 to water and moisture.
- The clamp-on transformers MT/MEg38, voltage extensions, load adapters and LV adapter may not be exposed to water and moisture.
- For electric shock protection, the voltage cords must be provided with contact elements included in Tab.1 or inserted into safe terminals of adapters or extensions before they are connected to the voltage. Magnetic contacts may be only installed on turned off voltage circuits with zero voltage.
- In LV switchgear with danger of touch with live parts is possible to plaec only parts of antenna with reinforced insulation



Caution

- The PQ monitor MEg38/C set is calibrated with the current sensors whose serial numbers are stated in the bottom part of the rating plate. The measurement accuracy specified in the technical specification is guaranteed only in this set.
- When the voltage is measured using adapters or voltage extensions, the voltage cords U1–U4 and N of the monitor are to be inserted into the marked safe terminals. Otherwise, the voltage cords of the monitor are to be installed either using crocodile clips or grips with fuses or magnetic contacts.
- When connecting GPS and GSM antennas, which have equivalent connector, it is necessary to pay attention to its correct connection. When antennas are not used, then connector must be properly tightened with caps in order to ensure waterproofness.

- During local parameterization of measurement and download of data using communication cable USBmini/EMC, the operator must ensure the protection against water on the connector in a different manner.

For current measurements, identical types of the current sensors, either the flexible sensors AMOSm/MEg38 or the clamp-on transformers MT0,5/MEg38 or clamp-on transformers MT1,0/MEg38 are to be connected to the current connector I1, I2, I3 and eventually to the current connector I4. The connector nuts or caps are to be properly tightened.

If the currents are not measured, the connector caps are to be properly screwed on one or both of the current connectors.

In LV networks are usually connected to current inputs I1, I2, I3 and I4 flexible current sensors AMOSm/MEg38 with the nominal value 100 A, 300 A, 1 000 A and 3 000 A.

For measurement of currents with nominal values 1 A or 5 A are also in LV networks intended current clamps MT0,5/MEg38 in overvoltage category CATIV/300 V and current clamps MT1,0/MEg38 in overvoltage category CAT III/300 V.

The communication cable USBmini/EMC is to be connected to the opened communication USB connector of the monitor and its other end is to be connected to the USB connector of PC with the running parameterization program **SW PQ** as instructed in its user documentation [1].

Connect GSM and GPS antennas to class A monitor and optionally also class S monitor according to figure 20. Pay attention to not interchange antennas!

CONNECTION TO THE VOLTAGE



Warning

- It is not allowed to connect voltage measuring cords to phase voltages higher than $450 V_{AC}$; otherwise there is a risk of electric shock.
- It is not allowed to connect the monitor to line to line voltages higher than $780 V_{AC}$; otherwise there is a risk of electric shock.
- In LV networks between MV/LV transformers and electricity meters of customers characterized by the overvoltage category CATIV, it is not allowed to connect the monitor to phase voltages higher than $300 V_{AC}$; otherwise there is a risk of electric shock.
- The monitor must be operated only by qualified persons provided with protective equipment against electric shock.

- The voltage extensions, load adapters and LV adapters must not be exposed to water.
- The operating voltage range is from 52 V to 440 V.
- If the monitor or its measuring cords are damaged mechanically, it is needed to dismount the monitor immediately and send for repair.



1. The voltage cords, first N and then U1–U4 are to be connected to the measured voltages according to the measuring diagrams in Fig. 9 – Fig. 20. If needed, then crocodile clips, magnetic contacts, adapters or voltage extensions are to be used.
2. During the measurement, the measuring cord U1 of the reference channel of the monitor must be always connected to the measured voltage.
3. The LED RUN lights up according to the programmed measurement mode, see Tab. 4.
4. The LEDs U1, U2, U3 and U4 light up according to voltages in the way specified in Tab. 4.

CONNECTING THE CURRENTS AND CHECK OF CORRECT WIRING



Warning

- The current sensors AMOSm/MEg38 and clamp-on transformers MT/MEg38 are allowed to be installed only in circuits with the overvoltage category specified in Tab. 1.
- Even if only the top insulation layer of the sensing part of the flexible sensor AMOSm/MEg38 is mechanically damaged, which can prove with a contrast change of the surface colour of the sensor, the sensor must be immediately removed and sent for repair.
- The current sensors are intended only for installation on insulated live parts.
- When the current sensors are installed in space with dangerous voltages, it is necessary so that the operator is provided with protective equipment against electric shock.
- When the current sensors must be installed on live parts or in space with dangerous voltages, it is necessary to perform its installation in deenergized state without voltage and meet safety requirements and regulations applicable in the respective distribution network.

- If the currents are not measured, the connector caps are to be properly screwed on both of the current connectors
- When the clamp-on current transformers MT/MEg38 are used, the monitor operator must ensure the protection against water on the sensing part of the clamp-on sensors MT/MEg38 in a different way.



5. The current sensors are to be installed on the wires with the measured current so that their arrows show the direction of current flow to the load.
6. On PC with the running program **SW PQ**, see Fig. 21, there is a pictogram of the established communication with the monitor, FW version and serial number displayed in the dropdown menu on the right side of window. Labels of all buttons of the window are in bold.

When the program SW PQ is running and the monitor is not connected to PC or is connected incorrectly, the window will be displayed with an empty field confirming the communication and the buttons labels will not be in bold; see Fig. 22.

7. The bold button **Settings MEg** opens measurement parameterization and the single-phase or three-phase measurement, voltage level, type and conversion ratio of the current sensors and possibly other parameters of the measurement are to be selected according to the measuring diagram.

Fig. 23 shows an example of parameterization of the single-phase measurement with the clamp-on transformers MT/MEg38 on the currents I1 and I4.

Fig. 24 shows an example of parameterization of the three-phase measurement with the flexible sensors AMOSm/MEg38 on the currents I1–I4.

8. After the button **Start of measurement** is enabled and the data measured until now are deleted, the measurement will be started according to the new selected parameterization. Using menu button **Measurement** with **RMS** selection displays window with values of measured voltages and currents, its time courses and phasor diagram of powers. Example is on Fig. 25. This way can be checked correct direction of installation of current sensors.
9. Using menu button **Measurement** with selection **Samples** displays harmonic component of measured voltages and currents, oscillographic waveforms and phasor diagram displaying orientation of currents and voltages. Example is in Fig. 26.

Attention!

When line to line voltages and phase currents on the MV level are measured, there is a phase shift approximately 30° between the voltage and the current. This may differ in case of the current I4.

TIME SYNCHRONIZATION USING GPS SYSTEM AND SETUP OF REMOTE GPRS COMMUNICATION



Warning

- GSM and GPS antennas are to be installed out of LV switchgear. In the coiled state can be placed also into LV switchgears.



- Pay attention to not interchange GPS and GSM antennas when connecting to monitor unit.
10. Antenna of the GSM network with GPRS function is to be installed into space with sufficient intensity of signal. Insulation protective tube of GSM antenna with magnetic holders is to be installed preferably in vertical position.
 11. GPS antenna must be installed in space with direct visibility to sky. For time synchronisation of monitor is needed to receive signal from three satellites and therefore insulation rounded cover of GPS antenna is usually placed in horizontal position on window ledge with sufficient visibility to sky.
 12. In main window of SW PQ are pictograms of GPRS and GPS, see Fig.27.

Meaning and use of pictograms:



Device supports GPRS function of GSM network and GPS synchronisation, but signal is insufficient.



Device supports GPRS function of GSM network and GPS synchronisation, but signal from satellites of GPS system is insufficient.



Device supports GPRS function of GSM network and GPS synchronisation, but signal for GPRS communication is insufficient.



In case of sufficient signal intensity of GSM network with GPRS function, then clicking its pictogram (button) displays in baragraph intensity of signal in given point. Lowest signal is presented by shortest bar. In displayed example is intensity on third level.



In case of sufficient intensity of GPS signal for time synchronisation, then clicking its pictogram (button) displays in baragraph intensity of signal in given point. Lowest signal is presented by shortest bar. In displayed example is intensity on second level. Date and time below GPS label shows time, when last GPS synchronisation occurred.

13. In case of insufficient GPS signal in place of measurement it is possible to bring powered on monitor with GPS antenna into space with sufficient signal and here let the internal clock synchronize. During time synchronization, which may not occur during one minute period of secured power supply operation, it is needed to ensure mains power supply of monitor. After synchronisation monitor supplied from its own internal uninterruptible power supply is to be returned back to measurement place and connected to measured voltages and currents. This way is internal clock synchronized at least on start of measurement.

Fig. 21: Main SW PQ window when the communication with MEg38/C is established

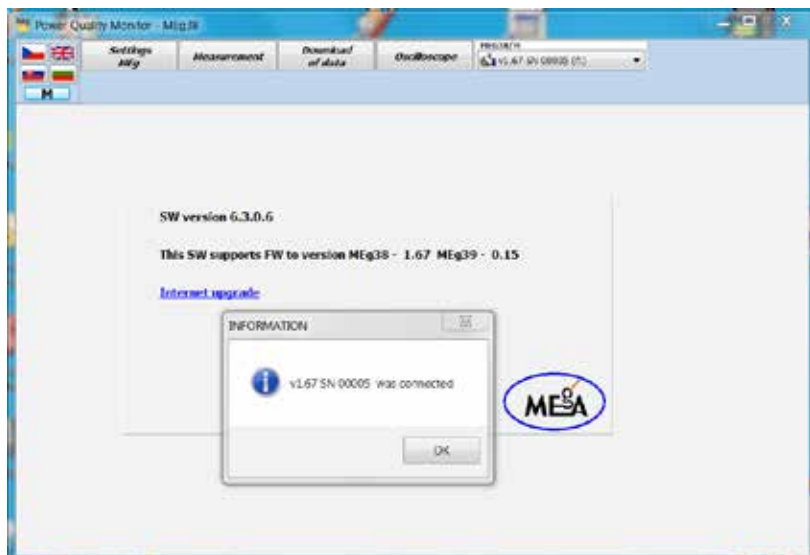


Fig. 22: Main SW PQ window when the communication with MEg38/C was not established

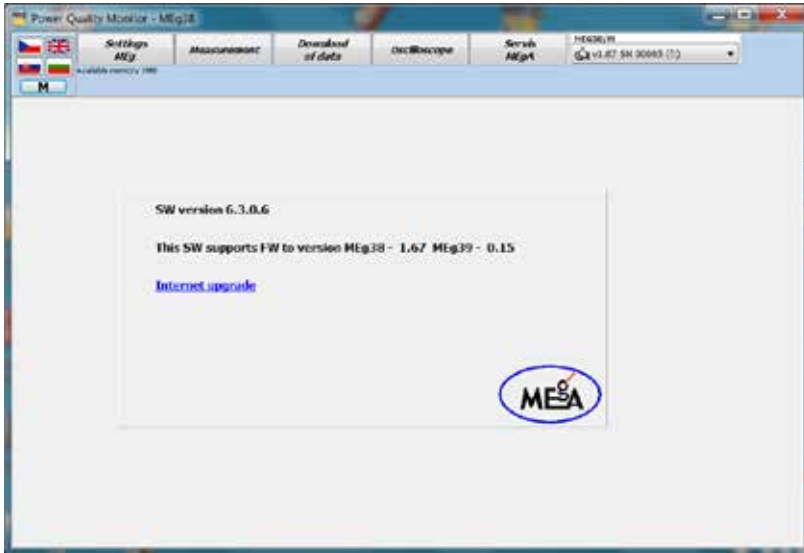


Fig. 23: Example of the monitor setting for the single-phase measurement

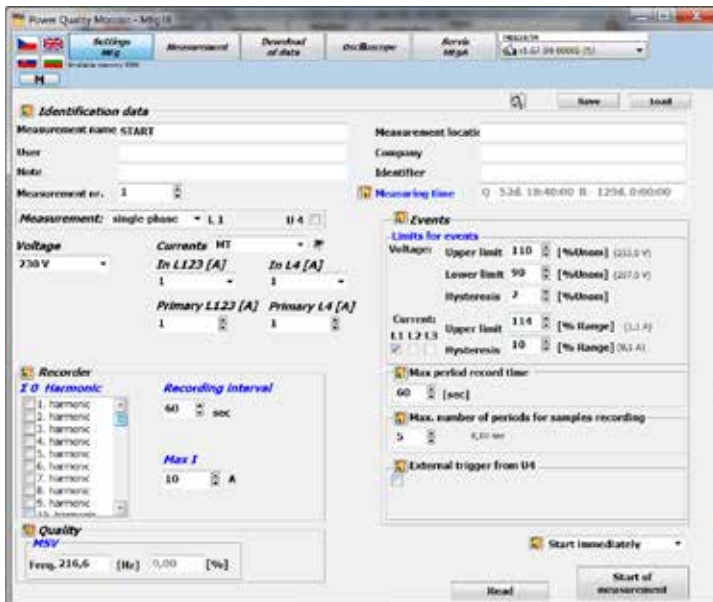


Fig. 24: Example of the monitor setting for three-phase measurement

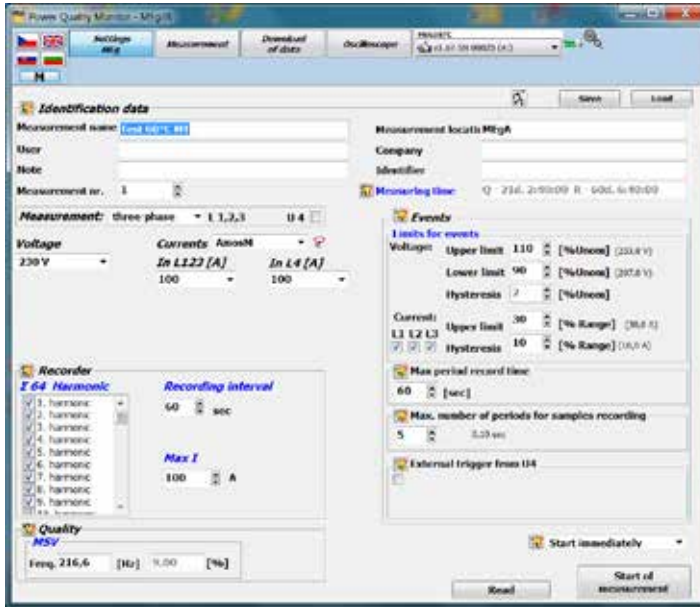


Fig. 25: Measurement and check of connected quantities, course of RMS values



Fig. 26: Measurement and check of connected quantities, oscillographic waveforms and FFT

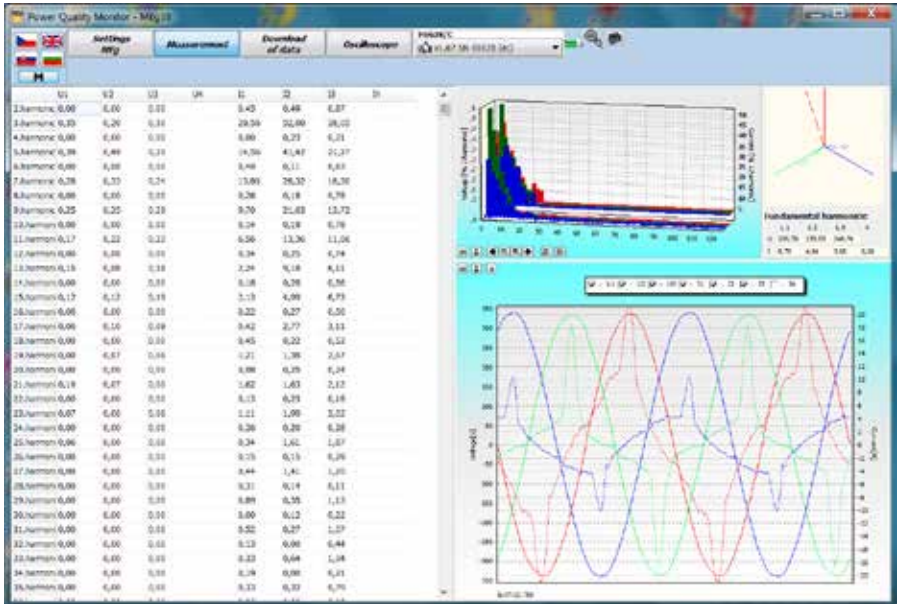


Fig. 27: Example of main window with information about intensity of GPS and GSM signals



MAINTENANCE



Caution

- Only trained and qualified personnel of the manufacturer or service organisation of the manufacturer may repair the monitor during the guarantee period. For contact to the manufacturer's service department see www.e-mega.cz.
- The monitor must not be exposed to chemicals.
- The monitor may be transported only in the original transport bags or cases delivered by the manufacturer.
- The PQ monitors MEg38/C of class A are recalibrated every 2 years and the PQ monitors MEg38/C of class S always every 3 years after the sale or the last calibration.

When the monitor is used properly in accordance with this manual, it does not require any special maintenance. Only when the instrument is unclean, it is suitable to clean it with a damp cloth without any detergents.

BATTERY

The following batteries are used in the monitor:

- Lithium battery of CR2032 type for the clock circuit,
- Ni-Mh accumulator of 8xV200H type for ensuring the measurement in case of a supply voltage outage.
- The accumulator is charging when the monitor is connected to any of measured voltage U1 to U4.
- The duration of charging of completely discharged accumulator when power supplying from single voltage with nominal value and positive temperature is shorter than 12 hours.
- Fully charged accumulator in positive temperatures secure at least ten successive one-minute supply intervals.
- In total range of operation temperatures the fully charged accumulator ensures during power outage at least two one-minute power supplying intervals.
- When starting monitor with fully charged accumulator after long-term power off state and in temperature of environment -20°C , then after short restoration of supply voltage monitor operates for at least 10 second.

DISPOSAL

After the use of the monitor is ended, the monitor must be recycled in collecting centres according to rules for electronic waste disposal.

GUARANTEE

A two-year guarantee is provided for the monitor since the date of sale, but no more than 30 months after its dispatch from the manufacturer. Defects incurred during this period due to provably defective construction, defective design or improper materials will be repaired by the manufacturer or a service firm of the manufacturer free of charge.

The guarantee becomes invalid also during the guarantee period if the user carries out unauthorized modifications or changes on the monitor MEg38/C, connects the instrument incorrectly, handles it incorrectly or roughly or the instrument is operated contrary to the technical specification.

Defects of the monitor and its accessories incurred during the guarantee period shall be claimed by the user to the manufacturer or the service firm authorised by the manufacturer.

In case of a guarantee and after-guarantee failure, it is useful to deliver also a description of the failure behaviour with the defective instrument.

TECHNICAL PARAMETERS

General data

The measurement uncertainties are applicable for reference conditions.

The monitor development and production is in accordance with ISO 9001.

Reference conditions

Ambient temperature: $23^{\circ}\text{C} \pm 2\text{K}$

Relative humidity: 40 % to 60 %

There is a left-rotating voltage system on the inputs U1, U2 and U3

Power supply – through the input U4 by a voltage higher than the calibrated voltages on the inputs U1, U2 and U3.

Working conditions

Operating temperature: -20°C to $+55^{\circ}\text{C}$

Stabilization time: 10 minutes after the power is turned on

Relative humidity 10% to 90 %, no condensation

Storage

Storage temperature: -30°C to $+60^{\circ}\text{C}$

Water and chemicals protection

Long-term UV radiation protection

Design details

Dimensions – version A: $167 \times 130 \times 35$ mm, with connectors $195 \times 130 \times 35$ mm

– version S: $152 \times 130 \times 35$ mm, with connectors $180 \times 130 \times 35$ mm

Weight: 0.7 kg

Length of voltage cords: 1 m

All-insulated surface, Polycarbonat material, UV-resistant, inflammable

Protection: IP65 according to EN 60 529

Overvoltage category: CATIV / 300 V, CATIII / 600 V
according to EN 61010-2-030

Safety class: II, reinforced insulation

Test voltage: 5.4 kV, 50 Hz, 1 minute

EMC

EN 61326-1:2006

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

Line terminal voltages

EN 55011 ed.3:2010

Industrial, scientific and medical equipment – Radio frequency disturbance characteristics – Limits and methods of measurement

Radiated emissions

EN 55011 ed.3:2010

Industrial, scientific and medical equipment – Radio frequency disturbance characteristics – Limits and methods of measurement

Radiated radio-frequency electromagnetic field

EN 61000-4-3 ed.3:2006

Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement equipment – Radiated, radio-frequency, electromagnetic field – Immunity test

Power supply

Supply voltage:	57.7 V _{AC} to 400 V _{AC} ±10 %, 50 Hz 80 V _{DC} to 400 V _{DC} ±10 %,
Consumption:	5 VA / 52 V _{AC} , 8 VA / 230 V _{AC} , 12 VA / 450 V _{AC}
UPS operation time:	1 min (SW selectable), also multiple repetitions
Fuse type:	FSK 00.1 / 500 mA-T, only the manufacturer or service firms trained by the manufacturer may replace the fuses

Data memory

Capacity: 128 MB, NAND

Memory organisation: circular

Example of a recording range in a three-phase network

(20% quality, 8% recorder, 52% events, 20% reserve):

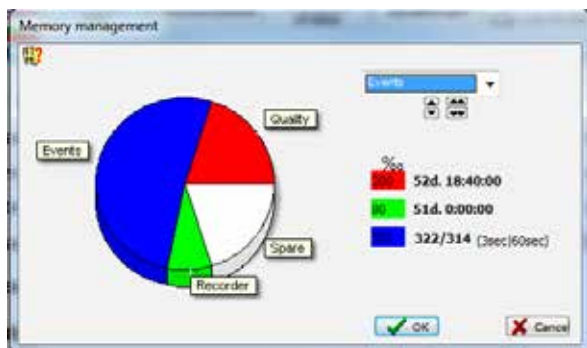
quality – 52 days 18 hours,

events – at least 322, with duration 3 sec,

- voltage $U_{RMS1/2}$, current $I_{RMS1/2}$, recording interval 10 sec,

- oscillographic recording of voltages and currents, recording interval 1 sec,

recorder – 51 days 0 hours.



Note: It is applicable for quality data of U1, U2, U3 and I1, I2, I3, for recorder data of U1, U2, U3, U4 and I1, I2, I3, I4.

The functions use the reserve part of the memory after the area defined for them was filled up.

Measuring characteristics

Sampling frequency: 256 samples per period

Antialiasing filter: digital FIR filter

Phase locked loop: controlled by the fundamental voltage harmonic U1 passing through zero

Aggregation intervals: quality function – according to EN 61000-4-30, ed. 2
recorder function – from 1 sec to ¼ hour

Aggregation synchronisation: according to EN 61000-4-30, ed. 2,

Time base: GPS synchronisation: ±10 ms

without GPS synchronisation: ±1 sec per 24 hours at 23°C ± 2K

Measurement uncertainties and measuring ranges of voltage quality parameters under testing states 1, 2 and 3 according to EN 61000-4-30, ed. 2.

LV and MV level, $f = 50 \text{ Hz}$

Parameter	Class	Uncertainty	Measuring range
Frequency	A	$\pm 2 \text{ mHz}$	42.5 Hz – 57.5 Hz
Voltage	A	$\pm 0.1 \% U_n$	10 % U_n – 150 % U_n
Flicker P_{st}	A	5 % P_{st} IEC 61000-4-15, ed. 2	P_{st} (0.2 – 10.0) 1 – 4 000 changes/min
Flicker $P_{inst, max}$	A	8 % P_{st}	$P_{st} = 1.0$ sine, rectangular
Voltage events	A	Amplitude: $\pm 0.2 \% U_n$ Duration: ± 1 period	5 % U_n – 150 % U_n 0.02 sec – 60 sec
Interruption	A	Duration: ± 1 period	0.02 sec – 180 sec
Unbalance	A	$\pm 0.1 \%$	0.5 % u_2 – 5 % u_2 0.5 % u_0 – 5 % u_0
Voltage harmonics	A	5 % U_{harm} , $U_{harm} \geq 1 \% U_n$ 0.05 % U_n , $U_{harm} < 1 \% U_n$	10 % – 200 % of class 3 IEC 61000-2-4
Voltage interharmonics	A	5 % U_{harm} , $U_{harm} \geq 1 \% U_n$ 0.05 % U_n , $U_{harm} < 1 \% U_n$	10 % – 200 % of class 3 IEC 61000-2-4
Signals in voltage	A	$\pm 5 \% U_{sig}$ for $3 \% U_n \leq U_{sig} \leq 15 \% U_n$, $\pm 0.15 \% U_n$ for $1 \% U_n \leq U_{sig} \leq 3 \% U_n$	0.5 % U_n – 15 % U_n
Voltage deviations	A	$\pm 0.1 \% U_n$	10 % U_n – 150 % U_n
Time base ¹⁾	A	$\pm 10 \text{ ms}$	-
Time base ²⁾	S	$\pm 1 \text{ sec per 24 hours}$	-

¹⁾ with GPS signal synchronization

²⁾ without GPS signal synchronization

Voltage inputs U1, U2, U3 and U4

SW setting of voltage level:	LV	MV and HV
Nominal phase voltages U_n P-N:	$230 V_{AC}$	$100/\sqrt{3}V_{AC}$
Nominal line to line voltages U_n P-P:	$400 V_{AC}$	$100 V_{AC}$
Measuring range of phase voltages:	$440 V_{AC}$	$250 V_{AC}$
Maximum input voltage P-N:	$450 V_{AC}$	
Voltage measurement uncertainty with $f=50$ Hz:	$0.05 \% M.V. \pm 0.025 \% U_n$	
Frequency range:	up to 6.5 kHz	
Input resistance:	1.68 M Ω	
Temperature coefficient:	0.05 % / 10 K	
Measurement:	direct	indirect
Max. ratio of voltage transformer:	–	999 kV / 100 V (optional SW PQ)

Current inputs with flexible sensors AMOSm/MEg38

SW setting of the nominal value

Nominal current I_n :	100 A, 300 A, 1 000 A, 3 000 A
Measuring current range:	$5 \% I_n$ to $120 \% I_n$
Frequency range:	40 Hz to 6.5 kHz
Current measurement uncertainty ^{1), 2)}	
$I_n = 100 A, 300 A, 1000 A, 3000 A$:	$0.5 \% M.V. \pm 0.1 \% I_n$ (45 Hz to 60 Hz)
Value change with position:	$\pm 1.0 \% M.V.$
Value change due to ext. fields:	$\pm 1.0 \% M.V. \pm 0.2 I_n$ (external field produced by the conductor with $0.3 I_n / 50$ Hz at 35 mm distance from the closure)
Temperature coefficient:	0.2 % / 10 K

Harmonic measurement uncertainty

$$I_n = 100 \text{ A}, 300 \text{ A}, 1000 \text{ A}: \quad \pm 5 \% I_{\text{harm}} \text{ at } I_{\text{harm}} \geq 3 \% I_n \\ \text{and } \pm 0.15 \% I_n \text{ at } I_{\text{harm}} < 3 \% I_n^{1)}$$

$$I_n = 3000 \text{ A}: \quad \pm 10 \% I_{\text{harm}} \text{ at } I_{\text{harm}} \geq 3 \% I_n \\ \text{and } \pm 0.5 \% I_n \text{ at } I_{\text{harm}} < 3 \% I_n$$

¹⁾ In the range from 5 % to 120 % I_n

²⁾ With correct position of the closure

Current inputs with clamp-on transformers

	MT0,5/MEg38	MT1,0/MEg38
Nominal current $I_n^{1)}$:	1 A, 5 A	1 A, 5 A
Current measurement uncertainty: 0.5 % of range		1.0 % of range
Harmonic measurement uncertainty:	$\pm 5 \% I_{\text{harm}} \text{ at } I_{\text{harm}} \geq 3 \% I_n \\ \text{and } \pm 0.15 \% I_n \text{ at } I_{\text{harm}} < 3 \% I_n^{1)}$	
	$\pm 10 \% I_{\text{harm}} \text{ at } I_{\text{harm}} \geq 3 \% I_n \\ \text{and } \pm 0.5 \% I_n \text{ at } I_{\text{harm}} < 3 \% I_n$	
Measuring range:	5 % to 120 % I_n	
Measurement category:	CATIV/300 V, CATIII/600 V	CAT III/300 V
Safety class:	II	
Protection rating:	IP40 with closed jaws IP30 with opened jaws	
Working temperature:	-10 °C to +55 °C	
Relative humidity:	≤ 85 %	
Dimensions:	135 × 51 × 35 mm	
Max. diameter of measured conductor:	20 mm	
Weight:	2 kg	

¹⁾ Class I according to EN 61000-4-7 ed.2

LITERATURE

- [1] User description of the program SW PQ, www.e-mega.cz
- [2] User description of the program Data viewer, www.e-mega.cz
- [3] User description of the program WebDatOr, www.e-mega.cz

MANUFACTURER

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PQ monitor MEG38/C User manual



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