

# PQ monitor MEg38/C

## User manual



# PQ monitor MEg38/C

## INTRODUCTION

The PQ monitor MEg38/C measures four voltages 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, all performed simultaneously. In the recording function, PQ monitor MEg38/C, hereinafter referred to as „monitor“, processes all measured values, evaluates powers, energies and harmonics up to the order of 64. In the function of Class A voltage quality analyser, the monitor evaluates all parameters for three measured voltages and three measured currents, as stipulated by the standard. It analyses harmonics and centred groups of interharmonics up to the order 125. When recording events, the monitor, aside from recording the course of  $U_{\text{RMS1/2}}$  and  $I_{\text{RMS1/2}}$ , makes an oscillographic record of all four values of voltage and current. The user SW working above the recording function evaluates the size of the compensation capacity 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 operate as an oscillograph with the function of recording the voltage values U1 to U4 and current values I1 to I4 into data memory; an oscillographic record can be triggered by voltage U4.

The monitor includes an uninterruptible power supply supplied from all of the four measured voltage inputs. 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 for Class A, it can be connected to GPS. It enables transmission of measured data as well as remote measurement parametrisation by the LTE service of the GSM network. It is designed in an all-plastic case with minimum dimensions with magnetic attachment and is waterproof and has increased insulation and measuring category CAT IV 300 V.

## INFORMATION ON SW

PQ monitor MEg38/C package includes a CD with user programs. Parametrization of measurements, reading of measured data, displaying of direct measurements, including an oscillographic recording, are carried out by the **PQ\_Meg** program. Unified program **DataViewer** ensures displaying of measured data in graphic and tabular form of a data file, export of measured data and printing tasks. Functions of the individual programs are specified in separate user manuals [1], [2].

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

## BASIC INFORMATION ABOUT THE MEg38/C SET

The PQ monitor MEg38/C set, see Fig. 1, consists if a MEg38/C monitor unit with an integrated uninterruptible power supply, current sensors, antennas, voltage extensions, contact elements and adapters.

The MEg38/C monitor unit is supplied in Class A or Class S. 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 sensors AMOSm/38 shown in Fig. 2 are intended for measuring at the LV level.

Clamp-on transformers with nominal currents of 1 A and 5 A are delivered in two designs, see Fig. 3 and Fig. 4. Clamp-on transformers MT0.5/38 provide current measurement preciseness of  $0.5\% I_n$  and CAT IV 300 V, therefore they can be used for measurements on conductors of a LV network. Clamp-on transformers MT1.0/38 with the preciseness of  $1.0\% I_n$  and CAT III can only be used for indirect measurement in secondary circuits of instrument current transformers or in measurement in LV circuits behind electricity meters; they have smaller dimensions.

Toroid sensors with a higher precision for even small currents needs measured circuits to be disconnected when installed or dismantled. They are also supplied in two design modifications, see Fig. 5 and Fig. 6. Toroids TORv/38 with nominal currents of 10 A and 50 A and CAT IV / 300 V are suitable for measurements on conductors of a LV network. Toroids TORM/38 with rated currents 1 A, 5 A and CAT III can be used for measurements of currents in secondary circuits of instrument current transformers or LV circuits in residences.

Crocodile clips and “open eye” contacts are included in the basic monitor set. The basic monitor set of Class A also includes an AGPS antenna shown in Fig. 7 which enables the required time synchronisation of the monitor with the GPS signal. Optionally, an

AGPRS antenna is delivered as shown in Fig.8 which enables remote transmission of measured data and parametrisation of measurements.

A single-phase load adapter Z/38 and a three-phase load adapter 3Z/38, see Fig. 9 and Fig. 10, are intended for measurements on appliances.

Voltage extensions, Fig. 11., which can have free ends or be equipped with banana plugs, serve for the connection of the monitor in large cases. The LV adapter enables connecting the monitor to a single-phase socket of a LV installation, see Fig. 12.

Optionally, magnetic contacts or grips with fuses can also be delivered in the set.

Fig. 1: PQ monitor MEG38/C, basic dimensions and user elements

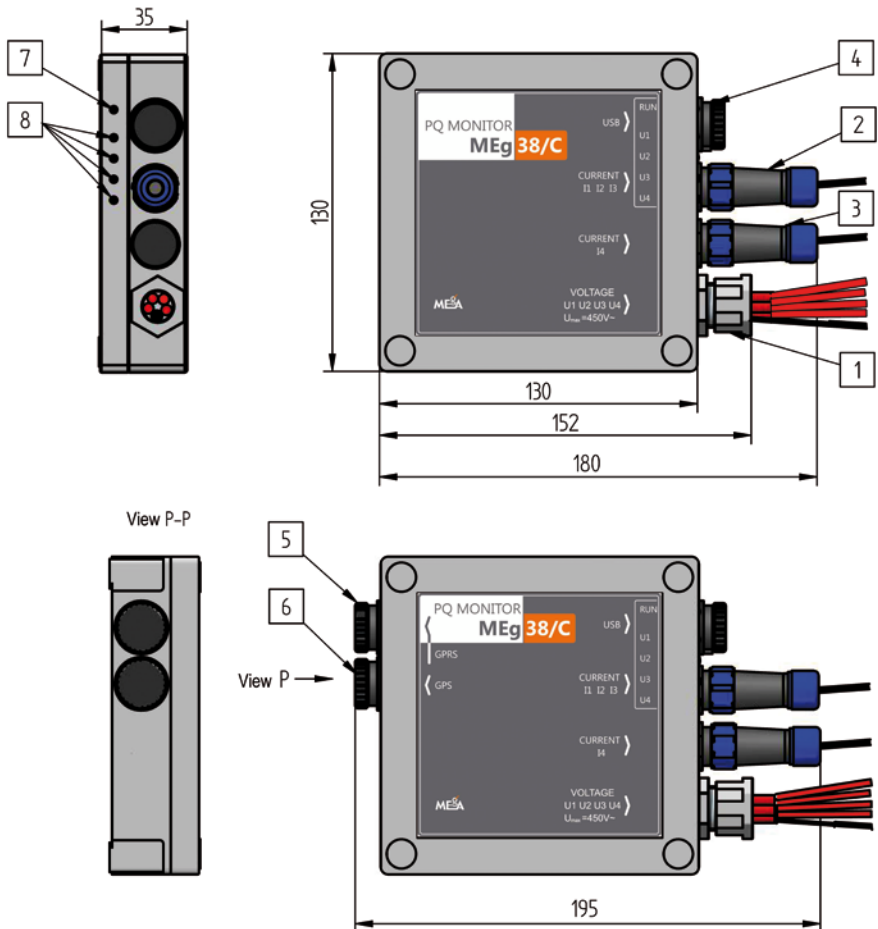


Fig. 2: Three flexible sensors of current 3AMOSm/38

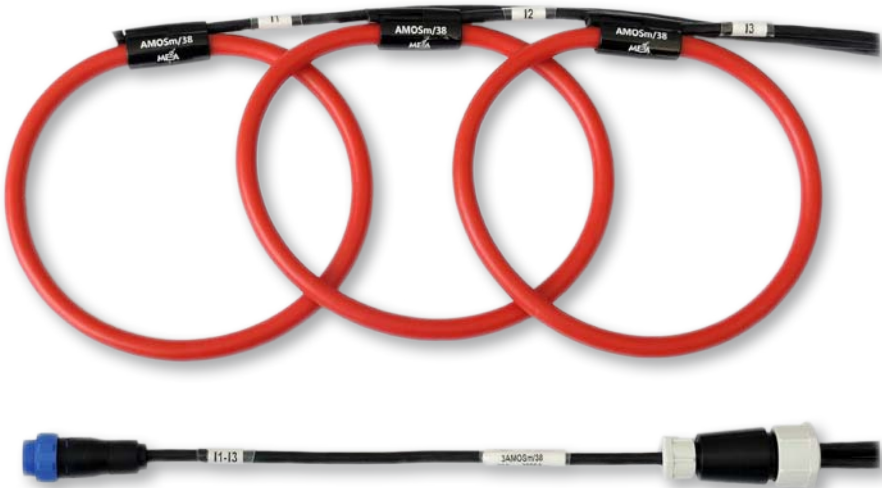


Fig. 3: Three clamp-on transformers 3MT0.5/38



Fig.4: Clamp-on transformer MT1.0/38



Fig.5: Three toroid sensors 3TORv/38



Fig. 6: Three toroid sensors 3TORm/38



Fig. 7: AGPS antenna



Fig. 8: AGPRS antenna



Fig. 9: Single-phase load adapter Z/38

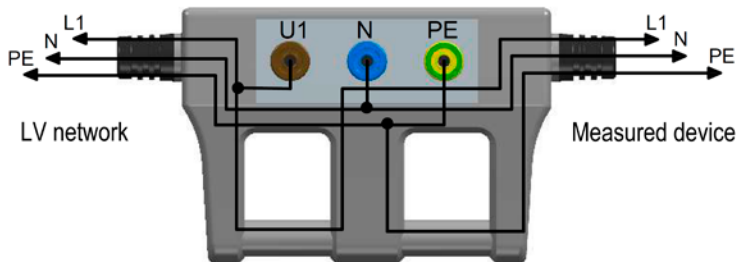


Fig. 10: Three-phase load adapter 3Z/38

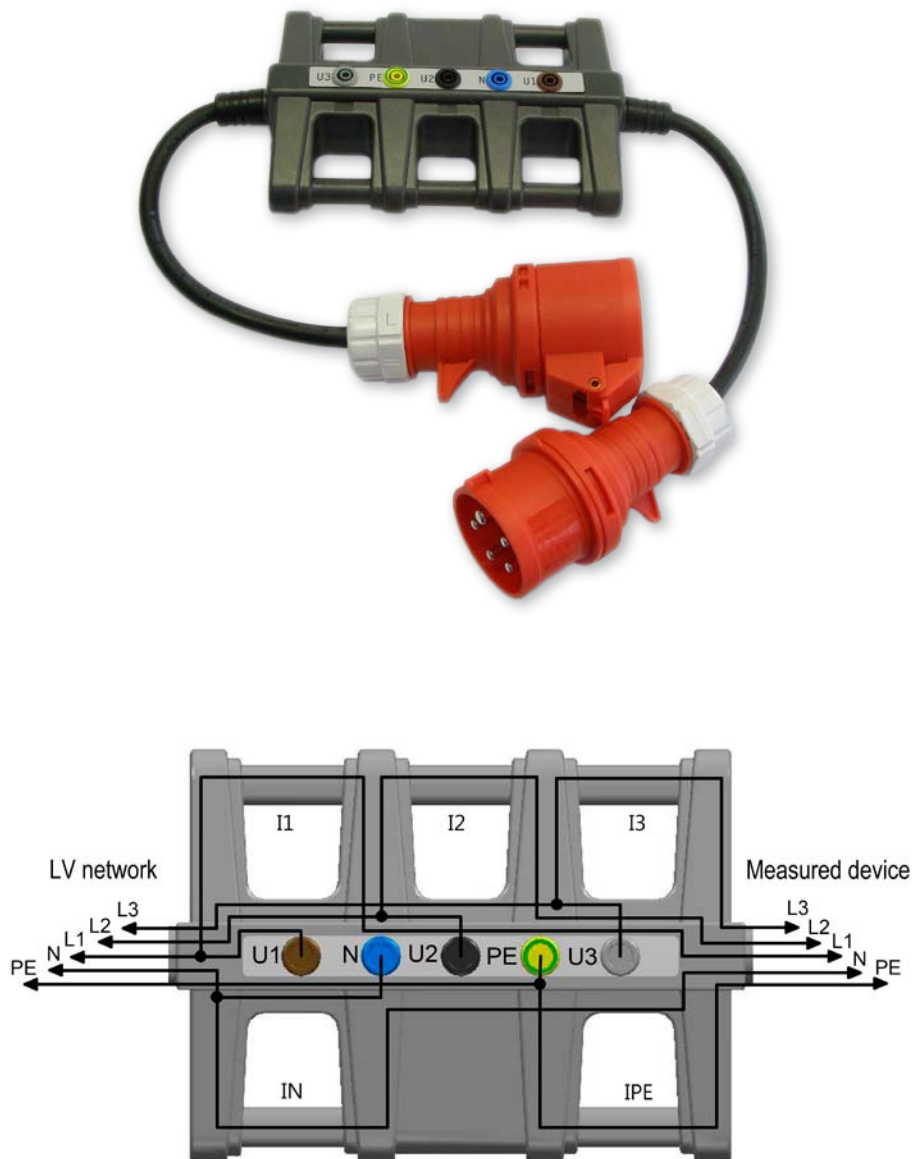


Fig. 11: Voltage extensions

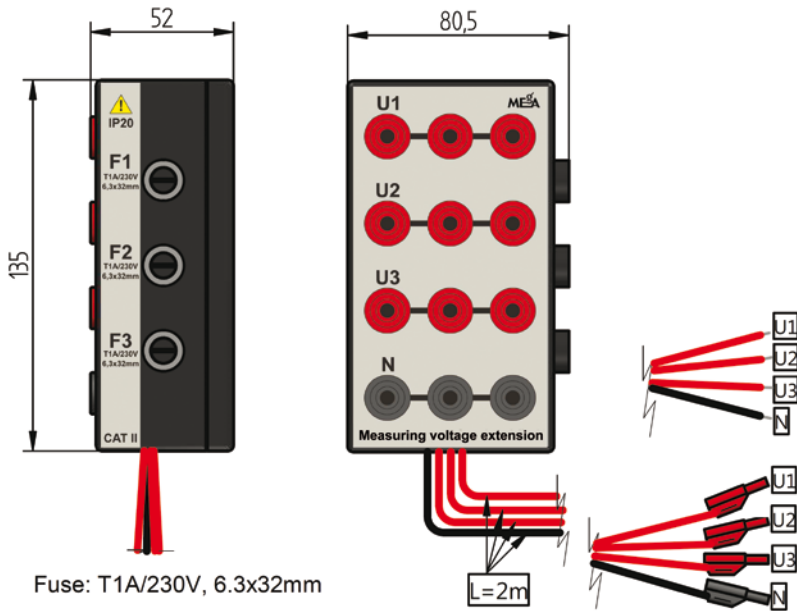
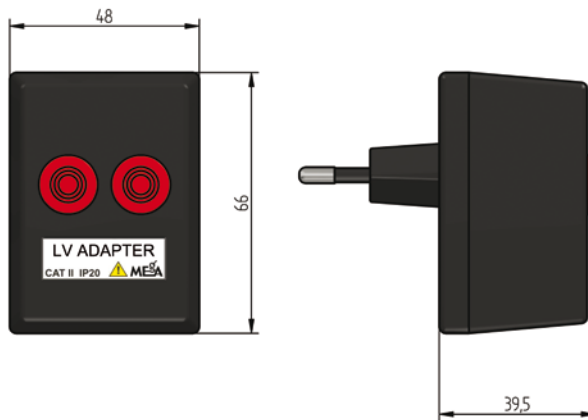


Fig. 12: LV adapter





## SAFETY INFORMATION

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

### Warning

- **Be careful, the operator performing the installation of current sensors on a live part must be equipped with personal protective equipment and additional safety devices and use them during the installation.**
- **When the PQ monitor 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 monitor set must be qualified for work on or near to dangerous voltages. The operator must be trained in providing the first aid.
- The monitor may only be operated by skilled personnel equipped with personal protective equipment against electrical injury.
- It is not permitted to connect voltage measuring cords to phase voltages higher than  $450 V_{AC}$  and phase-to-phase 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 CATIV 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 dismantled 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.
- Current sensors and antennas, properly tightened, must be connected to connectors, or connectors must be covered with housings due to the loss of water-tightness and resistance against the effect of humidity.

- During local parametrisation or reading of data the operator shall protect the monitor from water.
- Load adapters, voltage extensions and LV adapter may only be used in covered areas without the effect of water and humidity.
- It is not permitted to use other accessories than those included in the monitor set delivery.
- Current sensors, adapters and voltage extensions are first connected to the monitor and only then to the measured circuits.

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

| <b>Current sensors and contact elements</b> | <b>Environment of application</b>                 |
|---------------------------------------------|---------------------------------------------------|
| Clamp-on transformer MT0.5/38               | CATIV / 300 V                                     |
| Clamp-on transformer MT1.0/38               | CATIII / 300 V                                    |
| Flexible sensor AMOSm/38                    | CATIV / 300 V                                     |
| Toroid sensor TORv/38                       | CATIV / 300 V                                     |
| Toroid sensor TORM/38                       | CATIII / 300 V                                    |
| AGPS antenna                                | CATII,<br>2 m of a red cable of the CATIV / 300 V |
| AGPRS antenna                               | CATIV / 300 V                                     |
| Crocodile clamps                            | CATII / 1000 V                                    |
| „Open eye“ contacts                         | CATII / 1000 V                                    |
| Grips with fuses                            | CATIII / 1000 V                                   |
| Magnetic contacts                           | CATIII / 1000 V                                   |
| Load adapter Z/38                           | CATII / 250 V                                     |
| Load adapters 3Z/38                         | CATII / 415 V                                     |
| LV adapter                                  | CATII / 600 V                                     |
| Voltage extension with banana plugs         | CATII / 600 V                                     |

- Current sensor of AMOSm/38, MT/38 and TOR/38 types may only be installed on insulated parts of conductors.
- When current sensors are installed on non-insulated parts, they can only be installed to circuits of the overvoltage category according to Table 1, which will be switched off during the installation. When installing current sensors to the environment with dangerous voltage, personal protective equipment must be used and safety requirements valid for the respective network must be met.
- Current sensors may only be installed in circuits with overvoltage category prescribed in Table 1.
- When installing the monitor with the attached AGPS antenna to a LV case with the overvoltage category of CATIV, its cable with doubled insulation at the length of 2 m can only be placed in the case.

Tab. 2: Water-tightness of components of the MEg38/C set

| <b>Name</b>                                   | <b>Protection</b> |
|-----------------------------------------------|-------------------|
| MEg38/C unit                                  | IP 65             |
| Flexible current sensors, type AMOSm/38       | IP 65             |
| Clamp-on transformers, type MT/38             | IP 20             |
| Toroid sensors TOR/38                         | IP 20             |
| AGPS antenna                                  | IP 23             |
| AGPRS antenna                                 | IP 63             |
| Load adapters, type Z/38                      | IP 20             |
| LV adapter                                    | IP 20             |
| Voltage extensions with banana plugs          | IP 20             |
| Crocodile clamps, grips and magnetic contacts | IP 20             |

## **Caution**

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, electric shock risk



Do not install around non-insulated hazardous live conductors which can cause electrical shock, burning or arc discharge

CAT IV

Overvoltage category, characterizing the state of the transient overvoltage. General LV distribution network from a transformer station to fuses at the electricity meter

CAT III

Overvoltage category, characterizing the state of the transient overvoltage. General LV installations in buildings behind fuses at the electricity meter



Safety class II, double or increased insulation



Ground, grounding terminal

IP code

Degree of protection provided by enclosure



The product is intended for recycling and collection spots



Declaration of Conformity – European Community



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

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

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

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

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

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

| <b>Components of the basic set</b>                                                                                                   | <b>Identification</b> |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| PQ monitor MEg38/C unit, Class A (it includes the GPS and GPRS functions with AGPS and AGPRS antennas)                               | A/38                  |
| PQ monitor MEg38/C unit, Class S                                                                                                     | S/38                  |
| Communication cable with USBmini / EMC / 2 m                                                                                         | USB/38                |
| LV adapter for measuring in a LV socket                                                                                              | NN/38                 |
| Set of crocodile clamps (3 pcs red, 1 pc blue, 1 pc black)                                                                           | K/38                  |
| Set of 5 pcs of open eyes (3 pcs red, 1 pc black, 1 pc blue) with the inner diameter of 8.2 mm                                       | XKS-A                 |
| Set of 5 pcs of open eyes (3 pcs red, 1 pc black, 1 pc blue) with the inner diameter of 4.1 mm                                       | XKS-4                 |
| Transport case with lining                                                                                                           | B/38                  |
| CD with user manuals to the monitor, descriptions of the PQ_MEg user software and the Data Viewer user software, a calibration sheet | CD/38                 |

| <b>Components of optional accessories</b>                                                        | <b>Identification</b> |
|--------------------------------------------------------------------------------------------------|-----------------------|
| GPS and GPRS functions with AGPS and AGPRS antennas to the PQ monitor MEg38/C, Class S           | AGP/38                |
| Three flexible current sensors 3AMOSm/38, I1-I2-I3, 40 cm (30 A, 100 A, 300 A, 1 000 A, 3 000 A) | 3AMOSm/38             |
| Flexible current sensor AMOSm/38, I4, 40 cm (30 A, 100 A, 300 A, 1 000 A, 3 000 A)               | AMOSm/38              |
| 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             |

| Components of optional accessories                                                          | Identification |
|---------------------------------------------------------------------------------------------|----------------|
| Clamp-on current transformer MT1.0/38, I4,<br>Precision class 1.0 (1 A, 5 A)                | MT1,0/38       |
| Three toroid sensors 3TORv/38, I1-I2-I3 (10 A, 50 A)                                        | 3TORv/38       |
| Toroid sensor TORv/38, I4 (10 A, 50 A)                                                      | TORv/38        |
| Three toroid sensors 3TORM/38, I1-I2-I3 (1 A, 5 A)                                          | 3TORM/38       |
| Toroid sensor TORM/38, I4 (1 A, 5 A)                                                        | TORM/38        |
| Single-phase load adapters Z/38                                                             | Z/38           |
| Three-phase load adapter 3Z/38                                                              | 3Z/38          |
| Set of grips with fuses CATIII (3 pcs red, 2 pcs black)                                     | G/38           |
| Set of magnetic contacts $\varnothing 7$ mm, L 10 mm<br>(3 pcs red, 1 pc blue, 1 pc black)  | M7/38          |
| Set of magnetic contacts $\varnothing 11$ mm, L 35 mm<br>(3 pcs red, 1 pc blue, 1 pc 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         |
| Electrical assembly SW (a circuit breaker value, a compensation<br>capacity value)          | EMSW/38        |
| Leather transport case                                                                      | T/MEg38        |

The monitor of Class S without optional extension has the connectors and indication elements situated on one side, see Fig. 1.

The monitor of Class A uses a rear side of the unit for the connection of AGPS and AGPRS antennas.

Tab. 4: User elements

| Item | Name                                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Voltage inputs with supply             | <p>Fixedly connected measuring cords U1, U2, U3, U4 and N with the length of 1 m ending with banana plugs CATIV which are also the supply cords.</p> <p>Maximum voltage between the N cord and U1, U2, U3, U4 cords is <math>450 V_{AC}</math>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2    | Connector of current inputs I1, I2, I3 | <p>The connector for connecting three current sensors I1, I2, I3. Current sensors can be flexible 3AMOSm/38 ones, see Fig. 2, clamp-on transformers 3MT0.5/38 and 3MT1.0/38, see Fig. 3 and Fig. 4, or toroid sensors 3TORv/38 and 3TORM/38, see Fig. 5 and Fig. 6.</p> <p>Automatic identification of the connected type of sensors during parametrisation of the measurement.</p> <p>An identical type of sensors (SW check distinguishes AMOSm/38, MT0.5/38, MT1.0/38, TORv/38 and TORM/38) can only be used on current inputs I1, I2, I3 and the monitor input I4.</p> <p>An identical value of the rated current can only be set on current inputs I1, I2, I3:</p> <p>3AMOSm/38 (30 A, 100 A, 300 A, 1 000 A, 3 000 A),<br/> 3MT0,5/38 and 3MT1,0/38 (1 A, 5 A),<br/> 3TORv/38 (10 A, 50 A), 3TORM/38 (1 A, 5 A).</p> <p>The set nominal value of current of sensors on inputs I1, I2 and I3 need not to be identical with the rated value of the current set on input I4.</p> |

| Item | Name                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3    | Connector of current input I4  | <p>Connector for connecting the current sensor I4.</p> <p>The current sensor can be flexible AMOSm/38, clamp-on transformer MT0.5/38 or MT1.0/38, or toroid sensor TORv/38 or TORm/38.</p> <p>Automatic identification of the connected type of sensor during parametrization of the measurement.</p> <p>An identical type of sensors (SW check distinguishes AMOSm/38, MT0.5/38, MT1.0/38, TORv/38 and TORm/38) can only be used on current input I4 and current inputs I1, I2, I3.</p> <p>The software can set the following values of the rated current:</p> <p style="padding-left: 40px;">AMOSm/38 (30 A, 100 A, 300 A, 1 000 A, 3 000 A)</p> <p style="padding-left: 40px;">MT0.5/38 and MT1.0/38 (1 A, 5 A),</p> <p style="padding-left: 40px;">TORv/38 (10 A, 50 A), TORm/38 (1 A, 5 A).</p> <p>The set rated value of current of the sensor on input I4 need not to be identical with the rated value of currents of three sensors on inputs I1, I2, I3.</p> |
| 4    | Connector mini USB             | Connector of galvanically separated communication USB 2.0 / 5,4 Mbit/s.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 5    | Connector of the AGPS antenna  | <p>Connectors for connecting the AGPS antenna enabling time signal synchronization of Class A monitors.</p> <p>The function of time synchronization with the GPS signal is optional in Class S monitors.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 6    | Connector of the AGPRS antenna | <p>A connector for connecting the AGPRS antenna enabling remote transfer of measured data and remote parametrization of measurements of Class A monitors.</p> <p>The function of remote data transfer and parametrization of measurements is optional in Class S monitors.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Item | Name                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7    | Status of the RUN LED         | <p>Briefly interrupted lighting – the monitor measures according to the programmed parametrization</p> <p>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.</p> <p>Alternating lighting 1 : 1 – oscillographic record.</p>                                                                                                                                                                   |
| 8    | Status of LEDs U1, U2, U3, U4 | <p>Signalization 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).</p> <p>Lighting:</p> <p>permanent – the voltage is in the pre-set tolerance band (<math>0.9 U_n</math> to <math>1.1 U_n</math>),</p> <p>one flash – the voltage is in the pre-set interruption band,</p> <p>two flashes – the voltage is in the pre-set dip band,</p> <p>three flashes – the voltage is in the pre-set swell band.</p> |

Fig. 13: Rating plates of the PQ monitor MEg38/C Class A and Class S

| PQ MONITOR MEg38/C cl.A                                                                                                                                                                                                                                                                                                                                                                                                      |          |         |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|----------|
| Voltage inputs: U1, U2, U3, U4<br>$U_{nom LV} = 230V \sim L - N$ , $U_{nom MV} = 100V \sim L - L$<br>Measuring range: $LV = 440V \sim L - N$ $MV = 250V \sim L - N$<br>Current inputs: I1, I2, I3, I4<br>AMOSm/38, $I_{nom} = 30A, 100A, 300A, 1000A, 3000A$<br>MT0.5/38, $I_{nom} = 1A, 5A$ , TORm/38, $I_{nom} = 1A, 5A$<br>MT1.0/38, $I_{nom} = 1A, 5A$ , TORv/38, $I_{nom} = 10A, 50A$<br>Measuring range: $1.2 I_{nom}$ |          |         |          |
| MEg38/C cl.A                                                                                                                                                                                                                                                                                                                                                                                                                 | AMOSm/38 | AGPS/38 | AGPRS/38 |
| Nr                                                                                                                                                                                                                                                                                                                                                                                                                           |          |         |          |
| MT0.5/38                                                                                                                                                                                                                                                                                                                                                                                                                     | MT1.0/38 | TORv/38 | TORm/38  |
| Nr                                                                                                                                                                                                                                                                                                                                                                                                                           |          |         |          |
|     CAT IV 300V~, IP65                                                                    |          |         |          |

| PQ MONITOR MEg38/C cl.S                                                                                                                                                                                                                                                                                                                                                                                                      |          |         |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|----------|
| Voltage inputs: U1, U2, U3, U4<br>$U_{nom LV} = 230V \sim L - N$ , $U_{nom MV} = 100V \sim L - L$<br>Measuring range: $LV = 440V \sim L - N$ $MV = 250V \sim L - N$<br>Current inputs: I1, I2, I3, I4<br>AMOSm/38, $I_{nom} = 30A, 100A, 300A, 1000A, 3000A$<br>MT0.5/38, $I_{nom} = 1A, 5A$ , TORm/38, $I_{nom} = 1A, 5A$<br>MT1.0/38, $I_{nom} = 1A, 5A$ , TORv/38, $I_{nom} = 10A, 50A$<br>Measuring range: $1.2 I_{nom}$ |          |         |          |
| MEg38/C cl.S                                                                                                                                                                                                                                                                                                                                                                                                                 | AMOSm/38 | AGPS/38 | AGPRS/38 |
| Nr                                                                                                                                                                                                                                                                                                                                                                                                                           |          |         |          |
| MT0.5/38                                                                                                                                                                                                                                                                                                                                                                                                                     | MT1.0/38 | TORv/38 | TORm/38  |
| Nr                                                                                                                                                                                                                                                                                                                                                                                                                           |          |         |          |
|     CAT IV 300V~, IP65                                                                   |          |         |          |

### Legend to the rating plate

The rating plate of the monitor, see Fig. 13, is situated on the rear side of the monitor. In addition to manufacturer's identification data and monitor designation, there is a specification of the range of alternating supply voltage from 52 V to 440 V with the frequency of 50 Hz and the consumption for rated and limit values of supply voltage.

### Voltage inputs:

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

At the MV or HV level, delta voltages U1-U2, U2-U3 a U3-U1 with the rated value of 100V are measured indirectly, voltage U4 is measured against input N with the rated value of  $100/\sqrt{3} V$ .

Measurement at the LV or MV level is selected during parametrization 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  $450 V_{AC}$ .

Flexible current sensors AMOSm/38 with the rated value of 30A, 100A, 300A, 1000A and 3000A, clamp-on transformers MT0.5/38 with rated values of 1A or 5A or toroid sensors TORv/38 with the rated value of 10A, 50A are usually connected on **current inputs** I1, I2, I3 a I4 in LV networks.

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



Current sensor of AMOSm/38, MT/38 types may only be installed on insulated parts of conductors. When the mentioned current sensors and toroid sensors TORv/38 are installed on non-insulated parts, they can only be installed to circuits of the overvoltage category according to Table 1, which will be switched off during the installation. When installing current sensors to the environment with dangerous voltage, personal protective equipment must be used and safety requirements valid for the respective network must be met.

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



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

IP65 protection of the monitor is ensured with properly tightened housings of the USB connector, connectors I1, I2, I3, I4 and antenna connectors in Class A monitor, or with properly tightened current sensors and antennas.

When current sensors MT0.5/38, MT1.0/38, TORv/38, TORm/38, AGPS and AGPRS antennas, voltage extensions, load adapters and LV adapters intended only for installation in covered areas are used, the operator of the monitor shall ensure resistance to the effect of water in a different manner.

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

The PQ monitor MEg38/C set is calibrated with current sensors whose serial numbers are specified in the last but one part of the rating plate. The measurement precision specified in technical conditions is only ensured in this set.



## CHARACTERISTICS OF MONITOR DESIGN

A square monitor unit of safety class II with indication elements and connectors on the narrow front side creates an optimum rectangular format of a narrow profile in the completed set for lucid installation to energy networks.

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

Water-proof and dust-proof design of the case of the unit with water-proof current and antenna connectors when current sensors are installed, or covered with 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 currents I1, I2, I3 by three separated sensors and the current I4 by a separate sensor, which are types AMOSm/38, MT0.5/38 and TORv/38 approved for the installation in LV cases with supply cables with the total length of 2 m, well flexible even at below-zero temperatures.

The indirect measurement of currents I1, I2, I3 by three separated sensors and the current I4 by a separate sensor, which are types MT1.0/38 and TORM/38 for small 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 at the LV level is all-insulated, water-proof, with overvoltage category CAT IV / 300 V with the sensing part having the length of 40 cm, the range of rated currents from 30 A to 3000 A and the closure of the sensing part which enables opening with one hand.
- 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 transformers MT1.0/38 with the precision class of 1.0 for indirect measurements of currents with the rated value of 1 A and 5 A on insulated conductors at the MV level.
- 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 for indirect measurements of currents in covered areas with the rated value of 1 A and 5 A at the MV and HV levels.

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

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

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

GPS synchronisation of internal clock and two-directional data transmission by the LTE service of the GSM network in the basic monitor set of Class A, and optionally in monitor Class S. Both the antennas are equipped with an insulation cover and an improved insulation of a part of the cable.

## **CONNECTION FOR MEASUREMENT**

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

Measurement in MV as well as HV networks is indirect through instrument measuring transformers.

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

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

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

The monitor is supplied from 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 and three-phase 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.

Types of sensors AMOSm/MEg38, MT0.5/38, MT1.0/38, TORv/38 and TORm/38 automatically identified by SW. 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.

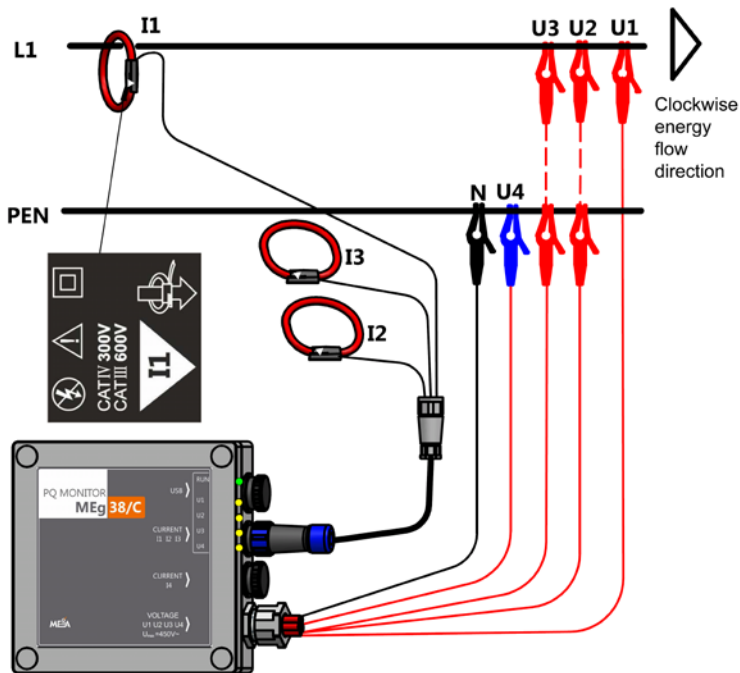
Flexible current sensors AMOSm/38, clamp-on transformers MT0.5/38 and toroid sensors TORv/38 are intended for measuring at the LV level.

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

Tab. 5: Permitted connections of types of sensors

| Connections<br>of types of sensors |          | Input I1, I2, I3 |          |          |         |         |
|------------------------------------|----------|------------------|----------|----------|---------|---------|
|                                    |          | AMOSm/38         | MT0.5/38 | MT1.0/38 | TORv/38 | TORm/38 |
| Input<br>I4                        | AMOSm/38 | YES              | NO       | NO       | NO      | NO      |
|                                    | MT0.5/38 | NO               | YES      | NO       | NO      | NO      |
|                                    | MT1.0/38 | NO               | NO       | YES      | NO      | NO      |
|                                    | TORv/38  | NO               | NO       | NO       | YES     | NO      |
|                                    | TORm/38  | NO               | NO       | NO       | NO      | YES     |

Fig. 14: Single-phase measurement of voltage and current by a 3AMOSm/38 sensor in the LV network



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

Fig. 15: Single-phase measurement of voltage and direct measurement of current by 3MT0.5/38 clamp-on transformers in the LV network

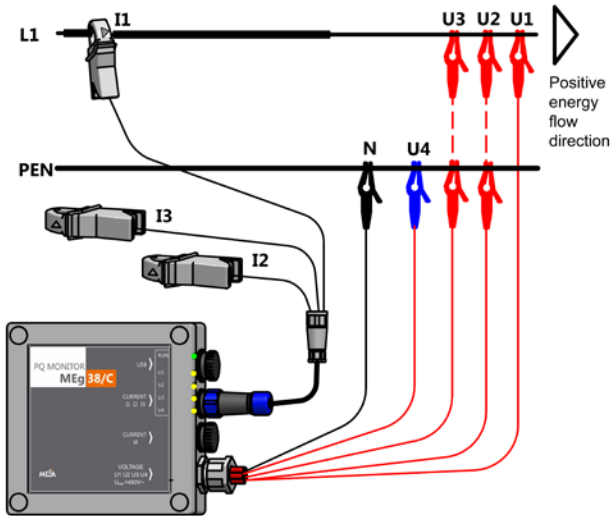


Fig. 16: Single-phase measurement of voltage and direct measurement of current by 3TORv/38 toroid sensors in the LV network

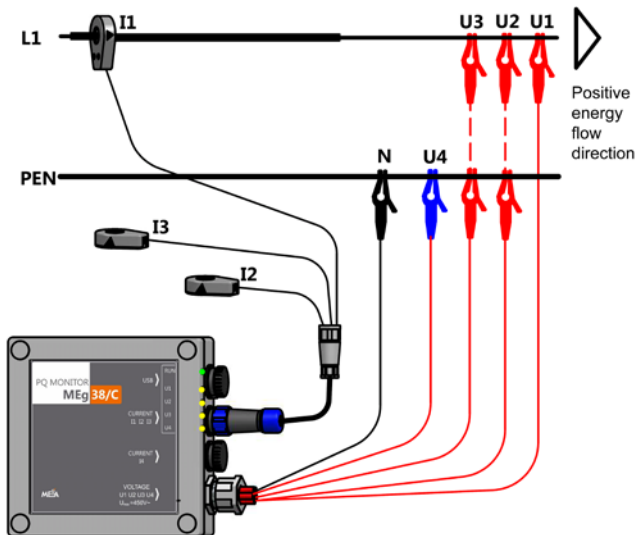


Fig. 17: Single-phase measurement of voltage and current and measurement of voltage of the middle conductor against ground and current of the middle conductor in the LV network

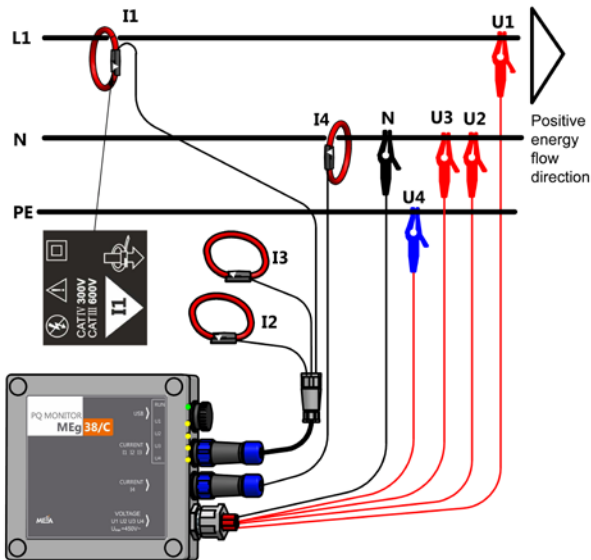


Fig. 18: Measurement of three-phase voltage and three-phase current by 3AMOSm/38 sensors in the LV network

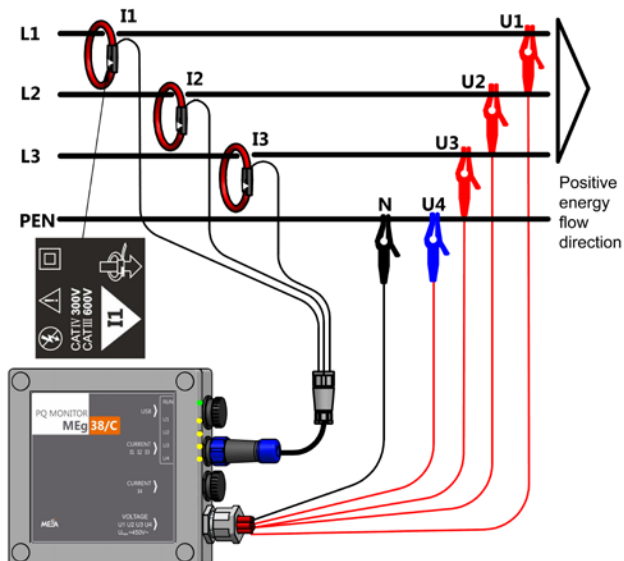


Fig. 19: Measurement of three-phase voltage and voltage between the middle conductor and the ground, measurement of three-phase currents and the current of the middle conductor by sensors 3AMOSm/38 and AMOSm/38 in the LV network

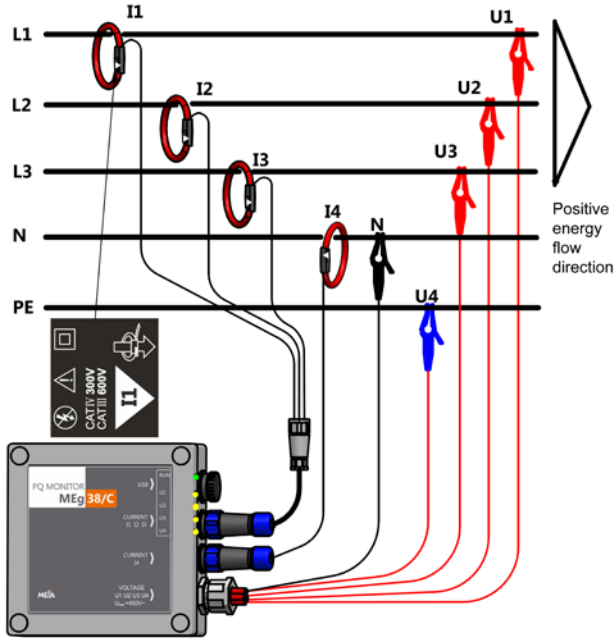


Fig. 20: Measurement of three-phase voltage and direct measurement of three-phase current by 3MT0.5/38 clamp-on transformers in the LV network

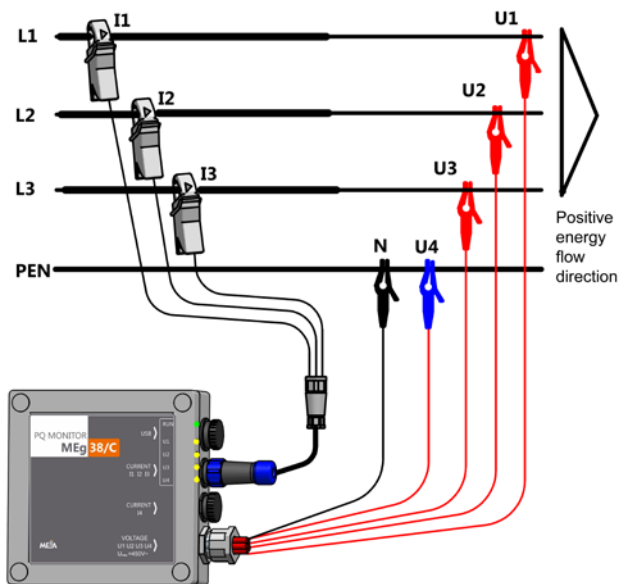


Fig. 21: Measurement of three-phase voltage and direct measurement of three-phase current by 3TORv/38 toroid sensors in the LV network

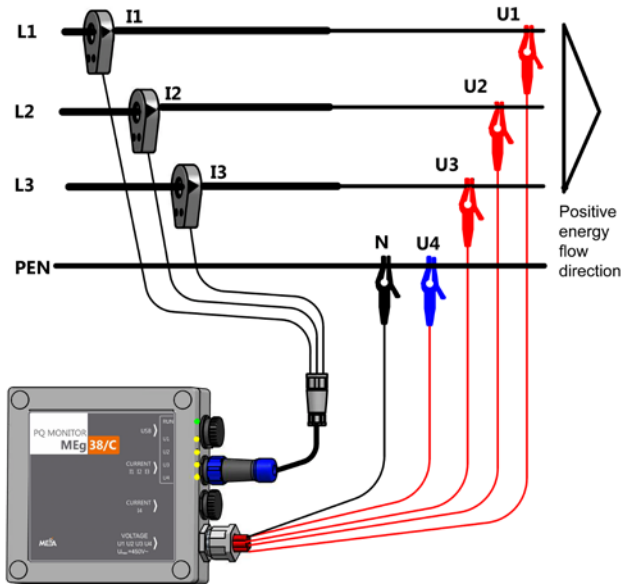


Fig. 22: Single-phase measurement of voltage in a LV socket

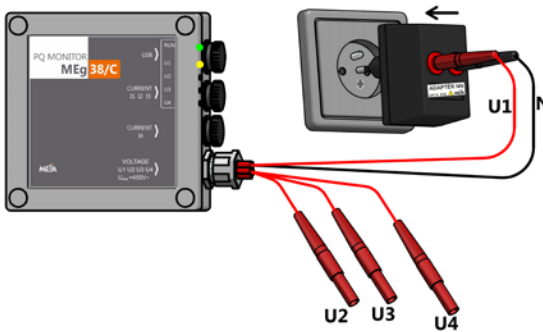


Fig. 23: Measurement of phase voltage, middle conductor voltage against ground and phase current of a single-phase device in a LV network by the load adapter Z/38 with clamp-on transformers MT0.5/38 or MT1.0/38

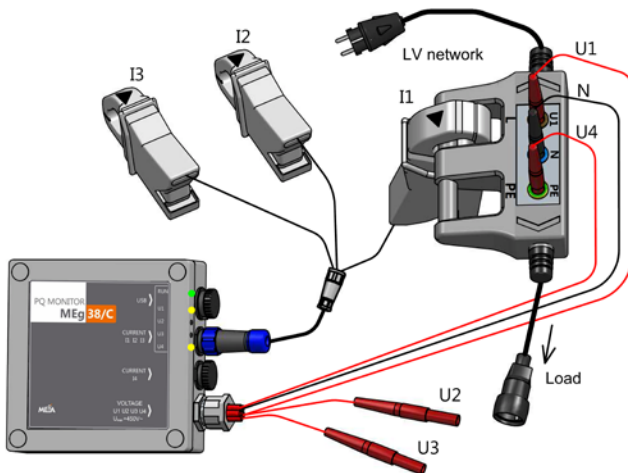


Fig. 24: Measurement of phase voltages, middle conductor voltage against ground and measurement of phase currents of a three-phase device in a LV network by the three-phase load adapter 3Z/38 with flexible sensors 3AMOSm/38 and AMOSm/38

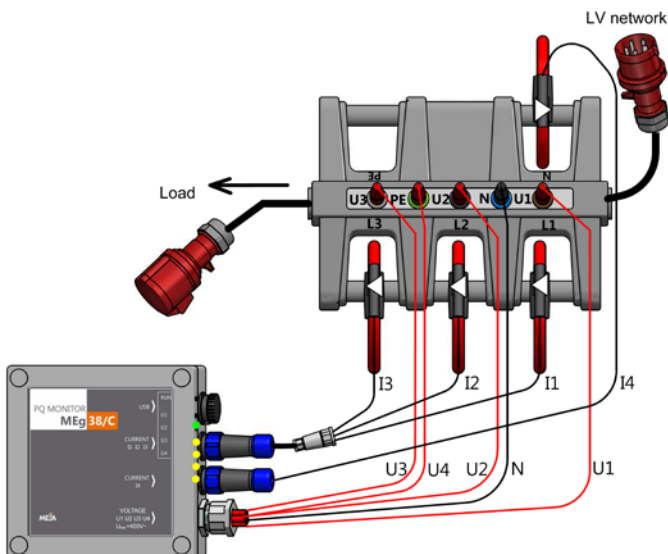


Fig. 25: Three-phase measurement of delta voltages and phase currents by clamp-on transformers 3MT0.5/38 or 3MT1.0/38 in grounded MV and HV networks

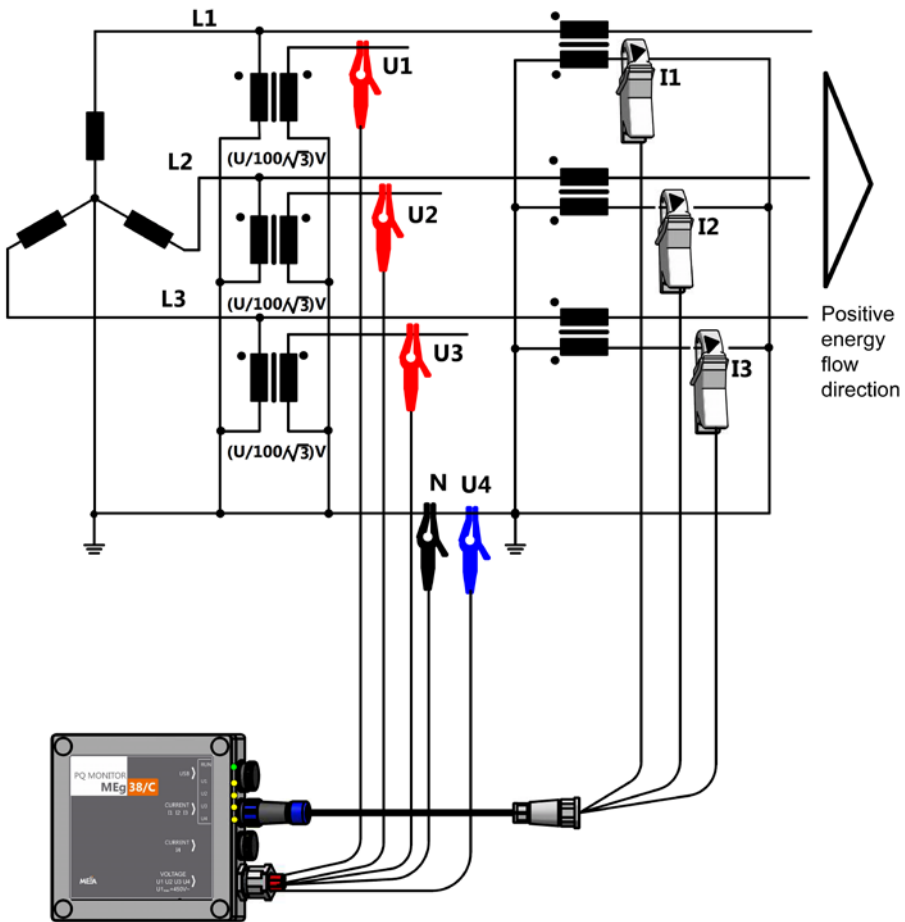


Fig. 26: Three-phase measurement of delta voltages and phase currents by toroid sensors 3TORM/38 in grounded MV and HV networks

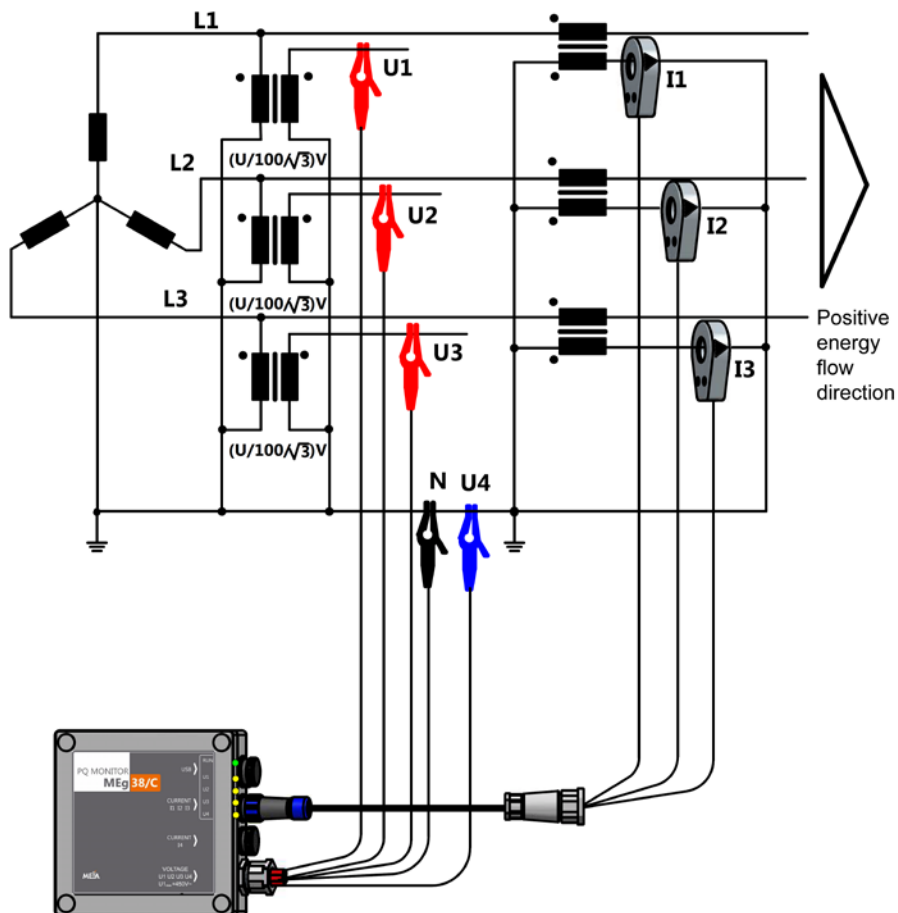


Fig. 27: Measurement of delta voltages, voltage  $U_0$ , phase currents by clamp-on transformers 3MT0.5/38 or 3MT1.0/38 and current  $I_0$  by a clamp-on transformer MT0.5/38 or MT1.0/38 in a compensated MV network

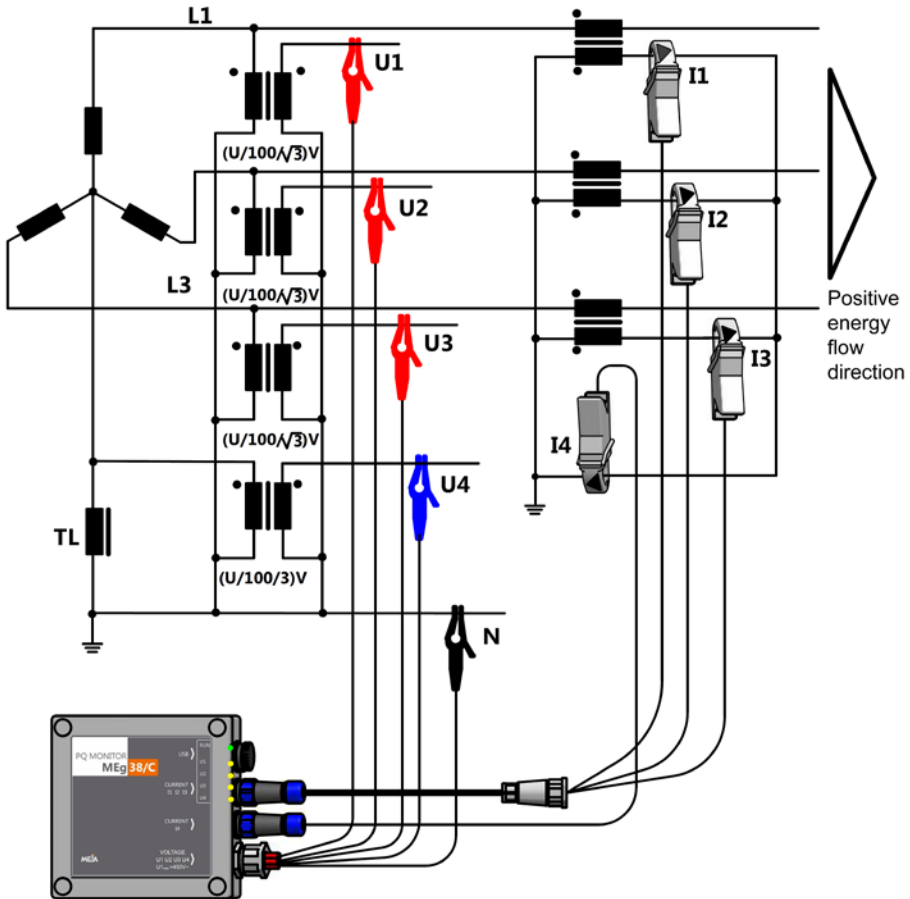
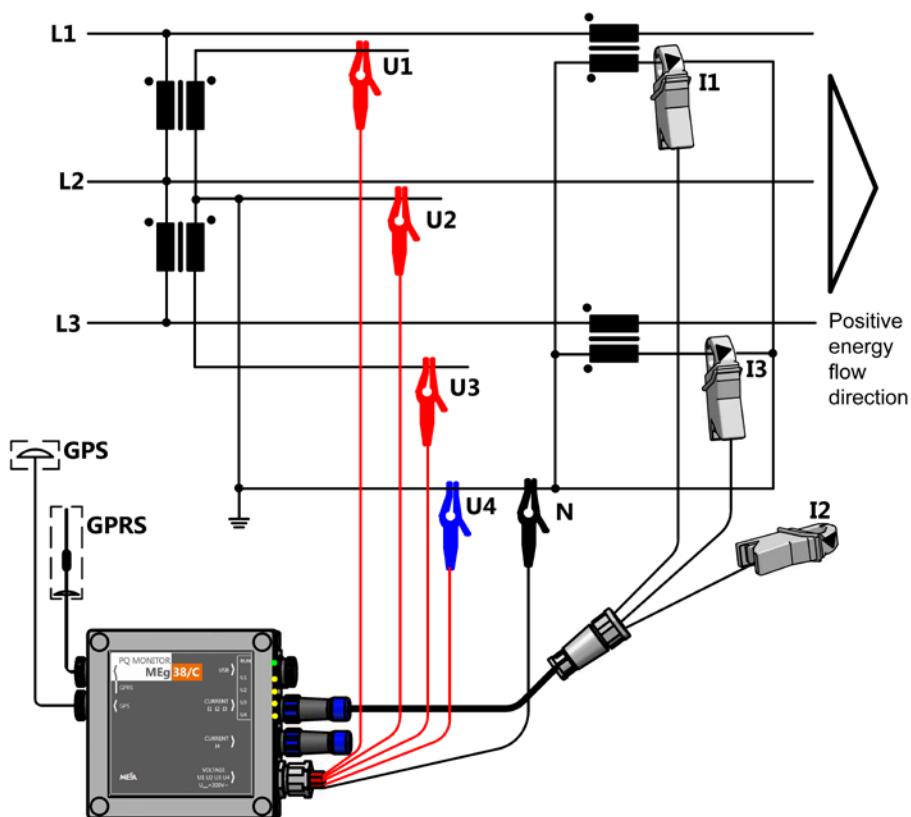


Fig. 28: Measurement in Aron connection by the MEG38/C monitor at the MV level with the connected GPRS communication and GPS time synchronisation



## MEASURED DATA

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

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

- Time of evaluation
- Voltage unbalance
- Frequency
- Voltage
- Voltage deviations  $U_{\text{over}}$ ,  $U_{\text{under}}$
- Flicker  $P_{\text{st}}$  and  $P_{\text{lt}}$
- $\text{THD}_U$
- DC component, fundamental harmonic up to 125<sup>th</sup> harmonic of voltage
- Centered subgroups of interharmonic component of voltage up to the order of 125
- Level of mains signaling voltage (HDO)
- Flagged data
- Currents
- $\text{THD}_I$
- Basic to 125<sup>th</sup> harmonics of currents
- Centered subgroups of interharmonic I up to the order of 125

Data at single events on voltage, currents and events initiated by voltage U4:

- Time of event
- Event duration
- Moments when the limits for interruption, dip and swell of voltage and current are exceeded
- Residual and maximum values of voltage and current
- Curves of voltages  $U_{\text{RMSI}/2}$  and currents  $I_{\text{RMSI}/2}$  with optional pre-trigger
- Oscillogram of voltage and current curves during event with fixed pre-trigger
- Harmonic voltages and harmonic currents during event

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

- Time of evaluation
- Voltage
- Currents
- Active powers
- Reactive powers
- Apparent powers
- PF
- Active and reactive energies – four quadrants, 6 registers for each phase
- Distortion powers
- Unbalance power
- Active powers of the 1<sup>st</sup> harmonic
- Reactive powers of the 1<sup>st</sup> harmonic
- Apparent powers of the 1<sup>st</sup> harmonic
- Cos φ
- Active and reactive energies of the 1<sup>st</sup> harmonic – four quadrants, 6 registers for each phase
- THD<sub>U</sub>
- THD<sub>I</sub>
- Harmonic components of voltages up to the order of 64.
- Harmonic components of currents up to the order of 64.

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

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

The above stated recorder data apply to voltages U1 to U4 and currents I1 to I4.

## ASSEMBLY OF THE MONITOR SET, PREPARATION FOR MEASUREMENT



### Warning

- The maximum connected voltages can be at the value of  $450 V_{AC}$ , the maximum connected delta voltages are at the value of  $780 V_{AC}$ .
- In the CAT IV/300 V environment, the maximum voltage against common conductor can be  $300 V_{AC}$ .
- Accessories included in the monitor set can only be used for the assembly of the monitor before measurement according to the approved overvoltage category which has to be in compliance with the overvoltage category in the measured point.
- Before connecting to measured voltages all components of the set must be mutually connected and housings shall be installed on free connectors.
- It is recommended not to unnecessarily expose the monitor and current sensors AMOSm/38 to the effect of water and humidity.
- Clamp-on transformers MT0.5/38 and MT1.0/38, toroid sensors TORv/38 and TORm/38, voltage extensions, antennas AGPS and AGPRS, load adapters Z/38 and 3Z/38 as well as the LV adapter must not be exposed to the effect of water and humidity.
- Due to the protection against electrical shock injury voltage cords must be fitted with contact elements stated in Table 1 or inserted to safe slots of adapters or extensions before their connection to voltage. Magnetic contact can only be installed to switched-off voltage circuits with zero voltage.
- A part of the AGPS antenna with reinforced insulation can only be placed in the LV case with the danger of contact.



### Caution

- The PQ monitor MEg38/C set is calibrated with current sensors whose serial numbers are specified on the rating plate situated on the rear side of the device. The measurement precision specified in technical conditions is only ensured in this set.



- 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 crocodile clamps or grips with fuses or magnetic contacts are installed on voltage cords.

- When connecting AGPS and AGPRS antennas which have the same design of the connector the attention must be paid to their correct connection. Unless antennas are used, housings must be properly screwed on antenna connectors to ensure water-tightness.
- During parametrization 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.

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/38 or clamp-on transformers MT0.5/38 or clamp-on transformers MT1.0/38 or toroid sensors TORv/38 or TORm/38. Nuts of connectors or housings shall be properly tightened.

Unless currents are measured, connector housings are properly screwed on on both current connectors.

Flexible current sensors AMOSm/38 with the rated value of 30 A, 100 A, 300 A, 1000 A and 3000 A, clamp-on transformers MT0.5/38 with rated values of 1 A or 5 A or toroid sensors TORv/38 with the rated value of 10 A, 50 A are usually connected on current inputs I1, I2, I3 a I4 in LV networks.

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 parametrization software according to the manual in its user description [1].

Corresponding antennas according to Fig. 28 are connected to GSM and GPS connectors on the PQ monitor MEg38/C of Class A and optionally on the PQ monitor MEg38/C of Class S. Be careful not to confuse antennas!

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



**Warning**



**Caution**

- It is not permitted to connect voltage measuring cords to phase voltages higher than  $450 V_{AC}$ , otherwise there is a risk of electric shock.
- It is not permitted to connect monitor to delta voltages higher than  $780 V_{AC}$ , otherwise there is a risk of electric shock.
- It is not permitted to connect the monitor to phase voltages higher than  $300 V_{AC}$  in LV networks between MV/LV transformers and customer electricity meters characterized by CAT IV overvoltage categories, otherwise there is a risk of electrical injury
- The monitor shall only be operated by skilled personnel equipped with personal protective equipment against electrical injury.
- Voltage extensions, load adapters and LV adapters must not be exposed to the effect of water.
- Operating range of voltage is from  $52 V_{AC}$  to  $440 V_{AC}$ .
- In case of a mechanical damage to the monitor or its measuring cords, the monitor must be immediately dismantled and sent for repair.
- Current sensors AMOSm/38, clamp-on transformers MT0.5/38 and MT1.0/38 as well as toroid sensors TORv/38 and TORM/38 may only be installed in circuits with overvoltage category stated in Table 1.
- In case of a mechanical damage even to the top layer of the insulation of the sensing part of the flexible sensor AMOSm/38, which can manifest in a contrast change in colour of the sensing part surface, the sensor must be immediately dismantled and sent for repair.
- Current sensors are only intended for installation on insulated live parts.
- If current sensors are installed in areas with dangerous voltage, the operator must be equipped with personal protective equipment against electric shock injury.
- If current sensors need to be installed on live parts or in areas with dangerous voltage, they have to be installed at the voltage-free status and safety requirements and regulations valid in the respective distribution network must be adhered to.
- Unless currents are measured, current connectors are properly covered with connected connector housings.

- When clamp-on current transformers MT0.5/38 and MT1.0/38 as well as toroid sensors TORv/38 and TORm/38 are used, the operator of the monitor shall ensure protection against the effect of water on sensing parts in a different manner.
- GPS and GSM antennas are preferably installed outside the LV case. Be careful not to confuse antennas AGPS and AGPRS when connecting them to the monitor unit.
- The AGPRS antenna and the red part of the AGPS cable can be placed in a LV case with CATIV/300 V.
- Connectors of monitors equipped with antenna connectors must be covered with housings unless antennas are connected to them.



1. Voltage cords N and then U1, and potentially U4, are connected to the measured voltages according to the measuring connection as in Fig. 14 through Fig. 28. If needed, crocodile clamps, open eyes, magnetic contacts, adapters or voltage extensions are used.
2. During measurement the measuring cord U1 of the reference channel of the monitor must always be connected to the measured voltage.
3. **RUN LED** turns on according to the programmed measuring mode, see Table 4.
4. LEDs **U1**, **U2**, **U3** and **U4** turn on according to the amount of voltage and are lit as described in Table 4.
5. Current sensors are installed on conductors with the measured current so that their arrows show directions of current flows to load. Conductors with the measured current must be free of voltage during installation.
  - a) A flexible element of the loop closure of the flexible sensor AMOSm/38 is deviated from the axis which inclines the free end of the loop closure. It is wound around the conductor with the measured current and the free end is inserted back to the sleeve. If needed the position of the flexible sensor on the measured conductor is fixed by means of reversible plastic fastening tape. The part of sensing loop opposite to the closure of the flexible sensor in which the sensor is calibrated is preferably attached to the measured conductor.
  - b) Clamp-on transformers MT0.5/38 and MT1.0/38 are opened by pressing the marked end with the safety barrier and slid on the conductor with the measured current.

- c) When toroid sensors TORv/38 and TORm/38 are installed, the circuit with measured current shall be disconnected first. A toroid sensor is slid on the free conductor and the circuit is closed.

**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 is unwound to the necessary length (max. 10 m) and placed on a level platform with visibility to the sky. A part of the red marked cable can only be placed in the LV case.
7. The cable of the AGPRS antenna in the basic design with the length of 3 m is unwound to the necessary length; the remaining part of the cable is wound up and fixed with a Velcro. The antenna is placed to the space with sufficient GSM signal intensity in the vertical position. When installed in an all-metal case, the antenna must be installed outside the case, e.g. in a plastic inlet tube.
8. A pictogram of connection of communication with the monitor, FW version and the monitor serial number are shown on the PC with the started **PQ MEg** software which is connected to the monitor via a USBmini/EMC cable, on the last right tab of the window, see Fig. 29. Captions of all window tabs are in bold.

In case of the started **PQ MEg** software and unconnected or incorrectly connected monitor, a window with an empty field is shown on the PC, which confirms the error in communication and tab captions are weakened, see Fig. 30.

9. The bold **Settings MEg** 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 at the LV level with a clamp-on transformer MT0.5/38 on current I1 is shown in Fig. 31.

An example of three-phase measurement parametrization at the LV level with flexible sensors AMOSm/MEg38 on currents I1 through I4 is shown in Fig. 32.

10. By pressing the **Start of measurement** push-button the previously measured data are deleted in the monitor and the measurement according to the newly selected parametrization is started. By activating the **Measurement** menu push-button and selecting the **RMS** menu, the PC shows amounts of measured voltages and currents, their time course and power phase diagram. An example is in Fig. 33.

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. 34.

**Warning!** When measuring delta voltages and phase currents at the HV level, there is a phase shift of about  $30^\circ$  between voltage and current. The same need not apply to current I4.

12. Pictograms of GPRS and GPS are shown in the main window of the PQ SW, see Fig. 35. Meaning of pictograms and working with them:



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



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



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



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



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

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

Fig. 29: Main window of the PQ SW when the communication with MEg38/C is established

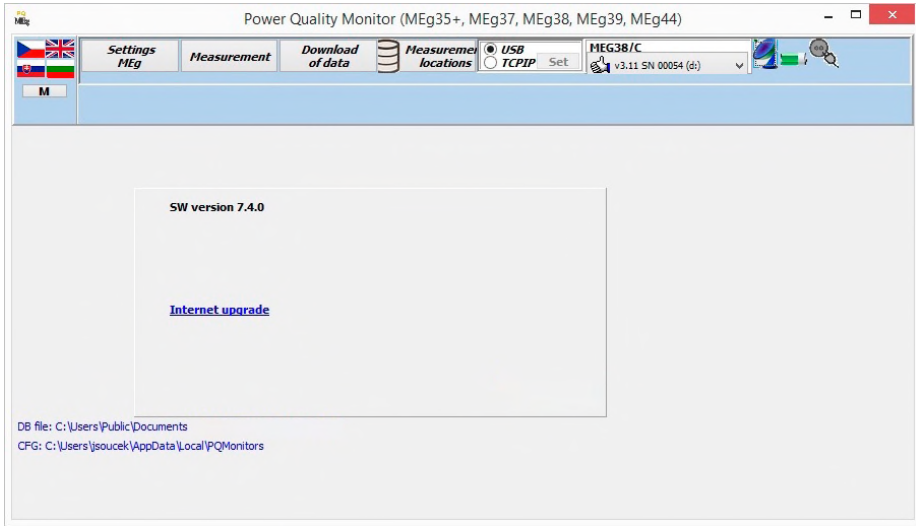


Fig. 30: Main window of the PQ SW when the communication with MEg38/C is not established

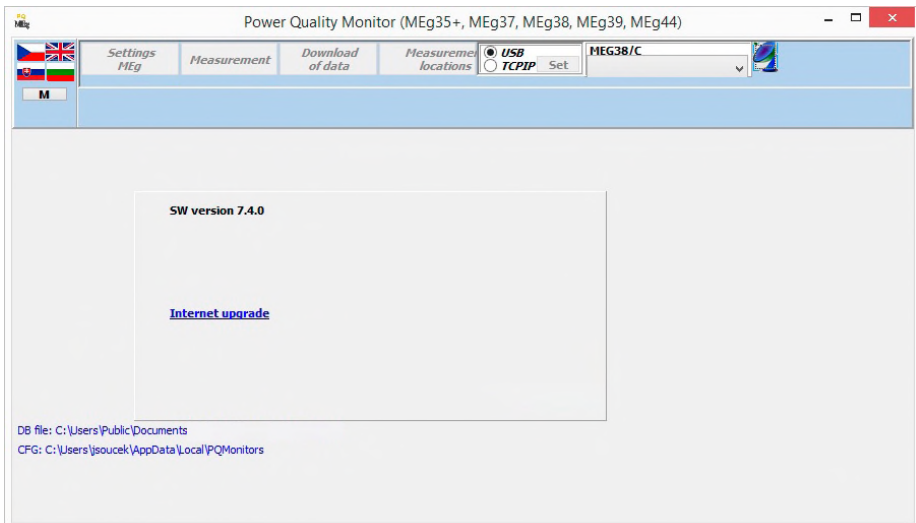


Fig. 31: Parametrization of a single-phase measurement in a LV network with clamp-on transformers 3MT0.5/38

**Power Quality Monitor (MEg35+, MEg37, MEg38, MEg39, MEg44)**

**Basic** | Advanced | Measurement | Download of data | Measurement locations | USB | TCP/IP

**Identification data**

Measurement name: Power quality measurement

Measured by: User 1

Note: Example of parameterization

Measurement nr.: 1

Measurement: three phase - L 1,2,3 V 4

**Voltage**

230 V

**Currents**

C 1 - C 3

Point of measuring: Calibrator 2

MT In

Actual connected sensor

Primary 100

**Recorder**

64 Harmonic

1. harm. 2. harm. 3. harm. 4. harm. 5. harm. 6. harm. 7. harm. 8. harm. 9. harm. 10. harm.

Recording interval: 60 sec

Max C: 100 A

**Quality**

RC According to EN 50160

Freq. 216.6 [Hz] 9.00 [%]

Recording interval: 600 sec

**Events**

Limits for events

Voltage: Upper limit 110 [%Unom] (253.0 V) Lower limit 90 [%Unom] (207.0 V) Hysteresis 2 [%Unom]

Current: L1 L2 L3 Upper limit 120 [% Range] (120.0 A) Hysteresis 10 [% Range] (10.0 A)

Max period record time: 60 [sec]

Max. number of periods for samples recording: 5 0.10 sec

External trigger from U4: ☒ S well

Value of U4 for trigger [V]: 10

Start immediately

Start of measurement

Fig. 32: Parametrization of a three-phase measurement in a LV network with flexible sensors 3AMOSm/38 and AMOSm/38

**Power Quality Monitor (MEg35+, MEg37, MEg38, MEg39, MEg44)**

**Basic** | Advanced | Measurement | Download of data | Measurement locations | USB | TCP/IP

**Identification data**

Measurement name: Power quality measurement

Measured by: User 1

Note: Example of parameterization

Measurement nr.: 1

Measurement: three phase - L 1,2,3 V 4

**Voltage**

230 V

**Currents**

C 1 - C 3

Point of measuring: Calibrator 2

Amos In

Actual connected sensor

Primary 100

**Recorder**

64 Harmonic

1. harm. 2. harm. 3. harm. 4. harm. 5. harm. 6. harm. 7. harm. 8. harm. 9. harm. 10. harm.

Recording interval: 60 sec

Max C: 100 A

**Quality**

RC According to EN 50160

Freq. 216.6 [Hz] 9.00 [%]

Recording interval: 600 sec

**Events**

Limits for events

Voltage: Upper limit 110 [%Unom] (253.0 V) Lower limit 90 [%Unom] (207.0 V) Hysteresis 2 [%Unom]

Current: L1 L2 L3 Upper limit 120 [% Range] (12.0 A) Hysteresis 10 [% Range] (0.1 A)

Max period record time: 60 [sec]

Max. number of periods for samples recording: 5 0.10 sec

External trigger from U4: ☒ S well

Value of U4 for trigger [V]: 10

Start immediately

Start of measurement

Fig. 33: Measuring and check of measured quantities, the course of RMS values

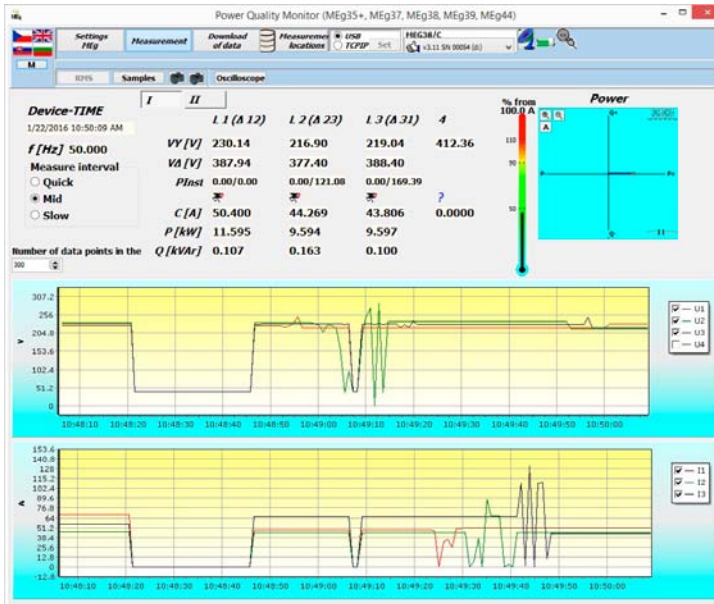


Fig. 34: Measuring and check of measured quantities, oscillographic courses and FFT

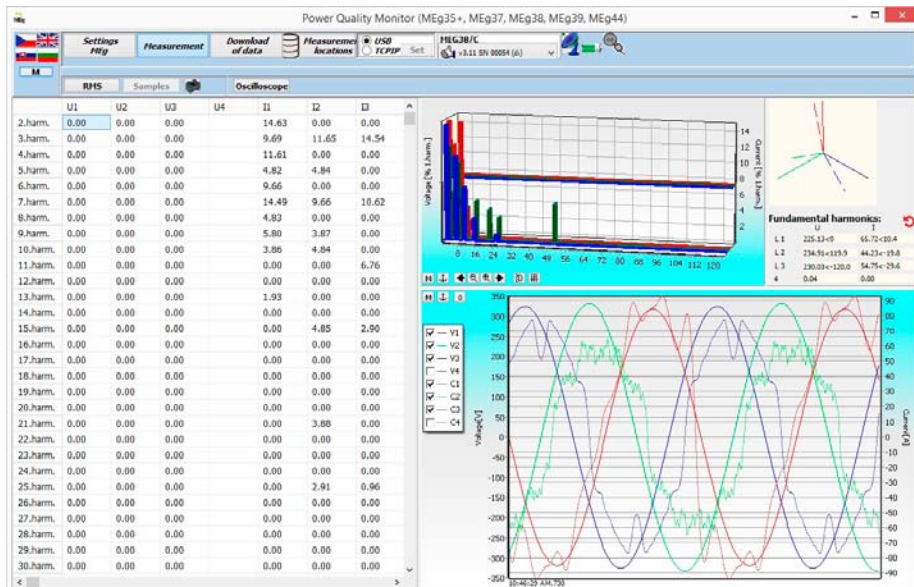


Fig. 35: Example of a main window with the information about GPS and GSM signal intensities



## MAINTENANCE



### Caution

- The repairs of the monitor during the warranty period may only be carried out by the manufacturer's skilled and trained personnel or by the manufacturer's service organizations. The contact to the manufacturer's service is indicated on the website [www.e-mega.cz](http://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.
- Re-calibration is always performed on PQ monitors MEg38/C after the expiry of 3 years after the sale or the previous calibration.

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

## BATTERIES

The following batteries are used in the monitor:

- Lithium battery type CR2032 for the clock circuit.
- Ni-Mh accumulator, type 8xV200H, to ensure measurement at power supply failure.

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

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

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

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

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

When the monitor is started with the fully charged accumulator after a long-term switch-off of the monitor and the ambient temperature of -20°C, the monitor remains in operation after a short-term supply voltage recovery at least for 10 seconds.

## **DISPOSAL**

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

## **WARRANTY**

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

The warranty becomes invalid even during the warranty period if the user carries out unauthorized modifications or changes on the 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.

## TECHNICAL PARAMETERS

### General information

Measurement uncertainties apply to the reference conditions.

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

### Reference conditions

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

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

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

### Operating conditions

|                                       |                                             |
|---------------------------------------|---------------------------------------------|
| Operating temperature:                | -25 °C to +55 °C                            |
| Stabilization period:                 | 10 minutes after start-up                   |
| Relative humidity:                    | 5 % to 95 %, without long-term condensation |
| Pollution degree:                     | 2                                           |
| External magnetic field:              | 0.5 mT, 50 Hz                               |
| Altitude:                             | up to 2000 m above sea level                |
| Operating position:                   | arbitrary                                   |
| Operation in indoor environments only |                                             |

### Storage

|                                                      |                  |
|------------------------------------------------------|------------------|
| Storage temperature:                                 | -30 °C to +60 °C |
| Protection against the effect of water and chemicals |                  |
| Protection against long-term effect of UV radiation  |                  |

**Design data**

|                                                                                         |                                                                     |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Dimensions – with GPS and GPRS:                                                         | 167 × 130 × 35 mm,<br>with connectors 195 × 130 × 35 mm             |
| – without GPS and GPRS:                                                                 | 152 × 130 × 35 mm,<br>with connectors 180 × 130 × 35 mm             |
| Weight:                                                                                 | 0.7 kg without GPS and GPRS<br>0.8 kg with GPS and GPRS             |
| 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                                         |
| Overvoltage category,<br>measuring category:                                            | CAT IV / 300 V, CAT III / 600 V<br>according to EN 61010-2-030:2010 |
| Safety class:                                                                           | II, reinforced insulation                                           |
| Testing voltage:                                                                        | 5.4 kV, 50 Hz, 1 minute                                             |
| Magnetic attachment                                                                     |                                                                     |

**EMC**

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

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

***Voltage on network terminals***

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

***Interference electromagnetic radiation***

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

***Radiated high-frequency electromagnetic field***

EN 61000-4-3:2006

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

## Power supply

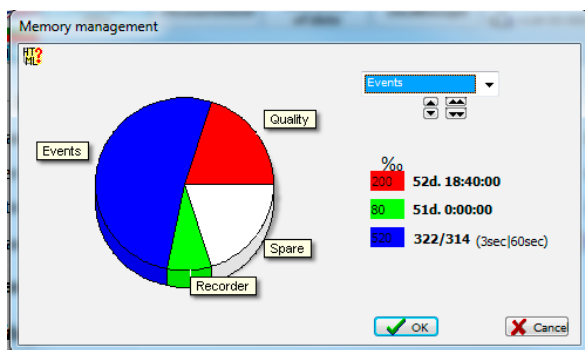
|                                    |                                                                                                             |
|------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Supply voltage:                    | 57,7 V <sub>AC</sub> to 400 V <sub>AC</sub> ±10 %, 50 Hz<br>80 V <sub>DC</sub> to 400 V <sub>DC</sub> ±10 % |
| Consumption without GPS and GPRS:  | 5 VA / 52 V <sub>AC</sub> , 8 VA / 230 V <sub>AC</sub> , 12 VA / 450 V <sub>AC</sub>                        |
| Consumption with GPS and GPRS:     | 6 VA / 52 V <sub>AC</sub> , 9 VA / 230 V <sub>AC</sub> , 13 VA / 450 V <sub>AC</sub>                        |
| Uninterrupted power supply period: | 3 min. (SW set-up), even for multiple repetition                                                            |
| Type of fuses:                     | FSK 00.1 / 500 mA-T, fuses can only be replaced by the manufacturer or service organizations trained by it  |

## 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 sec
  - voltage  $U_{RMS1/2}$ , current  $I_{RMS1/2}$ , record duration 10 sec
  - oscillographic record of voltages and currents, record duration 1 sec
- 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<br>recorder function – from 1 sec to ¼ hour |
| Synchronization<br>of aggregation: | according to EN 61000-4-30:2009                                                                  |
| Time base of:                      |                                                                                                  |
| – GPS synchronisation:             | ± 10 ms                                                                                          |
| – without GPS synchronisation:     | ± 1 sec per 24 hours at 23 °C ± 2 K                                                              |

**Communication**

USB 2.0, communication speed 5.4 Mbit/sec.

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

**Voltage inputs U1, U2, U3 and U4**

|                                                      |                                 |                                 |
|------------------------------------------------------|---------------------------------|---------------------------------|
| SW set-up of the voltage level:                      | LV                              | MV and HV                       |
| Rated phase voltages $U_n$ P-N:                      | $230 V_{AC}$                    | $100/\sqrt{3} V_{AC}$           |
| Rated delta voltages $U_n$ P-P:                      | $400 V_{AC}$                    | $100 V_{AC}$                    |
| Measuring range of phase voltages:                   | $440 V_{AC}$                    | $250 V_{AC}$                    |
| Maximum output voltage P-N:                          | $450 V_{AC}$                    |                                 |
| Voltage measurement<br>uncertainty with $f = 50$ Hz: | $0.05 \% M.V. \pm 0.025 \% U_n$ |                                 |
| Frequency range:                                     | up to 7,2 kHz                   |                                 |
| Input resistance:                                    | $1.68 M\Omega$                  |                                 |
| 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/38**

SW set-up of the rated value

Rated value of current  $I_n$ : 30 A, 100 A, 300 A, 1 000 A, 3 000 AMeasuring range of current: 5 %  $I_n$  to 120 %  $I_n$ 

Frequency range: 40 Hz to 7.2 kHz

Current measurement uncertainty <sup>1) 2) 3)</sup> $I_n = 30 \text{ A}$ : 1.0 % of M.V.  $\pm 0,1 \%$   $I_n$  (45 Hz to 60 Hz) $I_n = 100 \text{ A}, 300 \text{ A}, 1000 \text{ A}, 3000 \text{ A}$ : 0.5 % of M.V.  $\pm 0,1 \%$   $I_n$  (45 Hz to 60 Hz)Change of the value with position:  $\pm 1.0 \%$  of M.V.Change of value by the effect of ext. fields:  $\pm 1.0 \%$  of M.V.  $\pm 0.2 \%$   $I_n$  (external field caused by conductor with  $0.3 I_n / 50 \text{ Hz}$  at the distance of 35 mm from the enclosure)Harmonics measurement uncertainties to the 50<sup>th</sup> order <sup>1) 2) 3)</sup>: $I_n = 100 \text{ A}, 300 \text{ A}, 1000 \text{ A}$ :  $\pm 5 \%$   $I_{\text{harm}}$  at  $10 \% I_n \geq I_{\text{harm}} \geq 3 \% I_n$   
and  $\pm 0.15 \% I_n$  at  $I_{\text{harm}} < 3 \% I_n$  $I_n = 30 \text{ A}$  and  $3000 \text{ A}$ :  $\pm 10 \% I_{\text{harm}}$  at  $10 \% I_n \geq I_{\text{harm}} \geq 3 \% I_n$   
and  $\pm 0.3 \% I_n$  at  $I_{\text{harm}} < 3 \% I_n$ Operating temperature:  $-20^\circ\text{C}$  to  $+55^\circ\text{C}$ 

Temperature coefficient: 0.2 % / 10 K

Relative humidity:  $\leq 95 \%$  RH

Degree of protection provided by enclosure: IP42

Measuring category: CATIV/300 V

Safety class: II

Loop length: 40 cm

Loop diameter: 8 mm

Enclosure free end diameter: 10 mm

Permitted radius of loop bent:  $> 20 \text{ mm}$ <sup>1)</sup> In the range of 5 %  $I_n$  to 120 %  $I_n$ <sup>2)</sup> At the correct position of the enclosure<sup>3)</sup> To the 25<sup>th</sup> order maximum peak factor 2

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

|                                                                                             | <b>MT0.5/38</b>                                                                                                                      | <b>MT1.0/38</b>    |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Rated current $I_n$ :                                                                       | 1 A, 5 A                                                                                                                             |                    |
| Measuring range:                                                                            | 5 % to 120 % $I_n$                                                                                                                   |                    |
| Measurement error at $f = 50$ Hz:                                                           | 0.5 % of the range                                                                                                                   | 1.0 % of the range |
| Harmonics measurement<br>uncertainty to the 50 <sup>th</sup> order 50 <sup>1) 2) 3)</sup> : | $\pm 5 \% I_{\text{harm}}$ at $I_{\text{harm}} \geq 3 \% I_n$<br>and $\pm 0.15 \% I_n$ at $I_{\text{harm}} < 3 \% I_n$ <sup>4)</sup> |                    |
|                                                                                             | $\pm 10 \% I_{\text{harm}}$ at $I_{\text{harm}} \geq 3 \% I_n$<br>and $\pm 0.3 \% I_n$ at $I_{\text{harm}} < 3 \% I_n$               |                    |
| Measuring category:                                                                         | CAT IV / 300 V, CAT III / 600 V                                                                                                      | CAT III / 300 V    |
| Safety class:                                                                               | II                                                                                                                                   |                    |
| Degree of protection<br>provided by enclosure:                                              | IP40 with closed jaws<br>IP30 with opened jaws                                                                                       |                    |
| Operating temperature:                                                                      | -10 °C to +55 °C                                                                                                                     | 0 °C to +50 °C     |
| Temperature coefficient:                                                                    | 0.2 % / 10 K                                                                                                                         |                    |
| Relative humidity:                                                                          | $\leq 85 \% \text{ RH}$                                                                                                              |                    |
| Dimensions:                                                                                 | 135 × 51 × 35 mm                                                                                                                     | 100 × 60 × 26 mm   |
| Max. diameter<br>of measured conductor:                                                     | 20 mm                                                                                                                                | 25 mm              |
| Weight:                                                                                     | 0.2 kg                                                                                                                               | 0.16 kg            |

<sup>1)</sup> In the range of 5 %  $I_n$  to 120 %  $I_n$

<sup>2)</sup> At the correct position of the enclosure

<sup>3)</sup> To the 25<sup>th</sup> order. Maximum peak factor 2

<sup>4)</sup> Class I according to EN 61000-4-7:2002

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

|                                                                                             | <b>TORv/38</b>                                                                                                                                                                                                                                                                                                                                        | <b>TORm/38</b>       |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Rated current $I_n$ :                                                                       | 10 A, 50 A                                                                                                                                                                                                                                                                                                                                            | 1 A, 5 A             |
| Measuring range:                                                                            | 5 % to 120 % $I_n$                                                                                                                                                                                                                                                                                                                                    |                      |
| Measurement error at $f = 50$ Hz:                                                           | 0.5 % of the range                                                                                                                                                                                                                                                                                                                                    |                      |
| Harmonics measurement<br>uncertainty to the 50 <sup>th</sup> order 50 <sup>1) 2) 3)</sup> : | $\begin{aligned} &\pm 5 \% I_{\text{harm}} \text{ at } I_{\text{harm}} \geq 3 \% I_n \\ &\text{and } \pm 0.15 \% I_n \text{ at } I_{\text{harm}} < 3 \% I_n \end{aligned}$ $\begin{aligned} &\pm 10 \% I_{\text{harm}} \text{ at } I_{\text{harm}} \geq 3 \% I_n \\ &\text{and } \pm 0.3 \% I_n \text{ at } I_{\text{harm}} < 3 \% I_n \end{aligned}$ |                      |
| Measuring category:                                                                         | CAT IV / 300 V                                                                                                                                                                                                                                                                                                                                        |                      |
| Safety class:                                                                               | II                                                                                                                                                                                                                                                                                                                                                    |                      |
| Degree of protection provided by enclosure:                                                 | 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<br>of measured conductor:                                                     | 15 mm                                                                                                                                                                                                                                                                                                                                                 | 6 mm                 |
| Weight:                                                                                     | 0.1 kg                                                                                                                                                                                                                                                                                                                                                | 0.1 kg               |

<sup>1)</sup> In the range of 5 %  $I_n$  to 120 %  $I_n$

<sup>2)</sup> At the correct position of the enclosure

<sup>3)</sup> To the 25<sup>th</sup> order. Maximum peak factor 2

<sup>4)</sup> Class I according to EN 61000-4-7:2002

## 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-H,  $f = 50$  Hz, CATIV/300 V according to EN 61010-2-030:2010.

PQ monitor MEg38/C Class S has the classification of PQI-S-PO-H,  $f = 50$  Hz, CATIV/300 V according to EN 61010-2-030:2010.

### Table of functions of the PQ monitor MEg38/C according to EN 61000-4-30:2009, including EN 61000-4-15:2011 and EN 61000-4-7:2002.

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

Note.: According to 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.

### 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 61000-4-30:2009

LV and MV level,  $f = 50$  Hz

| Parameter                   | Class | Measurement uncertainty                                 | Measuring range                                          |
|-----------------------------|-------|---------------------------------------------------------|----------------------------------------------------------|
| Frequency                   | A     | $\pm 2$ mHz                                             | 42.5 Hz – 57.5 Hz                                        |
|                             | S     | $\pm 10$ mHz                                            | 42.5 Hz – 57.5 Hz                                        |
| Voltage                     | A     | $\pm 0.1 \% U_n$                                        | $10 \% U_n - 150 \% U_n$                                 |
|                             |       | $\pm 0.2 \% U_n$                                        | $10 \% U_n - 150 \% U_n$                                 |
| Flicker $P_{st}$ , $P_{lt}$ | A     | $5 \% P_{st}$ , $P_{lt}$<br>IEC 61000-4-15, ed. 2       | $P_{st}$ , $P_{lt}$ (0.2 – 10,0)<br>1 – 4000 changes/min |
|                             | S     | $7.5 \% P_{st}$ , $P_{lt}$<br>IEC 61000-4-15, ed. 2     | $P_{st}$ , $P_{lt}$ (0.4 – 4,0)<br>1 – 4000 changes/min  |
| Flicker $P_{inst, max}$     | A     | $8 \% P_{inst, max}$                                    | $P_{inst, max}$ (0 – 20)<br>sine, rectangular            |
|                             | S     | $8 \% P_{inst, max}$                                    | $P_{inst, max}$ (0 – 10)<br>sine, rectangular            |
| Voltage events              | A     | Amplitude: $\pm 0.2 \% U_n$<br>Duration: $\pm 1$ period | $5 \% U_n - 200 \% U_n$<br>0.02 sec – 60 sec             |
|                             | S     | Amplitude: $\pm 0.5 \% U_n$<br>Duration: $\pm 1$ period | $5 \% U_n - 150 \% U_n$<br>0.02 sec – 60 sec             |
| Interruptions               | A     | Duration: $\pm 1$ period                                | 0.02 sec – 180 sec                                       |
|                             | S     | Duration: $\pm 1$ period                                | 0.02 sec – 60 sec                                        |
| Unbalance                   | A     | $\pm 0.1 \%$                                            | $0.5 \% u_2 - 5 \% u_2$<br>$0.5 \% u_0 - 5 \% u_0$       |
|                             |       | $\pm 0.2 \%$                                            | $1.0 \% u_2 - 5 \% u_2$<br>$1.0 \% u_0 - 5 \% u_0$       |

| Parameter                        | Class           | Measurement uncertainty                                                                                                                                   | Measuring range                       |
|----------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Harmonic voltages                | A               | $\pm 5 \% U_{\text{harm}}, U_{\text{harm}} \geq 1 \% U_n$<br>$\pm 0.05 \% U_n, U_{\text{harm}} < 1 \% U_n$                                                | 10 % – 200 % class 3<br>IEC 61000-2-4 |
|                                  | S               | $\pm 5 \% U_{\text{harm}}, U_{\text{harm}} \geq 3 \% U_n$<br>$\pm 0.15 \% U_n, U_{\text{harm}} < 3 \% U_n$                                                | 10 % – 100 % class 3<br>IEC 61000-2-4 |
| Interharmonic voltages           | A               | $\pm 5 \% U_{\text{harm}}, U_{\text{harm}} \geq 1 \% U_n$<br>$\pm 0.05 \% U_n, U_{\text{harm}} < 1 \% U_n$                                                | 10 % – 200 % class 3<br>IEC 61000-2-4 |
|                                  | S               | $\pm 5 \% U_{\text{harm}}, U_{\text{harm}} \geq 3 \% U_n$<br>$\pm 0.15 \% U_n, U_{\text{harm}} < 3 \% U_n$                                                | 10 % – 100 % class 3<br>IEC 61000-2-4 |
| Mains signaling voltage          | A               | $\pm 5 \% U_{\text{sig}}$ for<br>$3 \% U_n \leq U_{\text{sig}} \leq 15 \% U_n$ ,<br>$\pm 0.15 \% U_n$ for<br>$1 \% U_n \leq U_{\text{sig}} \leq 3 \% U_n$ | $0 \% U_n - 15 \% U_n$                |
|                                  | S               | $\pm 10 \% U_{\text{sig}}$ for<br>$3 \% U_n \leq U_{\text{sig}} \leq 15 \% U_n$ ,<br>$\pm 0.3 \% U_n$ pro<br>$1 \% U_n \leq U_{\text{sig}} \leq 3 \% U_n$ | $0 \% U_n - 15 \% U_n$                |
| Underdeviation and overdeviation | A               | $\pm 0.1 \% U_n$                                                                                                                                          | $10 \% U_n - 150 \% U_n$              |
|                                  | S               | $\pm 0.2 \% U_n$                                                                                                                                          | $10 \% U_n - 120 \% U_n$              |
| Time base                        | A <sup>1)</sup> | $\pm 10 \text{ msec}$                                                                                                                                     | –                                     |
|                                  | S <sup>2)</sup> | $\pm 1 \text{ sec per 24 hours}$                                                                                                                          | –                                     |

<sup>1)</sup> with GPS signal synchronization

<sup>2)</sup> without GPS signal synchronization

**Function Recorder and electric power measurement****Power factor (PF,  $\cos \varphi$ )**

Measurement precision: 1 % of M.V.

Measuring range: 0.5 inductive to 0.8 capacitive

Voltage range: from  $0,8 U_n$  to  $U_{max}$ Current range: from  $10 \% I_n$  to  $I_{max}$ **Active power and active energy, MEg38/C with current sensors**Voltage range: from 80 % to 120 %  $U_n$ Current range: from 2 % to 120 %  $I_n = I_{max}$ 

Measurement uncertainties in % of M.V.:

| Current value                   | $\cos \varphi$ | AMOSm/38 | MT0.5/38 | MT1.0/38 | TORv/38<br>TORm/38 |
|---------------------------------|----------------|----------|----------|----------|--------------------|
| Class <sup>3)</sup>             |                | 2.0      | 1.0      | 2.0      | 1.0                |
| $2 \% I_n \leq I < 5 \% I_n$    | 1              | 3.0 %    | 1.5 %    | 2.0 %    | 1.5 %              |
| $5 \% I_n \leq I \leq I_{max}$  | 1              | 2.0 %    | 1.0 %    | 1.5 %    | 1.0 %              |
| $5 \% I_n \leq I < 10 \% I_n$   | 0.5 L, 0.8 C   | 3.0 %    | 1.5 %    | 2.0 %    | 1.5 %              |
| $10 \% I_n \leq I \leq I_{max}$ | 0.5 L, 0.8 C   | 2.0 %    | 1.0 %    | 1.5 %    | 1.0 %              |

**Reactive power and reactive energy, MEg38/C with current sensors**Voltage range: from 80 % to 120 %  $U_n$ Current range: from 2 % to 120 %  $I_n = I_{max}$ 

Measurement uncertainties in % of M.V.:

| Current value                  | $\sin \phi$<br>C or L | AMOSm/38 | MT0.5/38 | MT1.0/38 | TORv/38<br>TORm/38 |
|--------------------------------|-----------------------|----------|----------|----------|--------------------|
| Class <sup>3)</sup>            |                       | 3.0      | 2.0      | 2.0      | 2.0                |
| $2\% I_n \leq I < 5\% I_n$     | 1.0                   | 3.0 %    | 2.0 %    | 2.5 %    | 2.0 %              |
| $5\% I_n \leq I \leq I_{max}$  | 1.0                   | 2.5 %    | 1.5 %    | 2.0 %    | 1.5 %              |
| $5\% I_n \leq I < 10\% I_n$    | 0.5                   | 3.0 %    | 2.0 %    | 2.5 %    | 2.0 %              |
| $10\% I_n \leq I \leq I_{max}$ | 0.5                   | 2.5 %    | 1.5 %    | 2.0 %    | 1.5 %              |
| $10\% I_n \leq I \leq I_{max}$ | 0.25                  | 3.0 %    | 2.0 %    | 2.5 %    | 2.0 %              |

**Apparent power, MEg38/C with current sensors**Voltage range: from 80 % to 120 %  $U_n$ Current range: from 2 % to 120 %  $I_n = I_{max}$ 

Measurement uncertainties in % of M.V.:

| Current value                 | AMOSm/38 | MT0.5/38 | MT1.0/38 | TORv/38<br>TORm/38 |
|-------------------------------|----------|----------|----------|--------------------|
| Class <sup>3)</sup>           | 2.0      | 1.0      | 2.0      | 1.0                |
| $2\% I_n \leq I < 5\% I_n$    | 2.5 %    | 1.5 %    | 2.0 %    | 1.5 %              |
| $5\% I_n \leq I \leq I_{max}$ | 2.0 %    | 1.0 %    | 1.5 %    | 1.0 %              |

<sup>3)</sup> Function performance class according to EN 61557-12

**Measurement of powers and energies, MEg38/C unit without sensors**Voltage range: from 80 % to 120 %  $U_n$ Current range: from 2 % to 120 %  $I_n = I_{max}$ 

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

**Summary of evaluated quantities in the function Recorder**

| Quantity                                  | Symbol                  | For each phase | Fourth channel | Three-phase value | For interval <sup>4)</sup> | 200 ms minimum in interval | 200 ms maximum in interval |
|-------------------------------------------|-------------------------|----------------|----------------|-------------------|----------------------------|----------------------------|----------------------------|
| RMS voltage                               | $U_{ef}$                | PN+PP          | PN+PP          |                   | PN+PP                      |                            |                            |
| Harmonic voltages<br>– 1. to 64. harmonic | $U_{1,h}$ to $U_{64,h}$ | PN+PP          | PN+PP          |                   | PN+PP                      |                            |                            |
| Total harmonic voltage distortion         | $THD_U$                 | PN+PP          | PN+PP          |                   | PN+PP                      |                            |                            |
| RMS current                               | $I_{ef}$                | PN+PP          | PN+PP          |                   | PN+PP                      |                            |                            |
| Harmonic currents<br>– 1. to 64. harmonic | $I_{1,h}$ to $I_{64,h}$ | PN+PP          | PN+PP          |                   | PN+PP                      |                            |                            |
| Total harmonic current distortion         | $THD_I$                 | PN+PP          | PN+PP          |                   | PN+PP                      |                            |                            |
| $\cos \varphi$                            | $\cos \varphi$          | PN             |                | PN+PP             | PN+PP                      |                            |                            |
| Power Factor                              | PF                      | PN             |                | PN+PP             | PN+PP                      |                            |                            |
| Active power                              | P                       | PN             |                | PN+PP             | PN+PP                      | PN+PP                      | PN+PP                      |
| Reactive power                            | Q                       | PN             |                | PN+PP             | PN+PP                      | PN+PP                      | PN+PP                      |
| Apparent power                            | S                       | PN             |                | PN+PP             | PN+PP                      | PN+PP                      | PN+PP                      |
| Distortion power                          | D                       | PN             |                | PN                | PN                         | PN                         | PN                         |
| Unbalance power <sup>5)</sup>             | N                       |                |                | PN+PP             | PN+PP                      | PN+PP                      | PN+PP                      |

| Quantity                                                        | Symbol             | For each phase | Fourth channel | Three-phase value | For interval <sup>(4)</sup> | 200 ms minimum in interval | 200 ms maximum in interval |
|-----------------------------------------------------------------|--------------------|----------------|----------------|-------------------|-----------------------------|----------------------------|----------------------------|
| Active power (1. harmonic)                                      | $P_{1.h}$          | PN             |                | PN+PP             | PN+PP                       | PN+PP                      | PN+PP                      |
| Reactive power (1. harmonic)                                    | $Q_{1.h}$          | PN             |                | PN+PP             | PN+PP                       | PN+PP                      | PN+PP                      |
| Apparent power (1. harm.)                                       | $S_{1.h}$          | PN             |                | PN+PP             | PN+PP                       | PN+PP                      | PN+PP                      |
| Unbalance power (1. harm.)                                      | $N_{1.h}$          |                |                | PN+PP             | PN+PP                       | PN+PP                      | PN+PP                      |
| Active energy – consumption                                     | EP+                | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Active energy – supply                                          | EP-                | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Inductive reactive energy during active consumption             | EQL/EP+            | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Capacitive reactive energy during active consumption            | EQC/EP+            | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Inductive reactive energy during active supply                  | EQL/EP-            | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Capacitive reactive energy during active supply                 | EQC/EP-            | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Active energy – consumption (1. harmonic)                       | $EP_{1.h}^{+}$     | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Active energy – supply (1. harmonic)                            | $EP_{1.h}^{-}$     | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Inductive reactive energy during active consumption (1. harm.)  | $EQL/EP_{1.h}^{+}$ | PN             |                | PN+PP             | PN+PP                       |                            |                            |
| Capacitive reactive energy during active consumption (1. harm.) | $EQC/EP_{1.h}^{+}$ | PN             |                | PN+PP             | PN+PP                       |                            |                            |

| Quantity                                                   | Symbol                     | For each phase | Fourth channel | Three-phase value | For interval <sup>4)</sup> | 200 ms minimum in interval | 200 ms maximum in interval |
|------------------------------------------------------------|----------------------------|----------------|----------------|-------------------|----------------------------|----------------------------|----------------------------|
| Inductive reactive energy during active supply (1. harm.)  | EQL/<br>EP <sub>-1,h</sub> | PN             |                | PN+PP             | PN+PP                      |                            |                            |
| Capacitive reactive energy during active supply (1. harm.) | EQC/<br>EP <sub>-1,h</sub> | PN             |                | PN+PP             | PN+PP                      |                            |                            |

<sup>4)</sup> Recording interval is selectable from 1 sec to 15 minutes. For energy measurement it is a summary value for interval, for other quantities it is a mean value for interval.

<sup>5)</sup> In the phase-to-phase measurement mode the unbalance power includes also distortion component.

### Legend:

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

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

### Note:

PQ monitor MEg38/C in the LV measurement mode measures phase-to-neutral voltages by default and in the MV, HV measurement mode measures phase-to-phase voltages by default.

### **AGPS antenna**

|                                             |                                                          |
|---------------------------------------------|----------------------------------------------------------|
| Dimensions:                                 | $\varnothing = 135 \text{ mm}$ , $v = 55 \text{ mm}$     |
| Weight:                                     | 0.45 kg                                                  |
| Coaxial cable length:                       | 10 m                                                     |
| Safety class:                               | II                                                       |
| Overvoltage category:                       | CAT IV / 300 V<br><b>only red first 2 m of the cable</b> |
| Degree of protection provided by enclosure: | IP23                                                     |
| Frequency band:                             | 1575.42 MHz                                              |
| Frequency band width:                       | 10 MHz                                                   |
| Gain:                                       | 22.5 dBi typ.                                            |
| Operating temperature:                      | -20 °C to 60 °C                                          |

### **AGPRS antenna**

|                                             |                                                                                                 |
|---------------------------------------------|-------------------------------------------------------------------------------------------------|
| Dimensions:                                 | $v = 320 \text{ mm}$ , base $\varnothing = 50 \text{ mm}$ , rod $\varnothing = 13 \text{ mm}$ , |
| Weight:                                     | 0.175 kg                                                                                        |
| Attachment:                                 | magnetic                                                                                        |
| Coaxial cable length:                       | 3 m                                                                                             |
| Safety class:                               | II                                                                                              |
| Overvoltage category:                       | CAT IV / 300 V                                                                                  |
| Degree of protection provided by enclosure: | IP63                                                                                            |
| Frequency band:                             | 900/1800 MHz                                                                                    |
| Polarization:                               | vertical                                                                                        |
| Gain:                                       | 5 dB                                                                                            |
| Working temperature:                        | -20 °C to 60 °C                                                                                 |

# PQ monitor MEg38/C

## User manual

