

PQ monitor

MEg 30

MEg 31

MEg 32

MEg 33

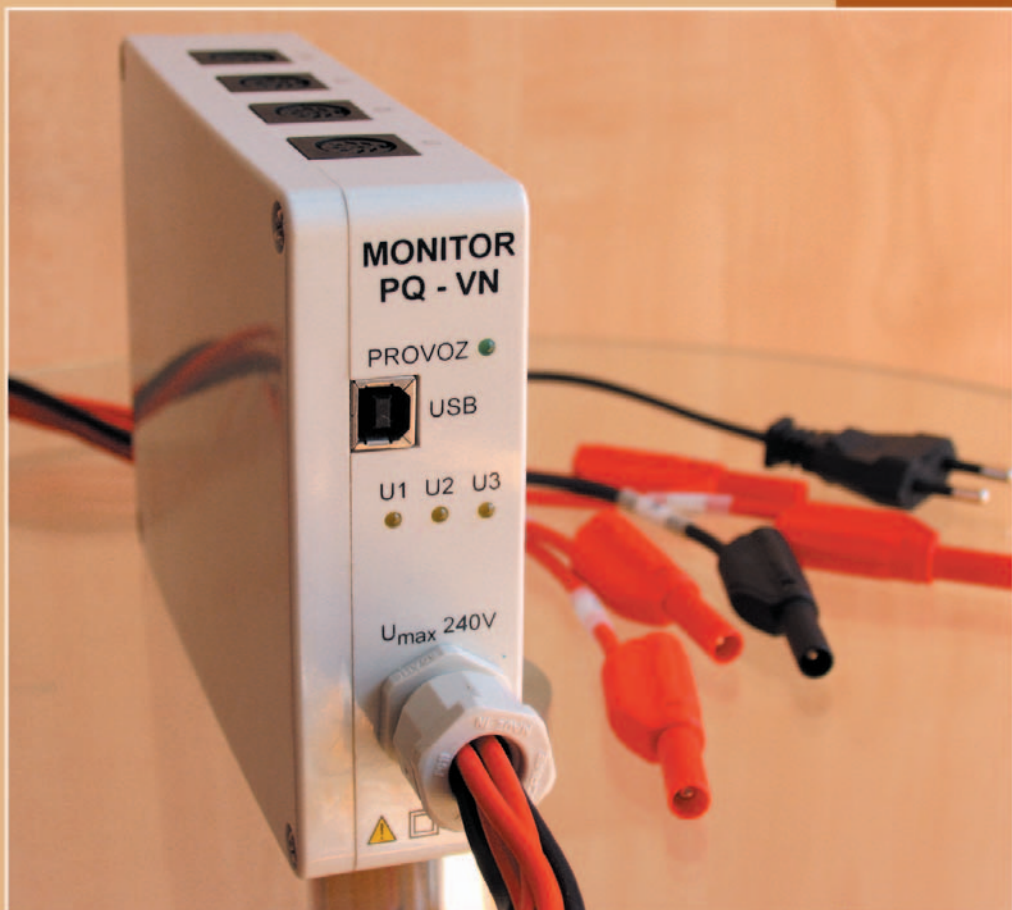


MEg 30 - portable version
for LV networks

Měřicí Energetické Aparáty

MEGA

MONITOR PQ MONITOR PQ MONITOR PQ MONITOR PQ



MEg 31 - portable version
for MV networks

MEg
MEg

1. Characteristics

PQ monitor is a multi-function measuring instrument to be used for the measurement and a long-term recording of up to four voltages and four currents, of active and reactive power and energy in three-phase four-conductor and five-conductor LV networks, as well as in MV and HV networks. Complying with the EN 50160 standard and with methods of the international standard IEC 61000-4-30, the PQ monitor analyses all parameters of the voltage quality on voltage inputs U1, U2 and U3.

It registers the events (voltage dips, swells and interruptions) on all the four voltages and it records not only the characteristics of events on voltages as defined by the standard but also the shapes of all the four voltages and currents at the beginning and at the end of each event – the so-called initial and final details. The initial detail of an event also comprises the section of time prior to the event while the final detail also includes the section of time following after this event.

Basing on the measured shapes of currents the PQ monitor enables to assess the direction of the origination of an event as well as of flicker. By its ability to measure even small voltages the PQ monitor is also ready for monitoring the voltages between the neutral conductor and ground. On its fourth current input the PQ monitor enables to carry out the measurement and harmonics analysis of the current of the neutral conductor. Variably, when using a corresponding sensor the fourth current input can also be used for the measurement of other physical quantities, e. g. for the measurement of temperature.

PQ monitor is provided with a galvanically separated synchronizing input SYNC. Its change of state can be registered as an event, too. This makes possible an external synchronization of the record of shapes of all voltages and of all currents, as well as a mutual synchronization of a set of several PQ monitors. The PQ monitor has, on its output, a change-over contact of the polarized relay with a programmable assignation of the meaning of the signalization.

PQ monitor enables to measure the relationship between the voltage quality and the power and/or energy. When the preset parameters of voltage quality have been overpassed, it is possible to switch an external two-state electricity meter or – for operational purposes – to initialize the internal function of the measurement of “non-quality energy”.

PQ monitor has been designed in the following versions:

MEg 30 – PQ monitor in portable version for LV networks

MEg 31 – PQ monitor in portable version for MV networks

MEg 32 – PQ monitor in version for fixed mounting in LV networks

MEg 33 – PQ monitor in version for fixed mounting in MV networks

The following instruments have been designed for PQ monitors in portable version:

- current sensor AMOS PQ (30 A, 100 A, 300 A, 1000 A)
- instrument current transformers MT PQ (1 A, 5 A, 30 A, 150 A).

PQ monitors in version intended for fixed mounting are manufactured with current inputs 5 A, 1 A or with a special current input. The versions with current inputs 5 A or 1 A are especially suitable for precise measurements of electric energy. So that the PQ monitor may be additionally installed for permanent utilization in substations being already under operation, it is advantageous to use current transformers with split cores MEG MT manufactured complying with Patent Nr. 286255. Fixed version of PQ monitors with flexible current sensors AMOS can also be delivered as option.

All versions of PQ monitors for the measurement in LV networks have a three-phase supply from voltages being measured U_1 , U_2 and U_3 . In order to prevent the degradation of accuracy and credibility of voltage quality parameters being measured, a single-phase external supply is used in PQ monitors intended for measurements in MV networks with heterogeneous instrument voltage transformers.

Each version of the PQ monitor is provided with an internal back-up battery which enables the monitor to be operated during up to 5 minutes without the external supply.

The measuring ranges of phase voltages of PQ monitors for LV networks are from $0 V_{ef}$ to $480 V_{ef}$ and of those for MV networks from $0 V_{ef}$ to $140 V_{ef}$. Phase-to-phase voltages can be registered and analysed by calculation as well.

The basis of all version of PQ monitors is a signal processor with a high-capacity non-destructive data memory which enables a really long-term (more than 1 year) autonomous performance. The parallel and continuous performance of all measuring, visualization and communication functions represents a substational characteristic of the PQ monitor. A high accuracy and independence on operational conditions is ensured by a high-quality A/D converter with a minimized extent of analog circuits and with a correction of errors of the whole measuring string made by calculation.

By means of communication interfaces the PQ monitor can also be used as an intelligent peripheral unit of large SCADA systems and energy systems of industrial enterprises and agglomerations.

Like all other measuring instruments MEG being manufactured till now, the PQ monitor enables not only the teleparametrization of measuring functions but also

the telereprogramming of their structure according to user's requirements and/or the teleprogramming of newly developed functions.

2. Principle of measurement and of data processing, organization of the data memory

The measurement of four voltages and of four currents is based on sampling them with frequency 5120 Hz. The total number of 1024 values with resolution of 14 bits are always sampled in 200 ms long intervals, following one after another without timeouts. After transformation into the frequency area, 512 complex harmonic components with step 5 Hz (i. e. 51 harmonic components regarding the multiple 50 Hz) and 461 interharmonic components are then calculated from these values. The magnitudes of voltages U1 to U4, currents I1 to I4 and "control signals" (ripple control) are calculated from the absolute values of the complete spectrum. Active and reactive power of individual components as well as the unbalance are calculated from complex components.

The data from channels U1, U2 and U3 for evaluating the events and flicker on voltages are processed in the time area. The square of the TRMS value for the elapsed period (20 ms) is calculated after every 10 ms. Frequency is calculated from the data of channel U1.

Corrections of DC components, corrections of strengthening the current sensors, of voltage and current measuring channels and frequency characteristics including corrections of a possible phase shift between individual measuring channels are made during the calculations. The tables of calibration constants are a part of the configuration. None up to 100 various tables of calibration constants can be stored in the memory of the firmware depending on the set of the whole measuring string (measuring converter + measuring channels).

The non-destructive data memory, type FLASH with capacity of 2 MB (4 MB as option) is divided into five circularly organized areas. The first area shall be used for recording the development in time of RMS values of measured voltages, currents and power in a complex form. Detailed data on voltage quality in the elapsed week shall be stored in the second area. The third data area includes unified data with a list of events according to methodology of ČSN EN 50160 and the fourth data area includes a detailed record of the development of RMS values of the half-periods of voltages U1, U2, U3, U4 and currents I1, I2, I3, I4. The fifth data area includes compressed weekly data on quality. The ratios of ranges of individual areas of the data memories can be mutually changed respecting the user's requirements.

The basic setting of ranges of the circular areas of the 2 MB memory has been chosen as follows:

- recording of average RMS values of four voltages, four currents and three real and three imaginary components of the power; the data memory will be sufficient for recording during 30 days when the records are made with step 1 min
- recording of the list of events with capacity of more than 910 events
- recording of a detailed development of events for more than 180 last events
- recording of compressed weekly data for the period longer than 52 weeks.

When extending the data memory to 4 MB it is possible to extend anyone of the above-mentioned data areas, e. g. the area of recording the average values and the area of recording the list of events.

3. Description of measuring functions and of input/output functions of the PQ monitor

3.1 Function of monitoring (time recorder, type MDS)

Average RMS values from all periods within the chosen step are being recorded when the monitor operates in this function. Average values of up to four voltages, four currents and three active and reactive powers (U1, I1), (U2, I2), (U3, I3) are being recorded according to setting. Basing on these recorded data, real power factors and energies are then calculated in the higher SW. When a suitable sensor is installed, another physical quality, e. g. the temperature can be recorded instead of the current I4.

3.2 Function of voltage quality (monitor, type QN)

The following ten-minute data can be recorded here:

- average frequency, maximum and minimum 10 s frequency derived from U1,
- numbers of overpassing the 10 s values of frequency of four limits defined by ČSN EN 50160,
- values of voltage unbalance calculated from the negative-sequence and the positive-sequence voltage component as well as from phase-to-phase voltages,
- average and maximum RMS values of voltages U1 to U4 and currents I1 to I4, minimum values of voltages U1 to U4 from the 0.2 s long intervals,
- average values of five selected harmonic components of voltages U1 to U4 and currents I1 to I4 in the range of the 2nd to 51st harmonic,

- average values of the basic harmonic of voltages U1 to U4 and current I1 to I4,
- values $U_{\max 95}$ and $U_{\min 95}$ of voltages U1 to U3,
- values U_{\max} and U_{\min} (0.2 s) of voltages U1 to U3,
- values of flicker Pst of voltages U1 to U3,
- magnitude of THD of voltages U1 to U3 in relation to the harmonics and to all interharmonic components,
- magnitudes of ripple control signals on voltages U1 to U3,
- total duration of dips, swells and interruptions of voltages U1 to U3.

The function of voltage quality can also be used in case of a single-phase or two-phase measurement. The recorded data enable to obtain a detailed survey of voltage quality parameters for the elapsed week and to evaluate the quality under changed requirements of the standards.

3.3 Function of recording the events (statistic voltmeter of events)

The function of recording the events operates over the quantities U1 to U3 and I1 to I3. Every new event is recorded into the list of events and into a detailed record.

Beside the parameters of events unified by standard ČSN EN 50160, i. e. the time of originating and ending of an event with resolution to 10 ms, the list of events includes the values of maximum deviations of voltages U1 to U3 from the nominal value.

A detailed record of events includes the developments of RMS values calculated for voltages U1 to U3 and currents I1 to I3 after every 10 ms for the elapsed 20 ms. The total duration of the record of the initial detail of an event makes 0.6 s from which the interval of 0.2 s is being recorded prior to the origination of an event. The total duration of the record of the final detail of an event makes 0.6 s from which an interval of 0.2 s is being recorded after the ending of an event. The length of these intervals can be changed programmably.

3.4 Function of compressing the weekly voltage quality data

This function serves for a long-term archiving of weekly quality parameters of voltages U1 to U3 complying with ČSN EN 50160. The following data can be recorded:

- number of 10 s intervals when the frequency overpassed the preset limits 47 Hz, 49.5 Hz, 50.5 Hz and 52 Hz,
- number of 10 s intervals in which the mean value of the voltage lied outside the tolerances $90\% U_{\text{nom}}$ to $106\% U_{\text{nom}}$ and $110\% U_{\text{nom}}$,
- order of two-hour intervals in which the Plt value was ≥ 1.0 ,

- number of ten-minute intervals in which average value of the 2nd to 25th harmonic was higher than the value defined by the standard,
- number of ten-minute intervals in which the THD for the 2nd to 40th harmonic was higher than the value defined by the standard,
- number of ten-minute intervals in which the average value of unbalance was higher than the limit defined by the standard,
- the number of 3 s mean values of voltage components with frequency of the ripple control signal, which overpassed the limit defined by the standard, is being recorded for each day of a compressed week.

3.5 Function of oscilloscopic measurements

The function of oscilloscopic measurements serves for checking the correct connection of the set the PQ monitor, the correct choice of measuring ranges and the correct orientation of current sensors. A notebook with a series interface USBII is used for displaying the shapes of voltages U1 to U4 and currents I1 to I4. The recording with duration of 2 periods (40 ms) can be started case by case or repeatedly.

3.6 Communication function

The basic communication interface of the PQ monitor is a series interface USBII with the data transmission rate up to 460.8 kbit/s. This enables to read out the content of the 2 MB data memory during about 2 minutes. It is also possible to choose another transmission rate (921.6 kbit/s).

Alternatively, the PQ monitors for fixed mounting can be ordered with interface RS 232 or with another series interface according to the customer's requirement (RS485, ...).

3.7 External input

The external input is a two-value one and it enables to connect DC and AC voltages in the range of 24 V to 230 V. The decision making level is at 15 V. The external input can generate an event without recording the detail of the event. The front edge or the trailing edge of the voltage of the external input may be active depending on programming.

3.8 Relay output

The relay output is made by a change-over contact of the polarized relay and one or more of the following meanings can be assigned to it by the program:

- voltage U1 to U4 outside the chosen tolerances,
- frequency outside the chosen tolerances,
- flicker Pst higher than 1.0,
- any harmonic component overpassed the chosen limit,
- THD overpassed the chosen limit,
- unbalance overpassed the chosen limit,
- the average RMS value of the current for 10 periods overpassed the chosen limit,
- conversion to supply from internal battery,
- change of state of the contact in case of the change of the voltage on the external input enables a mutual synchronization of more PQ monitors installed in one substation.

3.9 Signalization by LEDs

The indication of state of the PQ monitor is signalized by the diode OPERATION (PROVOZ) which is lighting permanently at the external supply (supply from measuring inputs or external supply) and intermittently with frequency 5 Hz at the supply from the internal battery. The lighting of this diode can be assigned to the indication of state of the relay output by program.

In a preset tolerance band (90% U_{nom} to 106% U_{nom}) the LED diodes U1, U2 and U3 indicate the state of voltages U1, U2, U3 by permanent lighting and by intermittent lighting with $f = 1$ Hz they signalize that the respective voltage is outside the preset tolerance band.

3.10 State of battery charge

Under reference conditions and at its full charge the internal battery ensures the supply of the PQ monitor during 5 minutes. Complying with the recommendation IEC 61000-4-30 and in accordance with the meaning of data measured in the course of failures in the distribution networks, the supply from the internal battery shall be automatically switched-off after any interruption of the external supply lasting more than 1 minute. The discharging of energy of the battery at the interruption of the external supply with duration of more than 5 minutes is thus prevented and – after a restored supply and its subsequent interruption due to e. g. switching-in into short-circuit – the instrument is able to remain in operation for a further 1 minute.

In order to save the energy of the internal battery, it is recommended to suppress the unnecessary (in this case) one-minute back-up supply of the monitor before each planned disconnection of measuring conductors from the supply voltage. This shall be done by using the notebook with the started program of the PQ monitor where the item U_{spat} shall be updated in menu Measuring instrument.

4. Technical data

4.1 Measurement of voltages

U_{nom} of phase voltages U1, U2, U3, U4:	230 V
Range of measurement of phase voltages:	0 to 2 U_{nom}
Highest permissible phase voltage:	480 V_{ef}
Accuracy of voltage measurement:	
$\pm 0.1\%$ of the measured value $\pm 0.1\% U_{\text{nom}}$ at 0.8 U_{nom} to 1.2 U_{nom}	
$\pm 0.2\%$ of the measured value $\pm 0.2\% U_{\text{nom}}$ outside 0.8 U_{nom} to 1.2 U_{nom}	
Resolution:	0.1% U_{nom} or better
Temperature coefficient:	better than 0.2% $U_{\text{nom}}/10^{\circ}\text{C}$

4.2 Measurement of currents

Accuracy of measurement:	
$\pm 0.2\%$ of the measured value and 0.2% I_{nom} at 0.1 I_{nom} to 1.2 I_{nom}	
$\pm 0.5\%$ of the measured value at 1.2 I_{nom} to 2 I_{nom}	
Resolution:	0.1% I_{nom} or better
Temperature coefficient:	better than 0.2% $I_{\text{nom}}/10^{\circ}\text{C}$
Highest permissible current loading:	$5 \times I_{\text{nom}}$ during 1 s

Measuring string AMOS PQ - MEG30

I_{nom} at shape coefficient $K = 1.11$:	30 A, 100 A, 300 A, 1000 A
Range of measurement:	0 to 1.2 I_{nom}
Accuracy of measurement:	0.1% I_{nom}
Linearity of measurement:	better than 0.5% I_{nom}
Change of the measured value with the change of position:	1% I_{nom}

Measuring string MT PQ - MEG30

I_{nom} at shape coefficient $K = 1.11$:	1 A, 5 A, 30 A, 150 A
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Maximum size of the conductor being clamped:	10 mm × 20 mm
Range of measurement:	0 to 1.2 I_{nom}
Accuracy of measurement:	0.5% I_{nom} + 0.2% of the measured value at $f = 50$ Hz
Frequency range:	40 Hz to 2 kHz

4.3 Measurement of frequency

Nominal value:	$f_{nom} = 50.0$ Hz
Range of measurement:	45.0 Hz to 55.0 Hz
Accuracy of measurement:	better than 10 mHz in range 48 Hz to 52 Hz
Resolution:	1 mHz

4.4 Measurement of power factor

Range of measurement:	0 to 1.0 in all four quadrants
Accuracy of measurement:	better than 0.5% at U_{nom} and I_{nom}

4.5 Measurement of power

Accuracy of measurement:	0.5% P_{nom} at $f = 50$ Hz, 0.8 U_{nom} to 1.2 U_{nom} 0.1 I_{nom} to 1.2 I_{nom}
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4.6 Measurement of voltage unbalance

resolution 0.01

4.7 Measurement of Pst

resolution 0.01

4.8 Measurement of THD

resolution 0.01

4.9 Measurement of Uharm

resolution 0.01% U_{nom}

4.10 Reference ambient conditions

Ambient temperature:	20°C ± 2°C
Relative humidity:	40% to 60%
Air pressure:	86 kPa to 105 kPa
Without hoarfrost, bedewing, rain and sunshine	

4.11 Ambient conditions

Operating temperature:	-20°C to +60°C
Operation:	in indoor space
Relative humidity:	20% to 90%
Altitude:	up to 2000 m
Operating position:	arbitrary
Protection:	IP40
Category of measurement:	IV (ČSN EN 61010-1)
Degree of contamination:	2
Protection under condition of one failure is ensured by protective impedance with a combination of component parts.	

4.12 Supply

Supply from any measuring input U1, U2, U3	
Range of input power:	5 VA
Back-up supply:	battery SANYO N-50AAA L 1×5, in average during up to five intervals of 1 minute at reference ambient conditions
Replacement of the battery shall be carried out by the manufacturer basing on order.	
Mean time between battery replacements makes 2 years.	

4.13 External connection

Terminals S1, S2 of signal SYNC	
U0:	0 V to 5 V DC and AC
U1:	20 V to 200 V DC and AC
The terminals are galvanically separated by an optoelectronic element with insulation strength 5 kV	

Terminals K1, K2, K3 of the change-over contact of the polarized relay

Maximum DC/AC voltage: 125 V/150 V

Maximum switched/permanent current: 1 A

Maximum switched power: 30 W/60 VA

Electric strength between the coil and the contact of the relay:
2.5 kV

4.14 Dimensions and weight

Length × height × width: 170 × 130 × 42 mm

Weight: 0.75 kg

5. Design

As far as constructional design is concerned, the PQ monitor in its MEg30 version is a portable measuring instrument emphasizing the requirements on minimum dimensions and on the flexibility of current sensors.

Its application even in modern, space-saving, compact switchboards is thus made possible. A unit of PQ monitors in its MEg30 version is placed in a plastic, all-insulated, self-extinguishing case with dimensions 170 × 120 × 42 mm, provided with firmly connected voltage cables, with four connectors for connecting current sensors or sensors of other physical quantities (I1, I2, I3, 14/T), with a signaling LED diode OPERATION (PROVOZ) and three LED diodes signaling the magnitude of connected voltages being measured. The case of MEg30 includes a two-pole terminal board with a removable plug of the signal SYNC and a three-pole terminal board with a removable plug of the change-over contact of the polarized relay. Maximum cross-section of the connected conductor is 2.5 mm².

Version MEg30 has five firmly connected double-insulated voltage cables with length 1.5 m, ended with safety modular banana plugs. These cables maintain a high flexibility even at negative temperatures. The measuring cables are marked with U1, U2, U3, U4 and N at their ends. The measuring cables U1, U2, U3 and N serve for a three-phase supply of MEg30 at the same time. The measuring cables U1, U2, U3 and U4 are red, the measuring cable N is black. As need be, either safety alligator clips or measuring grips with an integrated fuse type 10 133 01, manufacturer Legrand, 1 A/500 V (10 × 38 mm) shall be installed on banana plugs of the measuring cables. Red alligator clips shall be connected to cables U1, U2 and U3, a blue alligator clip to cable U4 and a black one to the measuring cable N. For voltage

measurements and supply in single-phase LV networks we can use a LV adapter which shall be inserted into a LV mains socket. Modular banana plugs of measuring cables U1 and N of the MEg30 unit shall be connected into its safety jacks.

In case of the MEg30 version, active flexible measuring sensors AMOS PQ with increased accuracy of measurement are intended to be used for the measurement of AC currents. The loop of these sensors is 16 mm. The loop has two insulation layers distinguished in colour. The minimum permitted radius of curvature of the loop is 30 mm. The loop is provided with a plastic closure. The supply cable between the loop and the converter unit is 150 cm long. The converter unit comprises a four-position switch of the nominal current (30 A, 100 A, 300 A, 1000 A) and a signaling diode RUN which – by its intermittent lighting – signalizes the supplying from MEg30 via the connector used for the connection of the current sensor.

Clamp instrument transformers MT PQ with the maximum size of the conductor being clamped 10×20 mm shall be used for a precise measurement of small currents with MEg30. The nominal current of transformers MT PQ can be set by means of a four-position switch. The length of supply cables is 150 cm. The direction of the current flowing through the current sensors AMOS PQ and MT PQ is indicated by an arrow with an integrated marking of the current being measured I1, I2, I3 and I4. The serial numbers of current sensors AMOS PQ and of instrument transformers MT PQ shall agree with the serial number of the MEg30 unit, forming a measuring set with it. This set can be delivered in a textile bag or in a leatherette case.

A contact thermometer T-PQ with a swinging, electrically insulated temperature sensor can be used with MEg30. This thermometer shall be connected into connector 14/T of the MEg30 unit by using a 150 cm long cable.

6. Installation

First of all, suitable current sensors, i. e. either AMOS PQ or MT PQ shall be chosen. The same type of the current sensor shall be usually chosen for the measurement of currents I1 to I3. A suitable value of I_{nom} shall be set on the current sensors according to the expected magnitude of the current. When the current sensors AMOS PQ and/or MT PQ are being installed the arrows on their sensing parts shall indicate a positive direction of the current being measured. Agreement between serial numbers of the current sensors and that of the MEg30 unit shall be checked when installing the current sensors. The current sensors shall be connected into a current connector I1, I2, I3 and 14/T with identical marking.

According to the place of measurement, either safety alligator clips or grips with an integrated fuse shall be inserted onto modular banana plugs of the measuring conductors U1, U2, U3, U4, complying with the category of measurement IV. Grips with an integrated fuse shall be used for measurements in unprotected circuits. Red alligator clips shall be connected to measuring conductors U1, U2 and U3, a blue alligator clip to conductor N and a black one to conductor N. The measuring conductor N shall be first connected to the neutral conductor of the measuring point and only then measuring conductors U1, U2, U3 and/or U4 shall be connected. In case of a single-phase or a two-phase measurement the conductors which are not being used shall be connected to conductor N. The supply for MEg30 shall be switched-on by connecting the first one of the measuring conductors U1, U2 or U3 to the phase voltage higher than $100 V_{ef}$.

After the supply has been connected, the LED diode OPERATION (PROVOZ) will be lighting permanently and, at a possible disconnection of the external supply during the following 1 minute interval, the PQ monitor continues to measure while being supplied with energy from the built-in battery. The LED diode OPERATION (PROVOZ) is lighting intermittently with frequency 5 Hz during this period. After 1 minute the PQ monitor stops the measurement and the LED diode OPERATION (PROVOZ) will not be lighting any more.

A switched-on notebook with the started program PQ-monitor shall be connected – at the place of measurement – to the monitor being supplied, using the cable of a series communication interface USBII. The item Setting of measurement shall be chosen and a correct choice of the nominal value of the current on the current sensors, a correct order of connected voltages and a correct orientation of the current sensors shall be checked. By using the procedure described in the user guide for the program PQ-monitor, the measuring protocol shall then be specified according to which the PQ monitor in version MEg30 will measure.

The portable version MEg30 of the PQ monitor can also be programmed in advance in the laboratory and at the place of measurement the monitor shall only be connected into measuring and supply circuits. However, a correct connection and a suitable choice of the range of currents being measured is not possible here.

The portable version MEg30 of the PQ monitor can be connected to telecommunication devices via a series interface USBII in a standard way.

In order to save the energy of the internal battery, it is recommended to suppress the unnecessary (in this case) one-minute back-up supply of the monitor when disconnecting it from the supply. This shall be done by using the notebook with the started program of the PQ monitor where the item Uspat shall be updated in menu Measuring instrument.

6.1 Basic steps when installing the monitor

- choice of type of current sensors
- checking the agreement between the serial number of MEg30 and those of current sensors
- choice of the range of current measurement
- installation of current sensors in a correct direction
- installation of contact elements on voltage measuring cables
- installation of a common conductor and then of measuring conductors
- checking the lighting of the LED diode OPERATION (PROVOZ) and of LEDs U1, U2 and U3
- communication connection of MEg30 with the notebook (program Control of PQ monitor)
- checking the correct installation and the ranges of measurement by means of the program



The utilization of the PQ monitor in version MEg30 in another way than in that for which it is intended may result in impairing the protection provided by the equipment.

7. Demands on maintenance

The MEg30 monitor has no requirements on forced ventilation, it contains no movable control elements and – beside the usual cleaning of its surface – it has no special demands on maintenance. Soft materials and non-aggressive solutions, preferably water with detergent, shall be used for cleaning the surface.

Preventive inspection of portable PQ monitors in version MEg30 includes:

- checking the undamaged state of insulation of measuring conductors, of alligator clips, current sensors and temperature sensors,
- checking the legibility of the marking of measuring elements,
- checking the undamaged mechanical state of the monitor unit and of all measuring accessories,
- checking whether water has not got into the monitor or into its accessories.

It is recommended to carry out preventive inspections before each installing – not later than after every three months. The periodicity of checking the accuracy of mea-

surement shall be chosen by the user of the monitor according to the significance and properties of the place of its installation. In case of the portable version MEg30 it is recommended to check the accuracy of measurement every 2 years in average. The battery of the internal back-up supply type SANYO N-50AAA L 1×5 shall always be replaced during the checking of the accuracy of measurement.

It is not permitted to remove the cover of the monitor unit at installed or connected monitors and their accessories. The removal of the cover is dangerous for life.

8. Content of the set of MEg30 monitor

- Unit of PQ monitor MEg30
- User guide for PQ monitor
- Program on CD
- Optional parts of the set:
 - Set of flexible current sensor AMOS-PQ (3 or 4 pcs)
 - Set of clamp transformers MT-PQ (3 or 4 pcs)
 - Contact thermometer T-PQ
 - Set of safety alligator clips (3 pcs red, 1 pc blue, 1 pc black)
 - Set of grips (3 pcs red, 1 pc black) with fuse 10 133 01, manufacturer Le-grand, 1 A/500 V with dimensions 10 × 38 mm
 - Adapter for single-phase measurement of PQ
 - Communication cable USB-PQ/1.5 m or 5 m
 - Textile bag with sling
 - Leatherette case, dimensions 50 × 33 × 17 cm

9. Delivery

The place of delivery is the address of the manufacturer's seat if not otherwise started. The portable set of the PQ monitor in version MEg30 is usually delivered either in a textile bag or in a leatherette case with lockable closures. Delivery protocol and certificate of guarantee with the marked date of sale are parts of the delivery.

10. Guarantee

It is not permitted to open the PQ monitor unit and its accessories during the guarantee period.

A guarantee in the length of two years since the date of sale is provided for the PQ monitor in version MEg30. 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. The place of repair is the manufacturer's seat.

The guarantee becomes invalid if the user damages the seals or carries out unpermitted modifications or changes on the monitor or on its accessories, if he connects the instrument incorrectly or if the monitor or its accessories were operated out of keeping with technical conditions.

The defects on the monitor and its accessories originating during the guarantee period shall be claimed by the user to the manufacturer of the PQ monitor. The claim without the attached certificate of guarantee will not be accepted.

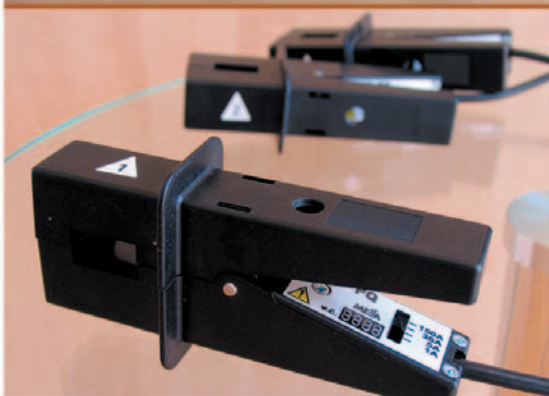
The manufacturer bears in any case no responsibility for subsequent damages caused by using the MEg30 monitor and its accessories. No responsibility which would exceed the price of the PQ monitor follows for the manufacturer from this guarantee.

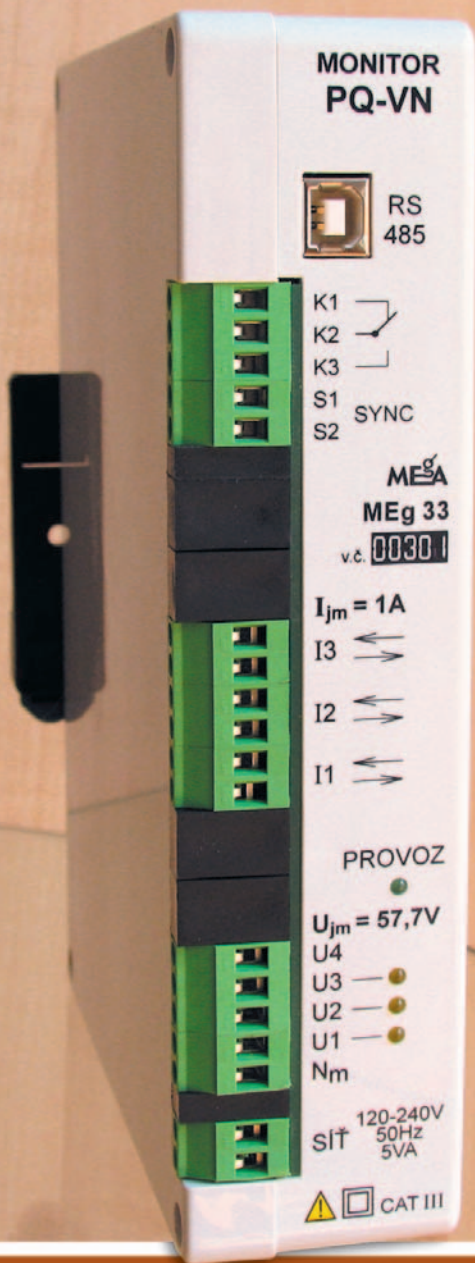
11. Manufacturer

MEgA – Měřicí Energetické Aparáty, s.r.o.
621 00 Brno, Letovická 1412/4

Office:

MEgA – Měřicí Energetické Aparáty, s.r.o.
638 00 Brno, Okružní 794/29a
phone/fax : +420 541 225 015
e-mail: mega@e-mega.cz
web: www.e-mega.cz





MEg 33 s nasazeným
plombovacím krytem
a bez něj

MEg 33
for fixed mounting
in LV networks