Multiple input MEg74 PQ monitor

User manual

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1/ INTRODUCTION

The robust and compact multiple input MEg74 PQ monitor for fixed installation is designed for long-term monitoring of operation in newly built or already operating stations or cabinets. The MEg74/LV version is designed for measurements at LV level and the MEg74/MV version for measurements at MV level. It is characterized by variability in the selection of current sensors for installation and by expandability of the number of current measurements. This is enabled by automatically detected sets of three low-power current sensors and uniformly calibrated inputs of the monitor's standard-voltage current sensors. As a result, you get a widely usable, gradually expandable measuring instrument that maintains the defined accuracy. The MEg74 monitor can be integrated into control systems, electric power measurement systems and voltage quality measurements. Measured data enables the analysis and optimization of the operation of distribution grids and the prediction of failures. Its design respects the safety requirements of the overvoltage category and of the measurement category of the given voltage level with an increased safety class due to reinforced insulation. The sets of three current sensors used according to the type with suitable length of leads allow easy direct mounting to LV outputs by using common shielded patch cables or indirect mounting to current circuits of already installed current transformers. The MEg74 monitor allows measurements only at the voltage level indicated on the rating plate.

The MEg74 PQ monitor is oriented towards unattended measurements with secure remote communication ensuring transmission of measured data, remote parametrization of measurements and remote administration including updating of measurement functions. Therefore, it has minimized elements for local operation, for which the USB interface, the indication of correct function of the monitor and the SIM card slot are designed

The multiple input MEg74 PQ monitor measures three phase voltages and twelve three-phase currents. It has an ETH interface and, when ordered, a GSM module with secure LINUX remote communication and a GPS module with 1 ms time synchronisation. The MEg74/LV monitor version has a three-phase backup power supply from the measured voltages, which allows remote transmission of information for at least 35 s after interruption of the supply voltages. The MEg74/MV monitor version has a single-phase mains voltage supply, which also provides backup power supply for at least 35 s. Both versions of the MEg74 monitor have terminals for connecting a 24 V_{DC} auxiliary power supply, which allows, for example, a long-term backup power supply or a common power supply for the measuring and control equipment with a safe voltage. The MEg74 monitor is designed for installation on a horizontally mounted DIN rail. In this position it is resistant to dripping water with a slope of up to 15°.

The MEg74 monitor measures synchronous ten-period values for all variables, from which it evaluates average and maximum values for currents and also minimum values for voltages, for the selected recording interval, and records them in memory. At the specified time intervals, it records the phase active and reactive powers for both single phases and for a three-phase output. It evaluates and records active and reactive inductive and capacitive energies for the selected recording intervals. For output power and energy, it distinguishes the direction of flow. It registers voltage phenomena and overcurrents including their waveforms with RMS½ values and oscillograms with the selected pre-trigger.

On the measured voltages together with the currents of the first input of the current sensors, which is also intended for measurement on the secondary side of the transformer, the MEg74 multiple input monitor additionally evaluates the quality of voltages and currents according to EN 50160, ed. 4 using the methods of EN 61000-4-30, ed. 3 standard. Voltage and current quality parameters are measured by methods specified for Class A, but the evaluation is done with Class S accuracies. All quality parameters, including their waveforms, are recorded in memory.

2/ CHARACTERISTICS OF THE MEg74 PQ MONITOR

- Measurement at LV or MV level according to instrument order.
- Fixed installation on DIN rail resistant to dripping water, cable connectors on the underside of the monitor with drip-off detail with a negative angle.
- Connection of the sets of three current sensors with a tri-splitter to the MEg74 monitor using a common shielded patch cable of the specified length at the place of installation.
- Possibility of gradual expansion of current measurement up to 12 outputs even during operation.
- Standardized 225 mV current sensor interface.
- Optional use of toroid-type current sensors, split-core transformer, flexible sensor, measuring rail with automatic detection of the type of connected sensor and correction constants of individual sensors.
- Connection of standard current measurement circuits via a three-phase CT/225 mV converter.

- Maintaining current measurement accuracy even with additionally installed current sensors.
- CAT IV / 300 V category, Safety Class II – reinforced insulation for MEg74/LV monitor, AMOS current sensors, MTPD.51 current transformers, MEgML73 measuring rails, TORm and TORv toroids. The monitor unit incorporates a measuring instrument, a GSM communication unit, a GPS time synchronization and a backup power supply.
- Simultaneous execution of the measurement functions recorder, electric power and registration of current phenomena on all current sensor inputs and corresponding voltage inputs.
- Voltage quality measurement, registration and recording of voltage phenomena on the first input of current sensors.
- The quality of the three-phase voltage, including currents at the I1–I3 input, is measured by Class A methods with Class S accuracy.
- Measurement of phase voltages and phase-to-phase voltages.
- Recording of voltage phenomena and events on currents by RMS½ values and oscillograms with optionally adjustable pre-trigger and post-trigger.
- Evaluation of protection functions on the first input of the current sensors and on the voltage inputs.
- Four-quadrant recording of phase energies and three-phase energies with a subsequently selectable evaluation step for all measured outputs.
- Power supply with integrated backup power supply (35 s).
- Auxiliary power supply with 24 V_{DC}.
- Optional GSM communication provided by LINUX system
- Optional time synchronisation by GPS with 1 ms resolution.
- USB, ETH and RS485 communication.

3/ SW INFORMATION

The **PQ_MEg** program [1] is designed for local and remote parametrization of MEg74 measurements, which includes settings for the measurement start time and reading of measured data, recording interval, nominal values and specification of the measured variables.

The **MEgA_Explorer** [2] program allows the display and detailed analysis of data from the local SQLite database. It is a Windows application installed on a PC or server. It is mainly focused on the detailed analysis of data from a single measurement, but also supports selected bulk functions (e.g. measurement reports).

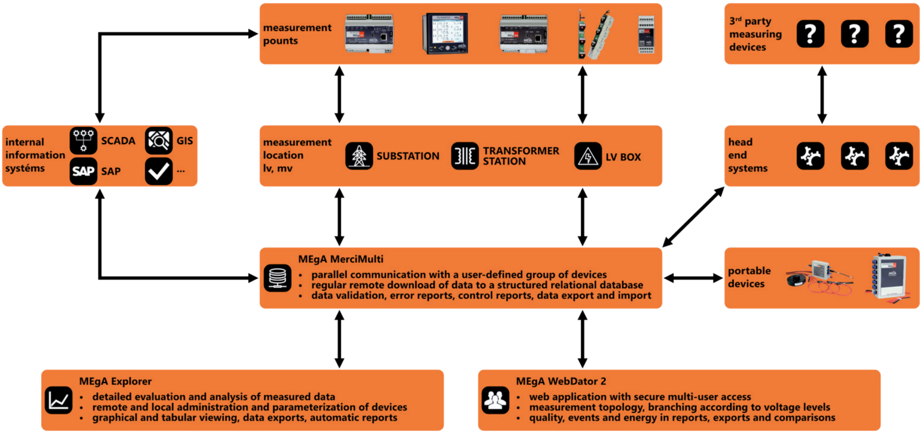
The **WebDator2** [3] web application allows multiple access for data display. It is mainly focused on large groups of instruments, for overview and informative evaluations and summary analyses. The application works over a PostgreSQL or Oracle database.

Continuous remote automatic data reading of one, but especially multiple instruments available on the network, including monitoring of input states is performed by the **MEgA_Merci Multi** system [4], which works as a Windows OS service on the server. Periodic data reading is performed at a set interval, usually daily. The system reads newly measured data in the range since the previous reading. The read data is stored in a SQLite, PostgreSQL or ORACLE database. The program also performs automatic exports in CSV format and reports on voltage quality in the form of emails. The program can be used to remotely update the DSP processor core FW after checking the transfer.

With the exception of the WebDatOr2 program, the mentioned programs, including their manuals, are available at http://www.e-mega.cz/DL/.

The MEg74 PQ monitor also enables working with third-party SW via MODBUS (RTU and TCP), EN 60870-5-104 and DLMS/COSEM communication protocols. It is possible to set deviation criteria for the automatic sending of measured values using the protocol as per EN 60870-5-104. For presentation in other systems, customisable COMTRADE and CSV formats can be used.

The instrument has a web interface for displaying the instantaneous values of selected variables via a web browser.



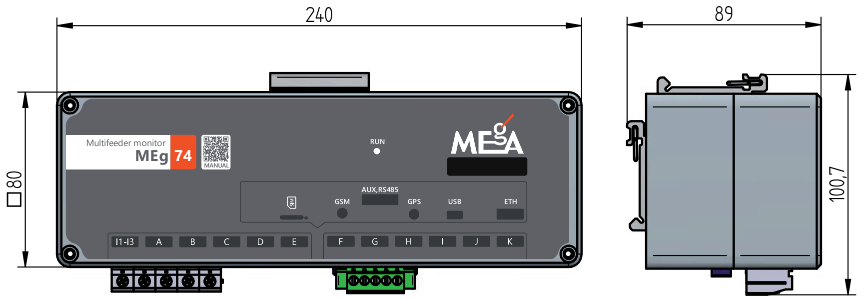
4/ DESCRIPTION OF THE INSTRUMENT

4.1 Design

The multiple input MEg74 PQ monitor consists of a base unit and sets of three current sensors of different principles and designs. The base unit of the MEg74 monitor in Fig. 1 has two versions, MEg74/LV for the LV level and MEg74/MV for the MV level. The MEg74 monitor is housed in a 240 × 80 × 80 mm box made of self-extinguishing polycarbonate. It has two TS35 DIN rail mounts so it can be installed with the front panel in a horizontal or vertical position. The layout of the components on the MEg74 monitor can be seen in Fig. 2 and their role is described in Table 1. On the front panel, next to the monitor label and a QR code pointing to the address of the user manual, there is a RUN light indicating the ON status of the monitor. There is also the manufacturer's logo and the serial number of the monitor on the panel. The bottom of the front panel shows the arrangement of the connectors, which are located in two groups at the adjacent side of the monitor. In the described installation of the MEg74 multi input monitor with a vertical front panel, the adjacent side with connectors is located at the bottom, thus achieving increased resistance to dripping water even when using standard connectors in a harsh environment of distribution transformer stations. The adverse effects of dripping water are counteracted by a detail with a negative angle.

The components of the MEg74 monitor can be seen in Fig. 2. In the front group on the left, there is a five-pole connector with terminals for connecting the measured three-phase voltage of the neutral conductor and the HF ground. In the version for measurements at MV level, there is also a POWER connector for mains voltage supply. There is also a slot for placing a NANO SIM card and a round connector used to connect an external GSM antenna. This is followed by a non-replaceable five-pole connector with AUX auxiliary power terminals and an RS485 interface. Then there are connectors for GPS synchronization and USB and ETH communication. The rear row of twelve RJ45 connectors is used to measure three-phase currents by sets of three low-power current sensors. The first connector on the left, labelled I1–I3, is intended for measuring secondary currents of power transformers. It can also be used to measure the current of the first one of the measured outputs. Sets of three current sensors of other measured outputs are connected to the other connectors A to K. The side panel of the MEg74 monitor bears a rating plate with basic technical parameters. The rating plates, see Fig. 3, vary according to the measured voltage level.

Fig. 1: Dimensions of the MEg74/LV monitor



Dimensions of the MEg74/MV monitor

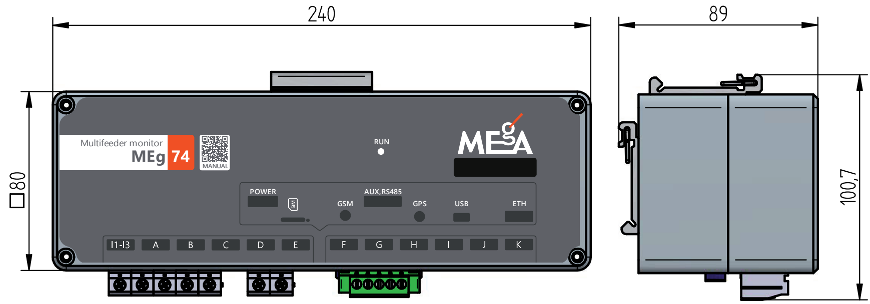
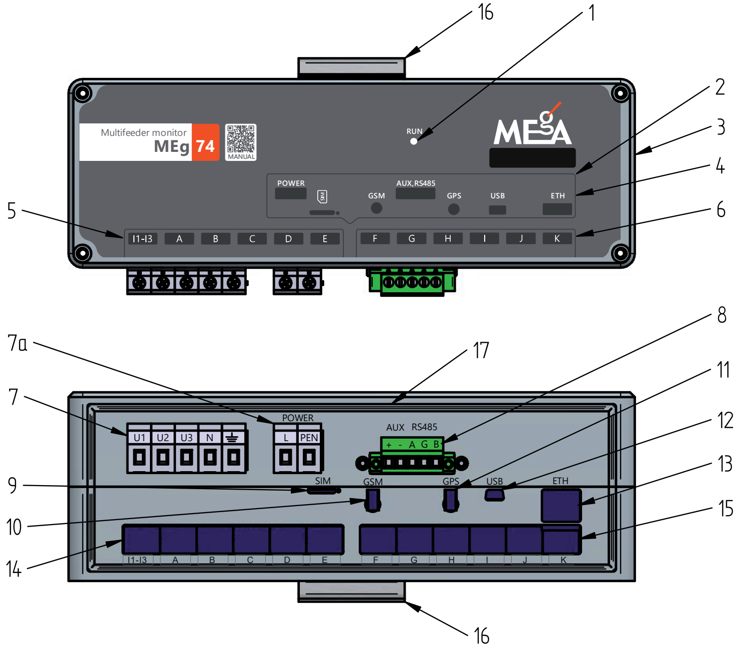


Fig. 2: Components of the multi input MEg74/MV PQ monitor



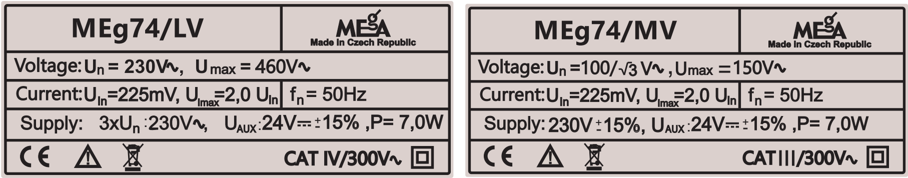
The TORm/225mV and TORv/225mV toroids, the LCT/225mV split-core current transformers with a window for 10 mm, 16 mm, 24 mm and 36 mm conductors, the AMOSm/225mV flexible sensors with a loop length of 20 cm, and the MTPD.51/225mV split-core current transformers with a 52 × 33 mm window and MEgML73/225mV measuring rails can be used as low-power current sensors. With the exception of the MEgML73/225mV measuring rail, which contains three current sensors, all other current sensors listed are connected by their output cables in triads via a tri-splitter with an RJ45 output connector. The individual current sensors of the triads are labelled I1, I2 and I3 and are installed on phase L1, L2 and L3 with measured voltages U1, U2 and U3. Shielded patch cables with lengths up to 10 m are used for connecting the sets of three current sensors to the current sensor inputs of the MEg74 monitor as required. This greatly simplifies installation and minimizes installation errors.

If three-phase currents are measured by conventional current measuring transformers rated 5 A or 1 A, a galvanically isolated CT5 A/225 mV or CT25 A/225 mV three-phase converter is used to connect them to the MEg74 monitor. CT converters are housed in an 18 mm wide plastic housing and mounted on a DIN rail. The inputs of the three measured currents I1, I2 and I3 consist of screw terminals S1 and S2, the output is the RJ45 connector.

A description of the current sensor sensing parts is given in chapter 14.

External GSM and GPS antennas are connected to separate, labelled SMA(f) connectors.

Fig. 3 Rating plates of the MEg74/LV and MEg74/MV monitors



Tab. 1: Table of components

Item	Group name	Description
1	RUN LED	• Light with 1 short fading out (periodically repeated after 2 s); the monitor measures according to programmed parametrization • Light with 2 short fading outs (2 s period); the measurement record is limited (e.g. due to a misconfiguration that caused that there is no more free space in the memory for a specific data type) • Repeated short flashing; the monitor is programmed, it does not measure yet. The preselected measurement start time has not come yet or the measurement has been stopped by the user. • Alternating light 1 : 1; power failure • Steady light, or light with fading out recurring after more than 8 s; fault condition indication • Continuously off; indication of a power supply failure or power off
2	Serial number	Serial number of the MEg74 PQ monitor
3	Rating plate	The rating plate lists information applicable to the monitor
4	Indication of the positions of connectors	Indication of the position of SIM card slot, GSM connector, AUX auxiliary power supply, RS485 communication interface, GPS, USB, ETH connectors, and of the POWER connector on the MEg74/MV version

Item	Group name	Description
5, 6	Indication of the position of sensor conne-ctors	Indication of the position of the twelve connectors I1–I3, A to K of the measured three-phase currents
7	Connector for voltage inputs and HF ground	Terminal U1 – L1 phase voltage, terminal U2 – L2 phase voltage, terminal U3 – L3 phase voltage, terminal N – neutral conductor, HF ground terminal ⏚ – to be connected to ground or PEN con-ductor
7a	POWER connector	Mains power supply for MEg74/MV
8	Auxiliary power supply connec-tor and RS485	Indication of the position of the $24\,V_{DC}$ AUX auxiliary power supply and the RS485 communication interface with A, G, B sig-nals
9	SIM card	NANO SIM card is inserted into the indicated slot in the drawn position using the supplied holder
10	GSM antenna	SMA(f) connector for connecting GSM antenna
11	GPS antenna	SMA(f) connector for connecting GPS antenna
12	USB interface	USB-MINI B connector for connecting USB interface
13	ETH connector	RJ45 connector for connecting ETH interface
14, 15	Connectors for current sensor inputs	Connector I1-I3 for connecting a set of three transformer sensors or for connecting a set of three sensors for the outputs. Connector A to K for connecting a set of three sensors for the outputs.
16	DIN rail lock	On the top and back of the instrument there are spring mechanis-ms for mounting the instrument on a DIN rail
17	Detail with a negative angle	A design measure to inhibit access of dripping water to the co-nnectors

4.2 Functions of the monitor

The multiple input MEg74 PQ monitor measures and communicates remotely. In the version for LV level it is three-phase powered from the measured voltages, in the version for MV level it has a separate pair of terminals for mains voltage supply. It also has an auxiliary 24 V_{DC} power supply.

It has a GSM remote communication and GPS time synchronization as an option.

After connecting the set of three current sensors to the multi input MEg74 PQ monitor, the type of connected sensor is identified, according to which the parametrization program pre-sets the current rating values. The connected set of three current sensors contains correction constants of sensors L1, L2 and L3, which are stored in their memory. This ensures the specified measurement accuracy of the entire measurement chain, even when the measured inputs of the current sensors of the operating monitor are gradually added without the need for additional calibration of the input and the connected current sensor.

The MEg74 monitor has the following measurement functions: Recorder, Energy, Events, Quality and Recording Oscilloscope, Protection functions.

In the **Recorder** measurement function, it measures the voltages and currents of all current inputs. From the individual phase voltages and phase currents, it evaluates the active and reactive powers during supply and consumption as well as the displacement power factors. The basic measuring interval of the Recorder function is a time period of ten periods. From the measured values, the calculated average and the selected extreme values are recorded in the monitor's memory for the selected recording interval; for voltage this is the minimum and maximum value, for current only the maximum value and for active and reactive power the maximum value without distinguishing the direction of flow. Extreme values over the entire measurement period are also evaluated. For output power, the three-phase values for the output are also evaluated. A summary overview of all evaluated variables measured and calculated in the Recorder measurement function is given in chap. 4.2.2.

The **Energy** measurement function measures and evaluates active, reactive inductive and capacitive energies during supply and consumption, accumulating the results in non-resettable registers, in registers set during parametrization of the ongoing measurement and in the Recorder function at individual recording intervals. The energies are evaluated from the measured variables.Three-phase and possibly also single-phase energies are evaluated at the MV level depending on the wiring of the current transformers.

The **voltage phenomena** and **events on currents** of the measured phase voltages and phase currents of all current sensor inputs are recorded in the form of a time waveform of RMS½ values and oscillograms. Their recording is initiated and terminated by exceeding the set threshold, and the recording includes both pre-trigger and post-trigger, the time of which is set during measurement parametrization.

The **Voltage Quality** measurement function measures and evaluates voltage quality parameters according to EN 50160, ed.4 using methods specified in EN 61000-4-30, ed. 3 for the measured voltage and phase currents measured by the first input of current sensors I1–I3. The list of measured variables of the Voltage Quality function is given in chap. 4.2.2. The voltage and current quality variables of the first I1–I3 channel of the multi input MEg74 PQ monitor are measured and evaluated using Class A methods, and the measurement accuracy of the basic version of the monitor meets Class S. The measurement methods and uncertainties of measurements are tested according to EN 62586-2 and the effects of operating conditions according to the procedures specified in EN 62586-1.

The MEg74 PQ monitor can be set to the Sample Record function until filling the whole memory, which records measured voltages and currents by means of oscillography. During oscillographic recording of details and functions of the recording oscilloscope, measured voltages and all measured currents are sampled simultaneously with a rate of 128 samples per period. The oscillographic recording uses a pre-trigger with a length of up to 20 periods before the event initialization. Also the number of recorded periods of variables, i.e. the length of oscillographic record, is SW-adjustable and depends on the extent of allocated memory space. The record initialization can be derived from exceeding the specified limits by any of the measured variables. By using the function for automatic remote transmission of measured data, demands on the required memory space in the monitor can be reduced.

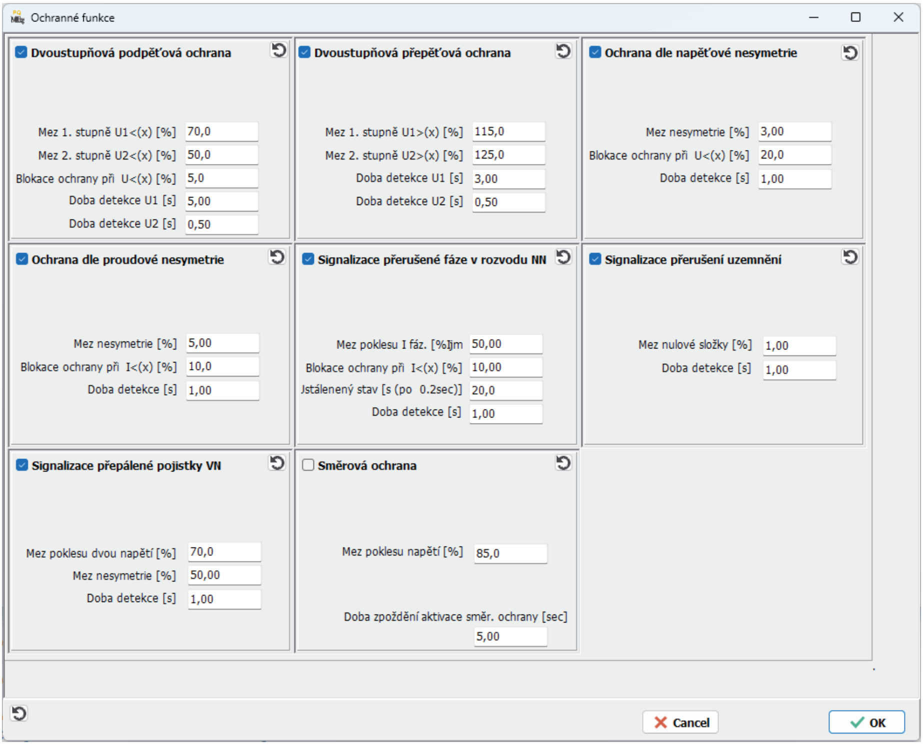
The record of waveforms of all measured variables in the form of RMS½ defined by the voltage quality standard has a fixed pre-trigger of 1 s length and the possibility of recording up to 400 events.

The instrument records rapid voltage changes according to IEC 61000-4-30 ed. 3. The algorithm is based on sliding measurement of 100 values of $U_{RMS1/2}$ in each phase. When parametrizing the device, the user defines a threshold value of voltage $U_{RMS1/2}$ change for starting recording and a size of hysteresis after the rapid change and return to the balanced state. Rapid changes are characterized by the time of beginning, the duration, the difference in voltage between balanced states before a rapid change and after it (ΔU_{SS}) and the maximum difference between voltage $U_{RMS1/2}$ during a rapid change and balanced state voltage before the start of a rapid change (ΔU_{max}). A record of rapid changes can be extended in user SW by a record of the entire course of $U_{RMS1/2}$ values. When the limits of voltage phenomena ($0.9\,U_n$ and $1.1\,U_n$) are exceeded, the rapid voltage change recording is cancelled and the event is evaluated and stored as a voltage phenomenon.

Protection functions are user-adjustable, examples of settings are shown in Fig. 4. By triggering the protection function, a message is sent via the ETH or GSM interface. Also, the recording of phase voltage and current courses and voltage and current unbalance into the monitor's memory when the protection functions activate is uniform.

The memory always stores the last 12 events of each type of fault.

Fig. 4: Examples of settings for protection and signalling functions



Two-stage undervoltage protection function

In the function input, the user sets the limit of the 1st stage and the lower limit of the 2nd stage of undervoltage in % U_n, the 1st stage detection time and detection time of the 2nd stage in seconds. In addition, the user sets protection blocking at a phase voltage lower than the set value.

With the undervoltage protection function, the instrument continuously evaluates independently for each phase whether all evaluated voltages are under the undervoltage limit within the detection time. If so, the protection function activates. The instrument records the activation time, the affected phase, the undervoltage value at the moment of protection activation as well as the course of RMS½ phase voltages and currents. Based on initial setting, it sends a message.

Each evaluation of voltage above the detection limit of the 1st stage resets the evaluation of the detection time of the given phase.

A voltage drop of any phase under the blocking level blocks the function of the two-stage undervoltage protection in that phase.

Two-stage overvoltage protection function

In the function input, the user sets the limit of the 1st stage and the limit of the higher 2nd stage of overvoltage in % U_n, the 1st stage detection time and detection time of the 2nd stage in seconds. A message sending can be set as an option.

With the overvoltage protection function, the instrument continuously evaluates independently for each phase whether all voltages evaluated in succession are above the detection limit within the detection time. If so, the protection function activates. The instrument records the activation time, the affected phase, the overvoltage value at the moment of protection activation as well as the course of RMS½ phase voltages and currents. Based on initial setting, it sends a message.

Each evaluation of voltage under the overvoltage limit of the 1st stage resets the evaluation of the detection time of the given phase.

Function of protection according to voltage unbalance

In the function input, the user sets the limit of the u2 unbalance of three-phase voltage in %, the detection time in seconds and protection blocking at phase voltage lower than the set value. A message sending can be set as an option.

For protection according to voltage unbalance, the instrument continuously evaluates the u2 unbalance. If all unbalance values evaluated within the detection time above the unbalance limit, the protection function according to voltage unbalance activates. The instrument records the moment of action, the value of voltage unbalance at this time, the course of RMS½ phase voltages and currents and, according to the initial setting, sends a message.

Each evaluation of voltage unbalance of a value lower than the set limit resets the detection time. A voltage drop of any phase below the blocking limit blocks the protection function.

Function of protection according to current unbalance

In the function input, the user sets the limit of current unbalance of three-phase current i2 in %, the detection time in seconds and protection blocking at phase current lower than the set value. A message sending can be set as an option. The two-voltage drop limit and the unbalance limit are preset.

For protection according to current unbalance, the instrument continuously evaluates the i2 unbalance. If all unbalance values evaluated within the detection time above the limit, the protection function according to current unbalance activates. The instrument records the moment of action, the value of current unbalance at this time and records the course of RMS½ phase voltages and currents. According to the initial setting, it sends a message. Each evaluation of current unbalance lower than the set limit resets the detection time.

A current drop of any phase below the blocking limit blocks the protection function.

Function of indication of a blown MV fuse

For the function indicating a blown MV fuse of the MV/LV transformer, you can set the detection time in seconds, and a message sending as an option.

With the blown MV fuse indication function, the parameters corresponding to a blown MV fuse are continuously evaluated at the LV level. If all parameters evaluated during the detection time correspond to a blown MV fuse, the protection function activates. The instrument records the moment of protection activation, the course of RMS½ phase voltages, currents and voltage unbalance and, according to the initial setting, sends a message.

Each evaluation that does not correspond to a blown MV fuse resets the detection time.

Direction protection function

In the function input, users set the limit of voltage drop in % of the rated voltage, the limit of overcurrent in the wrong direction in % of the rated current and the protection activation delay time in seconds. A message sending can be set as an option.

With the direction protection function, the instrument continuously evaluates the current flow direction. If all current values evaluated during the delay time are in the wrong (opposite) direction, the direction protection function activates. The direction protection function immediately activates if the value of current in the wrong direction exceeds the overcurrent limit and, at the same time, voltage dropped below the set limit. The direction protection function evaluates individual phases separately, which means that the fault is signalized even if the incorrect current direction is in one phase only. When the protection activates, the instrument records the activation time, the affected RMS½ phase and the course of voltages and currents with a pre-trigger of 0.5 s and the total duration of 1.0 s. The activation of the direction protection stays recorded even after restoring supply voltage.

The monitor memory holds data of the last twelve records of faults.

4.2.1 Indication on the MEg74 panel

After switching on the power supply of the device and the delay of checking the HW and minimum charge of the internal uninterruptible backup power supply, the correct operation of the device is indicated by intermittent lighting of the RUN LED.

The intermittent lighting of the RUN LED has the following meanings:

- Light with 1 short fading out (periodically repeated after 2 s); the monitor measures according to programmed parametrization
- Light with 2 short fading outs (2 s period); the measurement record is limited (e.g. due to a misconfiguration that caused that there is no more free space in the memory for a specific data type)
- Repeated short flashing; the monitor is programmed, it does not measure yet. The preselected measurement start time has not come yet or the measurement has been stopped by the user.
- Alternating light 1 : 1; power failure
- Steady light, or light with fading out recurring after more than 8 s; fault condition indication
- Continuously off; indication of a power supply failure or power off

LEDs in the ETH connector indicate :

- The green LINK_LED indicates the data line speed (on = 100 Mbit/s, off = 10 Mbit/s)
- An illuminated orange ACTIVITY_LED indicates data transmission.

4.2.2 Measured data

The choice of measured variables depends on the measurement connection and measurement parametrization.

Measured data is divided into recorder data, data of electric meter function, Ripple Control signal data, data of continuous phenomena of voltage quality, data of rapid voltage change, and data during single voltage events and events on the currents.

Recorder data for each aggregation interval and phase (from 1 s to 15 min, according to the parametrization).

Phase:

- Voltage U_{ef}, – average, minimum, maximum
- THD_U voltage harmonic distortion factor
- Direct-current component of voltage U_{DC},
- Harmonic components of voltage U_{Hn} of order n from 1st to 63rd,
- Currents I_{ef}, – average, maximum

- THD_I current harmonic distortion factor
- Current harmonics I_{Hn} of order from 1st to 63rd,
- Active power – average, minimum, maximum
- Reactive power – average, minimum, maximum
- Apparent power – average, minimum, maximum
- Deformation power – average, minimum, maximum
- Power factor PF and cos φ
- Active power 1_{stH} – average, minimum, maximum
- Reactive power 1_{stH} – average, minimum, maximum
- Apparent power 1_{stH} – average, minimum, maximum
- Active and reactive energy E_{P+}, E_{P-}, $E_{QC/P+}$, $E_{QL/P+}$, $E_{QC/P-}$, $E_{QL/P-}$

Phase-to-phase:

- Voltage U_{ef} – average, minimum, maximum

Three-phase:

- Active power – average, minimum, maximum
- Reactive power – average, minimum, maximum
- Apparent power – average, minimum, maximum
- Deformation power – average, minimum, maximum
- Unbalance power – average, minimum, maximum
- Power factor PF and cos φ
- Active power 1_{stH} – average, minimum, maximum
- Reactive power 1_{stH} – average, minimum, maximum
- Apparent power 1_{stH} – average, minimum, maximum
- Unbalance power 1_{stH} – average, minimum, maximum
- Active and reactive energy E_{P+}, E_{P-}, $E_{QC/P+}$, $E_{QL/P+}$, $E_{QC/P-}$, $E_{QL/P-}$

Data of electric meter function for output and each phase from the beginning of factory setting and from the start of measurement:

- Active and reactive energy E_{P+}, E_{P-}, $E_{QC/P+}$, $E_{QL/P+}$, $E_{QC/P-}$, $E_{QL/P-}$
- Possibility of energy evaluation in ¼ hour intervals.

Ripple Control signal data:

- Ripple Control telegram transmission start time
- Phase of the evaluated Ripple Control telegram
- Address and command part of the Ripple Control telegram
- Minimum and maximum voltage of Ripple Control telegram marks
- Ripple Control telegram carrier frequency

Data of continuous phenomena of three-phase voltage quality at the terminal for an aggregation interval (10 min):

- Number of frequency values in the range of ± 1 % f_n and in the range of +4 % to -6 % f_n
- Number of frequency values out of the range of ± 1 % f_n and out of the range of +4 % to -6 % f_n
- Frequency f – average, minimum, maximum
- Unbalance of voltage u2 and current i2
- Zero-sequence imbalance of voltage u0 and current i0

Data of continuous phenomena of phase voltage and current quality for each aggregation interval (10 min):

- Voltage – average, minimum, maximum in time and frequency domain
- Current – average, minimum, maximum in time and frequency domain
- Voltage deviations U_{over}, U_{under}
- Flicker P_{st} and P_{lt}
- THD_U voltage harmonic distortion factor
- Direct current component U_{DC}
- Basic to 63rd harmonic of voltage with a proportion of adjacent interharmonics
- Centred subgroups of interharmonic voltages up to the order of 63.
- Basic to 63rd harmonic of current with a proportion of adjacent interharmonics
- Centred subgroups of interharmonic currents up to the order of 63.
- Mains signalling voltage (Ripple Control) – average, maximum
- Number of 3 s intervals for voltage evaluation of mains signalling voltage
- Number of 3 s voltage values of signal in mains voltage above set limit

Data of rapid voltage changes – RVC:

- Start time of rapid voltage change
- Duration of rapid voltage change in ms
- Average voltage in balanced state before RVC
- Average voltage in balanced state after RVC
- Maximum absolute difference between $U_{RMS1/2}$ during RVC and balanced voltage before RVC
- Maximum absolute difference of ten-period voltage U_{RMS10} at RVC and balanced voltage before RVC
- Courses of voltage $U_{RMS1/2}$ and current $I_{RMS1/2}$ at RVC with time data
- Oscillograms of courses of voltage and current during RVC with time data.

Data during one-time voltage and current phenomena:

- Time of phenomenon occurrence
- Phenomenon duration
- Moments when the limits for interruption, dip and swell of voltage and current are exceeded
- Residual and maximum values of voltage, maximum values of current
- Courses of voltage $U_{RMS1/2}$ and currents $I_{RMS1/2}$
- Oscillogram of the courses of voltage and current during a one-time phenomenon
- Harmonic voltage and current values during a one-time phenomenon

Transmission of the measured data is possible simultaneously via the MODBUS RTU and TCP, DLMS/COSEM, or EN 60870-5-104 protocols, in both CSV and COMTRADE formats, description of which is given in [5] and [6].

5/ MEASURING AND COMMUNICATION CONNECTION

The block wiring diagram of the multi input MEg74/LV PQ monitor for measurements at LV level and of the MEg74/MV for measurements at MV level with Safety Class II is shown in Fig. 5. The common point of the monitor is connected to the negative pole of the power supply unit and to the terminal for connecting the negative pole of the auxiliary DC power supply. The measuring terminals of AC voltages and the neutral conductor are connected to it via protective impedances. Circuits of current sensors are connected directly to the common point. The galvanically isolated power supply of the RS485 interface has a common terminal of the communication interface labelled G. The separated high-frequency shielding of the ETH and USB interface is connected to PE ground conductor. This ground connection is not a safety connection and therefore uses a low-current conductor.

While in the MEg74/LV version the measured voltages are simultaneously used for three-phase power supply of the monitor while respecting the requirements of CAT IV / 300 V category, in the MEg74/MV version, due to the low output power of the measuring voltage transformers, separate **L** and **PEN** terminals of the POWER connector are used for single-phase mains power supply from CAT III / 300 V protected circuits. The MEg74/LV and MEg74/MV versions also differ in the nominal value of the measured phase voltages 230 V and 100 / √3 V. All other parts of the MEg74 monitor are identical. Both versions of the MEg74 monitors have terminals for 24 V_{DC} auxiliary backup power supply, labelled **+** and **–**, which allow, for example, a long-term backup power supply or a common power supply for measuring and control equipment with a safe voltage. The auxiliary power supply is connected via a two-pole disconnector with 1.0 A T fuses. The auxiliary power supply is either floating or with a grounded negative pole.

The current sensor inputs have a current sensor interface according to EN IEC 61869-10 with a nominal value of 225 mV and an input impedance of 2 MΩ, 50 pF. A standardized eight-pin RJ45 connector is used to connect a set of three current sensors of the same type of a three-phase measuring point, thus minimizing the required number of connectors, simplifying installation and reducing the risk of faulty wiring.

Examples of the connection of sets of three current sensors of the multi input MEg74/LV PQ monitor in a transformer station are shown in Fig. 6. The measured voltages are connected via a three-pole fused disconnector with 10×38 gG 1.0 A fuses. In the drawn example, the secondary circuits of the current measuring transformers with a rated current of 5 A are connected to the first input of the current sensors I1–I3 via a CT 25 A / 225 mV converter. The input I1–I3 measures indirectly the phase LV currents of the power transformer TR MV/LV. The phase currents of the 1st LV output are measured via the A input of the monitor using a set of three 3TORv/225 mV toroids. The maximum diameter of the phase conductors in TORv toroids is 15 mm and the maximum current is 50 A. For the measurement of phase currents of the 2nd LV output, low-power current transformers with a split core type LCT 36 with a 36 × 36 mm window and a maximum current of 600 A are used as an example. In this case, it is necessary to increase the installation safety, e.g. by using appropriately sized insulation for the transformer station.

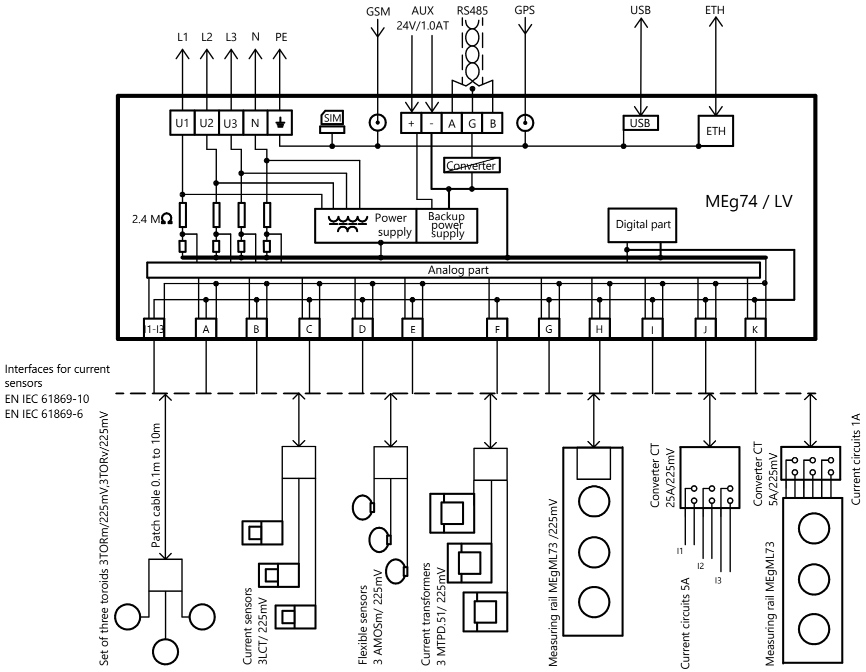
As an example of direct measurement of phase currents of the 3rd LV output, AMOSm flexible sensors with a loop length of 15 cm and a maximum current of 1000 A are used. This type of sensor is suitable for measurements with complicated or hardly accessible arrangements of phase conductors.

On the 4th output, current measuring transformers with split core MTPD.51, which have a window of 52 × 33 mm and a maximum current of 1000 A, are used for direct measurement of phase currents. Due to favourable design, this type of sensor meets CAT IV / 300 V requirements so that it can be installed directly on live parts.

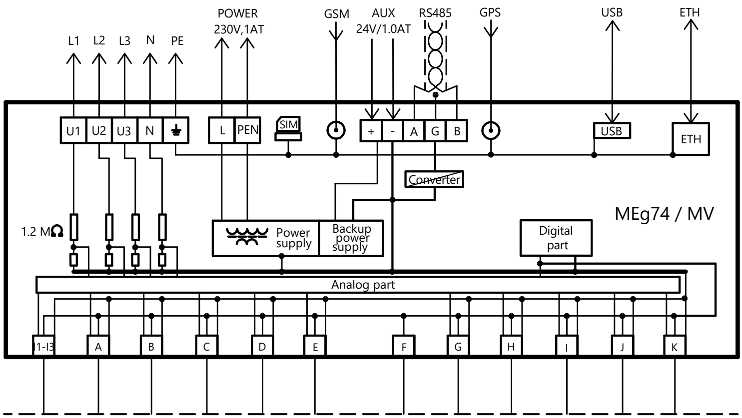
In LV cabinets with fuse rails or disconnector rails, the MEgML73 measuring rail with an output signal of 225 mV can be used to measure phase currents. It can also be installed additionally in already operating LV cabinets. The maximum measured current is 630 A, and the measuring rail is designed for long-term and safe measurement during the entire operation of the LV cabinet.

Current sensors with a standard voltage of 225 mV can be gradually connected to the inputs of the current sensors F to K of the monitor, depending on the expansion of the LV grid. By using sets of three current sensors with a tri-splitter containing a memory with sensor correction constants, the defined measurement accuracy is ensured without the need for additional calibration of the sensors and the monitor.

Fig. 5: Block wiring diagram of the MEg74/LV monitor and connected current sensors.



Block wiring diagram of a MEg74/MV monitor with a POWER mains power supply



Interfaces for current sensors EN IEC 61869-10, EN IEC 61869-6

Fig. 6: Example of wiring of the multi input MEg74/LV PQ monitor in a transformer station

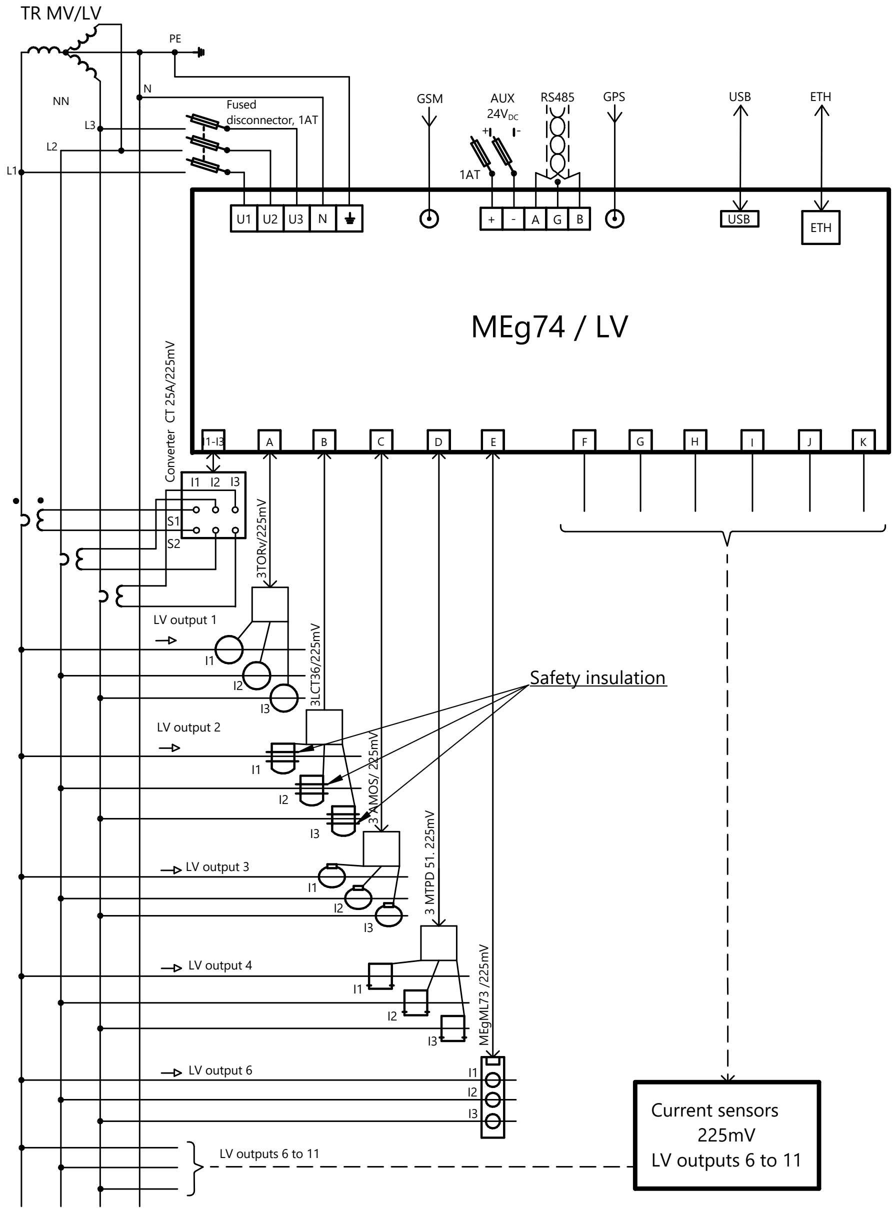
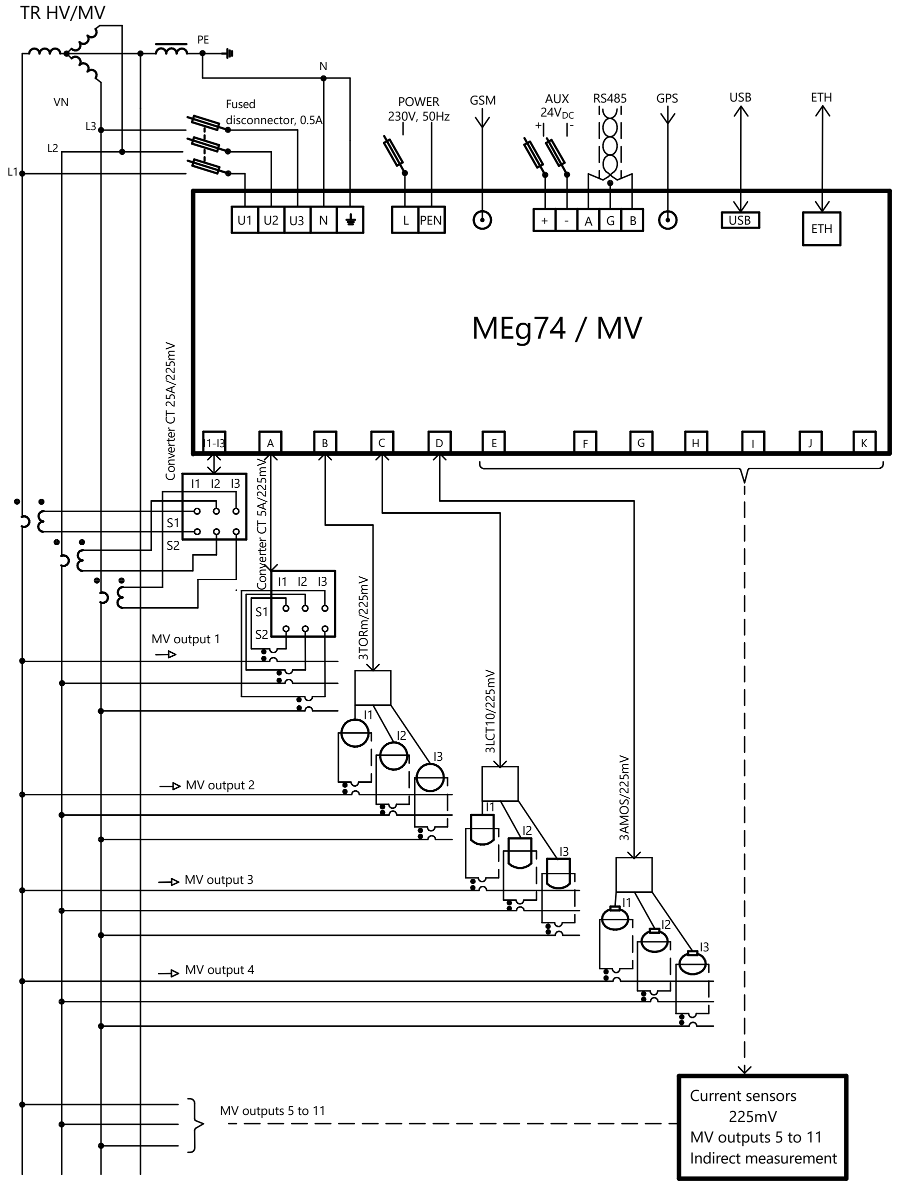


Fig. 7: Example of wiring of the multi input MEg74/LV PQ monitor in a transformer station



An example of the wiring of the MEg74/MV multilevel PQ monitor in an MV station with a compensated MV grid is shown in Fig. 7. The measured voltages of phases L1, L2 and L3 are connected to the voltage inputs U1, U2 and U3 of the monitor via measuring voltage transformers and a three-pole fused disconnector with 0.5 A fuses. Connected terminals N and ⏚ are connected to the ground of the MV station.

The secondary measuring or protection circuits of the installed measuring current transformers of the measured power transformer are connected to the input of the current sensors I1–I3 of the monitor via a CT converter as required. When overcurrent and short circuit waveforms need to be recorded, the protective windings of current transformers and the CT25 A / 225 mV converter shall be used. You can also use TORm/225 mV toroids or LCT10/225 mV low power sensors. When accurate measurement of the phase powers and energies of the power transformer is required, the 5 A/225 mV converter would be connected to the current circuits of measuring windings of the current measuring transformers in a similar manner as shown in the measurement of the 1st MV output.

For example, the currents of the 2nd MV output are measured indirectly by small 3TORm/225 mV toroids, which are connected in the secondary circuits of current transformers of this MV output. The used set of three 3TORm/225 mV sensors is connected to the B input of the monitor by a shielded patch cable of the required length.

In Fig. 7, currents of the 3rd MV output are measured by low-power current sensors with a split core type LCT and currents of the 4th MV output by flexible sensors type AMOSm. The other inputs of the current sensors E to K of the MEg74/MV monitor can be used to connect other sets of three measuring current sensors of other MV outputs fitted with voltage-rated measuring current transformers. When installing the sensing parts of the sets of three current sensors, you need to respect their designation I1, I2 and I3 and the direction of flow of the measured current.

An example of the connection of local communication between the measuring and control system and a group of monitors via RS485 interface is shown in Fig. 8. One RS485 interface with the MODBUS RTU allows communication with up to 30 devices. A 120 Ω terminating resistor must be connected between terminals A and B of the last device connected in the line with the RS485 interface.

Fig. 9 shows the connection of a GPS antenna for time synchronization and GSM antenna for remote communication to the MEg74 monitor. The GPS antenna must connect to at least three satellites to maintain time synchronisation. If necessary, use a 10 m long GPS extension cable with additional 2.5 m long insulation at the end with the connector connected to the monitor. For GSM communication in the CATIV environment of the transformer station, a safe GSM extension cable of 2.5 m length can be used to connect the antenna, and a GSM extension cable of up to 10 m length can be used in a safe environment.

Fig. 9 also shows connection of the MEg74 multiple input monitor to an Ethernet network via an RJ45 connector. Even in this case, if installed in a hazardous environment, a safe ETH extension cable with a length of 2.5 m can be supplied.

Fig. 10 shows an example of using an ETH interface with RJ45 connector for remote transmission of data of more than one MEg74 multiple input monitor when using a Switch unit.

Fig. 11 shows the use of a multi input MEg74 PQ monitor with an ARM communication core and a transparent channel to a secure bidirectional data transmission between an electric meter concentrator in DTS and the central IT of the distribution company. Here, the Linux IPsec functions are used to transmit data via GSM network.

6/ SAFETY INFORMATION

Pay utmost attention to this information.

⚠ The warning draws attention to the facts presenting safety risks to the operator.

⚠ Cautions indicate conditions and facts that may cause damage to the MEg74 monitor.

⚠ **Warning**

- **Be careful, the operator performing the installation of the multi input MEg74 PQ monitor set into circuits and areas with live parts must be equipped with personal protective equipment and additional safety means and use them during the installation.**
- **When the multi input MEg74 PQ monitor is used in a different way than specified by the manufacturer, the protection provided by MEg74 may be impaired.**
- The operator installing the instrument and its accessories must be qualified for work on or near dangerous voltages. The operator must also be trained in providing first aid.
- The monitor may only be operated by skilled personnel.
- Maintenance and repairs of monitors may only be carried out by the manufacturer or service organizations authorized by the manufacturer.

 **Caution**

Explanation of symbols used in the user manual and in the specifications of the multi input MEg74 PQ monitor:

	Note in the documentation / Caution, risk of danger
	Caution, risk of electric shock
CAT	Overvoltage category or measurement category, characterizing the state of transient overvoltage.
CAT IV 300V	is installation in transformer station at the LV level with a voltage of up to 300 V.
CAT III 300 V	is installation in parts of mains circuits with voltages up to 300 V.
	Safety class II, double or increased insulation
	Do not install around uninsulated hazardous live conductors which can cause electrical shock, burning or arc discharge
IP kód	Degree of IP rating
	The product is intended for recycling and for collection points
	Declaration of Conformity – European Community
	High-frequency grounding

7/ INSTALLATION OF THE MONITOR

 Power supply and measuring voltage circuits shall be connected in a voltage-free state.

The monitor circuits with CAT IV / 300 V measurement and overvoltage rating can be installed in sources of a grid installation, i.e. also in transformer stations with maximum phase voltage of 300 V_{AC} and a phase-to-phase voltage of up to 510 V_{AC}.

The monitor circuits with CAT III / 300 V measurement and overvoltage rating can be installed in parts of building power distribution systems with a maximum phase voltage of 300 V_{AC} and a phase-to-phase voltage of up to 510 V_{AC}.

⚠ Current sensor inputs are not designed for direct measurement of currents. They should be connected to the outputs of sets of three current sensors, which must meet the safety requirements at the place of installation. The current sensors shall be connected either in the off state, or with short-circuited secondary windings of the instrument current transformers.

⚠ When wiring patch cables with sets of three current sensors, extra care must be taken to avoid confusion with the ETH communication connector.

⚠ The MEg74 monitor shall only be installed by qualified personnel equipped with personal protective equipment against electric shock and trained in the provision of first aid.

In order to suppress hf interference, the contact marked with the symbol ⏚ must always be grounded.

Measured voltage must always be brought to the U1 reference voltage input.

1. Multiple input MEg74 PQ monitor fitted with locks with springs 16 according to Fig. 2, is installed on a horizontally positioned DIN rail TS 35. The monitor shall be put on the DIN rail with the upper side of the spring-loaded lock from above and pressed against the DIN rail. During disassembly, the monitor must be pushed down again and the bottom side of the monitor is to be released from the DIN rail by tilting it forward and up.

   The monitor is equipped with two locks on its top and back side. This allows it to be mounted with the front panel in two planes. Installation with the front panel in a vertical plane and the adjacent side panel with connectors facing downwards helps increase resistance to dripping water. When using the lock on the top of the monitor, the front panel will be in a horizontal plane and the side panel with connectors will be in a vertical plane with better access to the connectors.
2. The voltage terminals U1, U2, U3 of the five-pole connector are connected via a three-pole disconnecting element to phase conductors L1, L2, L3.

   For the MEg74/LV version, a three-pole disconnector with 1.0 A cylindrical fuses sized 10 × 38 mm is used.

   For the MEg74/MV version, a disconnector with 0.5 A tube fuses sized 5 × 25 mm is used.

   The N terminal of the five-pole connector MEg74/LV shall be connected to the neutral conductor.

   The HF grounding terminal ⏚ of the five-pole connector shall always be connected to the ground. In a LV TN-C type network to the PEN conductor, and in a LV TN-S network to the PE conductor.

3. For MEg74/MV monitor installed in an MV station, the L terminal of the POWER mains supply shall be connected to the phase of LV grid via a single-pole disconnector with a 1.0 A T slow-blow fuse. The PEN terminal of the POWER mains power supply to the MEg74/MV monitor shall be connected directly to the PEN conductor of the grid.
4. If a long-term backup power supply is required for both versions of the MEg74 monitor, a 24 V_{DC} backup power supply shall be used, which must be connected to the + and – terminals of the AUX double terminal via a double-pole fuse disconnector with 5 × 20 mm cylindrical fuses rated at 1.0 A. Connect the positive pole of the backup power supply to the + terminal and the negative pole of the power supply to the – terminal of the monitor. The backup power supply is either floating or has a grounded negative terminal.
5. Select a suitable version of sets of three current sensors or converters, depending on the design of conductors with the measured three-phase currents:
   - toroids 3TORv/225 mV, 3TORm/225 mV
   - current sensors 3LTC10/225 mV, 3LTC16/225 mV, 3LTC24/225 mV, 3LTC36/225 mV
   - flexible sensors 3AMOSm/225 mV
   - current transformers 3MTPD.51 / 225 mV
   - measuring rails MEgML73/225 mV
   - converters CT 25 A / 225 mV
   - converters CT 5 A / 225 mV.
6. The sensing parts I1, I2 and I3 of the selected sets of three current sensors are installed at the desired location on the phase conductors L1, L2 and L3 of the measured output. When selecting the place of installation, depending on the type of sensors, you must respect safe air and surface distances from live parts. Use procedure described in chap. 14 to ensure their position on the conductors with measured currents.
7. Tri-splitters of the sets of three current sensors shall be mounted at a safe air and surface distance from live parts.
8. Choose the length of the shielded patch cable connecting the current sensors and the multi input MEg74 PQ monitor according to the installation distance between the tri-splitter of the set of three current sensors and the selected input of current sensors. Safe distance of the patch cable from live parts shall be ensured by cable ties or other means.
9. The connection of local communication between the measuring and control system and a group of monitors using an RS485 interface is shown in Fig. 8. One RS485 interface with the MODBUS TCP allows communication with up to 30 devices.

A 120 Ω terminating resistor must be connected between terminals A and B of the last device connected in the line with the RS485 interface.

10. Fig. 9 shows the connection of a GPS antenna for time synchronization and GSM antenna for remote communication to the MEg74 monitor. The GPS antenna must have at least three satellites available for time synchronisation. If necessary, use a 10 m long GPS extension cable with additional 2.5 m long insulation at the end with the connector. For GSM communication in the CATIV environment of the transformer station, a safe GSM extension cable of 2.5 m length can be used to connect the antenna, and a standard GSM extension cable of up to 10 m length can be used in a safe environment.
11. Fig. 9 shows connection of the MEg74 multiple input monitor to an Ethernet network via an RJ45 ETH connector. Even in this case, if installed in a hazardous environment, a safe ETH extension cable with a length of 2.5 m can be supplied.
12. Fig. 10 shows an example of using an ETH interface with an RJ45 connector to remotely transmit data from more than one MEg74 multiple input monitor via a Switch unit.
13. Fig. 11 shows the use of a MEg74 multiple input monitor with an ARM communication core and a transparent channel with secure two-way data transmission using the Linux IPsec function for GSM data transmission between an electric meter concentrator in DTS and the central IT of a distribution company.

Fig. 8: Communication of the MEg74 monitors via the RS485 interface

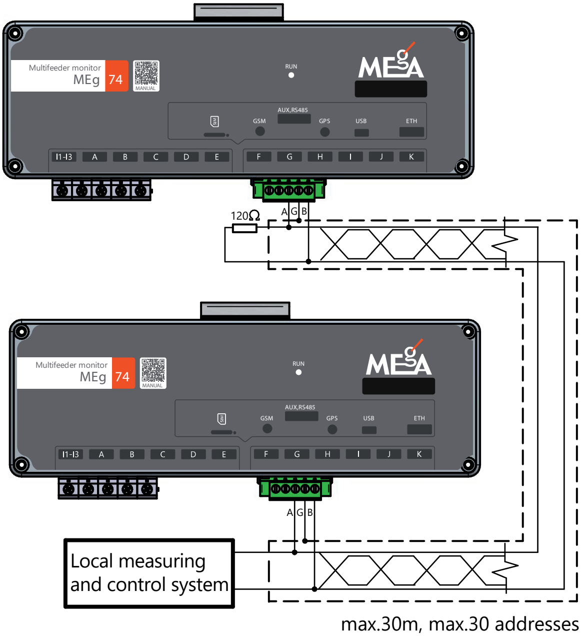
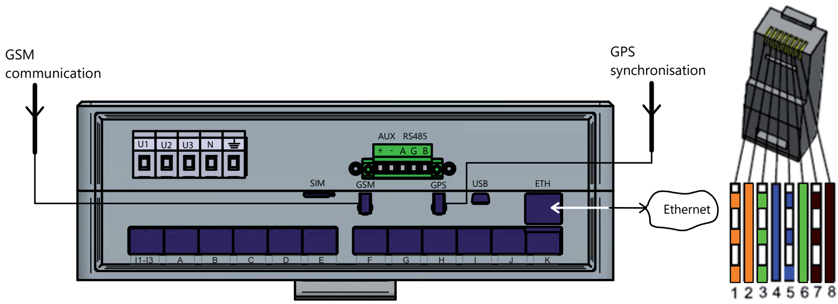


Fig. 9: Connection of GPS and GSM antennas and connection of the MEg74 monitor to an Ethernet network



Connector RJ45 - ETH
Signal TX+ is on pin 1
Signal TX- is on pin 2
Signal RX+ is on pin 3
Signal RX- is on pin 6
Pins 4,5,7,8 not used

Fig. 10: Communication of the MEg74 monitors via the ETH interface and Switch unit

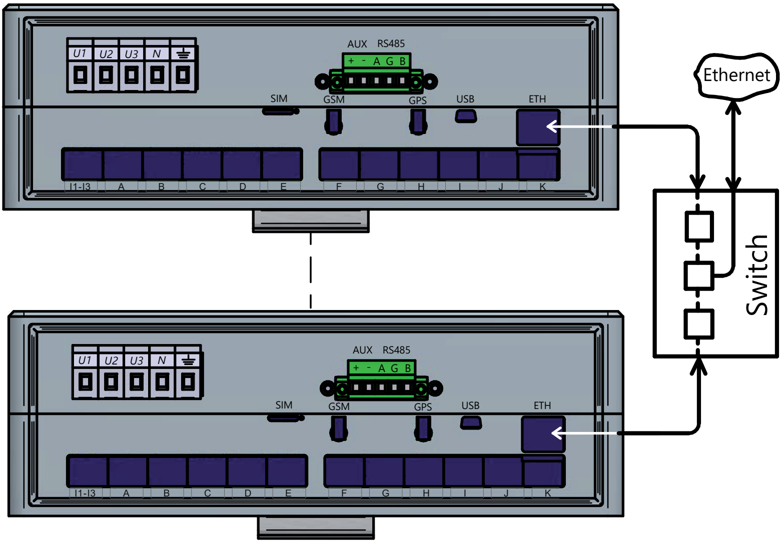
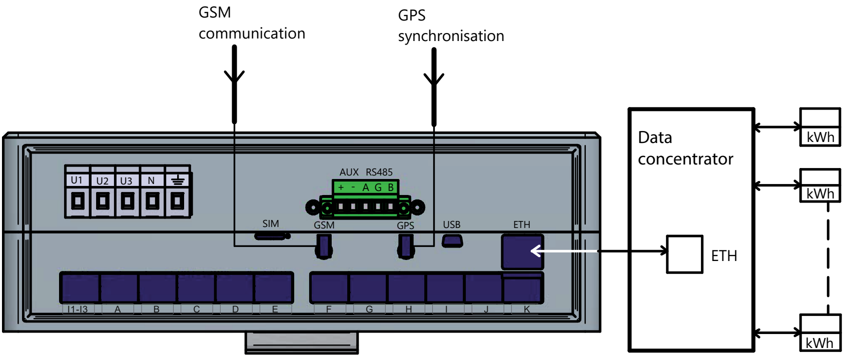


Fig. 11: Data transmission and time synchronization of remote electric meters via a transparent channel of GSM communication of the MEg74 monitor



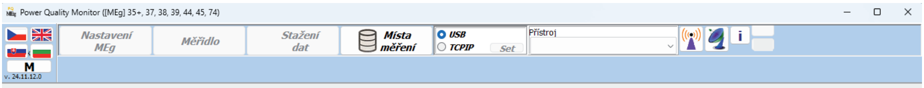
8/ SWITCHING ON THE MONITOR, PREPARATION FOR MEASUREMENT

1. After switching on any of the supply voltages of the multi input MEg74 PQ monitor, the **RUN** LED begins to flash with a delay of approx. 2 s, which is needed to start the power supply and check the correct function of the individual monitor blocks. The flashing pattern is determined by previous programming of the monitor. If the RUN LED is continuously on or off, the monitor or power supply is in a fault state.

   The LINUX system boots up in about 2 minutes after the power supply is connected.

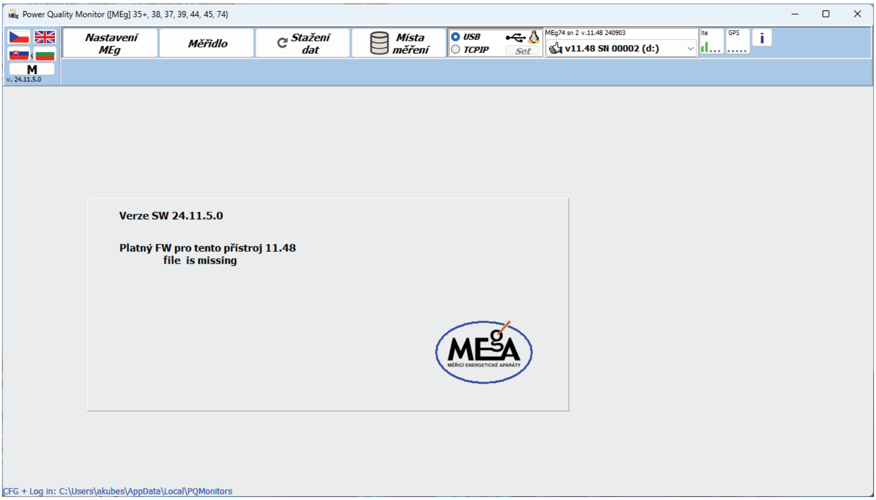
2. The software **PQ_MEg launches** in the inspection computer. If it launches correctly, the main window with a bar according to Fig. 12 is displayed, where USB communication is to be selected. For a detailed description of the PQ_MEg software, visit www.e-mega.cz/DL.

Fig. 12: Start of the PQ_MEg software



3. Use a USBmini communication cable to connect the inspection computer to the MEg74 monitor. The main window will display information on the SW and FW version. The bar in the main window displays the type and serial number of the connected monitor, see Fig. 13.

Fig. 13: Confirmation of USB communication between the MEg74 and an inspection computer



4. In the main bar, select “**Měřidlo**” (**Meter**) according to Fig. 14. This shows the values of the connected phase voltages and phase currents in the **Samples** view.
5. To check the correct direction of current connection, correct direction of phase voltage rotation and correct assignment of phase currents to phase voltages, press the Test button. An example of a correct test is shown in Fig. 15.

Fig. 14: Connection of the measured voltages and currents

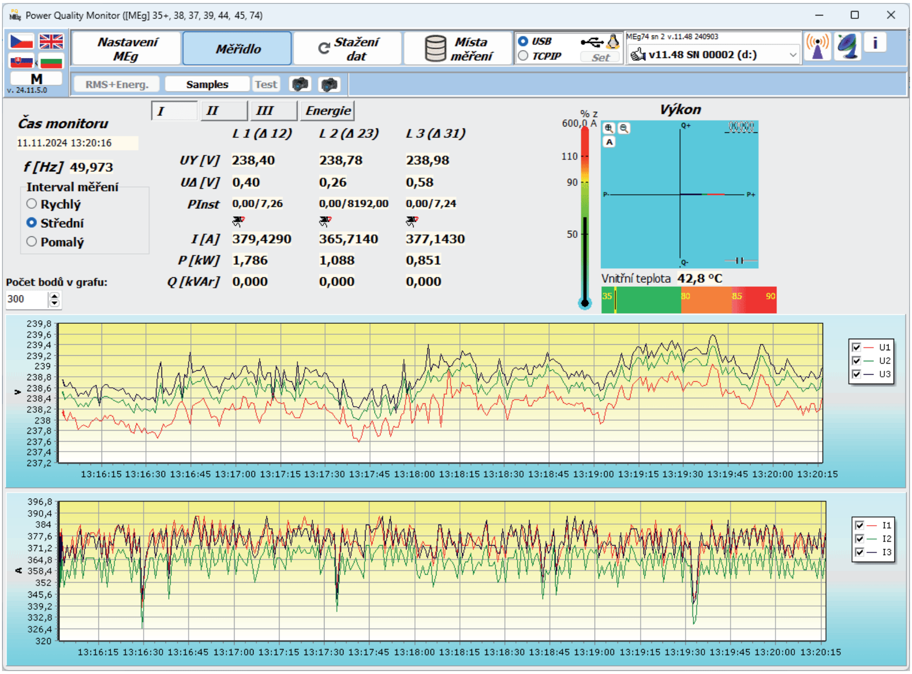
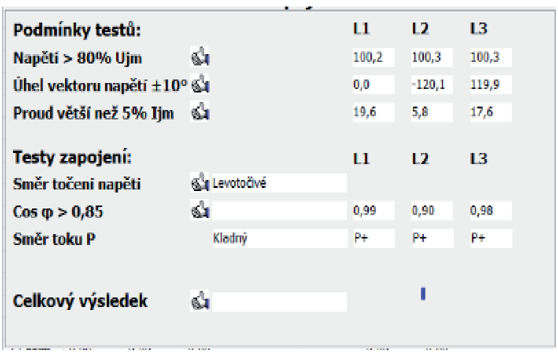


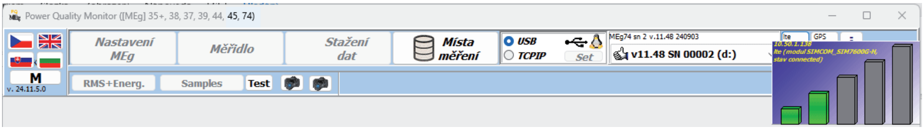
Fig. 15: Check of the correct connection of measured voltages and currents

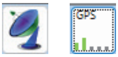


6.  After starting the program with the device connected or after connecting the antenna, the signal strength is displayed directly on the button (refresh rate after approx. 5 s, possibility to search for the optimal location for the antenna).

   Click on the pictogram to display information on the GSM network signal intensity at the antenna installation location, see Fig. 16.

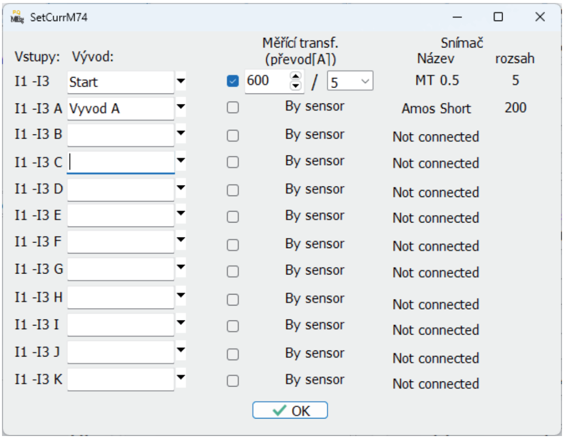
Fig. 16: Display of the GSM network signal intensity at the antenna installation location



7.  Approximately 2 minutes after connecting a GSM antenna installed with direct sky visibility, the GPS pictogram will be highlighted. After it is activated, a new window will display the number of received satellites, the monitor installation location and the moment of the last synchronisation of the monitor time.

8. An example of connecting and parametrizing current sensors connected to the inputs of the multi input MEg74 PQ monitor is shown in Fig. 17.

Fig. 17: Example of connecting current sensors to the MEg74



9/ MAINTENANCE

Caution

- Any repairs of the multi input MEg74 PQ monitor during the warranty period may only be carried out by the manufacturer's skilled and trained personnel or by the manufacturer's service organizations.
- The monitor may not be exposed to chemicals.
- The monitor must only be transported in original transport packaging supplied by the manufacturer.

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

Batteries

The monitor uses the following batteries:

- lithium battery type CR2032 for real time circuit,
- supercapacitors with a declared lifetime of 10 years.

Fuses

To protect all three measuring voltage inputs of the monitor, which are also power inputs in the MEg74/LV monitor, use cylinder fuses 10×38gG 1.0 A.

To protect all three measuring voltage inputs of the MEg74/MV monitor, use cylinder fuses 5 × 25 mm, 0.5 A. For single-phase power supply to the monitor at the POWER terminals, a 5 × 25, 1.0 A T slow-blow cylinder fuse is used.

To protect the AUX auxiliary backup DC power supply, cylinder fuses 5 × 25, 1.0 A T are used.

10/ DISPOSAL

When the multi input MEg74 PQ monitor set is no longer in use, it must be recycled together with its accessories in waste collection facilities in accordance with the rules for electronic waste disposal.

11/ WARRANTY

The multi input MEg74 PQ monitor and its accessories are covered by a 24-month warranty from the date of purchase, however not longer than 30 months from the date of release from the manufacturer's warehouse. Defects originating during this period as a demonstrable result of defective design, manufacturing or using improper material will be repaired free of charge by the manufacturer.

It is not permitted to open the MEg74 universal monitor during the warranty period.

The warranty becomes void if the user carries out unauthorized modifications or changes on the MEg74 monitor, if the user connects the monitor incorrectly or if the monitor has not been operated in accordance with technical conditions.

Defects on the MEg74 monitor originating during the warranty period shall be claimed by the user with the manufacturer. The claimed monitor shall include the warranty certificate.

Under no circumstances the manufacturer is liable for subsequent damage caused by using the MEg74 monitor. This warranty does not in any case imply manufacturer's liability exceeding the price of the MEg74 monitor.

12/ ORDERS

The multi input MEg74 PQ monitor of both versions includes:

- base unit
- 1 communication cable USBmini 1.5 m
- 1 socket for a nano SIM card 115 S-ACA1

The voltage inputs and all inputs of current sensors of the MEg74 monitor have the following functions implemented:

- Function W0, Recorder
- Function W2, Voltage phenomena and events related to currents
- Function W3, Four-quadrant active and reactive electric meter
- Function W4, Oscillographic measurement

In addition, the voltage inputs and the three-phase input I1–I3 has the following function implemented:

- Function W1, Voltage quality in Class S.

Optional accessories of the MEg74 monitor:

- Set of three toroids 3TORv/50 A/225 mV, l = 15 cm
- Set of three toroids 3TORm/5 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT10/ 5 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT10/ 20 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT10/ 60 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT10/ 75 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT16/ 100 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT16/ 120 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT16/ 200 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT24/ 100 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT24/ 200 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT24/ 400 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT36/ 300 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT36/ 400 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT36/ 500 A/225 mV, l = 15 cm
- Set of three low-power split-core current transformers 3LCT36/ 600 A/225 mV, l = 15 cm
- Set of three flexible sensors 3AMOSm/ 100 A/225 mV, l = 15 cm
- Set of three flexible sensors 3AMOSm/ 300 A/225 mV, l = 15 cm
- Set of three flexible sensors 3AMOSm/ 1000 A/225 mV, l = 15 cm
- Set of three split-core current transformers 3MTPD.51/ 400 A/225 mV, l = 25 cm
- Set of three split-core current transformers 3MTPD.51/ 600 A/225 mV, l = 25 cm
- Set of three split-core current transformers 3MTPD.51/ 1000 A/225 mV, l = 25 cm

- Measuring rail MEgML73/ 250 A/225 mV
- Measuring rail MEgML73/ 400 A/225 mV
- Measuring rail MEgML73/ 630 A/225 mV
- Converter CT25 A/225 mV
- Converter CT5 A/225 mV
  - Function W5, Evaluation of Ripple Control telegrams
  - Function W6, Measurement of fast active energy
  - Function W7, Direction protection
  - Function W8, Two-stage undervoltage and overvoltage protection
  - Function W9, Protection according to voltage and current unbalance
  - Function W10, Indication of a blown MV fuse
- Set of three brackets for MTPD.51 transformer with cable ties
- Set of three holders for AMOSm sensor on 10 mm busbar
- Set of three holders for AMOSm sensor on 5 mm busbar
- GPS time synchronisation module
- GSM remote communication module
- LTE/GPS PUCK, mounting antenna AO-AKOM-36SS/MEgA
- GPS PUCK, mounting antenna GPS PUCK AP-AGPS-36/MEgA
- LTE rod, rod antenna LTE AO-ALTE-G124S/MEgA
- GPS magnetic antenna GPS AP-A20C-M5RA/MEgA
- Extension cable GPS/10 m[1)] with reinforced insulation with a length of 2.5 m[1)]
- Extension cable GSM/10 m with reinforced insulation with a length of 2.5 m[1)]
- Safe ETH extension cable /2.5 m[1)]
- Cable USB OTG AF to mini-BM, 15 cm for flash drive connection

[1)] Other lengths are available upon approval

On special order, the above mentioned sets of three current sensors can be supplied with a different value of rated current, a different length of connection of l CAT IV / 300 V sensors, or with other types of sensors.

13/ TECHNICAL PARAMETERS

General information

The multi input MEg74 PQ monitor is classified as PQI-S-FI1-H according to EN 62586-1 ed. 2.

The development of the monitor complies with EN ISO 9001, EN ISO 14001:2005 BS OHSAS 18001:2008, ISO/IEC 27001:2014.

Operating conditions

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

Design data

Dimensions:	240 × 80 × 80 mm (240 × 89 × 100,7 mm, plugged connectors and DIN)
Weight:	0.75 kg
Measurement category:	CAT IV 300 V according to EN IEC 61010-2-030:2021, MEg74/LV CAT III 300 V according to EN IEC 61010-2-030:2021, MEg74/MV
Safety class:	II, reinforced insulation
Protection:	IP22
Use:	interior
Pollution degree:	2

Power supply	**Inputs**
Phase voltage range:	150 V_{AC} to 300 V_{AC}, measuring inputs U1, U2, U3, MEg74/LV 190 V_{AC} to 260 V_{AC}, L and PEN terminals of the POWER connector, MEg74/MV
Input power after supercap recharge:	6.0 W from AUX with 24 V_{DC} or 16,0 VA (80 mA) from 230 V_{AC}
Input power with supercap recharging:	8.0 W from AUX or 21.0 VA from 230 V_{AC}
Frequency:	50 Hz ± 15 %

Internal uninterruptible power supply: 35 s with charged supercapacitors, charge time 5 min

Protection

MEg74/LV,	inputs U1, U2, U3:	3 cylinder fuses 10×38gG 1.0 A
MEg74/MV,	inputs U1, U2, U3:	3 cylinder fuses 5 × 25 mm, 0.5 A
	L terminal - POWER:	1 slow-blow cylinder fuse 5 × 25, 1.0 A T
AUX auxiliary power supply:		2 slow-blow cylinder fuse 5 × 25, 1.0 A T.

Measuring characteristics

A/D converter:	16 bit
Sampling frequency:	128 samples per period
Antialiasing filter:	digital filter, type FIR
Phase-locked loop	controlled by the passage of the fundamental harmonic voltage U1 through zero
Aggregation intervals:	quality function – according to EN 61000-4-30, ed. 3 Recorder function – from 1 s to ¼ hour
Synchronisation of aggregation:	according to EN 61000-4-30, ed. 3, class A
Time base:	±1 s in 24 h at the operating temperature without external synchronisation ±1 ms at the operating temperature with GPS ETH interface can be used for time synchronisation
Data memory capacity:	512MB, circular organization for each function

Voltage inputs U1, U2 and U3

Level	LV, MEg74/LV	MV, MEg74/MV
Rated phase voltages U_n, P-N:	230 V_{AC}	100 / √3 V_{AC}
Rated phase-to-phase voltages U_n, P-P:	400 V_{AC}	100 V_{AC}
Maximum voltage, P-N:	300 V_{AC} for CAT IV	300 V_{AC} for CAT III
Voltage measuring range, P-N, cl. S:	0.2 V_{AC} to 350 V_{AC}	0.1 V_{AC} to 100 V_{AC}
Voltage measurement uncertainty, P-N, cl. S:	±0.2 % U_n ± 0.3 % of M.V., f = 50 Hz	±0.2 % U_n ±0.3 % of M.V., f = 50 Hz
Change of value with temperature:	0.05 % U_n / 10 K	0.05 % U_n / 10 K
Input resistance of voltage inputs:	2.4 MΩ	1.2 MΩ

The voltage inputs and neutral input are separated from the common conductor of the monitor by a safe impedance.

Inputs for current sensors

The rated voltage U_n = 225 mV at the inputs for the current sensors of the monitor corresponds to the rated current In at the input of the sensing part.

Measuring range:	5 % U_n to 200 % U_n
Measurement uncertainty:	±0.5 % U_n, ±0,5 % of M.V. (45 Hz to 60 Hz)
Change of value with temperature:	0.05 % U_n / 10 K
Permanent overload:	10 × Un
Maximum short-term overload:	50 × Un, 1 × per minute

Active power, reactive power, PF, energy

Active power:	± 0.5 % P_n ± 0.5 % M.V	at U ≥ 80 % U_n, I ≥ 5 % I_n, PF ≥ 0.5
Reactive power:	± 0.5 % Q_n ± 0.5 % M.V.	at U ≥ 80 % U_n, I ≥ 5 % I_n, PF ≤ 0.866
PF:	±0.01	at U ≥ 80 % U_n, I ≥ 5 % I_n
Active energy:	class B	EN 50470-1
Reactive energy:	class 1	TPM 2440-08, ČMI 2008

Note: M. H. – measured value

USB interface

Type:	USB2.0
Communication speed:	5.4 Mbit/s
Connector:	USBmini B

ETH communication

Speed:	10/100 Mbps Ethernet,
Standard:	Ethernet version 2.0/IEEE 802.3
Protocols for data reading:	MODBUS TCP, IEC 60870-5-104
VPN protocols:	L2TP/IPsec, IKEv2/IPsec
Other properties:	Firewall
Connector:	RJ45 type WS 8-8

GSM communication, can be ordered as an optional item

SIM card type:	nano SIM in a 115 S-AC1 slot	
Technology:	LTE Cat. 4, HSPA+, EDGE, GPRS (class B, CS1 to CS4)	
Frequency bands [MHz]:	4G	B1 (2100), B3 (1800), B7 (2600), B8 (900), B20 (800)
	3G	B1 (2100), B8 (900)
	2G	B3 (1800), B8 (900)

Watchdog for modem restart in case of communication loss

Protocols and other properties are the same as for ETH communication

Connector: SMA(f)

ETH time synchronization

Protocols: NTP, PTP (SW only), IEC 60870-5-104, MODBUS TCP

GPS time synchronization, optional

Uncertainty:	± 1 ms
Standards:	NMEA, RTCM104
Frequency band:	GPS(L1)
Connector:	SMA(f)

Table of measured variables of the PQ function of the multi input MEg74 monitor on input I1–I3 according to IEC 61000-4-30, ed.3

Function and measured data	Method of measurement	Measurement uncertainty, measuring range
Network frequency; 10 s data	Class A	Class S
Voltage value, 150 periods, 10 min, 2 hours	Class A	Class S
Flicker; 10 min P_{st}, 2 hours P_{lt}	Class A	Class S
Voltage drops and increases, residual and max. U, duration T	Class A	Class S
Supply voltage interruption, residual and maximum U, T time	Class A	Class S
Voltage unbalance, 150 periods, 10 min, 2 hours	Class A	Class S
Harmonic voltages, 150 periods, 10 min, 2 hours	Class A	Class S
Interharmonic voltages 150 periods, 10 min, 2 hours	Class A	Class S
Voltage of signals in the supply voltage, voltage value	Class A	Class S
Positive and negative voltage deviations 150 periods, 10 min, 2 hours	Class A	Class S
Rapid voltage changes – RVC, $U_{RMS1/2}$	Class A	Class S

According to EN 61557-12,

- the multi input MEg74/LV monitor is a PMD SD class measuring device (performance measuring and monitoring device) with direct voltage measurement and indirect current measurement using sensors at the LV level,
- the multi input MEg74/MV monitor is a PMD SS class measuring device (performance measuring and monitoring device) with indirect voltage and current measurement at the MV level.

It integrates the functions of electric variables recording, electric power measurement, voltage quality measurement, recording of Ripple Control telegrams and protection functions.

Measurement uncertainty and measuring ranges of the variables of Voltage Quality function of the multi input MEg74 monitor at the input I1–I3 at testing conditions 1, 2 and 3 according to EN 61000-4-30, ed. 3

Parameter	**Uncertainty**	**Measuring range**
Frequency	± 2 mHz	42.5 Hz – 57.5 Hz
Voltage deviation	± 0.2 % U_n	10 % U_n – 120 % U_n
Flicker P_{st} and P_{lt}	7.5 % P_{st}, P_{lt} IEC 61000-4-15, ed. 2	P_{st}, P_{lt} (0.4 – 4.0) 1 – 4 ,000 changes/minute
Flicker $P_{inst, max}$	8 % $P_{inst, max}$	$P_{inst, max}$ (0 – 4) sine, rectangular
Voltage phenomena	Amplitude: ± 0.5 % U_n Duration: ± 1 period	5 % U_n – 150 % U_n 0.02 s – 30 s [1)]
Přerušení	Duration: ± 1 period	0.02 s – 30 s [1]
Unbalance	± 0.2 %	1.0 % u_2 – 5 % u_2 1.0 % u_0 – 5 % u_0
Harmonic voltages	± 5 % U_{harm}, $U_{harm} \geq 3$ % U_n ± 0.15 % U_n, $U_{harm} < 3$ % U_n	10 % – 100 % class 3 IEC 61000-2-4
Interharmonic voltages	± 5 % U_{harm}, $U_{harm} \geq 3$ % U_n ± 0.15 % U_n, $U_{harm} < 3$ % U_n	10 % – 100 % class 3 IEC 61000-2-4
Signals in voltage	± 10 % U_{sig} for 3 % $U_n \leq U_{sig} \leq 15$ % U_n, ± 0.3 % U_n for 1 % $U_n \leq U_{sig} \leq 3$ % U_n	0.5 % U_n – 15 % U_n
Rapid changes of U – RVC, $U_{RMS1/2}$	Amplitude: ± 0,5 % U_n Duration: ± 1 period	Threshold 1,0 – 10 % U_n Hysteresis 50 % threshold
Current	± 2 % $I_{measured}$	10 % – 200 % I_{max}
Time base	± 1 s per 24 h ± 1 ms with GPS	-

[1)] With a DC backup power supply, duration depends on the auxiliary power supply

Technical parameters of the GSM and GPS antennas of the multi input MEg74 monitor

Antennas	**AO-AKOM-36SS/MEgA**	**AO-ALTE-G124S/MEgA**
Use	GSM/UMTS/LTE/GPS	GSM/UMTS/LTE
Frequency bands MHz	800 / 900 / 1700 / 1800 1900 / 2100 / 2600 2700 /1575.42	700 / 800 / 900 / 1700 1800 / 1900 / 2100 / 2600
Gain	0 / 30 dBi	6 dBi
VSWR	< 2.0 : 1	< 3.0: 1
Impedance	50 Ω	50 Ω
Direction	omnidirectional	omnidirectional
Angle of radiation	H 360° V 30°	H 360° V 30°
Polarisation	linear / R.H.C.P.	vertical
Output power	10 W	10 W
Supply voltage	2.7 – 5.5 V_{DC}	-
Dimensions	ø 54.4 × 24.6 mm	315 × ø 29.5 mm
Weight	165 g	55,99 g
Operating temperature	-30 °C to +90 °C	-40 °C to +85 °C
Design	PUCK	Rod
Fastening	installation	magnetic
Cable type	2 × RG174/U	R174/U
Cable length	2 × 3 m	3 m
Connector	SMA(f))	SMA(f)
Overvoltage category	CAT IV 2.5 m	CAT IV
Safety class	II 2.5 m	II 2.5 m

Antény	**AP-AGPS-36/MEgA**	**AP-A20C-M5RA/MEgA**
Use	GPS	GPS
Frequency bands MHz	1575.42	1575.24
Gain	30 dBi	32 dBi
VSWR	< 2.0 : 1	< 2.0 : 1
Impedance	50 Ω	50 Ω
Direction	omnidirectional	omnidirectional
Angle of radiation	H 360° V 30°	H 360° V 30°
Polarisation	R.H.C.P.	R.H.C.P.
Output power	10 W	10 W
Supply voltage	2.7 – 5.0 V	2.5 – 5.5 V
Dimensions	ø 54.7 × 23 mm	38.5 × 34.5 × 12.3 mm
Weight	190 g	88.38 g
Operating temperature	-30 °C to +90 °C	-40 °C to +90 °C
Design	PUCK	external
Fastening	installation	magnetic
Cable type	R174/U	R174/U
Cable length	10 m	5 m
Connector	SMA(f))	SMA(f)
Overvoltage category	CAT IV 2.5 m	CAT IV 2.5 m
Safety class	II 2.5 m	II 2.5 m

14/ DESCRIPTION OF THE CURRENT SENSORS

Measurement of currents on the outputs at LV and MV level cannot be effectively solved by a single type of sensor in terms of design, installation and economics. The MEg74 PQ monitor has an electrical interface for the current sensor inputs according to EN IEC 61869-10 with a nominal level of 225 mV.

The measuring range of the MEg74 is up to twice the nominal value.

When it is necessary to measure and record the course of events on currents e.g. up to ten times the nominal value, the nominal value of the primary current of the current sensor is chosen to be five times higher than the nominal value of the measured current.

The current sensors of the MEg74 monitor are manufactured in triads with three sensing parts and, depending on the type, 15 cm or 25 cm long leads to a tri-splitter, which has an RJ45 connector at its output.

The sensing parts of the sensors are labelled I1, I2 and I3 and are installed on phases with corresponding numbers.

When installing them, make sure that the current flow to the appliance in the measured conductor and the marked direction of current flow on the sensing part of the sensor match each other.

The MEg74 is connected to the tri-splitter with shielded patch cables of the required length. Installation safety of patch cables is ensured by mounting them in locations with sufficient surface and air distances from live parts.

The tri-splitter contains a memory with correction constants of the connected current sensors.

14.1 Set of three toroids 3TORv/225 mV and TORm/225 mV

Accurate, long-term stable and safe AC current sensor. Its basic component is a sensing part with a hole, which shall be put on the conductor with the measured current. Two sizes of toroids are distinguished.

When installing, you need to respect the direction of flow of measured current of the sensing part and the correct placement of the labelled sensing parts on the corresponding phase conductors. The sensing part is separated by galvanic isolation from the circuit of the measured current. The installation of both toroid versions meets the requirements of CAT IV/300 V and Safety Class II. These sensors can be installed in any location, the surface and air distances of both the sensors and their leads are controlled by the sensor design.

Technical parameters of 3TORv/225 mV and TORm/225 mV toroids

The 3TORv/225 mV and TORm/225 mV toroids can be used for direct and indirect measurements.

	3TORv / 225 mV	3TORm / 225 mV
Rated input current I_n:	50 A	5 A
Dimensions:	40 × 15 × 55 (80) mm	30 × 16 × 45 (70) mm
Max. diameter of measured conductor:	15 mm	6 mm
Weight:	0.1 kg	0.1 kg

Rated output voltage U_n:	225 mV_{AC}, (EN IEC 61869-10)
Rated load:	2 MΩ/50 pF
Length of the output cable of sensing parts:	15 cm
Measuring range:	5 % to 120 % I_n
Rated frequency:	42.5 Hz to 69 Hz
Frequency range:	40 Hz to 2.5 kHz
Measurement error at f=50Hz [1]:	0.5 % I_n
Harmonics measurement uncertainty up to the order of 50. [2), 3)]:	±10 % I_{harm} at $I_{harm} \geq 3$ % I_n ±0.3 % I_n at $I_{harm} < 3$ % In
Measurement category:	CAT IV / 300 V

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

Safety class:	II
IP rating:	IP40
Operating temperature:	-25 °C to +55 °C
Storage temperature:	-30 °C to +50 °C
Temperature coefficient:	0.2 % / 10 K
Relative humidity:	≤ 85 % RH, non-condensing

Fig. 18: Photo of sets of three current sensors 3TORm/5 A/225 mV and 3TORm/50 A/225 mV

14.2 Set of three low-power split-core current transformers 3LCT/225 mV

The sensing part of this sensor consists of a split magnetic circuit with a coil which, when opened, is installed in the correct direction on the conductor with the measured AC current. It is a sensor characterized by fast assembly, where the lower measurement category must be respected. When approved, it can be adapted, e.g. by additional insulation at the measuring point or by fixing the measuring position to the conductor with the measured current while respecting safe distances. Repeated measures are required at the splitting point of the magnetic circuit to reduce the effect of corrosion on the long-term accuracy of the measurement. The importance of these measures is proportional to the harshness of the working environment and the small cross-section of the magnetic circuit.

The 3LCT/225 mV current sensors can be used for both direct and indirect AC current measurements. Direct measurements can only be implemented in LV circuits usually in the off state, under power supply with PPN technology only. For indirect measurement in the secondary circuits of current transformers, installation is required when the secondary circuit of the current transformer is short-circuited. To ensure proper fixation of the measuring position of the toroids, it is advisable to use cable ties.

Technical parameters of 3LCT/225 mV

	3LCT10/225mV	3LCT16/225mV	3LCT24/225mV	3LCT36/225mV
Window dimensions [mm]:	10 × 10	16 × 16	24 × 24	36 × 36
Sensing part, h × w × d [mm]:	41,5 × 27 × 30	46 × 32 × 42	67 × 47 × 42	82 × 62 × 46
Weight [dkg]:	20	30	50	85

Rated primary current I_n:	3LCT10/225mV: 5 A, 20 A, 60 A, 75 A
	3LCT16/225mV: 100 A, 120 A, 200 A
	3LCT24/225mV: 100 A, 200 A, 400 A
	3LCT36/225mV: 300 A, 400 A, 500 A, 600 A
Rated secondary voltage U_n:	225 mV_{AC}, (EN IEC 61869-10)
Rated load:	2 MΩ / 50 pF
Length of the output cable of sensing parts:	15 cm
Precision class:	2.0 according to EN 61689-2
Rated frequency:	42.5 Hz to 69 Hz
Frequency range:	33 Hz to 1 kHz
Operating temperature range:	-20 °C to +50 °C
Teplota skladování:	-30 °C to +50 °C
Storage temperature:	≤ 85 % RH, non-condensing
Operating position:	any
Altitude:	up to 2000 m
Rated phase voltage:	230 V
Maximum phase voltage:	300 V
Measurement category:	CAT II / 300 V
Cable ties:	WT-200MC, length 203 mm, width 2.5 mm

The SCOTCH 3M22 insulating tape for installation on and near LV conductors enables increased installation safety.

Fig. 19: Photo of sets of three current sensors 3LCT24/225 mV

14.3 Set of three flexible sensors 3AMOSm/225 mV

The basic component of the sensing part is a coil wound on a flexible carrier, which senses the magnetic voltage around the conductor with the measured current. For this reason, integration of the sensed signal is a necessary part of the measurement chain. The sensing part does not contain any ferromagnetic material, which allows the sensor to be flexible on the one hand, but on the other hand, measures must be adopted to counteract the effect of adjacent magnetic fields. The AMOS flexible sensors have a double insulation, shielding, CATIV/300 V measurement category and are available with different lengths of the sensing part. The advantage of flexible sensors consists in a possibility to install them on structurally complex busbar assemblies and cable cores of LV cabinets. In a 'small' version, they can also be used for indirect measurement at LV and HV levels. Even with these sensors it is necessary to respect the direction of current flow and make sure that the marking of the sensing part matches with the phase marking. Cable ties can be used during installation to fix the position of the measuring point or the busbar can be fitted with a cover mount for closure.

Technical parameters of 3AMOSm/225 mV

A set of three 3AMOSm/225 mV flexible sensors allows connection to any current input of the MEg74 monitor.

Rated alternating current I_n 3AMOSm/74:	100 A, 300 A, 1000 A
Rated output voltage U_n:	225 mV_{AC}, (EN IEC 61869-10)
Rated load:	2 MΩ / 50 pF
Current measuring range:	5 % I_n to 120 % I_n
Frequency range:	40 Hz to 7.2 kHz
Current measurement uncertainty[1]:	± 1.0 % I_n ± 0.5 % of M.V. (45 Hz to 60 Hz)
Change of value with position:	± 0.5 % I_n
Change in reading due to external fields:	± 0.5 % I_n (external current field 0.3 I_n / 50 Hz, distance 35 mm from closure)
Harmonics measurement uncertainties to the 50th order [1] [2] [3]:	±10 % I_{harm} at 3 % $I_n \leq I_{harm} \leq$ 10 % I_n ±0.3 % I_n at I_{harm} < 3 % I_n
Phase error, (45 Hz to 60 Hz) [1]:	2.0 °
Operating temperature:	-20 °C to +55 °C
Temperature coefficient:	0.2 % I_n / 10 K
Relative humidity:	≤ 95 % RH
IP rating:	IP65
Measurement category:	CAT IV / 300 V
Safety class:	II
Loop length:	20 cm
Loop diameter:	8 mm
Enclosure free end diameter:	10 mm
Permissible loop bending radius:	≥ 20 mm
Length of the output cable of sensing parts:	15 cm

Note
[1] Up to the order of 25 the maximum peak factor 2
[2] In the range of 5 % I_n to 120 % I_n and in the reference point of the sensor
[3] Class 1 according EN 61000-4-7, ed. 2

On special request, flexible sensors with a loop length of 40 cm (standard) or 60 cm (long) can be supplied with a specified value of rated current.

Fig. 20: Photo of sets of three current sensors 3AMOSm/225 mV

14.4 Set of three split-core current transformers 3MTPD.51/225 mV

The design of the current sensing part consists of a measuring transformer with a split core characterized by a large window size that allows installation on both free LV cable cores and live LV busbars. Its design with CAT IV / 300 V measurement category and Safety Class II is intended primarily for installation in transformer stations and LV cabinets at the distribution-customer interface.

Even with these sensors, measures need to be taken to eliminate the effect of corrosion on the magnetic core splitting.

The 3MTPD.51/225 mV current sensors are designed for direct measurement of currents at LV level.

A profiled plastic bracket and two cable ties can be used to secure them.

A locking pin will prevent the core of the installed transformer from opening.

Technical parameters of 3MTPD.51/225 mV [1)]

Rated primary current I_n [2)]:	400 A, 600 A, 1000 A
Rated frequency:	42.5 Hz to 69 Hz
Precision class:	0.5 % according to EN 61869-2
FS safety factor:	5

Rated short-term thermal current I_{th}:	$10 \times I_n$
Rated dynamic current I_{dyn}:	$2{,}5 \times I_{th}$
Operating temperature range:	-25 °C to +60 °C
Temperature range with non-destructive effects:	-40 °C to +70 °C
Insulation temperature class:	+120 °C
Maximum temperature of conductor with measured current:	+120 °C
Average relative humidity:	≤ 90 % RH, non-condensing
IP rating:	IP20
Impact protection:	IK08
Pollution degree:	2
Altitude:	up to 2,000 m
Rated phase voltage of measured conductor:	$230\,V_{AC}$
Maximum phase voltage of measured conductor:	$300\,V_{AC}$
Measurement category:	CAT IV / 300 V
Impulse withstand voltage:	6 kV
Testing voltage:	5.4 kV / 5 s
Safety class:	II
Weight:	0.5 kg
Outer dimensions:	100 × 95 × 29 mm
Dimensions of transformer window:	52 × 33 mm
Length of the output cable of sensing parts:	25 cm
Cable ties:	WT-200MC, length 203 mm, width 2.5 mm

Note [1] Technical data apply to the reference conditions: T ambient = 20 °C, humidity 40 to 60 % RH

[2] One value only

[3] It shall not be used for currents with a rated frequency value outside the stated frequency range

Note: Due to mechanical strength and high temperature, it can only be installed in inaccessible areas.

Fig. 21: Photo of sets of three current sensors 3MTPD.51/225 mV

14.5 Measuring rail MEgML73/225 mV

The MEgML73 measuring rail also allows additional installation of current measurement in already operating LV cabinets with standardized fuse or disconnector rails of 100 mm width. The basic components of the MEgML73/225 mV sensing part are toroids with conversion to 225 mV voltage, impregnated against long-term environmental influences. The connections are also routed through internal layers of a multi-layer PCB, which ensures both reliability and operational safety, characterized by the CAT IV/300 V measurement category and Safety Class II. The RJ45 output connector is integrated in the MEgML73/225 mV measuring rail.

With its design and minimal installation costs, the MEgML73/225 mV measuring rail is a cost-effective and long-term stable measurement solution for standard LV outputs with power strips.

Technical parameters of MEgML73/225 mV measuring rail

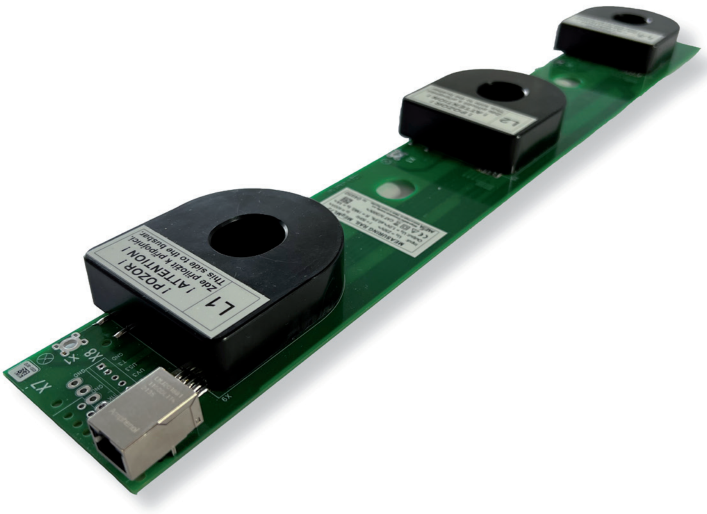
Rated frequency:	50 Hz		
Frequency range:	40 Hz to 60 Hz		
Rated primary current I_n [1]:	250 A_{AC}	400 A_{AC}	630 A_{AC}
Overcurrent factor:	5	3	2
Rated secondary voltage U_n:	225 mV_{AC}, (EN IEC 61869-10)		
Rated load:	2 MΩ / 50 pF		
Output connector:	RJ45		
Measuring range:	5 % to 120 % $I_{n\ prim}$		
Rated frequency:	42.5 Hz to 69 Hz		
Rated short-term (thermal) current:	20 kA for 1 s		
Maximum voltage between current inputs:	520 V_{AC}		
Voltage drop on coupling of measuring rail [2]			
at I_{nom} = 640 A	< 10 mV		
at I_{max} = 6400 A	< 100 mV		
Dimensions::	495.5 × 80.4 × 25.5 mm		
Centre-to-centre distance of holes:	185 mm		
Fastening screws of the connection:	M12×60 6HR, flat washer 12 and spring washer 12		
Prescribed tightening torque for fastening screws:	28 Nm		
Temperature range:	-20 °C to +60 °C		

Maximum relative humidity:	95 % R.H. without long-term condensation
Measurement category:	CAT IV / 300 V
IP rating:	IP 00
Altitude:	up to 2,000 m

Designed for indoor use.

Note [1] Only one of the values
[2] At the specified tightening torque of the fastening screws of fuse rail

Fig. 22: Photo of the measuring rail MEgML73 / 400 A_{AC} / 225 mV



14.6 Converter CT25 A/225 mV and CT5 A/225 mV

If current transformers with a rated output current of 5 A or 1 A are installed at the current measurement point, a CT25 A/225 mV or CT5 A/225 mV three-phase converter with screw terminals can be used for connection to the MEg74. S1 is the input terminal and S2 is the output terminal. The pairs of terminals are designed to measure the currents of phase L1, L2 and L3. The nominal value of the output signal at an input current of 25 A or 5 A is 225 mV. CT converters are designed to measure currents up to five times higher than the rated range of the measured current circuits to allow recording of overcurrent waveforms. The output signals together with the connection to the CT memory are on the RJ45 connector. The three-phase CT converter is in a plastic housing with installation on a DIN rail of one module width, i.e. 18 mm.

The circuits of measured currents of 5 A or 1 A are separated by galvanic isolation from the circuits of output voltages of 225 mV.

Technical parameters of CT25 A/225 mV a CT5 A/225 mV

	25 A/225 mV	5 A/225 mV
Input current I_n:	25 A	5 A
Rated secondary voltage U_n:	225 mV_{AC}, (EN IEC 61869-10)	
Rated load:	2 MΩ/50 pF	
Output connector:	RJ45	
Measuring range:	5 % to 120 % I_n	
Rated frequency:	42.5 Hz to 69 Hz	
Measurement error at f = 50 Hz [2)]:	0.5 % I_n	
Harmonics measurement uncertainty up to the order of 50. [3), 4)]:	± 10 % I_{harm} at I_{harm} ≥ 3 % I_n ± 0.3 % I_n at I_{harm} < 3 % I_n	
Measurement category:	CAT III / 300 V	
Safety class:	II	
IP rating:	IP00	
Operating temperature:	-10 °C to +55 °C	
Temperature coefficient:	0.2 % / 10 K	
Relative humidity:	≤ 85 % RH, non-condensing	

Obr. 23: Photo of the converter CT 5 A / 225 mV

15/ LITERATURE

[1] User description of PQ_MEg, www.e-mega.cz/DL

[2] User description of MEgA Explorer, www.e-mega.cz/DL

[3] User description of WebDatOr2, on request

[4] User description of MEgA Merci Multi, www.e-mega.cz/DL

[5] User description of MODBUS TCP protocol for MEgA instruments, www.e-mega.cz/DL

[6] User description of EN 60870-5-104 protocol for instruments on request

16/ MANUFACTURER

MEgA – Měřící Energetické Aparáty, a.s.

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CONTENTS

Multiple input MEg74 PQ monitor
User manual

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