ENERGY SECTOR

POWER QUALITY ANALYZER MC774

- **Class A** measuring accuracy according to EN61000-4-30.
- **Evaluation of power quality** in compliance with EN 50160.
- Voltage and current auto range measurements up to 1000 V_{RMS}, 12.5 A.
- **4 voltage** and **4 current channels** with 32µs sampling time.
- **Wide frequency** measurement **range** 16 Hz – 400 Hz.
- Up to **three independent communication ports**.
- Support for **GPS, IRIG-B and NTP real time synchronisation**.
- Up to **20 inputs/outputs**.

Iskra®

FEATURES

- Evaluation of the electricity supply quality in compliance with EN 50160 with automatic report generation.
- Measurements of instantaneous values of more than 140 quantities including harmonics, flicker, power line signalling voltage, unbalance …
- Class A (0.1%) accuracy in compliance with EN61000-4-30.
- Four quadrant energy measurement with class 0.2S for active energy, 8 programmable counters, up to four tariffs, tariff clock …
- Automatic range selection of 4 current and 4 voltage channels (max. 12.5 A and 1000 VRMS) with 32 kHz sampling rate.
- Recording all measured parameters including all voltage and current harmonics up to 65th, 32 adjustable alarms, anomalies and quality reports in the internal memory.
- Measurements of 40 minimal and maximal values in different time intervals (from 1 to 256 periods).
- Frequency range from 16 Hz to 400 Hz.
- Up to three independent communication ports (RS 232/485 up to 115,200 bit/s, Ethernet and USB 2.0).
- MODBUS and DNP3 communication protocols.
- Support for GPS, IRIG-B (modulated and digital) and NTP real time synchronisation.
- Up to 20 inputs and outputs (analogue inputs/outputs, digital inputs/outputs, alarm/watchdog outputs, pulse input/outputs, tariff inputs).
- Multilingual support.
- Universal power supply (two voltage ranges).
- 144 mm square panel mounting.
- User-friendly setting and evaluation software, MiQen.

DESCRIPTION

MC774 is an important device for permanent monitoring of power quality from its production (especially renewable), transmission, distribution to final consumers, who are most affected by insufficient quality of voltage. Lack of information about supplied quality of voltage can lead to unexplained production problems and malfunction or even damage to equipment used in production process. Therefore, ***MC774*** can be used for utility purposes (evaluation against standards) as well as for industry purposes (monitoring supplied power quality).

MC774 performs measurements in compliance with regulatory requested standard EN 61000-4-30 and evaluates recorded parameters for analysis according to parameters defined in European supply quality standard EN 50160:2011.

Moreover ***MC774*** stores measurements and quality reports in internal memory for further analysis over recorded measurements. By accessing recorded or real time values from multiple instruments installed on different locations it is possible to gain the overall picture of systems' behaviour. This can be achieved with regard to ***MC774*** accurate internal real time clock and wide range of synchronization sources support, which assure accurate, time-stamped measurements from dislocated units.

All required measurements, weekly PQ reports and alarms can also be stored locally in an internal memory. Stored data can be then transferred to a memory card or accessed through communication for post analysis.

APPLICATION AND BENEFITS

MC774 Quality Analyser can be used as a standalone PQ monitoring device for detection of local PQ deviations. For this purpose it is normally positioned at the point-of-common-coupling (PCC) of small and medium industrial and commercial energy consumers to monitor quality of delivered electric energy or at medium or low voltage feeders to monitor, detect and record possible disturbances caused by (unauthorized) operation of consumers.

Identifying relevant fixed measuring points is the most important task prior to complete system installation. This system itself will not prevent disturbances in network but it will help diagnose their origin and effects. And this is possible only with system approach by using time synchronized meters and predefined measuring parameters relevant for each individual measuring point.

Therefore the most extensive benefits are achieved when ***MC774*** is used as a part of an energy monitoring system comprising of strategically positioned meters connected to ***MiSMART*** software solution. This three-tier middleware software represents a perfect tool for utility companies, energy suppliers and other parties on both ends of supply-demand chain. ***MiSMART data collector*** with "push" communication system allows automatic records of all predefined measuring parameters. They are stored in ***MiSMART database***, while leaving a copy of same parameters stored locally in memory of each device as a backup copy. Database records in XML format can be searched and viewed in tabelaric and graphical form using ***MiSMART client*** or other third-party application software.

Database records can involve numerous parameters of three-phase system, power quality parameters, physical parameters (temp., pressure, wind speed …) as well as alarms and detailed time-stamped event logs.

COMPLIANCE WITH STANDARDS

Measurements and reports of power (voltage) quality (PQ) indexes are only useful when can be compared with measurements and reports from other PQ measuring devices in the supply network and evaluated against agreed limits for assessment of measured PQ indexes to establish an overall view about PQ issues in the network.

For this purpose it is essential to follow guidelines described in series of international and local standards. Beside requirements for safe operation (LVD directive) and immunity against more and more demanding disturbances (EMC directive), PQ measuring depends on two levels of standardization:

Procedures for proper acquirement of PQ indexes, their timed aggregation and required accuracy are described in a standard IEC EN 61000-4-30 and two supplementary standards IEC EN 61000-4-7 (harmonics), IEC EN 61000-4-15 (flickermeter)

Procedures for evaluation of measured PQ indexes according to limit levels described in European standard EN 50160

MC774 Quality Analyser follows required procedures and meets the precision requirements for class A measuring device as described in standard IEC EN 61000-4-30. It uses acquired measurements to perform automatic evaluation of PQ according to EN 50160 and issues weekly reports. In case if certain PQ indexes fail to meet required quality it also shows details of problematic measurements and time of occurrence of discrepancy.

Standard EN	*Description*
61010-1: 2010	*Safety requirements for electrical equipment for measurement, control and laboratory use*
61557-12:2008	*Electrical safety in LV distribution systems up to 1kV a.c. and 1.5kV d.c. – Combined performance measuring and monitoring devices for electrical parametrs*
61000-4-30:2009	*Electromagnetic compatibility (EMC) – Power quality measurements methods*
61000-4-7:2003 + A1:2009	*Electromagnetic compatibility (EMC) – General guide on harmonics and interharmonics measurements*
61000-4-15:2010	*Electromagnetic compatibility (EMC) – Flickermeter*
50160:2011	*Voltage characteristics of electricity supplied by public distribution networks*
62053-22:2003	*Electricity metering equipment - Static meters for active energy (classes 0,2 S and 0,5 S)*
62053-23:2003	*Electricity metering equipment - Static meters for reactive energy (classes 2 and 3)*
61326-1:2006	*EMC requirements for electrical equipment for measurement, control and laboratory use*
60529:1997/A1:2000	*Degrees of protection provided by enclosures (IP code)*
60068-2-1/ -2/ -6/ -27/-30	*Environmental testing (-1 Cold, -2 Dry heat, -30 Damp heat, -6 Vibration, -27 Shock)*
UL 94	*Tests for flammability of plastic materials for parts in devices and appliances*

Table 1: ***List of applicable standards***

VOLTAGE QUALITY

Voltage Quality is well defined term (sometimes also termed Power Quality – PQ) and is covered with a selection of parameters, each of which represents certain phenomenon. They represent only most common types of phenomena which can describe operation of electrical network with closest approximation.

MC774 Quality Analyser measures, detects, stores and evaluates parameters, which are defined in several standards. Evaluation is by default performed according to limits set in European standard EN50150. Beside that users can always alter parameters according to their requirements or according to immunity of their equipment which operates within analyzed power network.

PQ recording settings

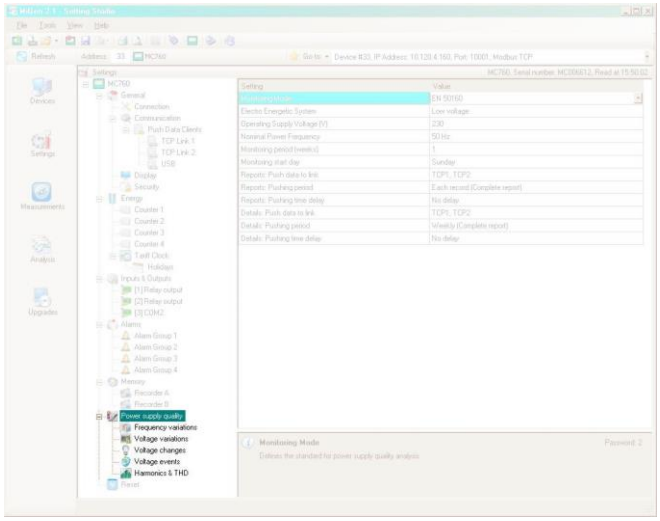


Figure 1 ***Settings for power quality parameters are set with setting and monitoring software MiQen***

Characteristic parameters that describe power quality are shown in table 1:

Phenomena	*PQ Parameters*
Frequency variations	*Frequency distortion*
Voltage variations	*Voltage fluctuation* *Voltage unbalance*
Voltage changes	*Rapid voltage changes* *Flicker*
Voltage events	*Voltage dips* *Voltage interruptions* *Voltage swells*
Harmonics & THD	*Harmonics* *Interharmonics* *Signalling voltage*

Table 2 ***Voltage quality parameters as defined in EN50160***

PQ reports

PQ report is issued on a basis of chosen PQ parameters as well as information about a period of tracking and place of tracking (type of network).

Each record is internally stored for later analysis. Settings software allows user to quickly view PQ report with limit lines and compliance results.

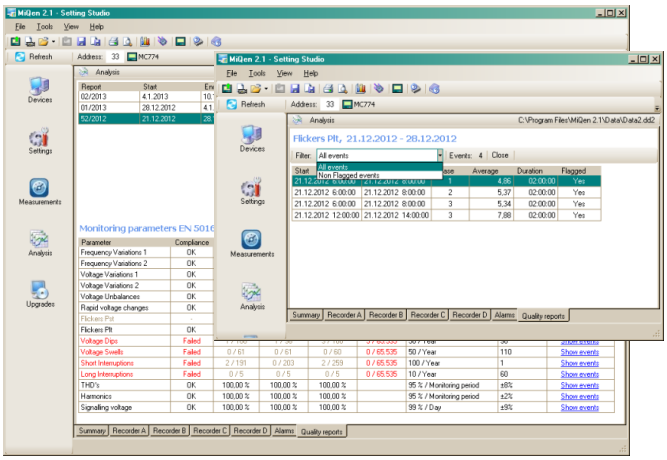


Figure 2 ***Viewing power quality report parameters and log details with setting software MiQen***

To analyze in **details** which and when certain parameters are outside limit lines it is possible to view time stamped details and with that establish true origin of anomaly and its consequences.

MEASUREMENTS

Online measurements

Online measurements are available on display or can be monitored with setting and monitoring software ***MiQen***.

Readings on display are performed continuously with refresh time dependent on set average interval whereas rate of readings monitored with ***MiQen*** is fixed and refreshed approx. each second.

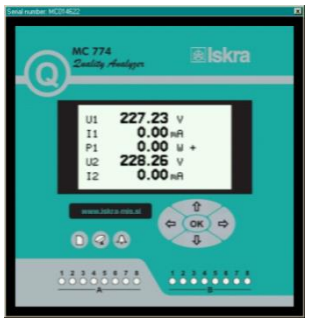
For better overview over numerous readings, they are divided into several groups, which contain basic measurements, min. and max. values, harmonics, PQ parameters and alarms.

Each group can represent data in visually favored graphical form or detailed tabelaric form. Latter allows freezing readings and/or copying data into various report generation software tools.

Interactive instrument

Additional communication feature of a device allows interactive handling with a dislocated device as if it would be operational in front of user.

This feature is useful for presentations or product training.



Selection of available quantities

Available online measuring quantities and their appearance can vary according to set type of power network and other settings such as; average interval, max. demand mode, reactive power calculation method …

Complete selection of available online measuring quantities is shown in a table on the next page.

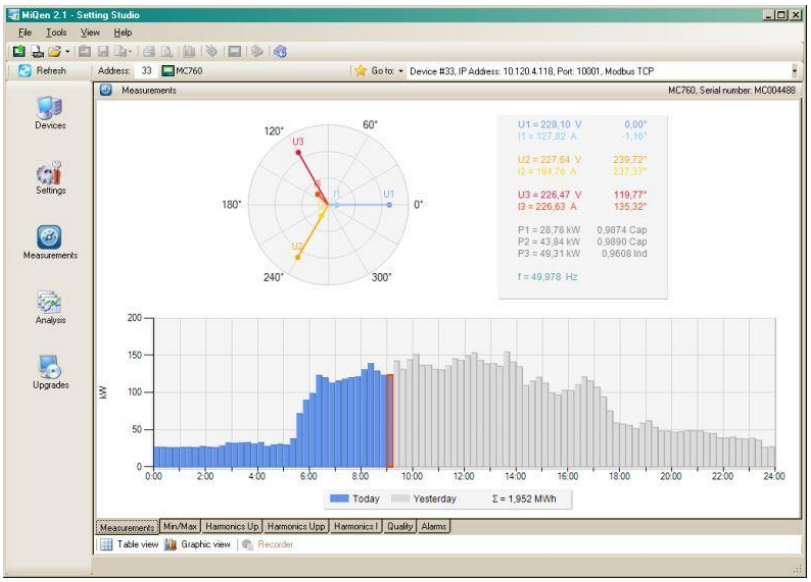


Figure 3 ***Online measurements in graphical form – phase diagram and daily total active power consumption histogram***

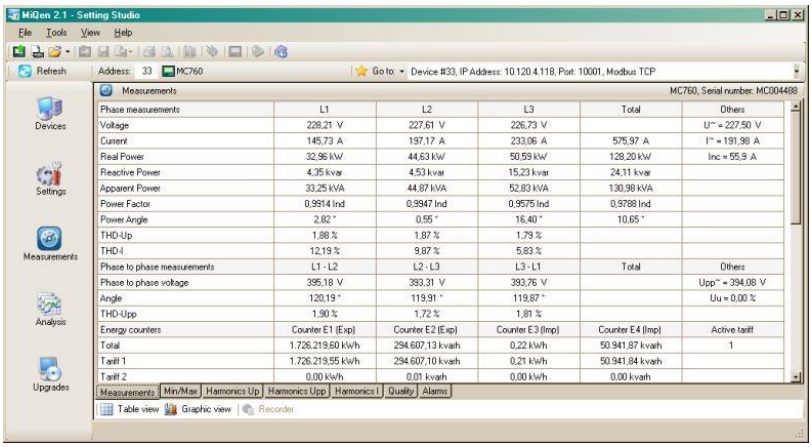


Figure 4 ***Online measurements in tabelaric form***

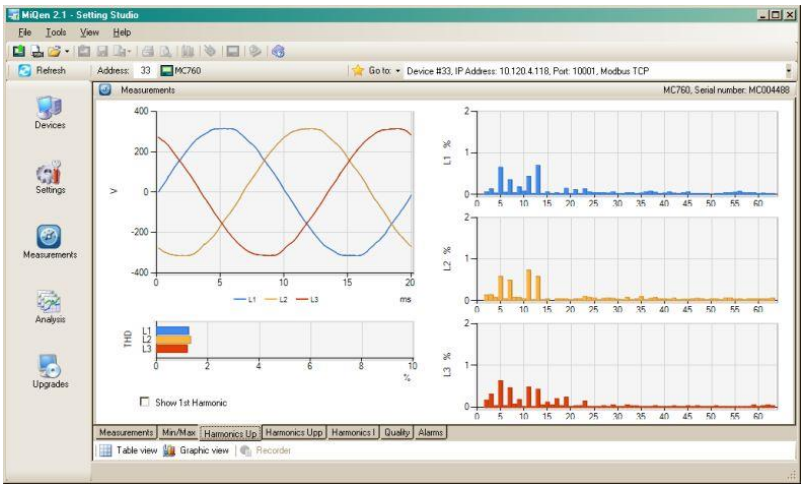


Figure 5 ***Online harmonic measurements in graphical form***

Meas. type	Measurement	3-phase 4-wire	3-phase 3-wire	1-phase	Comments
Phase measurements	Voltage				
	$U_{1\text{-}3\_RMS}$	☑		☑1ph	
	U_{AVG_RMS}	☑		☑	
	$U_{unbalance\_neg\_RMS}$	☑📖	☑📖		
	$U_{unbalance\_zero\_RMS}$	☑📖	☑📖		
	$U_{1\text{-}3\_DC}$	☑		☑1ph	DC component of phase voltages
	Current				
	$I_{1\text{-}3\_RMS}$	☑	☑	☑1ph	
	I_{TOT_RMS}	☑	☑	☑	
	I_{AVG_RMS}	☑	☑	☑	
	Power				
	$P_{1\text{-}3\_RMS}$	☑		☑1ph	
	P_{TOT_RMS}	☑	☑	☑	
	$Q_{1\text{-}3\_RMS}$	☑📖		☑1ph📖	reactive power can be calculated as a squared difference between S and P or as sample delayed
	Q_{TOT_RMS}	☑	☑	☑	
	$S_{1\text{-}3\_RMS}$	☑		☑1ph	
	S_{TOT_RMS}	☑	☑	☑	
	$PF_{1\text{-}3\_RMS}$	☑		☑1ph	
	PF_{TOT}	☑	☑		
	$\varphi_{1\text{-}3\_RMS}$	☑		☑1ph	
	Harmonic analysis				
	THD-$U_{1\text{-}3}$	☑		☑1ph	
	THD-$I_{1\text{-}3}$	☑	☑	☑1ph	
	TDD-$I_{1\text{-}3}$	☑	☑	☑1ph	
	$U_{1\text{-}3\_harmonic\_1\text{-}63\_\%}$	☑📖		☑1ph📖	% of RMS or % of base
	$U_{1\text{-}3\_harmonic\_1\text{-}63\_ABS}$	☑		☑1ph	
	$U_{1\text{-}3\_harmonic\_1\text{-}63\_\varphi}$	☑		☑1ph	
	$U_{1\text{-}3\_inter\text{-}harmonic\_\%}$	☑📖		☑1ph📖	monitoring up to 10 different fixed frequencies. % of RMS or % of base
	$U_{1\text{-}3\_inter\text{-}harmonic\_ABS}$	☑		☑1ph	
	$U_{1\text{-}3\_signaling\_\%}$	☑📖		☑1ph📖	monitoring of signalling (ripple) voltage of set frequency. % of RMS or % of base
	$U_{1\text{-}3\_signaling\_ABS}$	☑		☑1ph	
	$I_{1\text{-}3\_harmonic\_1\text{-}63\_\%}$	☑📖	☑📖	☑1ph📖	% of RMS or % of base
	$I_{1\text{-}3\_harmonic\_1\text{-}63\_ABS}$	☑	☑	☑1ph	
	$I_{1\text{-}3\_harmonic\_1\text{-}63\_\varphi}$	☑	☑	☑1ph	
	Flickers				
	$Pi_{1\text{-}3}$	☑		☑1ph	Instantaneous flicker sensation measured with 150 samples / sec (original sampling is 1200 smpl/sec)
	$Pst_{1\text{-}3}$	☑		☑1ph	10 min statistical evaluation (128 classes of CPF)
	$Plt_{1\text{-}3}$	☑		☑1ph	derived from 12 Pst acc. to EN 61000-4-15
	Miscellaneous				
	K-$factor_{1\text{-}3}$	☑	☑	☑1ph	
	Current Crest factor $I_{1\text{-}3}$	☑	☑	☑1ph	
Phase to phase measurements	Voltage				
	$Upp_{1\text{-}3\_RMS}$	☑	☑		
	Upp_{AVG_RMS}	☑	☑		
	THD-$Upp_{1\text{-}3}$	☑	☑		
	$Upp_{1\text{-}3\_harmonic\_1\text{-}63\_\%}$	☑📖	☑📖		% of RMS or % of base
	$Upp_{1\text{-}3\_harmonic\_1\text{-}63\_ABS}$	☑	☑		
	$Upp_{1\text{-}3\_harmonic\_1\text{-}63\_\varphi}$	☑	☑		
	$U_{underdeviation}$	☑	☑	☑1ph	$U_{under.}$ and $U_{over.}$ are calculated for phase or phase-to-phase voltages regarding connection mode.
	$U_{overdeviation}$	☑	☑	☑1ph	

📖 For more information see MC774 Quality Analyser User's manual

Meas. type	Measurement	3-phase 4-wire	3-phase 3-wire	1-phase	comments
	Flickers				
	Pi_pp_{1-3}		☑		Phase-to-phase flickers
	Pst_pp_{1-3}		☑		
	Plt_pp_{1-3}		☑		
Metering	Energy	☑	☑	☑	
	Counter E_{1-8}	☑	☑	☑	each counter can be dedicated to any of four quadrants (P-Q, import-export, L-C). Total energy is a sum of one counter for all tariffs. Tariffs can be fixed, date/time dependent or tariff input dependent
	E_{TOT_1-8}	☑	☑	☑	
	Active tariff	☑	☑	☑	
Auxiliary channel measurements	Aux. line				
	$U_{NEUTRAL-EARTH}$	☑		☑	aux. voltage is dedicated for neutral-earth meas. only
	$I_{NEUTRAL\_meas}$	☑		☑	measured neutral current with 4th current input
	$I_{NEUTRAL\_calc}$	☑	☑	☑	calculated neutral current
	$I_{NEUTRAL\_err}$	☑		☑	error neutral current (difference between measured and calculated)
Maximum demand measurements	Maximum demand				
	MD_I_{1-3}	☑	☑	☑1ph	
	MD_P_{import}	☑	☑	☑	
	MD_P_{export}	☑	☑	☑	
	MD_Q_{ind}	☑	☑	☑	
	MD_Q_{cap}	☑	☑	☑	
	MD_S	☑	☑	☑	
Min and max measurements	Min and max				
	$U_{1-3\_RMS\_MIN}$	☑		☑1ph	
	$U_{1-3\_RMS\_MAX}$	☑		☑1ph	
	$Upp_{1-3\_RMS\_MIN}$	☑	☑	☑	
	$Upp_{1-3\_RMS\_MAX}$	☑	☑	☑	
	$I_{1-3\_RMS\_MIN}$	☑	☑	☑1ph	
	$I_{1-3\_RMS\_MAX}$	☑	☑	☑1ph	
	$P_{1-3\_RMS\_MIN}$	☑		☑1ph	
	$P_{1-3\_RMS\_MAX}$	☑		☑1ph	
	$P_{TOT\_RMS\_MIN}$	☑	☑	☑1ph	
	$P_{TOT\_RMS\_MAX}$	☑	☑	☑1ph	
	$S_{1-3\_RMS\_MIN}$	☑		☑1ph	
	$S_{1-3\_RMS\_MAX}$	☑		☑1ph	
	$S_{TOT\_RMS\_MIN}$	☑	☑	☑1ph	
	$S_{TOT\_RMS\_MAX}$	☑	☑	☑1ph	
	$freq_{MIN}$	☑	☑	☑	
	$freq_{MAX}$	☑	☑	☑	
Other measurements	Miscellaneous				
	freqMEAN	☑	☑	☑	
	Internal temp.	☑	☑	☑	
	Date, Time	☑	☑	☑	
	Last Sync. time	☑🕮	☑🕮	☑🕮	UTC
	GPS Time	☑🕮	☑🕮	☑🕮	If GPS receiver is connected to dedicated RTC time synchronization input
	GPS Longitude	☑🕮	☑🕮	☑🕮	
	GPS Latitude	☑🕮	☑🕮	☑🕮	
	GPS Altitude	☑🕮	☑🕮	☑🕮	

🕮 For more information see MC774 Quality Analyser User's manual

Table 3 Selection of available measurement quantities

RECORDER

A built-in recorder (8Mb) enables storing measurements, detected alarms and PQ reports with details. It supports recording of all measured quantities including voltage and current harmonics up tp 65th in 4 configurable partitions. For each partition is possible to set storage interval and other recording parameters.

Fifth partition is used for recording alarms. Each alarm triggered by preset limit lines is stored in a form of alarm i.d. and its timestamp.

Sixth partition is used for PQ reports. Each report in recorder is identified by a monitoring interval (date).

Last partition is used for PQ report details. They represent time stamped PQ values that are outside PQ limit lines.

Content of recorder can be viewed with monitoring software ***MiQen*** in a detailed tabelaric or visually favoured graphical form.

Memory card

MC774 Power Quality Analyzer & Recorder is equipped with a front panel slot for full sized SD memory card that supports capacity up to 2 GB. It is intended for downloading internally stored data, uploading setting file and performing firmware upgrade.

ALARMS

Alarms are powerful tool for ***MC774*** Quality Analyser control and supervision features. Devices' performance can with this features reach beyond measuring and analyzing power network.

MC774 Quality Analyser supports recording and storing of 32 alarms in four groups. A time constant of maximal values in a thermal mode, a delay time and switch-off hysteresis are defined for each group of alarms.

For each parameter is possible to set limit value, condition and alarm activation action (sound signal and/or digital output switch if available).

All alarms are also stored in internal memory for post-analysis.

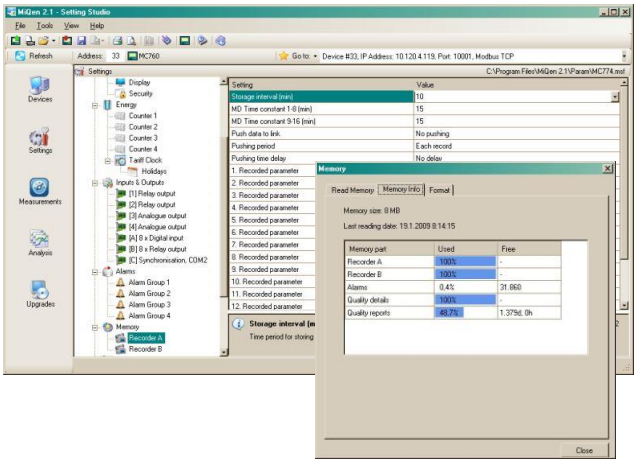


Figure 6: *Setting recorder parameters and viewing memory consumption information*

Figure 7 *Viewing recorder content in tabelaric and graphical form*

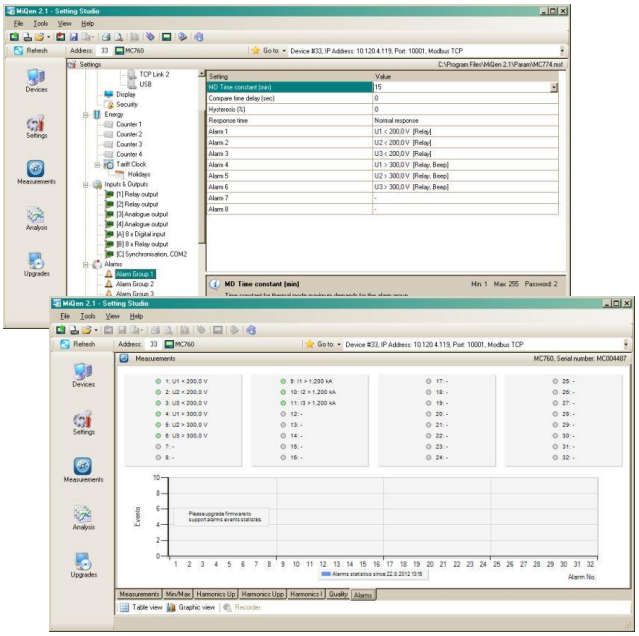


Figure 8 *Setting and viewing alarms*

REAL TIME SYNCHRONISATION

Synchronized real-time clock (RTC) is an essential part of any Class A analyzer for proper chronological determination of various events. Without RTC synchronization MC774 acts as a Class S device.

To distinct cause from consequence, to follow a certain event from its origin to manifestation in other parameters it is very important that each and every event and recorded measurement on one instrument can be compared with events and measurements on other devices. Even if instruments are dislocated, which is normally the case in electro distribution network events have to be time-comparable with accuracy better than a single period.

For this purpose instruments normally support highly accurate internal RTC. Still this is not enough, since temperature is location dependant and it influences its precision. For that reason it is required to implement periodical RTC synchronization.

MC774 Quality Analyzer supports three types of RTC synchronization.

GPS time synchronization:

1pps and serial RS232 communication with NMEA 0183 sentence support.

GPS interface is designed as 5 pole plugable terminal (+5V for receiver supply, 1pps input and standard RS232 communication interface).

Proposed GPS receiver is GARMIN GPS18x.

IRIG time code B (IRIG-B):

Unmodulated (DC 5V level shift) and modulated (1 kHz) serial coded format with support for 1pps, day of year, current year and straight seconds of day as described in standard IRIG-200-04. Supported serial time code formats are IRIG-B007 and IRIG-B127.

Interface for modulated IRIG-B is designed as BNC-F terminal with 600 Ω input impedance. Interface for unmodulated IRIG-B is designed as pluggable terminal.

Network time protocol (NTP):

Synchronization via Ethernet requires access to a NTP server.

NOTE!

NTP can usually maintain time to within tens of milliseconds over the public Internet, but the accuracy depends on infrastructure properties - asymmetry in outgoing and incoming communication delay affects systematic bias. It is recommended that dedicated network rather than public network is used for synchronisation purposes.

COMMUNICATION

MC774 Quality Analyzer has a wide variety of communication possibilities to suit specific demands. It is equipped with standard communication port COM1 and auxiliary communication port COM2. This allows two different users to access data from a device simultaneously and by using TCP/IP communication, data can be accessed worldwide.

COM2 port is always present as a part of synchronization module C. It is available as a general purpose communication port when it is not used for time synchronization purposes.

Different configurations are possible (to be specified with an order).

Configuration	*COM1*	*COM2[2]*
1	*RS232/485*	*/*
2	*RS232/485*	*RS232/485*
3	*USB*	*/*
4	*USB*	*RS232/485*
5[1]	*Ethernet & USB*	*/*
6[1]	*Ethernet & USB*	*RS232/485*

[1] Galvanic separation between Eth. and USB is 1 kV$_{ACRMS}$

[2] COM2 is NOT available if GPS time synchronization is used

Table 3: *List of communication configurations*

MC774 Quality Analyser supports standard communication protocols MODBUS RTU, TCP and DNP3 L1.

Additionally it supports proprietary PUSH communication mode, which is used in system applications where devices send predefined readings in predefined time intervals in XML format. Web based software MiSMART collects data and stores it into database. Stored data can then be viewed with MiSMART client software.

For more information about PUSH communication mode and XML format see MC774 Quality Analyser User's manual GP K 22.444.053.

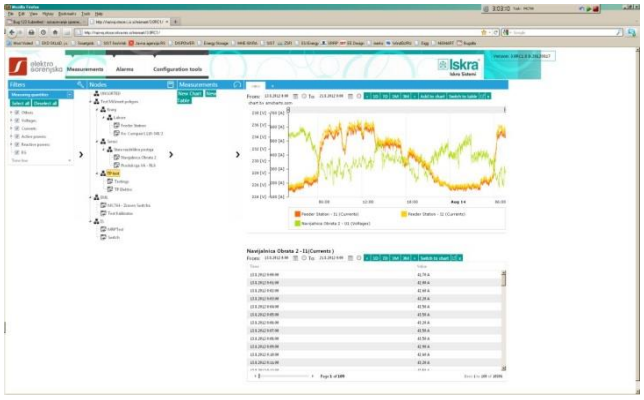


Figure 9 *MiSMART client window*

TECHNICAL DATA

Measurement inputs

Nominal frequency range	50, 60 Hz
Measuring frequency range	16–400 Hz

Voltage measurements:

Number of channels	4 (1)
Sampling rate	31 kHz
Min. voltage for sync.	1 V_{rms}
Nominal value (U_N)	500 V_{LN} , 866 V_{LL}
Max. measured value (cont.)	600 V_{LN} ; 1000 V_{LL}
Max. allowed value	1.2 × U_N permanently
	2 × U_N ; 10 s
Consumption	< U^2 / 4.2MΩ per phase
Input impedance	4.2MΩ per phase

(1) 4th channel is used for measuring U EARTH-NEUTRAL

Current measurements:

Number of channels	4
Sampling rate	31 kHz
Nominal value (I_{NOM})	1 A, 5 A
Max. measured value (I_1-I_3 only)	12.5 A sin.
Max. allowed value (thermal)	15 A cont.
	≤ 300 A; 1s
Consumption	< I^2 × 0.01Ω per phase

System:

Voltage inputs can be connected either directly to low-voltage network or via a VT to higher voltage network.

Current inputs can be connected either directly to low-voltage network or shall be connected to network via a corresponding CT (with standard 1 A or 5 A outputs).

For more information about different system connections see CONNECTION on page **Napaka! Zaznamek ni definiran.**.

Basic accuracy under reference conditions

Accuracy is presented as percentage of reading of the measurand except when it is stated as an absolute value.

Measurand	Accuracy	
Voltage L-N, L-L	± 0.1%	acc. to EN 61557-12
Current	± 0.1%	acc. to EN 61557-12
Active power (I_N = 5A)	± 0.2%	acc. to EN 61557-12
Active power (I_N = 1A)	± 0.5%	acc. to EN 61557-12
Active energy	Cl. 0.2S	acc. to EN 62053-22
Reactive energy	Cl.2	acc. to EN 62053-23
Frequency (f)	± 0.01Hz	acc. to EN 61557-12
Power factor (PF)	± 0.5%	acc. to EN 61557-12
THD (U)	± 0.3%	acc. to EN 61557-12
THD (I)	± 0.3%	acc. to EN 61557-12
Real time clock (RTC)	< ± 1s / day	acc. to IEC61000-4-30

All values required for PQ analysis, which should be measured according to IEC61000-4-30 correspond to Class A accuracy.

For complete overview of accuracy for all measured parameters and measuring ranges see Users' manual (doc. no. *GB K 22.444.053*) on page 143.

INPUT / OUTPUT modules

MC774 Quality Analyser is equipped with two main I/O slots, two auxiliary I/O slots and special time-synchronisation module. The following I/O modules are available:

Module type	*Number of modules per slot*	
	Main slot	*Aux slot*
Analogue output (AO)	*2*	*/*
Analogue input (AI)	*2*	*/*
Digital output (DO)	*2*	*8*
Digital input (DI)	*2*	*8*
Bistable Digital output (BO)	*1*	*/*
Status output (WO)	*1 + 1xDO*	*/*

Table 4: ***List of available I/O modules***

Analogue input (AI):

Three types of analogue inputs are suitable for acquisition of low voltage DC signals from different sensors. According to application requirements it is possible to choose current, voltage or resistance (temperature) analogue input. They all use the same output terminals.

MiQen software allows setting an appropriate calculation factor, exponent and required unit for representation of primary measured value (temperature, pressure, wind speed …).

DC current input:

Nominal input range	*–20…0…20 mA (±20%)*
input resistance	*20 Ω*
accuracy	*0.5 % of range*
temperature drift	*0.01% / °C*
conversion resolution	*16 bit (sigma-delta)*
Analogue input mode	*internally referenced Single-ended*

DC voltage input:

Nominal input range	*–10…0…10 V (±20%)*
input resistance	*100 kΩ*
accuracy	*0.5 % of range*
temperature drift	*0.01% / °C*
conversion resolution	*16 bit (sigma-delta)*
Analogue input mode	*internally referenced Single-ended*

Resistance (temperature) input:

*Nominal input range (low)**	*0 - 200 Ω (max. 400 Ω)*
	PT100 (-200°C–850°C)
*Nominal input range (high)**	*0 – 2 kΩ (max. 4 kΩ)*
	PT1000 (-200°C–850°C)
connection	*2-wire*
accuracy	*0.5 % of range*
conversion resolution	*16 bit (sigma-delta)*
Analogue input mode	*internally referenced Single-ended*

***** Low or high input range and primary input value (resistance or temperature) are set by the MiQen setting software

Analogue output (AO):

Output range	*0…20 mA*
Accuracy	*0.5% of range*
Max. burden	*150 Ω*
Linearization	*Linear, Quadratic*
No. of break points	*5*
Output value limits	*±120% of nominal output*
Response time (measurement and analogue output)	*depends on set general average interval (0.1s – 5s)*
Residual ripple	*< 1 % p.p.*

Outputs may be either short or open-circuited. They are electrically insulated from each other and from all other circuits.

Output range values can be altered subsequently (zoom scale) using the setting software, but a supplementary error results.

Digital input (DI)

Purpose	*Tariff input, Pulse input, General purpose digital input*
Max. current	*8 mA (48V), <0.6mA (110, 230V)*
SET voltage	*40...120 % of rated voltage*
RESET voltage	*0...10 % of rated voltage*
Tariff input	*Main slot only*
Rated voltage	*(5…48), 110, 230 ± 20% $V_{AC/DC}$*
Frequency range	*45…65 Hz*
Pulse input	*Main slot only*
Rated voltage	*5 - 48V_{DC}*
Min. pulse width	*0.5 ms*
Min. pulse period	*2 ms*
Digital input	*(5…48), 110, 230 ± 20% $V_{AC/DC}$*
Min. signal width	*20 ms*
Min. pause width	*40 ms*

Digital output (DO, BO)

Type	*Relay switch*
Purpose	*Alarm output, General purpose digital output*
Rated voltage	*230 $V_{AC/DC}$ ± 20% max*
Max. switching current	*1000 mA (main slot)*
	100 mA (aux. slot, DO only)
Contact resistance	*≤ 100 mΩ (100 mA, 24V)*
Impulse	*Max. 4000 imp/hour*
	Min. length 100 ms
Type	*Optocoupler open collector switch*
	(main slot only)
Purpose	*Pulse output*
Rated voltage	*40 $V_{AC/DC}$*
Max. switching current	*30 mA (R_{ONmax} = 8Ω)*
Pulse length	*programmable (2 … 999 ms)*

Status (watchdog) output (WO)

Time synchronisation input

Digital input	*GPS or IRIG-B TTL*
1pps voltage level	*TTL level (+5V)*
Time code telegram	*RS232 (GPS)*
	DC level shif (IRIG-B)
AM analogue input	*IRIG-B AM modulated*
Carrier frequency	*1 kHz*
Input impedance	*600 Ohms*
Amplitude	*2.5V_{P-Pmin}, 8V_{P-Pmax}*
Modulation ration	*3:1 – 6:1*

Universal Power Supply

Standard (high):	*CAT III 300V*
Nominal voltage AC	*80 … 276 V*
Nominal frequency	*40 … 65 Hz*
Nominal voltage DC	*70 … 300 V*
Consumption (max. all I/O)	*< 8VA*
Power-on transient current	*< 20 A ; 1 ms*
Optional (low):	*CAT III 300V*
Nominal voltage AC	*48 … 77 V*
Nominal frequency	*40 … 65 Hz*
Nominal voltage DC	*19 … 70 V*
Consumption (max. all I/O)	*< 8VA*
Power-on transient current	*< 20 A ; 1 ms*

Safety:

Protection:	*protection class II*
⚠ ⧈	*functional earth terminal must be connected to earth potential!*
	Voltage inputs via high impedance
	Double insulation for I/O ports and COM ports
Pollution degree	*2*
Installation category	*CAT II ; 600 V*
(measuring inputs)	*CAT III ; 300 V*
	Acc. to EN 61010-1
Test voltages	*U_{AUX}↔I/O, COM1: 3510 VAC_{rms}*
	U_{AUX}↔U, I inputs: 3510 VAC_{rms}
	U, I inputs↔I/O, COM1: 3510 VAC_{rms}
	HV I/O ↔ I/O, COM1: 3510 VAC_{rms}
	U inputs↔I inputs: 3510 VAC_{rms}

Mechanical

Dimensions	144 × 144 ×100 mm
Mounting	Panel mounting 144×144 mm
Required mounting hole	137 × 137 mm
Enclosure material	PC/ABS
Flammability	Acc. to UL 94 V-0
Weight	550 g
Enclosure material	PC/ABS
	Acc. to UL 94 V-0

Ambient conditions:

Ambient temperature	K55 temperature class
	Acc. to EN61557-12
	-10…55 °C
Storage temperature	-40 to +70 °C
Average annual humidity	≤ 90% r.h. (no condensation)
Pollution degree	2
Enclosure protection	IP 40 (front plate)
	IP 20 (rear side)
Installation altitude	≤ 2000 m

Real time clock

A built-in real time clock is also without external synchronization very stable when device is connected to auxiliary power supply. For handling shorter power interruptions without influence on RTC, device uses high capacity capacitor. It ensures auxiliary supply (for internal RTC only) for more than two days of operation.

Type	Low power embedded RTC
RTC stability	< 1 sec / day

Connection cables

MC774 Quality Analyser is equipped with European style pluggable terminals for measuring voltages, auxiliary supply, communication and I/O modules. Measuring current cables shall be attached as through-hole connection without screwing.

NOTE!

Stranded wire must be used with insulated end sleeve to assure firm connection.

Voltage inputs (4)	≤ 2.5 mm^2 , AWG 24-12 single wire
Current inputs (3)	≤ Ø 6 mm one conductor with insulation
Supply (3)	≤ 2.5 mm^2 , AWG 24-12 single wire
Com (5), I/O (6)	≤ 2.5 mm^2 , AWG 24-12 single wire

MiQen - setting and acquisition Software

MiQen software is intended for supervision of **MC774** and many other instruments on a PC. Network and the device setting, display of measured and stored values and analysis of stored data in the device are possible via the serial, Ethernet or USB communication. The information and stored measurements can be exported in standard Windows formats. Multilingual software functions on Windows XP, W7 operating systems.

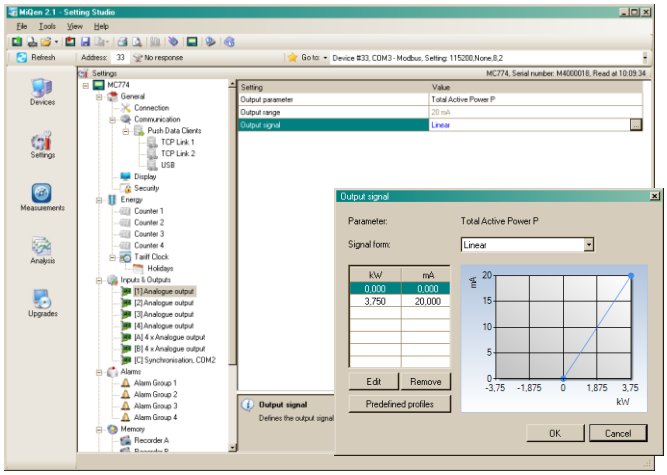
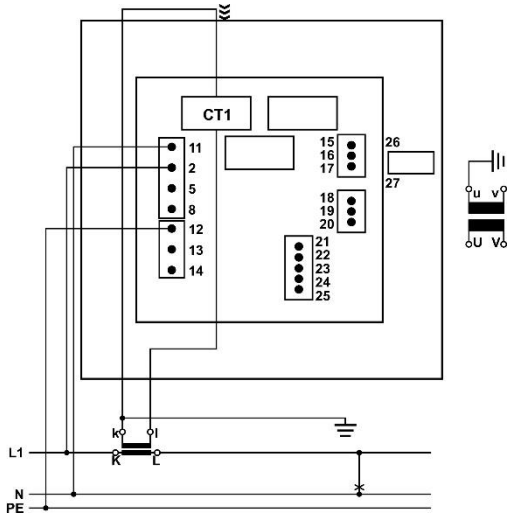
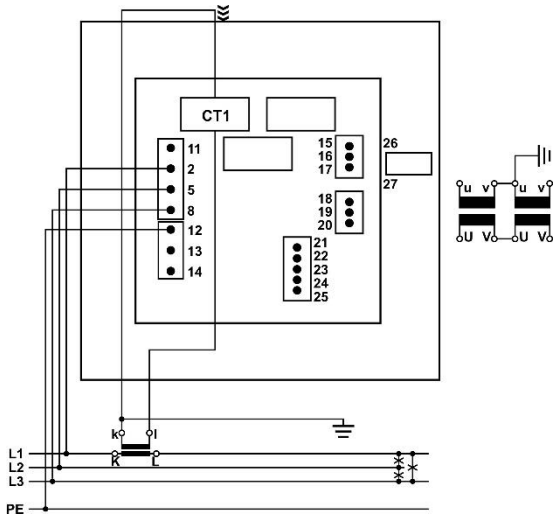
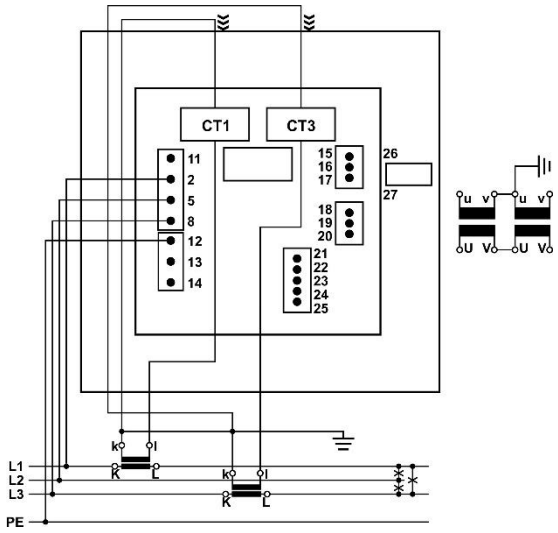


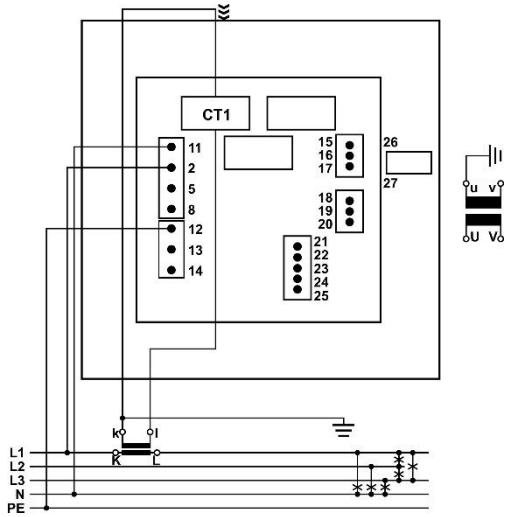
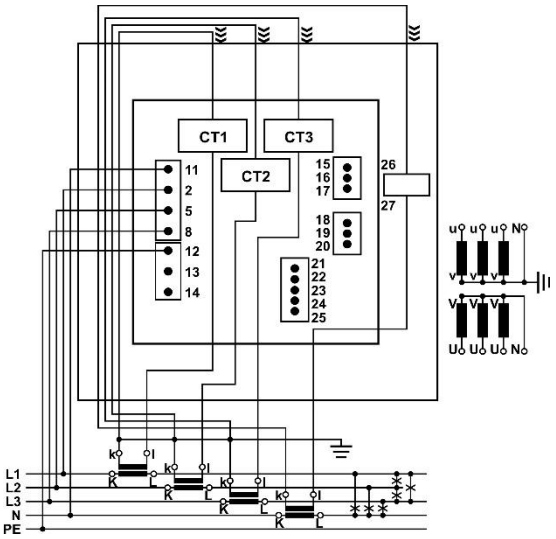
Figure 9 *MiQen setting and acquisition software*

MiQen software is intended for:

- Setting all of the instruments parameters (online and offline).
- Viewing current measured readings and stored data.
- Setting and resetting energy counters.
- Complete I/O modules configuration.
- Evaluation of the electricity supply quality in compliance with SIST EN 50160.
- Viewing and exporting time-stamped PQ anomaly details.
- Upgrading instruments firmware.
- Searching the net for devices.
- Virtual interactive instrument.
- Comprehensive help support.

CONNECTION

System/ connection	*Terminal assignment*
1b (1W1b) *Single-phase connection*	
3b (1W3b) Three-phase, three-wire connection with balanced load	
3u (2W3u) Three-phase, three-wire connection with unbalanced load.	

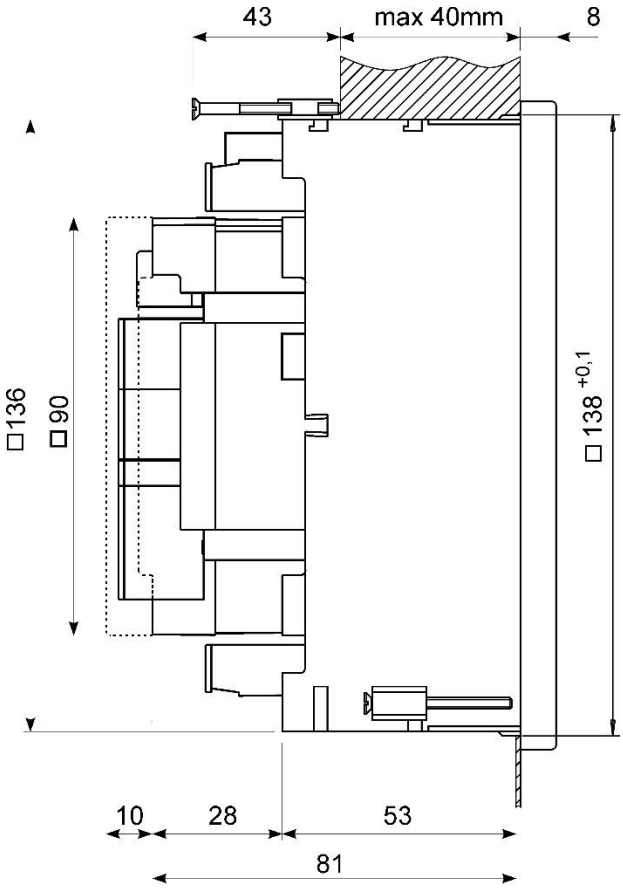
System/ connection	*Terminal assignment*
4b (1W4b) Three-phase, four wire connection with balanced load	
4u (3W4) Three-phase, four wire connection with unbalanced load. With this connection, a neutral current can be measured with 4th current sensor.	

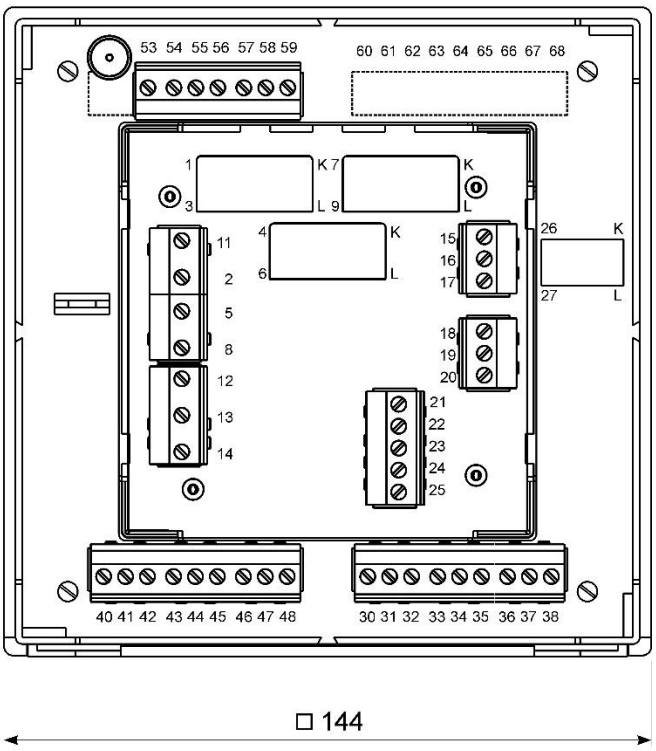
NOTE!

With all connection schemes must be terminal 12 (PE) ALWAYS connected.

Fourth voltage channel is dedicated for measuring voltage between EARTH (PE, terminal 12) and NEUTRAL (N, terminal 2).

DIMENSIONAL DRAWING





Connection table

Function			Connection	Comment
Measuring input:	AC current	IL1	1/3	⚠ CAT II 600V CAT III 300V
		IL2	4/6	
		IL3	7/9	
		ILN	26/27	
	AC voltage	UL1	2	⚠ CAT II 600V CAT III 300V
		UL2	5	
		UL3	8	
		UN	11	
Inputs / outputs:	Module 1/2	⊖→ +	15	
		⊖→ – (common)	16	
		⊖→ +	17	
	Module 3/4	⊖→ +	18	
		⊖→ – (common)	19	
		⊖→ +	20	
	Module A	⊖→	30-38	
	Module B	⊖→	40-48	
	Module C	⊖→	52-58	
Auxiliary power supply:		+ / AC (L)	13	⚠ CAT III 300V ⚠ GROUND terminal must be always connected !!
		– / AC (N)	14	
		GROUND	12	
Communication:	RS485	A	21	RS232 and RS485 are both supported, but only one at the time can be used! In case of Ethernet / USB communication, terminals from 21 to 25 are not used (unconnected).
		B	22	
	RS232	RX	23	
		GND	24	
		TX	25	

Table 4: *Connections*

DATA FOR ORDERING

When ordering **MC774** Quality Analyser, all required specifications shall be stated in compliance with the ordering code. Additional information could be stated. Note that fixed or programmable specifications are not part of ordering code.

General ordering code

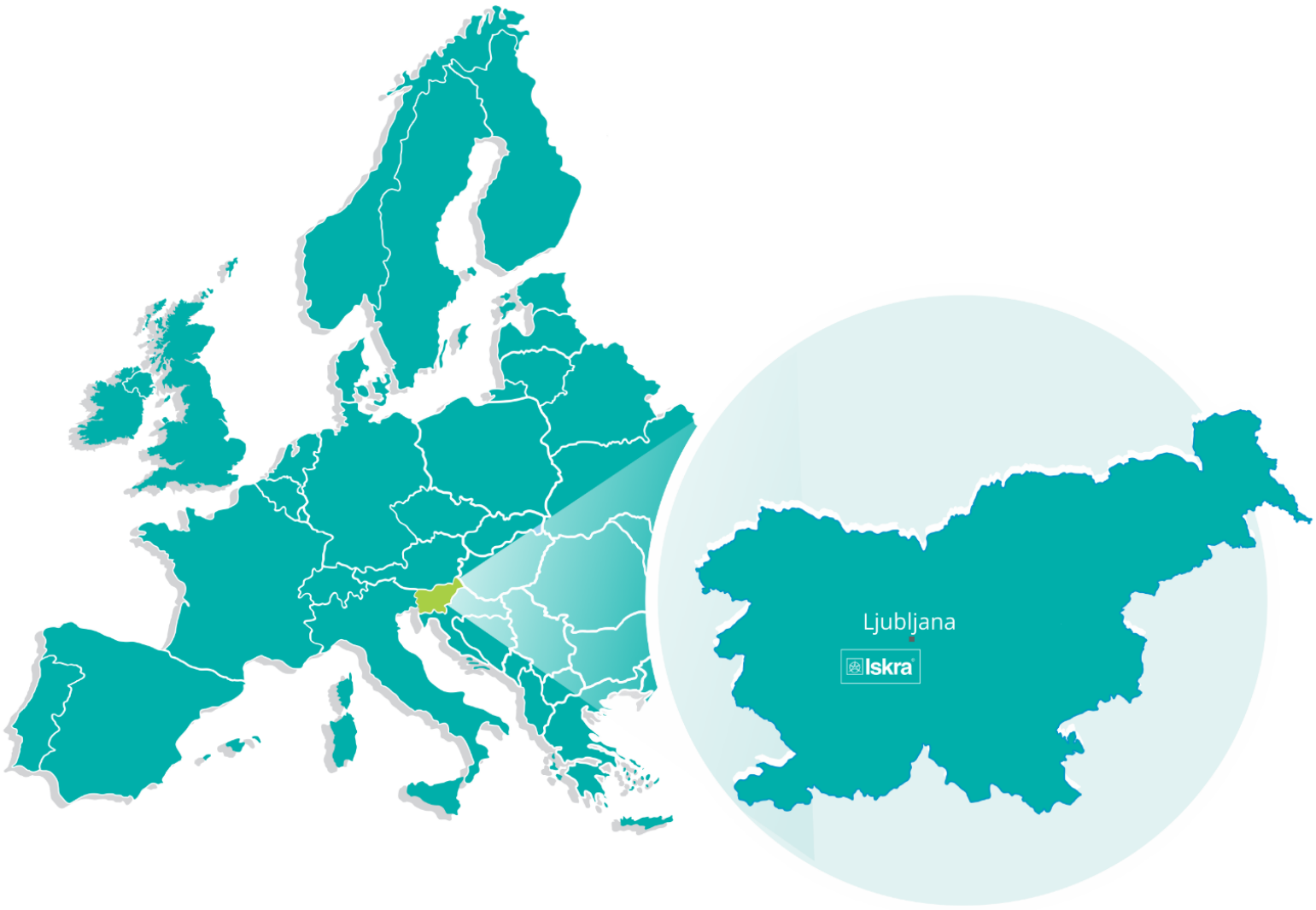
The following specifications shall be stated:

Device Type	Nominal freq.	Aux. power supply	Comm. COM1	I/O module 1/2	I/O module 3/4	I/O module A	I/O module B		
MC774	**X**	**X**	**X**	**X**	**X**	**X**	**X**		
						N		Without *	
						M		8x Relay (alarm) output	
						D		8x Digital input 230 VAC/DC	
						E		8x Digital input 110 VAC/DC	
						F		8x Digital input 5-48 VAC/DC	
				N				Without *	
				A				2× Analogue output	
				S				2× Pulse output	
				M				2× Relay (alarm) output	
				B				1× Bistable relay (alarm) output	
				W				1× Status + 1× Relay output	
				I				2× Analogue input - mA $_{DC}$	
				U				2× Analogue input - V $_{DC}$	
				R				2× Analogue input - R/Temp.	
				P				2× Pulse input 5 - 48 V $_{DC}$	
				D				2× Digital input 230 V $_{AC/DC}$	
				E				2× Digital input 110 V $_{AC/DC}$	
				F				2× Digital input 5 - 48 V $_{AC/DC}$	
				T				2× Tariff input 230 V $_{AC/DC}$	I/O module 1/2 only
				Z				2× Tariff input 110 V $_{AC/DC}$	I/O module 1/2 only
				Y				2× Tariff input 5 - 48 V $_{AC/DC}$	I/O module 1/2 only
			T					RS232 & RS485 Terminal *	
			E					Ethernet & USB	
			U					USB	
		H						70...300 V $_{DC}$, 80...276 V $_{AC}$ *	
		L						19...70 V $_{DC}$, 48...77 V $_{AC}$	
	S							50, 60 Hz *	
	A							400 Hz	

***- standard**

Dictionary:

PQ	*Power Quality alias Voltage Quality*
RMS	*Root Mean Square*
PA	*Power angle (between current and voltage)*
PF	*Power factor*
VT	*Voltage measuring transformer*
CT	*Current measuring transformer*
THD	*Total harmonic distortion*
Ethernet	*IEEE 802.3 data layer protocol*
MODBUS / DNP3	*Industrial protocol for data transmission*
MiQen	*ISKRA setting and acquisition Software*
AC	*Alternating quantity*
RTC	*Real Time Clock*
IRIG	*Inter-range instrumentation group time codes*
NTP	*Network Time Protocol*



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PE Kondenzatorji
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PE MIS
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PE Baterije in potenciometri
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SI-1296 , Šentvid pri Stični
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PE Galvanotehnika
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