UMT540 / MT540

Multifunction Transducer

Iskra MIS, d.d.

PROPERTIES

- **Measurements of instantaneous values of more than 140 quantities (U, I, P, Q, S, PF, PA, f, φ, THD, MD, energy, energy cost by tariffs, etc.)**
- **Power accuracy class 0.2**
- **Harmonic analysis of phase, phase-to-phase voltages and currents up to 31st harmonic**
- **Measurements of 40 minimal and maximal values in different time periods**
- **32 adjustable alarms**
- **Frequency range from 16 Hz to 400 Hz**
- **RS 232/RS 485 communication up to 115,200 bit/s or Ethernet communication or USB communication or Ethernet and USB communication simultaneously**
- **MODBUS and DNP3 communication protocols**
- **Remote display connection**
- **Up to 4 inputs or outputs (analogue outputs, digital inputs, alarm (digital) outputs, pulse outputs, tariff inputs)**
- **Additional communication port (COM2)**
- **Universal power supply (two voltage ranges)**
- **Automatic range of nominal current and voltage (max. 12.5 A and 600 V_{L-N})**
- **Adjustable tariff clock, display of electric energy consumption in selected currency**
- **Housing for DIN rail mounting**
- **User-friendly PC MiQen software**

Fig. 1: MT540/UMT540 for DIN rail mounting

DESCRIPTION

(U)MT540 are intended for measuring and monitoring single-phase or three-phase electrical power network. They measure RMS value by means of fast sampling of voltage and current signals, which makes instruments suitable for acquisition of transient events. A built-in microcontroller calculates measurands (voltage, current, frequency, energy, power, power factor, THD phase angles, etc.) from the measured signals.

APPLICATION

The (U)MT540 multifunction transducer is used for measuring and monitoring single-phase or three-phase electrical power network. Optional limits and required quality in a monitored period can be defined for each monitored characteristic. The following characteristics are measured and recorded:

COMPLIANCE WITH STANDARDS:

Standard EN	Description
61 010-1	Safety requirements for electrical equipment for measurement, control and laboratory use
60 688	Electrical measuring transducers for converting AC electrical variables into analogue and digital signals
62 052−11	Electricity metering equipment – General requirements, tests and test conditions
62 053−21	Electricity metering equipment – Particular requirements
61000-6-2	Electromagnetic compatibility (EMC) – Immunity for industrial environments
61000-6-4	Electromagnetic compatibility (EMC) – Emission standard for industrial environments
60 529	Degrees of protection provided by enclosures (IP code)
60 068-2-1/ -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

Frequency deviations	Over-voltages
Voltage deviations	Flicker intensity
Voltage dips	THD
Voltage interruptions	Harmonics
Voltage unbalances	Fast voltage changes

TECHNICAL DATA

MEASUREMENT INPUT ω

Nominal frequency range	50, 60 Hz
Measuring frequency range	16−400 Hz (max. 1000 Hz)

Current measurements:

Nominal value (I_N)	0.31…5 A
Max. measured value	12.5 A sinusoidal
Max. allowed value (thermal)	15 A cont.
(acc. to IEC/EN 60 688)	20 × I_N ; 5 × 1s
Consumption	< I^2 × 0.01Ω per phase

Voltage measurements:

Nominal value (U_N)	57.7…500 V_{LN}
Max. measured value (cont.)	600 V_{LN} ; 1000 V_{LL}
Max. allowed value	2 × U_N ; 10 s
(acc. to IEC/EN 60 688)	
Consumption	< U^2 / 4.2MΩ per phase
Input impedance	4.2MΩ per phase

System:

Voltage inputs can be connected either directly to low-voltage network or via a high-voltage transformer to high-voltage network.
Current inputs can be connected either directly to low-voltage network or shall be connected to network via a corresponding current transformer (with standard 1 A or 5 A outputs).
For more information about different system connections see CONNECTION on page 5.

single-phase, balanced load	1b
three-wire, balanced load	3b
three-wire, unbalanced load	3u
four-wire, balanced load	4b
four-wire, unbalanced load	4u

Table 2: List of system configurations

BASIC ACCURACY UNDER REFERENCE CONDITIONS

Total accuracy (measurements and analogue output) according to IEC/EN 60 688

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

Measurand	Accuracy (±% of reading)
Current Rms (I1, I2, I3, Iavg, In)	0.2
Voltage Rms P-N (U1, U2, U3, Uavg)	0.2
Voltage Rms P-P (U12, U23, U31, Uavg)	0.2
Power (P, Q, S)	0.2
Power factor (PF)	0.1°
Frequency (f)	10 mHz
P-N and P-P angle (φ, φ12, φ23, φ31)	0.1°
THD(U), THD(I) (0…400 %)	0.5
Active energy	Class 1
Reactive energy	Class 2
Real time clock (RTC)	1 min/month

COMMUNICATION

(U)MT540 has a wide variety of communication possibilities to suit specific demands. It is equipped with two standard communication ports (COM1A and COM1B) and one optional (COM2). This allows different users to access data from a device simultaneously and by using ethernet communication, data can be accessed worldwide. Additional (COM2) port is available (optional), when two independent serial communications are required.

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

Configuration	COM1A	COM1B	COM2[2]
1	RS232/485	/	/
2	RS232/485	/	RS485
3	Ethernet	/	/
4	Ethernet	/	RS485
5	USB	/	/
6	USB	/	RS485
7[1]	Ethernet	USB	/
8[1]	Ethernet	USB	RS485

[1] Galvanic separation between COM1A and COM1B is 1 kV_{ACRMS}
[2] COM2 excludes remote display and uses connection terminals of I/O4 module (RS485 only)

Table 3: List of communication configurations

Serial communication:	RS232[1]	RS485[1][2]
Connection type	Direct	Network
Connection terminals	DB9[1]	screw terminals[1]
Function	Settings, measurements and records acquisition, firmware upgrade	
Insulation	Protection class I, 2.2 kV_{ACRMS} 1 min	
Max. connection length	3 m	1000 m
Transfer mode	Asynchronous	
Protocol	MODBUS RTU, DNP3 (autodetect)	
Transfer rate	2.4 kBaud to 115.2 kBaud	
Number of bus stations	/	≤ 32

[1] Both types of comm. are available but only one at a time
[2] Specifications are identical for COM2

Ethernet:	
Connection type	Network
Connection terminals	RJ-45
Function	Settings, measurements and records acquisition, firmware upgrade
Insulation	Protection class I, 2.2 kV_{ACRMS} 1 min
Transfer mode	Asynchronous
Protocol	MODBUS TCP, DNP3 (autodetect)
Transfer rate	10/100Mb/s autodetect

USB:	
Connection type	Direct
Connection terminals	USB-B
Function	Settings, measurements and records acquisition, firmware upgrade
Insulation	Protection class I, 2.2 kV_{ACRMS} 1 min
Transfer mode	Asynchronous

Protocol	MODBUS RTU, DNP3 (autodetect)
Transfer rate	USB 2.0

INPUT / OUTPUT MODULES

(U)MT540 is equipped with four multipurpose input/output slots. The following modules are available:

Alarm (digital) output	4 outputs	any I/O
Analogue output	4 outputs	any I/O
Pulse output	4 outputs	any I/O
Tariff input	2 inputs	I/O 1,2
Digital input	4 inputs	any I/O
Additional comm. port (COM2)	1 I/O	I/O 4

Analogue output:

Each of up to four analogue outputs is fully programmable and can be set to any of 6 hardware ranges, 4 current and 2 voltage, without opening an instrument. They all use the same output terminals.

Programmable DC current output:

Output range values –100…0…100%

-1…0…1 mA	Range 1
-5…0…5 mA	Range 2
-10...0...10 mA	Range 3
-20...0...20 mA	Range 4
other ranges possible	by software
Burden voltage	10 V
External resistance	R_{Bmax} =10 V / I_{outN}

Programmable DC voltage output:

Output range values –100…0…100%

-1…0…1 V	Range 5
-10…0…10 V	Range 6
other ranges possible	By MiQen software
Burden current	5 mA
External resistance	R_{Bmin}= U_{outN} / 5 mA

General:

Linearization	Linear, Quadratic
No. of break points	5
Output value limits	± 120% of nominal output
Response time (measurement and analogue output)	< 300 ms
Residual ripple	< 0.5 % p.p.

The outputs 1, 2, 3 and 4 may be either short or open-circuited. They are electrically insulated from each other and from all other circuits (floating).

All output range values can be altered subsequently (zoom scale) using the setting software, but a supplementary error results (see INTRINSIC ERROR).

Digital / Alarm output:

Type	Relay switch
Rated voltage	48 V AC/DC (+40% max)
Max. switching current	200 mA
Contact resistance	≤ 100 mΩ (100 mA, 24V)
Impulse	Max. 4000 imp/hour
	Min. length 100 ms
Signal shape	
Normal	Until the condition is fulfilled
Impulse	Start at any new condition
Permanent	Since condition

Pulse output

Type	Solid state
Max. voltage	40 V AC/DC
Max. current	30 mA (R_{ONmax} = 8Ω)
Pulse length	programmable 1…999 ms

Tariff input

Voltage	230 / 110 V_{AC} ± 20 %
Max. current	< 0.6 mA
Frequency range	45…65 Hz
SET voltage	80...264V AC
RESET voltage	0...40V AC

Digital input

Rated voltage	48 V AC/DC (+ 40% max)
Max. current	< 0.6 mA
Min. signal width	20 ms
Min. pause width	40 ms
SET voltage	11...67V AC/DC
RESET voltage	0...5V AC/DC

Additional comm. port (COM2)

See COMMUNICATION / Serial communication

UNIVERSAL POWER SUPPLY

Standard (high):

Nominal voltage AC	70 … 276 V
Nominal frequency	40 … 65 Hz
Nominal voltage DC	70 … 300 V
Consumption	< 20VA
Power-on transient current	< 20 A ; 200 ms

Optional (low):

Nominal voltage AC	45 … 70 V
Nominal frequency	40 … 65 Hz
Nominal voltage DC	19 … 76 V
Consumption	< 20VA
Power-on transient current	< 20 A ; 200 ms

SAFETY:

Protection:	protection class I (protective earth terminal due to touchable metal parts (USB-B, RJ-45, DB9), current limiting fuse 0.5A on aux. supply Voltage inputs via high impedance Double insulation for I/O ports and COM1-2 ports
τ	
Pollution degree	2
Installation category	CAT III ; 600 $V_{\#}$ meas. inputs CAT III ; 300 $V_{\#}$ aux. supply Acc. to EN 61010-1: 2002
Enclosure material	PC/ABS Acc. to UL 94 V-0

Enclosure protection	IP 40 (IP 20 for terminals)

MECHANICAL

Dimensions	160 × 123 ×75 mm
Mounting	Rail mounting 35 × 15 mm acc. to DIN EN 50 022
Enclosure material	PC/ABS
Flammability	Acc. to UL 94 V-0
Weight	500 g

AMBIENT CONDITIONS:

Ambient temperature	usage group III -10…0…45…55 °C Acc. to IEC/EN 60 688
Operating temperature	-30 to +70 °C
Storage temperature	-40 to +70 °C
Average annual humidity	≤ 93% r.h.

AUXILIARY BATTERY

A built-in auxiliary battery enables the clock operation. The battery shall be replaced by the authorised service.

Type	CR2032 Li-battery
Nominal voltage	3 V
Life span	approx. 6 years (typical 23°C)

INTRINSIC-ERROR (FOR ANALOGUE OUTPUTS):

For intrinsic-error for analogue outputs with bent or linear-zoom characteristic multiply accuracy class with correction factor (c). Correction factor c (the highest value applies):

Linear characteristic

$$c = \frac{1 - \frac{y_0}{y_e}}{1 - \frac{x_0}{x_e}} \quad or \quad c = 1$$

Bent characteristic

$$x_{b-1} \le x \le x_b$$

b – number of break point (1 to 5)

$$c = \frac{y_b - y_{b-1}}{x_b - x_{b-1}} \cdot \frac{x_e}{y_e} \quad or \quad c = 1$$

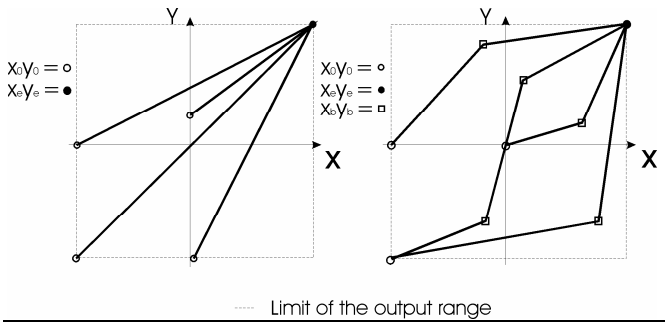


Fig 2: Examples of settings with linear and bent characteristic

ALARMS

(U)MT540 supports displaying 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.

REMOTE DISPLAY

The transducer is provided with a terminal (RJ-11 type terminal) for connection to remote display (item RD500). (Using COM2 on I/O 4 excludes remote display operation)

MiQen - setting and acquisition Software

MiQen software is intended for supervision of (U)MT540 and many other ISKRA MIS instruments on a PC. Network and the transducer setting, display of measured and stored values and analysis of stored data in the transducer 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 98, 2000, NT, XP operating systems.

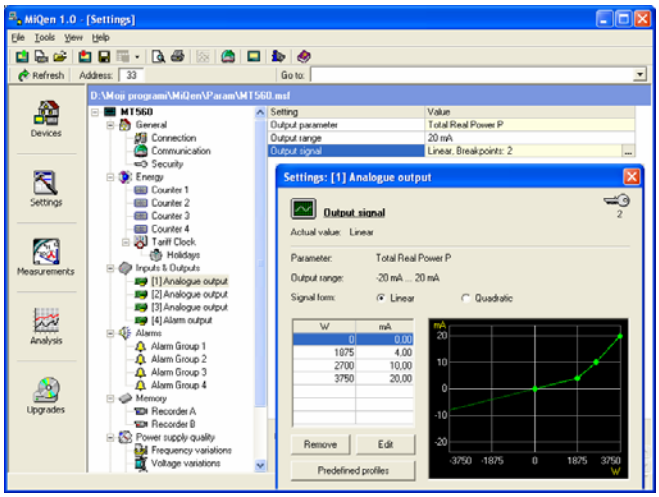
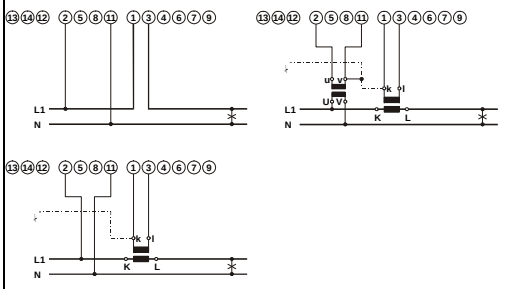
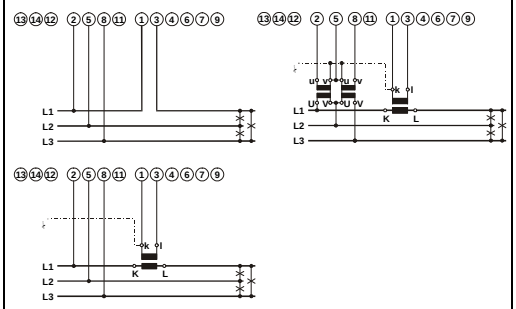
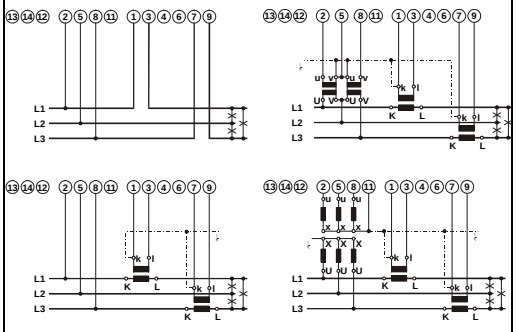


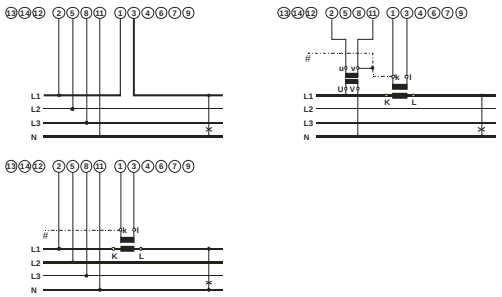
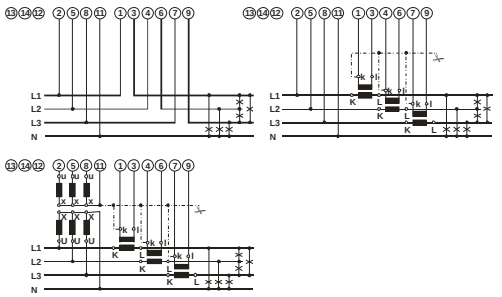
Fig 3: MiQen setting and acquisition software

MiQen software is intended for:

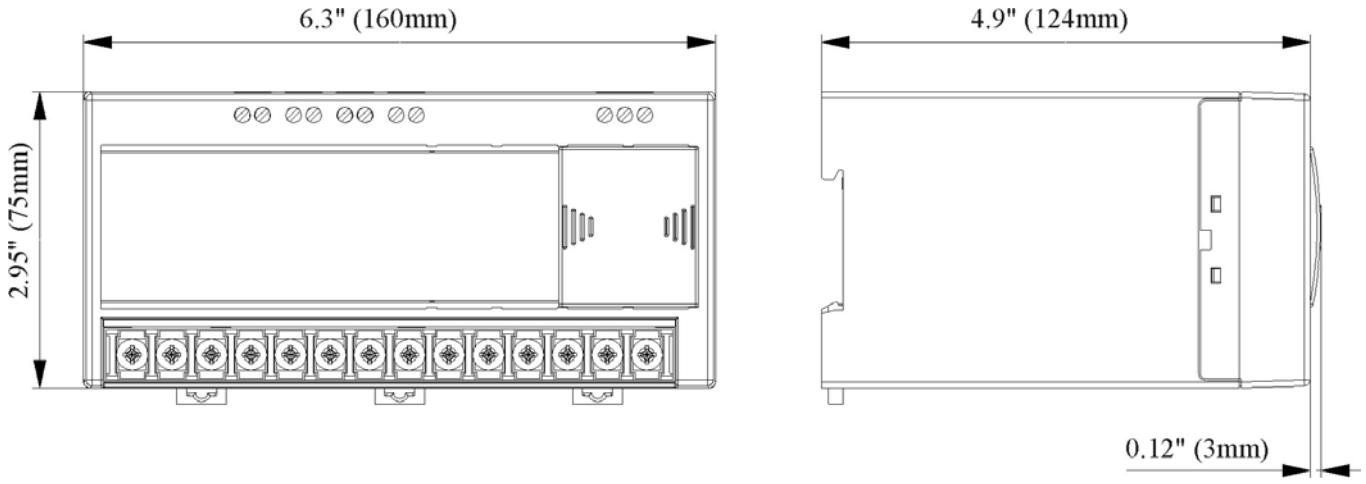
- Setting all of the instruments parameters (online and offline)
- Viewing current measured readings
- Setting and resetting energy counters
- Complete I/O modules configuration
- Upgrading instruments firmware
- Searching the net for devices
- Virtual interactive instrument
- Comprehensive help support

CONNECTION

System/ connection	Terminal assignment
Single-phase connection 1b (1W)	
Three-phase three-wire connection with balanced load 3b (1W3)	
Three-phase three-wire connection with unbalanced load 3u (2W3)	

System/ connection	Terminal assignment
Three-phase four wire connection with balanced load 4b (1W4)	
Three-phase four wire connection with unbalanced load 4u (3W4)	

DIMENSIONAL DRAWING



CONNECTION TABLE

Function			Connection
Measuring input:	AC current	IL1	1/3
		IL2	4/6
		IL3	7/9
	AC voltage	UL1	2
		UL2	5
		UL3	8
		N	11
		I/O	
Inputs / outputs:	Module 1	ϖ+	15
		ϖϑ	16
	Module 2	ϖ+	17
		ϖϑ	18
	Module 3	ϖ+	19
		ϖϑ	20
	Module 4	ϖ+	21
		ϖϑ	22
Auxiliary power supply:		+ / AC (L)	13
		– / AC (N)	14
		GROUND	12
Communication:	RS485	Rx / A	23
		NC	24
		Tx / B	25

Table 4: Connections

DATA FOR ORDERING

(U)MT540 multifunction transducer:

The following data shall be stated:

- Type of a transducer
- Type of power supply
- Type of communication
- Type of I/O module(s)

Supplement:

MiQen software

ORDERING

When ordering (U)MT540, all required specifications should be stated in compliance with the ordering code. Additional information could be stated regarding functionality of analogue outputs. Default settings for analogue outputs provided that no ordering information is given will be:

Analogue output	Input quantity	Output quantity
AO1	U1 (0...500V)	0…20 mA
AO2	I1 (0...5A)	0...20 mA
AO3	P1 (-2500...0...2500)W	-20...0...20 mA
AO4	Q1 (-2500...0...2500)var	-20...0...20 mA

If different analogue output settings are required, a proper input quantity / output quantity pair for each analogue output should be provided.

The transducers automatic range of input current (5 A) and voltage (500 V_{L-N}) is not stated in the code.

EXAMPLE OF ORDERING:

UMT540 quality transducer is connected to secondary phase voltage up to 500 V_{L-N} and 5 A secondary current. A universal HI supply is built-in the transducer. RS 232/RS 485 communication, one tariff input, one alarm output one analogue output and additional communication are applied.

Ordering code:

UMT540 − 1 1 5 1 3 6

Dictionary:

RMS	*Root Mean Square*
PA	*Power angle (between current and voltage)*
PF	*Power factor*
THD	*Total harmonic distortion*
MD	*Measurement of average values in time interval*
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*

GENERAL ORDERING CODE

All specifications are obligatory except function of analogue output(s), which should be stated in a form of description.

Transducer type

UMT540

1. Power supply

1	universal high
2	universal low

2. Communication (COM1)

1	RS232/485
2	Ethernet
3	USB
4	Ethernet + USB

3. I/O modul 1

1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Tariff input
5	Digital input

4. I/O modul 2

1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Tariff input
5	Digital input

5. I/O modul 3

1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Digital input

6. I/O modul 4

1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Digital input
5	Additional COM2

Iskra
Iskra MIS, d.d.
Ljubljanska 24a
SI-4000 Kranj
Slovenia
Tel.: +386 4 237 21 40
Fax: +386 4 237 21 29
E-mail: iskra@iskra-mis.si
Internet: www.iskra-mis.si

Printed in Slovenia • Subject to change without notice • Preliminary version 03 / Feb. 2008 • E P22.496.000