Multifunction Transducer

UMT540 / MT540

Iskra MIS

CLASS 0.1

RS 232 485

USB 2.0

ETHERNET

- ***Voltage and current auto range measurements up to 600V_{L-N}, 12.5A***
- ***Wide measurement frequency range 16 – 400 Hz***
- ***Power accuracy class 0.2 (IEC-688), 0.1 on communication***
- ***Up to three independent communication ports (Serial, Ethernet and USB communication)***
- ***Remote display***
- ***Up to four I/O modules (analogue in/out, pulse in/out, digital in/out, alarm out, tariff in)***
- ***Powerful analogue out; 6 voltage and current ranges, non-linear characteristics…***

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 the 31st harmonic**
- **Measurements of 40 minimal and maximal values in different time periods**
- **32 adjustable alarms**
- **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 communication possible)**
- **MODBUS and DNP3 communication protocols**
- **Remote display connection**
- **Up to 4 inputs or outputs (analogue inputs/outputs, digital inputs/outputs, alarm outputs, pulse input/outputs, tariff inputs)**
- **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 setting software, MiQen**

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.

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
62 053−22	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

APPLICATION

The (U)MT540 multifunction transducer is used for measuring and monitoring of all single-phase or three-phase values. Wide range of various I/O modules makes (U)MT540 a perfect choice for numerous applications. (U)MT540 can be delivered pre-configured to the required measuring set-up and output characteristic or it can be delivered un-configured for customer configuration with user friendly setting software MiQen. (U)MT540 supports a wide range of communication interfaces. Standard serial RS232/485 with speed up to 115200 baud is perfect for simple applications and serial bus interfacing. Ethernet 10/100 is ideal for a long distance monitoring and configuration of numerous transducers. USB 2.0 can be used for a fast set-up or memory acquisition.

Pulse inputs are suitable for reading consumption counters (water, gas, heat, compressed air…) and displaying that consumption in primary values.

In combination with analogue extender **EX104** it is possible to support up to 7 analogue outputs.

In combination with remote display **RD500** it is possible to remotely monitor readings and make settings of up to 32 in a network connected transducers.

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.

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	0.2	0.05(1)
Voltage Rms P-N and P-P	0.2	0.05(1)
Power (P, Q, S)	0.2	0.1(1)
Power factor (PF)	0.1°	
Frequency (f)	10 mHz	
P-N and P-P angle	0.1	
THD (U), THD (I) (0…400 %)	0.5	
Active energy	Class 1	0.5S(2)
Reactive energy	Class 2	0.5(2)
Real time clock (RTC)	1 min/month	

(1) On communication
(2) Optional

COMMUNICATION

(U)MT540 has a wide variety of communication possibilities to suit specific demands. It is equipped with two standard communication ports (COM1A, COM1B) and one optional (COM2). This allows UP TO THREE different users to access data from a device simultaneously and by using ethernet communication, data can be accessed worldwide.

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

Configuration	COM1A	COM1B	COM2(2)
1	RS232/485(3)	/	/
2	RS232/485(3)	/	RS485
3	USB	/	/
4	USB	/	RS485
5(1)	Ethernet	USB	/
6(1)	Ethernet	USB	RS485

(1) Galvanic separation between COM1A and COM1B is 1 kV_{ACRMS}

(2) COM2 (RS485 only) uses connection terminals of I/O4 module in case of secondary communication or RJ11 connector in case of remote display communication

(3) RS485 communication is available through DB9 or screw-in terminals, while RS232 is available only through DB9

Table 2: 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, 3.3 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

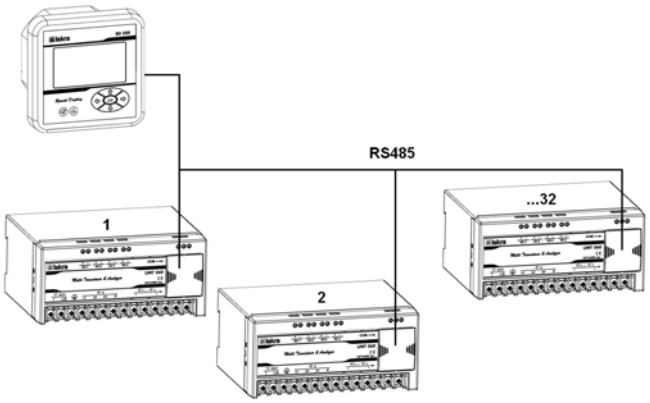
(1) Both types of comm. are available but only one at a time
(2) Specifications are identical for COM2

Ethernet:	
Connection type	Network
Connection terminals	RJ-45
Function	Settings, measurements and records acquisition, firmware upgrade
Insulation	Protection class I, 3.3 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, 3.3 kV_{ACRMS} 1 min
Transfer mode	Asynchronous
Protocol	MODBUS RTU, DNP3 (autodetect)
Transfer rate	USB 2.0

REMOTE DISPLAY

Remote display is very useful for a quick look-up to all measured parameters or to set up the (U)MT540 measuring transducers without the PC. Navigation keys and graphical LCD display enable remote application and remote display settings. By choosing different RD500 target communication addresses it is possible to track measurements and change settings for up to 32 (U)MT540 measuring transducers.



Connection of remote display RD500 depends on application:

- DIRRECT CONNECTION TO A SINGLE (U)MT540

  This type of connection is useful for instant measurement and waveform acquisition as well as adjusting settings of a single (U)MT560/550 by using a quick access RJ11 jack (under the transparent cover).

- BUS CONNECTION TO MULTIPLE (U)MT540

  This type of connection is useful for a remote monitoring and adjusting settings of multiple (up to 32) (U)MT540 attached to a RS485 bus through COM1 or COM2 (if available) communication port. To access each individual (U)MT540, the user should enter an address of required (U)MT540.

For more information about connection, and using of remote display see User's manual.

INPUT / OUTPUT MODULES

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

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

*See page 3 (serial communication)

Analogue input:

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, flux…)

DC current input:

Nominal input range 1	–20…0…20 mA (±20%)
Nominal input range 2	–2…0…2 mA (± 20%)
input resistance	20 Ω
accuracy	0.5 % of range
temperature drift	0.1% / °C (for range 2)
conversion resolution	16 bit (sigma-delta)
Analogue input mode	internally referenced Single-ended

DC voltage input:

Nominal input range1	–10…0…10 V (±20%)
Nominal input range 2	–1…0…1 V (±20%)
input resistance	100 kΩ
accuracy	0.5 % of range
temperature drift	0.1% / °C (for range 2)
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:

Each of up to four analogue outputs is fully programmable and can be set to any of 6 full-scale 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	Sub range
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	Sub range
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)	< 100 ms
Residual ripple	< 0.5 % p.p.

The outputs 1 to 4 may be either short or open-circuited. They are electrically insulated from each other (500 VACrms) and from all other circuits (3320 VACrms).

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

Digital input

Rated voltage	48 V AC/DC (+ 40% max)
Max. current	< 1.5 mA
Min. signal width	20 ms
Min. pause width	40 ms
SET voltage	40...120 % of rated voltage
RESET voltage	0...10 % of rated voltage

Alarm (digital) 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
Insulation voltage	
Between coil and contact	4000 VDC
Between contacts	1000 VDC

Pulse input

Rated voltage	5 - 48 V DC (± 20%)
Max. current	8 mA (at 48 VDC + 20%)
Min. pulse width	0.5 ms
Min. pulse periode	2 ms
SET voltage	40...120 % of rated voltage
RESET voltage	0...10 % of rated voltage

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

Rated voltage	230 or 110 V_{AC} ± 20 %
Max. current	< 0.6 mA
Frequency range	45…65 Hz
SET voltage	40...120 % of rated voltage
RESET voltage	0...10 % of rated voltage

UNIVERSAL POWER SUPPLY

Standard (high):

Nominal voltage AC	80 … 276 V
Nominal frequency	40 … 65 Hz
Nominal voltage DC	70 … 300 V
Consumption	< 8VA
Power-on transient current	< 20 A ; 1 ms

Optional (low):

Nominal voltage AC	48 … 77 V
Nominal frequency	40 … 65 Hz
Nominal voltage DC	19 … 70 V
Consumption	< 8VA
Power-on transient current	< 20 A ; 1 ms

SAFETY:

Protection: τ ⏚	protection class I (protective earth terminal due to touchable metal parts (USB-B, RJ-45, DB9), current limiting fuse 1A on aux. supply Voltage inputs via high impedance Double insulation for I/O ports and COM1-2 ports
Pollution degree	2
Installation category	CAT III ; 600 $V_{\#}$ meas. inputs CAT III ; 300 $V_{\#}$ aux. supply Acc. to EN 61010-1
Test voltages	U_{AUX}↔I/O, COM1,2: 2210 VAC_{rms} U_{AUX}↔U, I inputs: 3320 VAC_{rms} U, I inputs↔I/O, COM1,2: 3320 VAC_{rms} HV Tariff input↔I/O, COM1,2: 2210 VAC_{rms} U inputs↔I inputs: 3320 VAC_{rms}
Enclosure material	PC/ABS Acc. to UL 94 V-0
Enclosure protection	IP 40 (IP 20 for terminals)

MECHANICAL

Dimensions	100 × 123 ×75 mm
Mounting	Rail mounting 35 × 15 mm acc. to DIN EN 50 022
Enclosure material	PC/ABS, PC (sliding cover)
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 replaceable auxiliary battery enables the clock operation and recording the measurements in the memory with the time stamp. The battery shall be replaced by the authorised service.

Type	CR2032 Li-battery
Nominal voltage	3 V
Life span	approx. 6 years (typical at 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

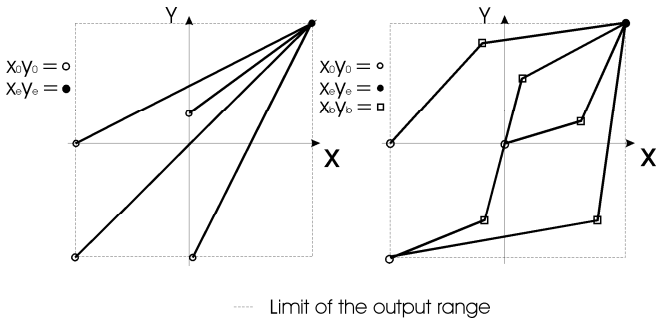
$$c = \frac{1 - \frac{y_0}{y_e}}{1 - \frac{x_0}{x_e}} \quad or \quad c = 1$$

Bent characteristic

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

b – number of break point (1 to 5)

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



Examples of settings with linear and bent characteristic

ALARMS

(U)MT540 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.

MiQen - setting and acquisition Software

MiQen software is intended for supervision of (U)MT540 and many other 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.

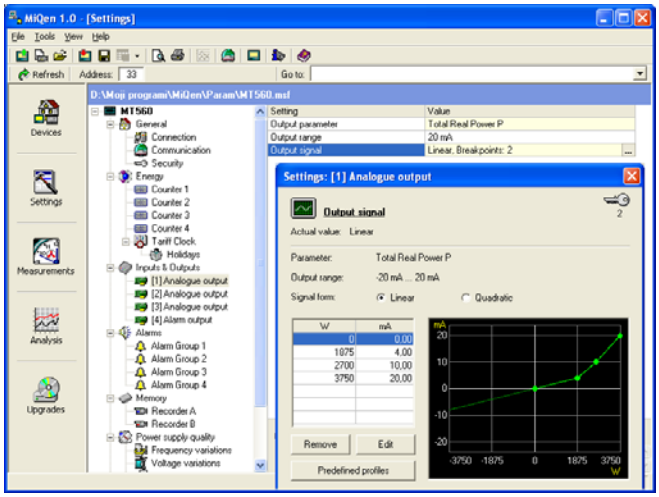
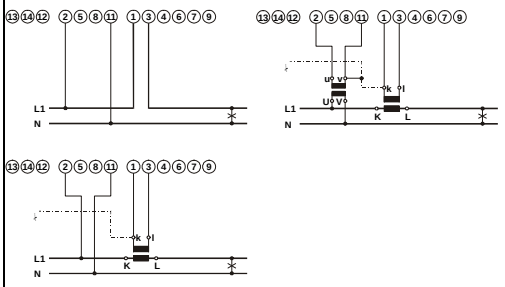
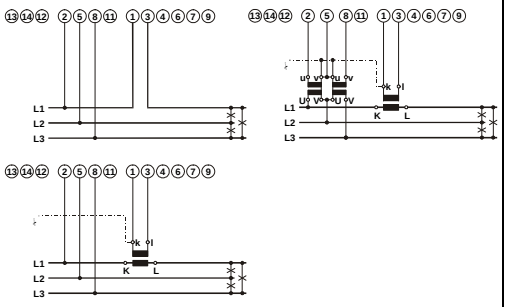
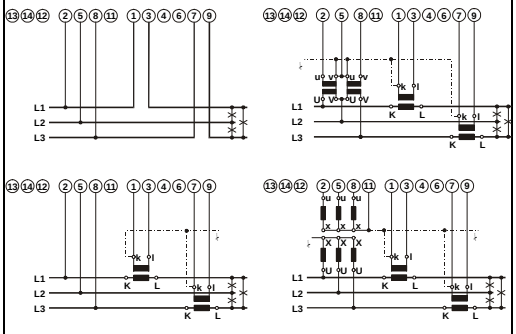
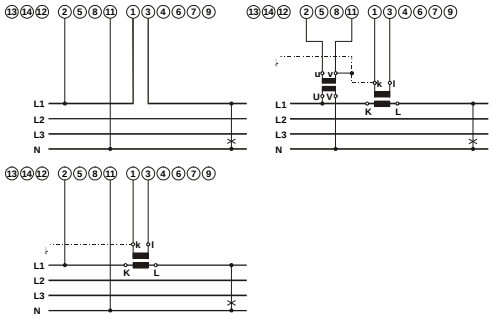
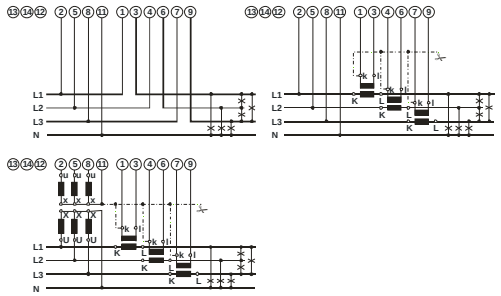


Fig 3: MiQen setting and acquisition software

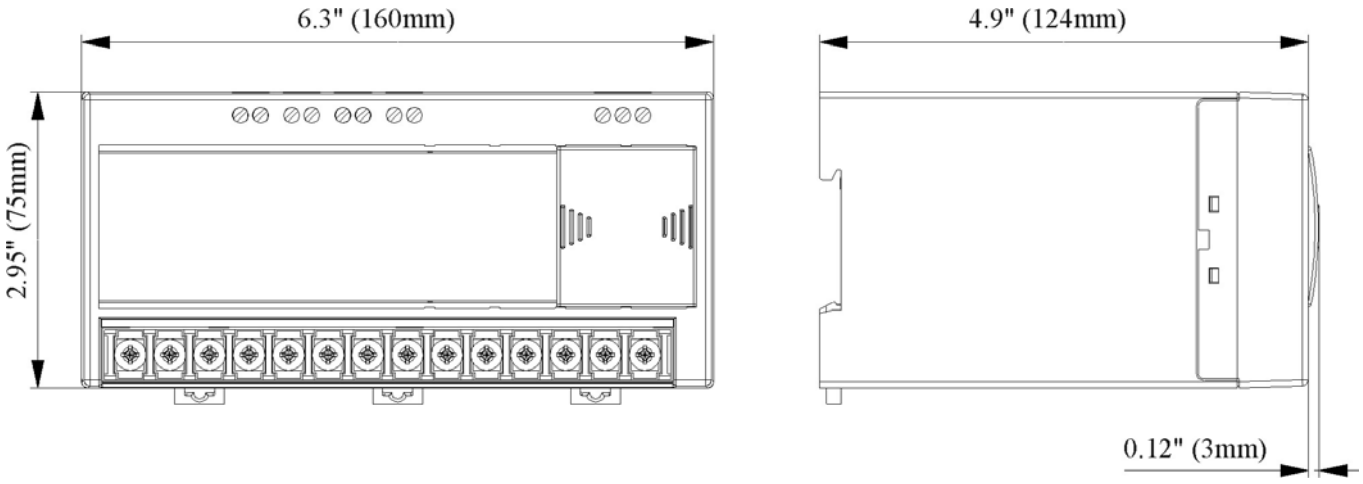
MiQen software is intended for:
Setting all of the instruments parameters (online and offline)
Viewing current measured readings
Setting and resetting energy counters
Complete I/O modules configuration
Upgrading instruments firmware
Searching the net for devices
Virtual interactive instrument
Comprehensive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



Dimensions for MT540 are the same as for UMT540.

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	A	23
		NC	24
		B	25

Table 4: Connections

DATA FOR ORDERING

(U)MT540:

The following data shall be stated:
Type of a transducer
Type of power supply
Type of communication
Type of I/O module(s)
Required energy accuracy

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	P (-7500...0...7500)W	-20...0...20 mA
AO2	Q (-7500...0...7500)var	-20...0...20 mA
AO3	U1 (0...500V)	0…20 mA
AO4	I1 (0...5A)	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 transducer with a universal-HI supply is connected to a secondary phase voltage up to 500 V_{L-N} and 5 A secondary current. RS 232/RS 485 communication, one tariff input, one alarm output one analogue output and additional communication are applied. High accuracy energy measurement (0.5S) is required.

Ordering code:

UMT540 − 1 1 1 4 1 2 5 2

Dictionary:

RMS	*Root Mean Square*
PA	*Power angle (between current and voltage)*
PF	*Power factor*
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*

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, MT540

1. Power supply

1	universal high
2	universal low

2. Communication (COM1)

1	RS232/485
2	USB
3	Ethernet + USB

3. Communication (COM2)

0	Without
1	RS485 over 4th I/O modul
2	Remote display port

4. I/O modul 1

0	Without
1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Tariff input
5	Digital input
6	Analogue input
7	Pulse input

5. I/O modul 2

0	Without
1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Tariff input
5	Digital input
6	Analogue input
7	Pulse input

6. I/O modul 3

0	Without
1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Digital input
5	Analogue input
6	Pulse input

7. I/O modul 4

0	Without
1	Alarm (digital) output
2	Analogue output
3	Pulse output
4	Digital input
5	Additional COM2
6	Analogue input
7	Pulse input

8. Energy accuracy

1	Active / reactive; cl.1 / cl.2
2	Active / reactive; cl.0.5S / cl.0.5

TÜV SÜD Management Service

CE

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