Energy sector

Measuring Transducer

Multifunction Transducer MT440

- Voltage and current auto range measurements up to 600V_{LN}, 12.5A
- Universal wide auxiliary power supply range 24 – 300 Vdc, 40 – 276 Vac
- Power accuracy class 0.5 (EN 60 688)
- Up to four I/O modules (analogue out, pulse out, alarm out, general purpose digital out)
- Programmable bipolar analogue output; multiple breakpoints, non-linear characteristics …
- Simple USB setting without auxiliary power supply
- Certified ship version

Iskra®

PROPERTIES

- Measurements of instantaneous values of more than 50 quantities (V, A, kW, kVA, kvar, kWh, kvarh, PF, Hz, MD thermal, THD, etc)
- Power accuracy class 0.5
- 32 adjustable alarms
- Input frequency: 50/60 Hz, 400 Hz
- Serial communication (RS232 or RS485 up to 115,200 bit/s) and USB 2.0
- MODBUS RTU communication protocol
- Up to 4 I/O (analogue outputs, alarm outputs, pulse outputs, general purpose relay output, general purpose solid-state output)
- Single wide auxiliary power supply range 24 – 300 Vdc, 40 – 276 Vac or fixed AC: 110V, 230V, 400V
- Automatic range of current and voltage (max. 12.5 A and 600 V_{L-N})
- Housing for DIN rail mounting
- User-friendly setting software, MiQen

DESCRIPTION

MT440 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 MT440 multifunction transducer is used for measuring and monitoring of all single-phase or three-phase values. Wide range of various I/O modules makes MT440 a perfect choice for numerous applications.
Analogue outputs with fast response.
Alarm (relay) outputs can be used as a supervisory functions with user defined limit lines to all measured parameters.
Precise energy measuring in all 4 quadrants with 4 configurable counters can be used as a secondary energy metering device.
MT440 is delivered un-configured for customer configuration with user friendly setting software MiQen. MT440 supports standard serial communication RS232 or RS485 with speed up to 115200 baud, which is perfect for simple applications and serial bus interfacing.
Additional USB 2.0 interface can only be used for a fast set-up without need for auxiliary power supply. This interface is provided with only BASIC insulation and can be used ONLY unconnected to power inputs.
Special "ship version" is available, certified by Bureau Veritas.

PROGRAMMING

MT440 multifunction transducer is completely programmable. It can be programmed using standard RS232/485 communication (if available) or USB communication (always present). For more information about connection and programming see *MT440 Users manual*.
Primary-secondary ratio (U, I), alarm limits, energy counter, input and output values are all programmed by setting software MIQen via RS232 or RS485 communication.

It is possible to choose between several standard output value ranges (- 100 … 0 … 100%):
- 10 … 0 … 10 V,
- 1 … 0 … 1 V,
- 20 … 0 … 20 mA,
- 10 … 0 … 10 mA,
- 5 … 0 … 5 mA,
- 1 … 0 … 1 mA,.

Within these six ranges it is possible to set any linear or bent (with maximum 5 break points) output characteristic.

COMPLIANCE WITH STANDARDS:

Standard EN	Description
61010	Safety requirements for electrical equipment for measurement, control and laboratory use
60688	Electrical measuring transducers for converting AC electrical variables into analogue and digital signals
61326-1	EMC requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
60529	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

TECHNICAL DATA

Measurement input

Nominal frequency (f_N)	50/60 Hz

CURRENT MEASUREMENTS:

Nominal values	1, 5, 10 A
Nominal current (I_N)	5 A
Max. measured value	12.5 A sinusoidal
Max. allowed value (thermal)	15 A cont.
(acc. to EN 60 688)	20 × I_N ; 5 × 1s
Consumption	< I^2 × 0.01Ω per phase

VOLTAGE MEASUREMENTS:

Nominal values	62.5, 125, 250, 500 V_{L-N}
Nominal voltage(U_N)	500 V_{L-N}
Max. measured value (cont.)	600 V_{L-N} ; 1000 V_{L-L}
Max. allowed value (acc. to EN 60 688)	2 × U_N; 10 s
Consumption	< U^2 / 3.3 MΩ per phase
Input impedance	3.3 MΩ per phase

FREQUENCY MEASUREMENT:

Frequency measuring range (Only for frequency meas.)	16 … 400 Hz (on comm.) f_N ± 30 Hz (on analogue out)

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 6.

Basic accuracy under reference conditions

Total accuracy (measurements and analogue output) according to EN 60 688
Accuracy is presented as percentage of measurands nominal value except when it is stated as an absolute value. Presented accuracy is valid only for a full output range. In case if used output range is less than full output range (zoom-characteristics) see INTRINSIC ERROR on page 5. Defined accuracy of analogue output is valid only after 45 minutes after power up, due to self-heating.

Measurand	Accuracy (± % of range)	
Current Rms	0.3	0.2[(1)]
Voltage Rms L-N and L-L	0.3	0.2[(1)]
Power (P, Q, S)	0.5	0.4[(1)]
Power factor (PF)	*0.5*	
Frequency (f)	10 mHz	
Power and phase angle	0.5°	
THD (U), THD (I) (0 … 400 %)	0.5	
Active energy	Class 1	
Reactive energy	Class 2	

[(1)] On communication

Communication

MT440 has one isolated communication port, which can be equipped with RS232 or RS485 or left open (to be specified with order).
Different configurations are possible (to be specified with order):

Configuration	COM
WO	USB [(2)]
RS232	RS232 + USB [(2)]
RS485	RS485 + USB [(2)]

[(2)] Read WARNING below

SERIAL COMMUNICATION:	**RS232**	**RS485**
Connection type	Direct	Network
Connection terminals	screw terminals	screw terminals
Function	Settings, measurements and firmware upgrade	
Insulation	Protection class II, 3.3 kVACRMS 1 min	
Max. connection length	3 m	1000 m
Transfer mode	Asynchronous	
Protocol	MODBUS RTU	
Transfer rate	2.4 kBaud to 115.2 kBaud	
Number of bus stations	/	≤ 32

Additionally, MT440 has a USB communication port, located on the bottom under small circular plastic cover. It is intended for settings ONLY and requires NO auxiliary power supply. When connected to this communication port MT440 is powered by USB.

WARNING:

USB communication port is provided with only BASIC insulation and can ONLY be used unconnected to aux. supply AND power inputs.

USB:

Connection type	Direct
Connection terminal	USB-mini
Max. connection length	3 m
Function	Settings, firmware upgrade
Transfer mode	Asynchronous
Protocol	MODBUS RTU
Transfer rate	USB 2.0

The USB cover should not remain open. It should be closed immediately after the initial setting through USB port was done and should remain closed during all time of storing & operation. If unit operates without USB cover the warranty is void.

INPUT/OUTPUT modules

MT440 can be equipped with up to four modules(3) The following modules are available:

Analogue output	up to 4	any I/O
Fast analogue output	up to 4	any I/O
Electromechanical relay output	up to 4	any I/O
Solid-state relay output	up to 4	any I/O

Electromechanical or solid-state relay output can be used as:

- Alarm output
- Pulse output
- General purpose digital output

(3) With fixed AC supply only one I/O module is available

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. It is possible to set other sub-ranges (e.g. 4 … 20 mA) by setting breakpoints.

FAST analogue output has the same functionality as standard analogue output with faster response time.

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

Max. burden voltage	10 V
External resistance	R_{Bmax} =10 V / I_{outN} (4)

(4) At low power supply (Universal type), < 48 V, RBmax = 4 V / IoutN

Programmable DC voltage output:

Output range values –100 … 0 … 100%

-1 … 0 … 1 V	Range 5
-10 … 0 … 10 V	Range 6

Max. burden current	20 mA
External resistance	R_{Bmin}= U_{outN} / 20 mA

General:

Max. voltage on output (open circuit current output)	35 V
Max. current on output (short circuit voltage output)	35 mA
Linearization	Linear, Quadratic
No. of break points	5
Output value limits	± 120% of nominal output
Response time (5) (measurement and analogue output)	< 100 ms
Response time of fast (5) analogue output	≤ 50 ms
Residual ripple	< 1 % p.p.
Residual ripple of fast analogue output	< 2 % p.p.

(5) Response time for frequency is:

Typical:	100 ms
Max; (freq. change > 10Hz):	<200 ms

All outputs may be either short or open-circuited. They are electrically insulated from each other (500 VAC_{rms}) and from all other circuits (3320 VAC_{rms}).

All output range values can be altered subsequently (zoom scale) using the setting software with a supplementary error (see INTRINSIC ERROR on page 5).

ELECTROMECHANICAL RELAY OUTPUT:

Purpose	alarm, pulse, general purpose digital output
Type	Electromechanical Relay switch
Rated voltage	48 V AC/DC (+40% max)
Max. switching current	1000 mA
Contact resistance	≤ 100 mΩ (100 mA, 24V)
Pulse (if used as pulse output)	Max. 4000 imp/hour Min. length 100 ms
Insulation voltage	
Between coil and contact	4000 VDC
Between contacts	1000 VDC

SOLID-STATE RELAY OUTPUT

Purpose	alarm, pulse, general purpose digital output
Type	Optocoupler open collector switch
Rated voltage	40 V AC/DC
Max. switching current	30 mA (R_{ONmax} = 8Ω)
Pulse length (if used as pulse output)	programmable (2 … 999 ms)

AUX POWER SUPPLY

UNIVERSAL SUPPLY

Nominal voltage AC range	48 … 276 V
Nominal frequency range	45 … 65 Hz
Nominal voltage DC range	20 … 300 V
Consumption	< 8VA
Power-on transient current	< 20 A; 3 ms
AC supply	
Nominal voltage AC	63.5 V, 110 V, 230V, 240 V, 400V
Nominal frequency range	45 … 65 Hz
Consumption	< 5VA

SAFETY:

Protection:	protection class II
Pollution degree	2
Installation category	CAT III; 600 V⏚ meas. inputs CAT III; 300 V⏚ aux. uni.supply CAT III; 600 V⏚ aux. AC supply Acc. to EN 61010-1
Test voltages	U_{AUX}↔I/O, COM: 5000 VDC U_{AUX}↔U, I inputs: 5000 VDC U, I in↔I/O,COM: 3320 VAC_{rms} U in↔I in: 3320 VAC_{rms}
Enclosure material	PC/ABS Acc. to UL 94 V-0

MECHANICAL

Dimensions	W100 × H75× D105 mm
Max. conductor cross section for terminals	2.5 mm^2 with pin terminal 4 mm^2 solid wire
Vibration withstand	0.7 g, 3 … 100 Hz, 1 oct/min 10 cycles in each of three axes
Shock withstand	300 g, 8 ms pulse 6 shocks in each of three axes
Mounting	Rail mounting 35 × 15 mm acc. to DIN EN 50 022
Enclosure material	PC/ABS
Flammability	Acc. to UL 94 V-0
Weight	370 g
Enclosure protection	IP 20

ENVIRONMENTAL CONDITIONS:

Ambient temperature	usage group III - 10 … 0…45 … 55 °C Acc. to IEC/EN 60 688 (Accuracy outside reference temp. range is not more than 2x class)
Operating temperature	- 30 to + 70 °C
Storage temperature	- 40 to +70 °C
Average annual humidity	≤ 93% r.h.
Altitude	≤ 2000 m

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

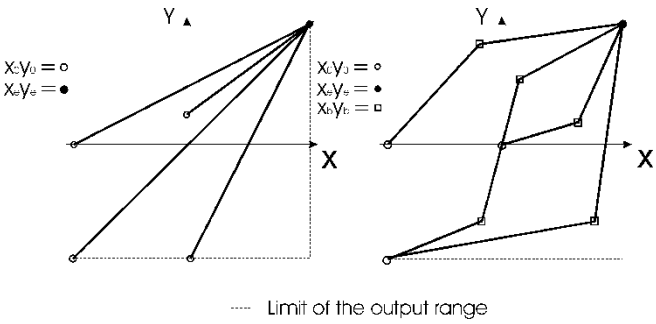
$$c = \frac{1 - \frac{y_0}{y_e}}{1 - \frac{x_0}{x_e}} \quad or \quad c = 1$$

Bent characteristic

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

b – number of break point (1 to 5)

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



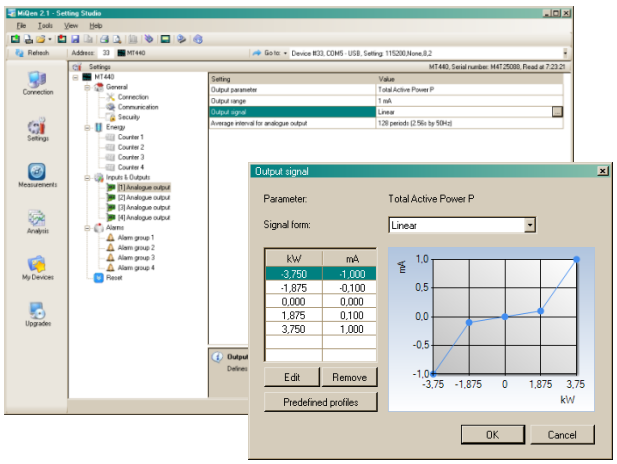
Examples of settings with linear and bent characteristic

Alarms

MT440 supports setting up to 32 alarms in four alarm groups. Alarms can be set for any of measured parameters by setting condition and a limit value. A time constant of maximum demand values in a thermal mode, a delay time and switch-off hysteresis are defined for each group of alarms. To each of two alarm groups an alarm output (solid-state or electromechanical relay) can be dedicated.

MiQenen - setting and acquisition Software

MiQen software is intended for supervision of MT440 and many other instruments on a PC. Network and the transducer setting, display of measured values are possible via the serial communication. The information and measurements can be exported in standard Windows formats. Multilingual software functions on Windows 98, 2000, NT, XP, Vista, Windows 7 operating systems.

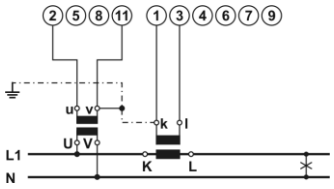
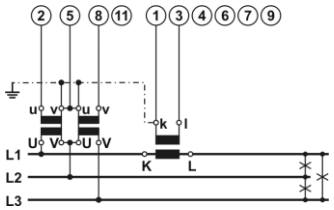
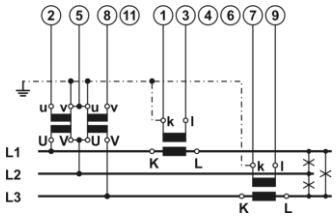
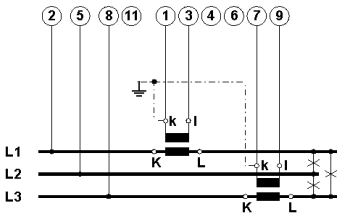
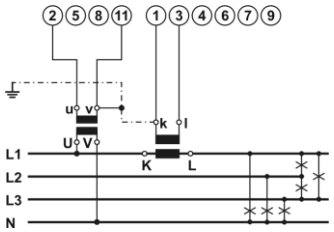
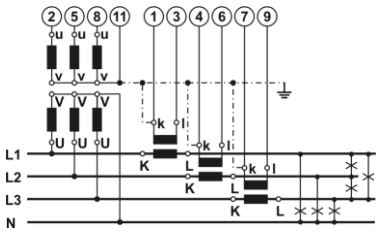


MiQen software is intended for:

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

MiQen software can be download free on Iskra, d.d. website (www.iskra.eu).

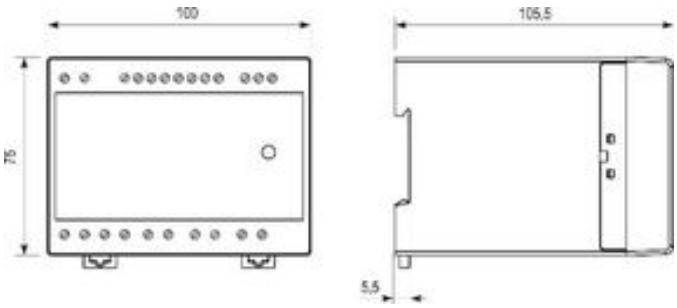
CONNECTION

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)	
Three-phase three-wire direct connection 3u (2W3)	
Three-phase four wire connection with balanced load 4b (1W4)	
Three-phase four wire connection with unbalanced load 4u (3W4)	

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:	I/O 1	+	15
		—	16
	I/O 2	+	17
		—	18
	I/O 3	+	19
		—	20
	I/O 4	+	21
		—	22
Auxiliary power supply:		+ / AC (L)	13
		– / AC (N)	14
Communication:	RS232 / RS48	Rx / A	23
		GND / NC	24
		Tx / B	25

DIMENSIONAL DRAWING



Dimensions for MT440

DATA FOR ORDERING

When ordering MT440, 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

Code for MT440 for use at standard frequency range 50Hz, Universal power supply, RS232 serial communication, two analogue and two relay outputs would be:

MT440 S S U S A A M M A

GENERAL ORDERING CODE

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

Type	Class	Nominal Frequency	Power supply	Communication (COM1)	Output: Out. 1	Output: Out. 2	Output: Out. 3	Output: Out. 4	Finish
MT440	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Finish
- **A** Standard *
- **H** HVE (Tropical Seal)
- **S** Ship version**

Output (Out. 1 / Out. 2 / Out. 3 / Out. 4)
- **A** Analogue output *
- **H** Analogue output (Fast)
- **S** Pulse output (SO)
- **M** Relay output
- **N** Without

Communication (COM1)
- **S** RS232
- **D** RS485
- **N** without

Power supply
- **U** 20...300 V DC, 48...276 V AC *
- **B** 63,5 V AC***
- **D** 110 V AC***
- **E** 230 V AC***
- **I** 240 V AC***
- **F** 400 V AC***

Nominal Frequency
- **S** 50, 60 Hz *
- **A** 400 Hz

Class
- **S** 0.5

* - standard
** - For this option, the universal power supply should be chosen
*** - With fixed AC supply only one I/O module (OUT1) is available

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