ENERGY SECTOR

Programmable AC Voltage Transducer **MT416**

- **TRMS AC VOLTAGE** OR **FREQUENCY** MEASUREMENTS.
- **VOLTAGE AUTO RANGE MEASUREMENTS** UP TO 600 V_{L-N}.
- **FREQUENCY** MEASUREMENT **RANGE 16 Hz– 400 Hz.**
- **AC OR UNIVERSAL** WIDE AUXILIARY **POWER SUPPLY.**
- ACCURACY CLASS **0.5** (EN 60 688).
- **SERIAL** (RS232 OR RS485) **COMMUNICATION.**
- **SIMPLE USB SETTING** WITHOUT AUXILIARY POWER SUPPLY.

Iskra®

PROPERTIES

- Measurements of TRMS voltage, frequency and THD U.
- Power accuracy class 0.5.
- 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.
- Universal power supply or transformer power supply.
- Automatic range (max. 600 V_{L-N}).
- Housing for DIN rail mounting.
- User-friendly setting software, MiQen.

DESCRIPTION

MT416 is intended for measuring and monitoring single-phase voltage or frequency. Voltage input is electrically isolated from the system by means of voltage transformer. It measures TRMS voltage value by means of fast sampling of voltage signals, which makes instruments suitable for acquisition of transient events. A built-in microcontroller calculates measurands (voltage, frequency, THD U, MD) from the measured signals. Measurands (U, f) can be then converted into load independent DC current or voltage which is proportional to the TRMS measured value for the purpose of regulation of analogue and/or digital devices.

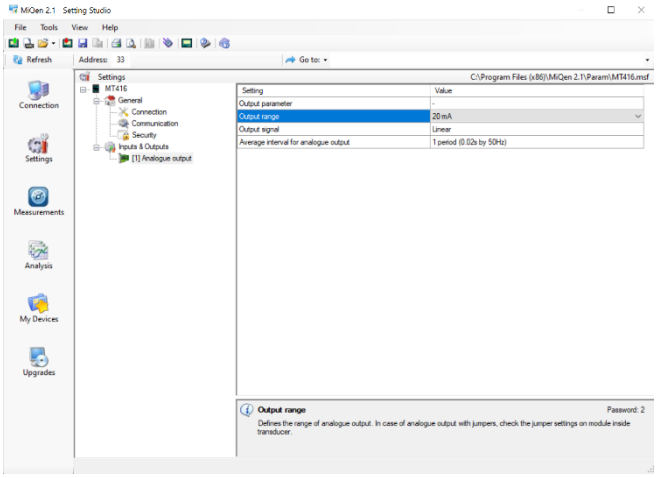
APPLICATION

The MT416 programmable AC voltage transducer is used for a permanent monitoring of a single-phase voltage and frequency values. MT416 is delivered configured to default values. Subsequent customer configuration is possible with user friendly setting software MiQen. MT416 supports standard serial RS232/RS485 with speed up to 115200 bps. USB 2.0 can be used for a fast set-up or memory acquisition (after installation USB connection is not possible any more).

Additional USB 2.0 interface can only be used for a fast set-up without need for auxiliary power supply. This interface is NOT galvanically isolated from analogue output and can be used ONLY unconnected to aux. supply and measuring inputs.

SETTING AND ACQUISITION

MiQen software is intended for supervision of MT416 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 or USB communication. The information and stored measurements can be exported in standard Windows formats. Multilingual software functions on Windows 98, 2000, NT, XP, Vista, Windows 7 / 8 / 10 operating systems.



MiQen software is intended for:

- Setting all of the instruments parameters (online and offline)
- Viewing current measured readings
- Searching the net for devices
- Virtual interactive instrument
- Comprehensive help support

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, 400 Hz

VOLTAGE MEASUREMENTS

Nominal values	62.5, 125, 250, 500 V_{LN}
Rated voltage (U_N)	500 V_{LN}
Max. measured value (cont.)	600 V_{LN}
Max. allowed value (acc. to EN 60 688)	2 × U_N; 10 s
Input impedance	500 kΩ
Consumption	U^2 / 500 kΩ

FREQUENCY MEASUREMENT

Frequency measuring range (Only for frequency meas.)	16 … 400 Hz

SYSTEM

Voltage input can be connected either directly to low-voltage network or via a high-voltage transformer to high-voltage network.
For more information about connection see chapter 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)	
Voltage Trms	0.5	0.2 [1]
Frequency (f)	10 mHz	2 mHz [1]
THD (U) (0 … 400 %)	0.5	

[1] on communication

Communication

MT416 has one galvanic separated 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] Please read WARNING below

Serial communication:	RS232	RS485
Connection type	Direct	Network
Connection terminals	Screw terminals	
Function	Settings, measurements and 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	
Transfer rate	2.4 kBaud to 115.2 kBaud	
Default settings	#33 \ 11520 \ N \ 8 \ 2	
Number of bus stations	/	≤ 32

Additionally, MT416 has a USB communication port, located on the bottom, behind removable cap. When connected to this communication port MT416 is powered by USB.

WARNING:

USB communication port is NOT galvanically isolated and can ONLY be used unconnected to aux. supply AND measuring inputs.
After installation of instrument on DIN rail, USB port is not accessible any more.

USB:	
Connection type	Direct
Connection terminal	USB-mini
Max. connection length	3 m
Function	Settings and records acquisition, firmware upgrade
Isolation	None, directly coupled with analogue output
Transfer mode	Asynchronous
Protocol	MODBUS RTU
Transfer rate	USB 2.0
	USB communication port is NOT galvanically isolated and can ONLY be used unconnected to aux. supply AND measuring inputs.

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.

Output module

ANALOGUE OUTPUT

Each of up to one unipolar analogue output 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 (0 … 100 %)

0 … 1 mA	Range 1
0 … 5 mA	Range 2
0 ... 10 mA	Range 3
0 ... 20 mA	Range 4
other ranges possible	by MiQen software
Max. burden voltage	10 V
External resistance	$R_{B\,max} = 10\ V / I_{outN}$

Programmable DC voltage output:
Output range (0 … 100 %)

0 … 1 V	Range 5
0 … 10 V	Range 6
Other ranges possible	By MiQen software
Max. burden current	20 mA
External resistance	$R_{B\,min} = U_{outN} / 10\ mA$

General:

Max. current on output (short circuit voltage output)	33 mA
Linearization	Linear, Quadratic
No. of break points	5
Output value limits	± 120 % of nominal output
Response time [3] (measurement and analogue output)	< 100 ms
Response time of fast [3] analogue output	≤ 50 ms
Residual ripple	< 1 % p.p.
Residual ripple of fast analogue output	< 2 % p.p.

[3] Response time for frequency is:

Typical:	300 ms
Max; (freq. change > 10Hz):	3000 ms

The output may be either short or open-circuited. It is electrically isolated from all other circuits.
All output range values can be altered subsequently (zoom scale) using the setting software with a supplementary error (see Intrinsic-error on page 5).

Aux power supply

Universal power supply	
Nominal voltage AC range	48 V… 276 V
Nominal frequency range	45 Hz… 65 Hz
Nominal voltage DC range	20 V… 300 V
Consumption	< 5 VA
Power-on transient current	< 20 A; 1 ms

TRANSFORMER POWER SUPPLY

Nominal voltage AC	110 V, 230 V
Nominal frequency range	45 Hz… 65 Hz
Consumption	< 5 VA

SAFETY

Protection:	protection class II
Pollution degree	2
Installation category	CAT III; 600 V⏚ meas. Inputs Universal aux. power supply CAT III; 300 V⏚ Transformer aux. power supply CAT III; 600 V⏚ aux. AC supply Acc. to EN 61010-1
Test voltages	I Input↔Output, U_{AUX}, COM: 5200 V_{ACTRMS} Transformer aux. power supply U_{AUX}↔Output: COM: 5200 V_{ACTRMS} Universal aux. power supply 3500 V_{ACTRMS} Output↔COM 500 V_{ACTRMS}
Enclosure material	PC / ABS Acc. to UL 94 V-0
Enclosure protection	IP20

MECHANICAL

Dimensions	W45 × H75 × D105 mm
Mounting	Rail mounting 35 × 15 mm acc. to DIN EN 50 022
Enclosure material	PC / ABS
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
Connection terminals	≤ 4.0 mm² solid wire ≤ 2.5 mm² stranded wire
Flammability	Acc. to UL 94 V-0
Weight	Transformer aux.power supply 340 g Universal aux.power supply 170 g
Enclosure protection	IP 20

ENVIRONMENTAL CONDITIONS

Ambient temperature	usage group II 0 … 15…30 … 45 °C Acc. to IEC / EN 60 688
Operating temperature	- 30 to + 70 °C
Storage temperature	- 40 to +70 °C
Temperature coefficient	± 0.1 % per 10 °C
Average annual humidity	≤ 93 % r.h.
Altitude	≤ 2000 m

REFERENCE CONDITIONS

Ambient temperature	0 ... 45 °C
Relative humidity	≤ 93 % r.h.
Voltage input	57.7 … 500 V
Frequency	45 … 65 Hz
Waveform	Sinus

INTRINSIC-ERROR (FOR ANALOGUE OUTPUT)

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

Linear characteristic:

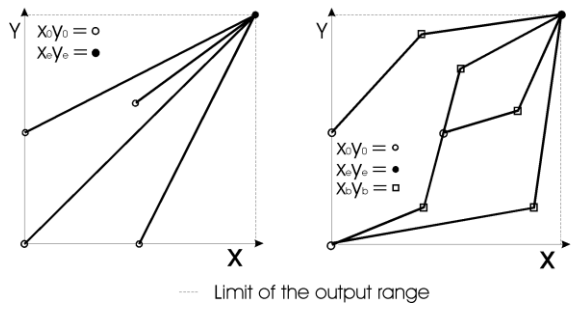
$$c = \frac{1 - \frac{y_0}{y_e}}{1 - \frac{x_0}{x_e}} \quad or \quad c = 1$$

Bent characteristic:

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

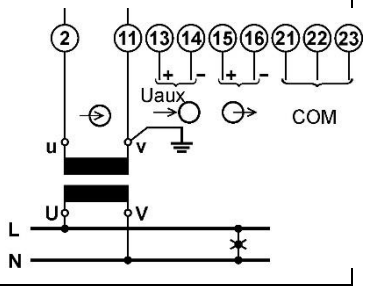
b – number of break point (1 to 5)

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



Examples of settings with linear and bent characteristic.

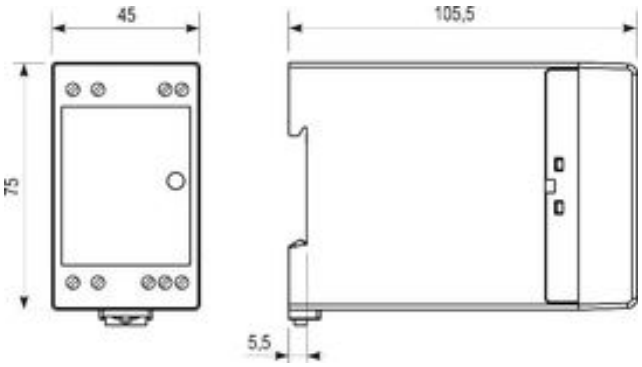
CONNECTION

System/ connection	Terminal assignment
Single-phase connection 1b (1W)	

CONNECTION TABLE

Function			Connection
Measuring input	AC voltage	U ω	2/11
Analogue output		+ ϖ	15
		– ϖ	16
Auxiliary power supply		+ / AC	13
		– / AC	14
Communication	RS232/RS485	Rx / A	21
		GND / C	22
		Tx / B	23

DIMENSIONAL DRAWING



Dimensions for MT416.

DATA FOR ORDERING

When ordering MT416, all required specifications should be stated in compliance with the ordering code. Additional information could be stated regarding functionality of analogue output. Default settings for analogue output provided that no ordering information is given will be:

Input quantity	Output quantity
U_{in}: 0 … 500 V	I_{out}: 0 … 20 mA

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

EXAMPLE OF ORDERING

Example of ordering code for MT416: Nominal frequency 45 ... 65 Hz; High power supply; Without communication COM1; Analogue output; Standard finish.

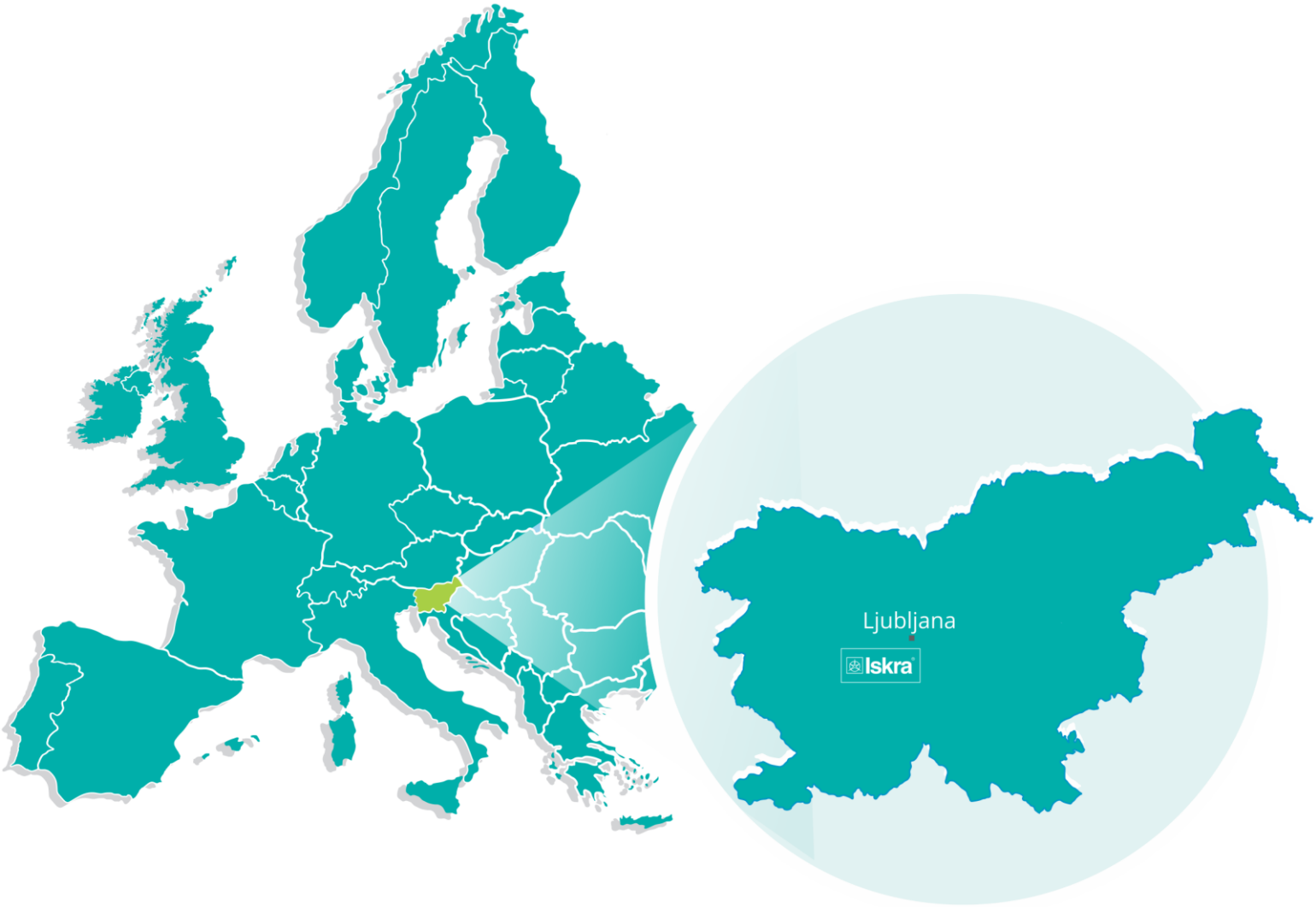
MT416 S U N H A

General ordering code

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

Type	Nominal Frequency	Power supply	Communication (COM1)	Output	Finish
MT416	**X**	**X**	**X**	**X**	**X**
					A Standard *
					H HVE (Tropical Seal)
				A Analogue output *	
				H Analogue output (Fast)	
			S RS232		
			D RS485		
			N Without *		
		U 20 ... 300 V DC, 48 ... 276 V AC *			
		D 110 V AC			
		E 230 V AC			
	S 45 ... 65 Hz *				
	A 400 Hz				

* - standard



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