Energy sector

Measuring transducers MI4x0 series

Programmable transducers for RTD sensors MI450

- Measuring of resistance of RTD sensors (Pt100, Pt1000, Ni100, Cu10, ...)
- Accuracy class up to: 0.5
- Programmable input and output
- Serial communication RS232 or RS485, MODBUS protocol
- Universal AC/DC or AC Auxiliary power supply

Iskra®

PROPERTIES

- Measuring of resistance of RTD sensors (Pt100, Pt1000, Ni100, Cu10*, ...)
- Accuracy class: 0.5 (Cu10 - Accuracy class: 1*)
- Programmable input and output
- Serial communication RS232 or RS485, MODBUS protocol
- Universal AC/DC or AC Auxiliary power supply
- (very high speed data rate: up to 115,200 bit/s, MODBUS protocol)
- Low power consumption
- Housing for DIN rail mounting
- Correspond to EN 60770-1: 1999

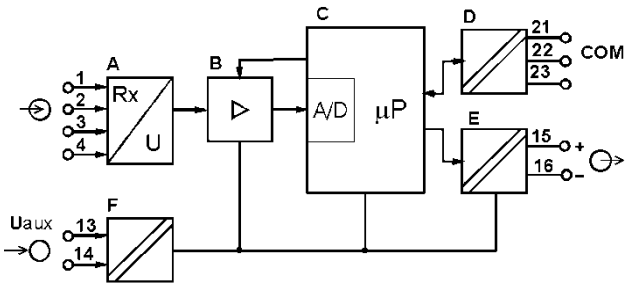
*See chapter Technical data - Accuracy.

APPLICATION

Measuring transducer MI450 is designed for use in industrial process for conversion of nonlinear resistance sensors (RTD – sensors) in to appropriate DC current or DC voltage signal. The analogue output signal is proportional to the measured value and it is appropriate for regulation of analogue and digital devices with reasonable dependence on environmental conditions, where they are planned to be used.

LAYOUT AND MODE OF OPERATION

Resistance on the input terminals can be measured with three methods, two, three or four wire connection. In all cases U-I method is used for measuring. Enforced current causes a voltage drop (A - Picture 2) on measured RTD sensor which is supplied to the programmable amplifier B. After A/D conversion the signal is computed in microprocessor C. The measured value determined by the microprocessor is assigned to the programmable analogue output E. Communication D enables programming of the measuring transducer and monitoring of the measuring resistance on the input terminal.
Communication, analogue output and auxiliary power supply are electrically insulated from other system by means of separation transformer.



Picture 1: Block diagram

PROGRAMMING

Input and output values are programmed[1)] with MiQen setting software via RS232 or RS485 communication. Before setting the transducer, output value must be selected by the jumpers on the output module[2)]. It is possible to choose between three ranges 0...±10 V, 0...±5 mA and 0...±20 mA. Within this three ranges it is possible to set any linear or bent (with maximum 5 break points) output characteristic.

[1)] – Programming is not possible in versions without communication
[2)] – Qualified person only

VERSIONS

The following transducer versions are available as programmable via communication or to be specified at the placing order:

Input	Type of RTD	Measuring voltage	Output	Supply	Communication	Bent characteristic of analogue output
-200° to 850°C for Pt..., -60° to 250°C for Ni..., 20Ω to 10kΩ for polinom[3)], -50° to 250°C for Cu...	Pt100 Pt1000 Ni100 Cu10*	< 2.2 V	1 mA 5mA 10 mA 20 mA 4...20 mA 1 V 10 V other on request	Universal or AC: 57 V 100 V 230 V 400 V 500 V	RS232 or RS485	Programmable via communication or to be specified at the placing order

Table 1: Versions of MI450

[3)] – With program package MiQen it is possible to set 6th grade polynomial function
*Cu10: Accuracy class 1; see chapter Technical data.
Transducers are mounted on standard rail 35 x 15 mm (according to DIN EN 50022)

TECHNICAL DATA

GENERAL:

- Measured quantity: temperature from RTD sensor
- Measured principle: microprocessor sampling

INPUT:

- Measuring method: two wire connection
  three wire connection
  four wire connection
- Input range with programmable ratings:
  RTD sensors limit values: Measuring voltage:
  20 Ω to 10 kΩ < 2.2 V
- Minimum temperature range [4]: 100° K
- Minimum differential resistance [5]: 40 Ω (100Ω -> 140Ω)
- Lead resistance: < 10 Ω per lead
- Consumption: < 0.5 VA

[4] – Cu10: 80° K

[5] – Cu10: 3 Ω (10Ω -> 13Ω)

ANALOGUE OUTPUT:

Programmable DC current output:

- Output I_{OutN} (output range end value):
- Output range values [6]: 0...±1 mA to 0...±5 mA or,
  0...±5 mA to 0...±20 mA
- Burden voltage: 15 V
- External resistance: $RBmax.[k\Omega]=\frac{15V}{I_{OutN}\ [mA]}$

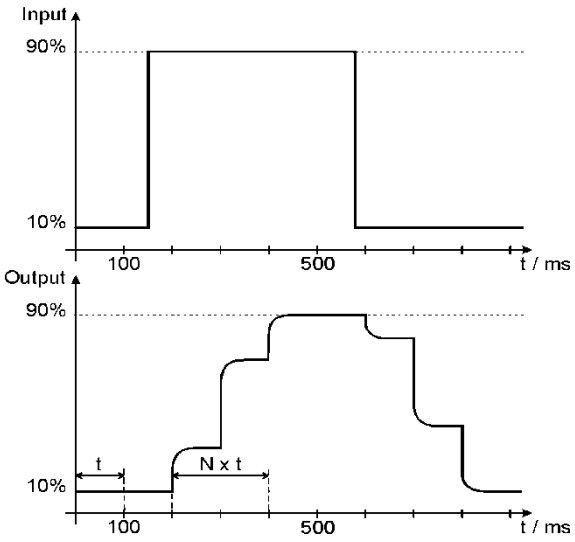
[6] - Depends of set jumpers on output module

Programmable DC voltage output:

- Output U_{OutN} (output range end value):
- Output range values 0...±1 V to 0...±10 V
- Burden current: 20 mA
- External resistance: $R_{Bmin}.[k\Omega]=\frac{U_{OutN}\ [V]}{20mA}$

General:

- Response time: programmable from 0.5 s to 60 s
- Residual ripple: < 1 % p.p.
- Maximum output value: limited at 125 %



Picture 2: Output transfer characteristic

N – Number of sliding windows
t – Sampling time
The output may be either short or open-circuited and it is electrically insulated from all other circuits (floating).

All the output range end values can be reduced subsequently using the programming software, but a supplementary error results.

ACCURACY:

- Reference value: Input range end value
- Accuracy class:
  Analogue output [7),8)]: Temperature 0.5 c
  Communication [8)]: Temperature 0.5

[7] – To calculate intrinsic error, see chapter intrinsic-error (for analogue outputs) on this page.

[8] – Cu10: Accuracy class 1, due to low resistance range (10Ω -> 13Ω).

Reference conditions:

Ambient temperature: 15...30 °C
Input: 0...100 % R_N

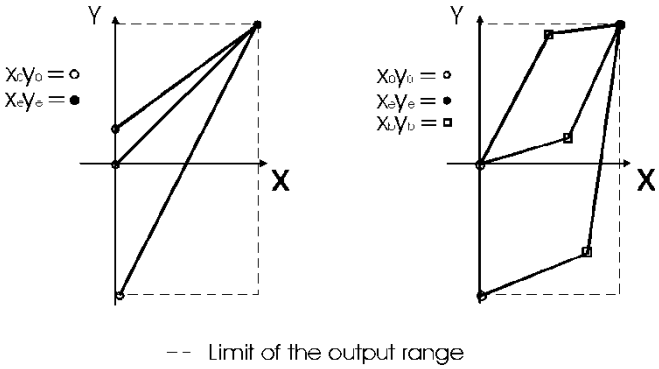
Intrinsic-error (for analogue outputs):

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

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

Bent characteristic

$x_{b-1} \le x \le x_b$ b - number of break points (1 to 5)



Picture 3: Examples of settings with linear and bent characteristic

POWER SUPPLY:

Auxiliary AC/DC voltage (universal):

- Rated voltage (Ur): 24...300 V DC
  40...276 V AC
- Frequency range: 40...70 Hz
- Power consumption: < 3 VA

Auxiliary AC voltage:

Rated voltage (Ur)	Rated operating range
57.74 V 100 V 230 V 400 V [9)] 500 V [9)]	80...120 % Ur

[9] – to 300 V installation category III, from 300 to 500 V installation category II – see chapter Regulations.

Table 3: Rated AC voltage for Auxiliary power supply

- Frequency range: 45...65 Hz
- Power consumption: < 3 VA

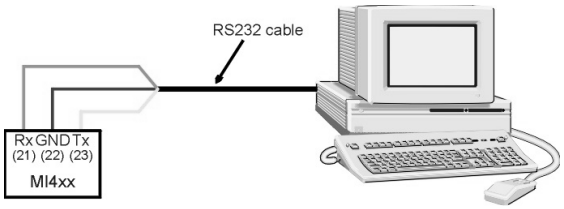
COMMUNICATION (OPTIONAL):

RS232

- Connection type: Point to point
- Signal levels: RS232
- Maximum cable length: 15 m
- Connector: Screw terminals
- Isolation: 3.7 kV rms for 1 minute between all terminals and all other circuits, except between communication terminals and output terminals, 2 kV rms for 1 minute
- Transmission mode: Asynchronous
- Message format: MODBUS RTU
- Data rate (very high speed): 1.200 to 115.200 bits/s
- RS232 connections

MI450	9 pin D connector (PC)	25 pin D connector (PC)
Rx (21)	Tx (3)	Tx (2)
⏚ (22)	GND (5)	GND (7)
Tx (23)	Rx (2)	Rx (3)

Table 4: RS232 connections



Picture 4: Connection of MI450 on PC via RS232 communication

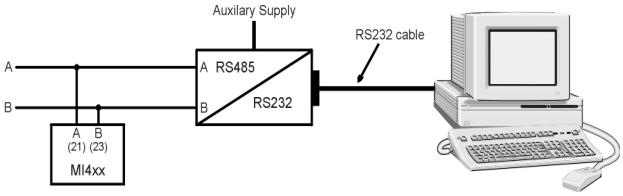
RS485

- Connection type: Multi-drop (32 connections per link)
- Signal levels: RS485
- Cable type: Screened twisted pair
- Maximum cable length: 1000 m
- Connector: Screw terminals
- Isolation: 3.7 kV rms for 1 minute between all terminals and all other circuits, except between communication terminals and output terminals, 2 kV rms for 1 minute
- Transmission mode: Asynchronous
- Message format: MODBUS RTU
- Data rate (very high speed): 1,200 to 115,200 bits/s
- RS485 connections

MI450	RS485
A (21)	DATA +
C (22)	NC [10)]
B (23)	DATA -

Table 5: RS485 connections

[10)] – NC – do not connect



Picture 5: Connection of MI450 on RS485 communication line

HOUSING:

- Material of housing: PC/ABS uninflammable, according to **UL 94 V-0**
- Mounting: For rail mounting, 35 x 15 mm according to **DIN EN 50022**: 1978
- Enclosure protection: IP 50 (IP 20 for connection terminals) according to **EN 60529**: 1989
- Weight: Approx. 300 g

CONECTION TERMINALS:

- Permissible cross section of the connection leads: ≤ 4.0 mm^2 single wire, 2 x 2.5 mm^2 fine wire

REGULATIONS:

- Protection: Protection class **II** **300 V rms**, installation category **III** **500 V rms**, installation category **II** Pollution degree 2
- Test voltage: 3.7 kV rms according to **EN 61010-1**: 1990

ENVIRONMENTAL CONDITIONS:

- Climatic rating: Climate class 2 acc. to EN 60688: 1992
- Operating temperature -10 to +55 °C
- Storage temperature -40 to +70 °C
- Annual mean relative humidity: ≤ 75% r.h.

EU DIRECTIVES CORRESPONDING FOR CE MARKING

Low voltage directive **73/23/EEC**:
EN 61010-1: 1993 and **EN 61010-A3**: 1995
Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General requirements

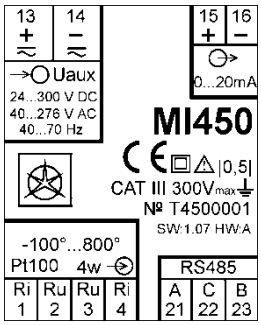
EMC directive **89/336/EEC**:
EN 61326-1: 1997
Electrical equipment for measurement, control, and laboratory use EMC requirements, Part 1: General requirements.

Commentary: If strong HF electromagnetic fields are expected in the place where transducer will be used, usage of 5mA analogue output is recommended, because in that case field influence on the transducer is the lowest.

Marking

Measuring transducers with linear characteristic:

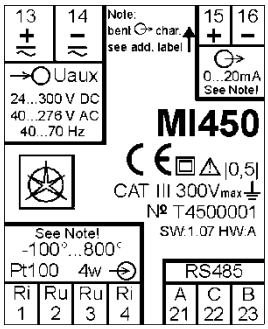
One label at the front of housing (Picture 7a):



Picture 6a: Example of label for transducer with linear characteristic

Measuring transducers with bent characteristic:

One label at the front of the housing and additional label at the top of the housing (Picture 7b):

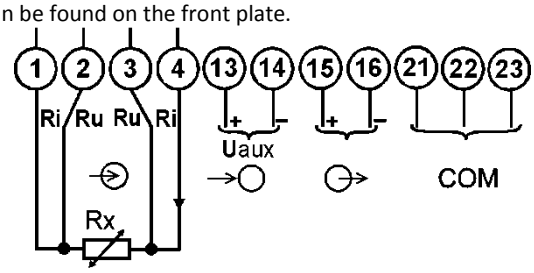


Break point	Input value [Ω]	Output value [mA]
start point	0	0
1	1000	2
2	1800	8
3	-	-
4	-	-
5	-	-
end point	2000	10

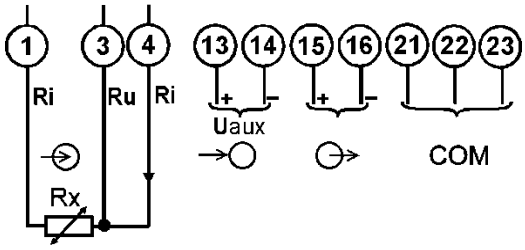
Picture 6b: Example of label for transducer with bent characteristic

CONNECTION

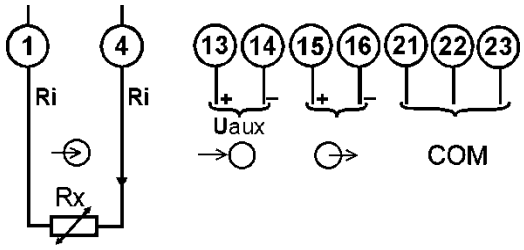
Type of connection can be specified with the order or changed via communication with MiQen software. The connection terminals marking can be found on the front plate.



Picture 7a: Connection diagram 4-wire

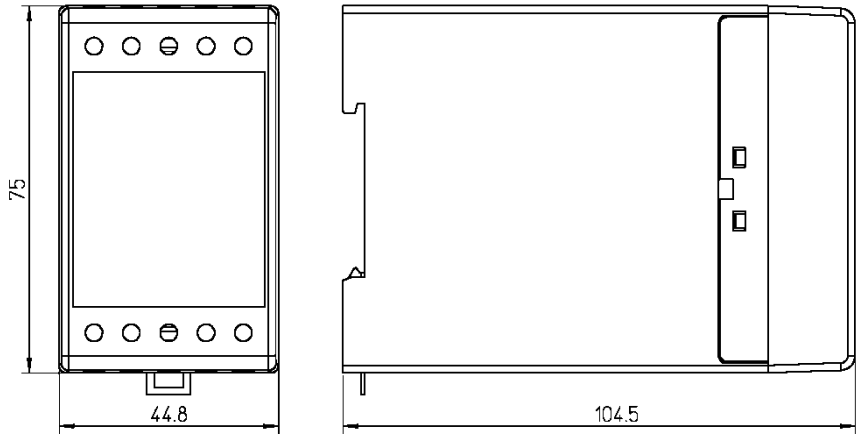


Picture 7b: Connection diagram 3-wire



Picture 7c: Connection diagram 2-wire

DIMENSIONAL DRAWING



Picture 8: Dimensional drawing (all dimensions are in mm)

SPECIFICATION AND ORDERING INFORMATION

For ordering it is necessary to declare type of the transducer (MI450), type of RTD sensor or polynomial function, measuring range, output quantity and range, type of power supply, type of communication and shape of output characteristic.

ORDERING CODE:
MI450 b; c; d…e F; G; H(i V); J; K

MI450		Value	Code
b	Type of sensor or input polynomial function of X^6 order	Pt100; Pt1000; Ni100; Cu10* ...	b
c	Measuring range:	-200° to 850° C (depends of sensor type)	-200°≤ *c* ≤ 850°
		20 Ω to 10 kΩ (for polynomial function)	20 Ω ≤ *c* ≤ 10 kΩ
d	Start value of output signal	-20…20 - current output -10…10 - voltage output	-20 ≤ *c* ≤ 20
e	End value of output signal	0…20 - current output 0…10 - voltage output	1 ≤ *d* ≤ 20
F	Type of output signal	current - mA	mA
		voltage - V	V
G	Type of connection	2 - wire	2
		3 - wire	3
		4 - wire	4
H	Type of power supply	universal power supply	U
		AC power supply	A
i	Value of power supply voltage (only for AC power supply)	57 V	57
		100 V	100
		110 V	110
		230 V	230
		300 V	300
J	Type of communication	RS 232	2
		RS 485	4
		no communication	0
K	Type of output characteristic	linear	L
		[11] bent 1…5 (number of break points)	1 ≤ *I* ≤ 5
		Voltage - V	V

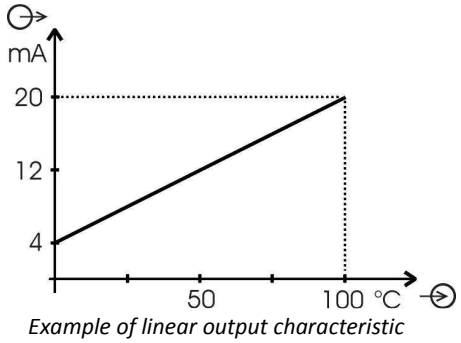
Table 6: Ordering information

*Cu10: Accuracy class 1; see chapter Technical data - Accuracy.

[11] - For ordering code for bent characteristic see additional ordering information Table 7.

ORDERING EXAMPLE FOR TRANSDUCER WITH LINEAR OUTPUT CHARACTERISTIC

Measuring transducer MI450, for Pt100 RTD sensor with temperature range 0…100 C, output range 4…20 mA, 4-vire connection, 110 V AC power supply, communication RS232 and linear output characteristic (Graph 1).
MI450 Pt100; 0...100°; 4...20 mA; 4; A 110 V; 2; L.



Graph 1: Example of linear output characteristic

Additional ordering information

For ordering transducer with bent characteristic it is necessary to declare breaking points in output characteristic (maximum 5 breaking points).
Ordering code for transducers with bent output characteristic:

MI450 b; c; d…e F; G; H(i V); J; K***(*I_1*/*m_1*;*I_2*/*m_2*;…)***

MI450		Value	Code
I	value of input quantity	depends of measuring range	-200° ≤ *I* ≤ 850° or 20Ω ≤ *I* ≤ 10 kΩ (depends of measuring range and type of RTD sensor)
m	value of output quantity when input value is *k*	-20…20 (depends of output range)	-20 ≤ *m* ≤ 20

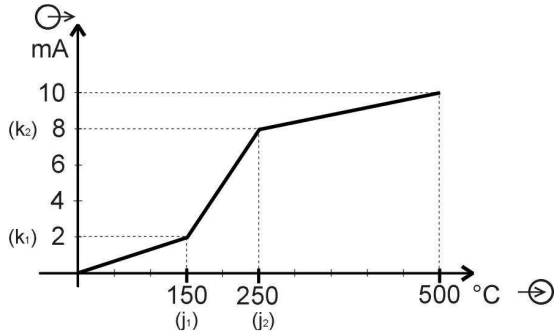
Table 7: Ordering information for bent characteristic

The sequence of breaking points must rise with measured quantity.

ORDERING EXAMPLE FOR TRANSDUCERS WITH BENT OUTPUT CHARACTERISTIC

Measuring transducer MI450 for Pt100 RTD sensor with temperature range 0…500°C, output range 0…10 mA, 4-vire connection, universal power supply, communication RS485 and bent output characteristic. The transducer is zooming the range from 150°C to 250°C (Graph 2)

MI450 Pt100; 0...500°; 0…10 mA; 4, U; 4; 2(150/2; 250/8)



Graph 2: Example of bent output characteristic with two breaking points

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