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CZAKI ®
THERMO-PRODUCT

MICROPROCESSOR CONTROLLED TEMPERATURE METER

EMT-200

OPERATING MANUAL

Contents

1. Meter features

The EMT 200 is an universal microprocessor controlled temperature meter. Its main features are:

- input adjusted to most commonly used types of thermocouples and thermistors
- two alarms controlling independent relays, programmable in five modes
- bi-directional RS232 serial port, isolated, making possible remote readout and storage of the most important parameters
- memory of 300 measurements
- meter parameters and configuration set through a keyboard or serial port
- two four digit LED displays and three additional status lights

2. Display and keyboard

Double display and three key keyboard are placed on the front panel of the meter. The panel is presented in the picture below:
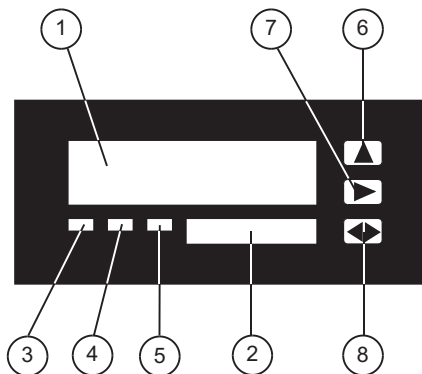
1 Main display
2 Auxiliary display
3 „ALARM 1" LED
4 „ALARM 2" LED
5 „TRANSMISSION" LED
6 „ " key
7 „ " key
8 „ " key

2.1.Description of display functions

Switching on the meter results in displaying the "*LOAD*" message on the main display. It means starting the meter.

In the basic mode the display presents temperature in degrees Centigrade. The unit of measurements is shown on the auxiliary display..

In the programming mode the main display shows consecutive positions of menu or parameter names, and the auxiliary display presents their respective values..

If the LED „ALARM 1" or / and „ALARM 2" comes on it means that the measured temperature has entered the programmed alarm range.

While modifying (meter) parameters the value indicated in the active field of the auxiliary display is also changed. The active field is distinguished by blinking of selected position.

If the main display shows the "*ERR*" message it means that the processing range has been exceeded, a sensor has been incorrectly connected, or the sensor previously programmed differs from the sensor actually connected.

2.2.Using keyboard

The meter is equipped with the three key membrane keyboard..

The key „   " is used for changing the value of the active (blinking) digit. It is also intended for entering the parameter programming mode and for leaving this mode.

The key „   " makes possible changing the menu position and changing the active digit.

The key „   " is intended for confirming the selected menu position, or for confirming the (selected) value.

3.Programming mode

The programming mode is entered by pressing „ " for approx. 3 seconds.

It results in the message „**AL_1**" appearing on the main display.

Repetitive depressing of „ " scrolls consecutive menu positions.

Finding the appropriate menu position is confirmed by pressing „ ".

Depressing „ " causes entering the higher menu level. The same at the highest menu level results in leaving the programming mode and entering the temperature measurement mode.

If the user does not change any parameters the programming mode will go off automatically after approx. 90 seconds.

At the parameter change procedure the key „ " changes the value under the cursor, and the key „ " shifts the cursor position (if possible).

Changing parametr value:

Using „ " activate the digit to be changed on the auxiliary display ;
Using „ " set the new value;
Repeat this procedure till the required value is set completely;
Introduced changes confirm by „   ". It causes memorizing the parameter value.

*ATTENTION: If the entered value exceeds premissible limits then on the auxiliary display the „**ERR**" message appears for a while, after that the previous value (before modification) is continously displayed.*

Displayed symbol		Admissible values	Factory settings	Parameter description
AL_1	TAL	0, 1, 2, 3, 4, 5	0	alarm mode 1
	P1	-100...+1800	2	item 1
	P2	-100...+1800	10	item 2
AL_2	TAL	0, 1, 2, 3, 4, 5	0	alarm mode 2
	P1	-100...+1800	4	item 1
	P2	-100...+1800	100	item 2
MEMO	RSCT	1...240	10	readout period
	TPRI	0, 1, 2	0	results readout
	TMEM	0, 1, 2	0	results recording
SYST	PROT	0, 1, 2	0	protection
	RESE	0, 1	0	reset
TEPR	SNSR	Pt,Ni,T,J,K,R,S,B,N	K	sensor type
	TPOI	0, 1	0	resolution
	TOFF	-9.9...+9,9	0.0	offset
R232	ADR	1...99	1	address
	BAUD	600,1200,2400 4800,9600	2400	rate
	PARI	NONE, ODD, EVEN	NONE	parity

ATTENTION: *Parameters in the shaded fields are accessible if the
,, '' key has been depressed at the moment of switching
on the meter.*

4.Menu *AL_1* or *AL_2*

Programming alarms consists in setting their work modes and values of threshold temperatures.

Enter the programming mode by depressing „   " for approx. three seconds.

Using „   " select from the menu position „*AL_1*" or „*AL_2*", confirm by „   ".

4.1.   Setting the alarm mode

In the alarm programming mode using „   " select „*TAL*" position.

The auxiliary display will show the current alarm mode. To change the mode depress „   " (the digit on the auxiliary display starts blinking).

Using „   " set the required alarm mode.

Mode **0** alarm is off,

Mode **1** alarm comes on when the current temperature exceeds the first alarm threshold,

Mode **2** alarm comes on when the current temperature drops below the first alarm threshold,

Mode **3** alarm comes on when the current temperature exceeds the first alarm threshold, and at the same time is lower than the second alarm threshold.

Mode **4** alarm comes on when the current temperature drops below the first alarm threshold or exceeds the second alarm threshold.

Mode **5** alarm comes on when the current temperature exceeds the second alarm threshold, and comes off when temperature drops below the first alarm threshold (hysteresis). If a power outage appears in this mode the meter memorises states of relays and the last temperature, This makes possible correct alarm operation after re-powering.

Alarm modes are presented in a graphical form on page 22.

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After making changes confirm them by depressing „   " („**TAL**"
message will start blinking again).

Depressing „   " we can reach the next position of menu.

Depressing „   " we leave „**TAL**", pressing again „   " we go out of
the programming mode and enter the temperature measurement mode.

4.2. Setting alarm thresholds

Using „   " select position „**P1**" or „**P2**" in the alarm programming mode.

The auxiliary display will show the current value of the alarm
threshold temperature. To change its value depress „   ", (the first
digit of the auxiliary display will start blinking).

Using „   " set the required value, then using „   " go to the next digit.

A parameter can assume values from **100** to **+1800**.

After making changes confirm them by „   " („**P1**" or „**P2**" will start
blinking again).

Depressing „   " we come out of „**P1**" or „**P2**", depressing again „   "
we leave the programming mode and enter the temperature
measurement mode.

> *ATTENTION: Take care to set the value of the first threshold
> („**P1**") below the value of the second threshold („**P2**").
> Otherwise alarms may function improperly.*

5.   MEMO menu

The meter is equipped with the RS232 serial port. It enables easy
connection between the meter and the computer for bi-directional data
transmission, or between the meter and the printer for creating a simple
temperature recorder.

The serial port makes possible:

- Non-recurrent or periodical readout of measured temperature
- Alarm parameter readout,
- Alarm parameters recording,
- Adjustment of data transmission rate

The keyboard makes possible triggering the cyclic temperature readout through the port (this option is used for the meter - printer arrangement), and setting the meter address.

The parameter programming mode is entered by selecting the "*MEMO*" position from menu, and confirming it by " ".

5.1. Cyclic readout period

Determining the period between the consecutive recordings of data, or consecutive data transmissions to the RS232 port.

In the programming mode "*MEMO*" select the position "*RSCT*" by " ". The auxiliary display indicates the current value in seconds. To change it depress " " (the digit on the auxiliary display will start blinking). Using " " set the required value.

The parameter can assume values from **1** to **240**.

Changes should be confirmed by " " (the message "*RSCT*" would start blinking again).

Depressing " " we can reach the next position of menu.

Depressing " " we come out of "*RSCT*", depressing " " again we leave the programming mode and enter temperature measurement mode.

5.2. Printing results

Determining whether measurement results should be sent to the RS232 port.

Using " "select the position "*TPRI*" in the programming mode "*MEMO*".

The auxiliary display indicates the current value of the parameter. To change it depress " " (the digit on the auxiliary display will start blinking).

Using " " set the required value.

The parameter can assume the following values:

0 results are not sent to the RS232 port,

1 sends measured temperature with frequency determined by "*RSCT***"** (see item. **5.1**).

2 sends measurement data from the memory (this operation does not erase the results).

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Completed changes should be confirmed by „   " (Factory settings will be recorded in the meter memory).

Depressing „   " we can go to the next menu position.

Depressing „   " we leave „*RSCT*", depressing „   " again we come out of the programming mode and we enter the temperature measurement mode.

5.3.   Recording results

Determining whether measurement results should be recorded in the meter memory.

Using „   " select „*TMEM*" position in the programming „*MEMO*" mode.

The auxiliary display indicates the current value of the parameter. To change it depress „   " (the digit on the auxiliary display will start blinking).

Using „   " set the required value.

The parameter can assume the following values:

0 results are not recorded,

1 storing in memory consecutive 300 measurements with frequency determined by „*RSCT"* (see item **5.1**),

2 storing in memory consecutive measurements. After memory overflow measurements are shifted "upwards" (the first position is deleted, and the (latest) result is recorded in the last position.

*ATTENTION : When the parameter value is **1** the first position of the auxiliary display presents symbol **Π**. It means that recording results in memory is in progress.*

The symbol comes off after recording 300 (results of) measurements.

Completed changes should be confirmed by „   " („*TMEM*" message would start blinking again). Depressing „   " we come out of „*TMEM*", depressing „   " again we leave the programming mode and enter the temperature measurement mode.

6.   SYST menu

The meter is equipped with parameter values protection against accidental changes or changes made by unauthorised persons. Restoring factory settings is also possible.

Enter the programming mode by depressing „   " for approx. 3 seconds . Select from menu the *"SYST"* position using „   ", confirm by „   ".

6.1. Protection

Setting the protection level.

In the *SYST*" programming mode use „   " to select „*PROT*".

The auxiliary display will show the current parameter value. To change it depress „   " (the digit in the auxiliary display will start blinking).

Using „   " set the required protection level.

The parameter can assume the following values:

0 protection off,

1 protection covers all parameters (excluding protection itself),

2 protection covers all parameters (excluding protection itself).

Removing protection is possible if the key „   " is depressed at the moment of switching on the meter.

Completed changes should be confirmed by „   " („*PROT*" message would start blinking again).

By depressing „   " we can enter the next position of menu.

Depressing „   " we leave „*PROT*", depressing „   " again we come out of the programming mode and enter the temperature measurement mode.

6.2.   Reset

Restoring factory parameter settings.

Switch on the meter depressing „   " at the same time.

Enter the programming mode by depressing „   " for approx. for 3 seconds. Select from menu the *"SYST"* position using „   ", confirm by „   ".

Using „ " select „**RESE**" position.

The auxiliary display will show the current parameter value. To change it depress „ " (the digit in the auxiliary display will start blinking).

Using „ " set the required value.

The parameter can assume the following values:

0 function off,

1 depressing „ " will restore factory settings.

Confirm completed changes by depressing „ " (factory settings will be entered to the meter memory)).

Depressing „ " we come out of „**SYST**".

Switch off the meter.

7. TEPR menu

7.1. Sensor type
Selection of the type of sensor connected to the meter.

Switch on the meter depressing „ " at the same time.

Enter the programming mode by depressing „ " for approx. 3 seconds. Select from menu the „**TEPR**" position using „ ", confirm by „ ".

Using „ " select „**SNSR**" position.

The auxiliary display will show the sensor symbol. To change it depress „ " (the sensor symbol in the auxiliary display will start blinking).

Using „ " set the required sensor type.

The parameter can assume the following values (corresponding symbols that will be displayed are shown in square brackets):

thermocouples T [t], J [J], K [h], R [r], S [5], B [b], N [n]

thermistors Pt100 [Pt], Ni100 [nl]

Confirm completed changes by depressing „ " („**SNSR**" will start blinking again).

Depressing „ " we come out of „**SNSR**".

Switch off the meter.

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7.2. Resolution of measurements

Determining the method of presenting results on the display.

Enter the programming mode by depressing „   " for approx. for 3 seconds. Select from menu the „**TEPR**" position using „   ", confirm by „   ".

Using „   " select „**TPOI**" position.

The auxiliary display will show the current parameter value. To change it depress „   " (the digit in the auxiliary display will start blinking).

Using „   " set the required value.

The parameter can assume the following values:

0 results displayed in 0.1°C resolution,

1 results rounded to full degrees.

Completed changes should be confirmed „   " („**TPOI**" would start blinking again).

Depressing „   " we leave z „**TPOI**", depressing „   " again we come out of the programming mode and enter the temperature measurement mode.

7.3. Characteristic offset

This parameter makes possible compensating resistance of cables connecting the meter and the thermistor, or to offset the thermocouple characteristic in case lower grade thermocouple sensor is used. Appropriate (different from zero) offset should be introduced to compensate a constant difference between the actual temperature of the sensor and the temperature indicated by the meter.

Switch on the meter depressing „   " at the same time.

Enter the programming mode by depressing „   " for approx. 3 seconds. Using „   "select the „**TOFF**" position from menu.

The auxiliary display will show the current value of the parameter. To change it depress „   " (the first digit of the auxiliary display will start blinking).

Using „   " set the required value, then depressing „   " go to the next digit.

The parameter can assume values from **9.9** to **+9.9**.

Completed changes should be confirmed by „   " („**TOFF**" message would start blinking again).

Depressing „   " we leave „**TOFF**".

Switch off the meter.

8.   R232 menu

These parameters make possible adequate configuration of the RS232 port for co-operation between the meter and a computer or a printer. Data transmitted between the computer and the meter are in ASCII code. They consist of 8 data bits and one stop bit.

Switch on the meter depressing „   " at the same time.

Enter the programming mode by depressing „   " for approx. 3 seconds. Select from menu the „*R232*" position using „   ", confirm by „   ".

8.1.   Meter address

A meter address is intended for selecting data directed to a particular meter by the co-operating computer. Different address values are required in case few meters are connected to one computer (it concerns meters equipped with the RS485 interface).

Using „   " select „*ADR* in the programming mode „*R232*"" .

The current value of the parameter will be presented on the auxiliary display. To change this value depress „   " (the first digit of the auxiliary display will start blinking). Using „   " set the required value, depressing „   " go to the next digit.

The parameter can assume values from **1** to **99**.

Completed changes should be confirmed by „   " („*ADR*") message would start blinking again).

Depressing „   " we leave „*ADR*".

Switch off the meter.

8.2. Transmission rate

Using „   " key select the position„*BAUD*" In the programming mode „*R232*".

The current value of the parameter will be presented on the auxiliary display. To change this value depress „   " (the first digit of the auxiliary display will start blinking). Using „   " set the required value.

The parameter can assume the following values: **600, 1200, 2400, 4800, 9600**

Completed changes should be confirmed by depressing „   "
("*BAUD*" message would start blinking again).

Depressing „   " we leave „*BAUD*".

Switch off the meter.

8.3.   Parity check

In the programming mode „*R232*" select „*PARI*' using „   " key.

The current value of the parameter will be presented on the auxiliary
display. To change this value depress „   " (the parameter value will start
blinking on the auxiliary display).

Using „   " key set the required value.

The parameter can assume the following values: **NONE**, **ODD**, **EVEN**.

Completed changes should be confirmed by „   " („*PARI*' message
would start blinking again)

Depressing „   " we leave „*PARI*'.

Switch off the meter.

# 9. Programming the meter through the RS232 port

The serial port makes possible remote programming of selected
parameters: modes and alarm thresholds, the mode and period of the cyclic
temperature readout, transmission rate, measurements recording mode,
and single temperature readout.

The programmed parameter value is always assigned to one particular
meter provided with a specific address.

Sending any data from the computer to the port interrupts the cyclic
readout of results

9.1 Data format

recording instruction or parameter

enquiry for temperature or parameter value

temperature readout

parameter value readout
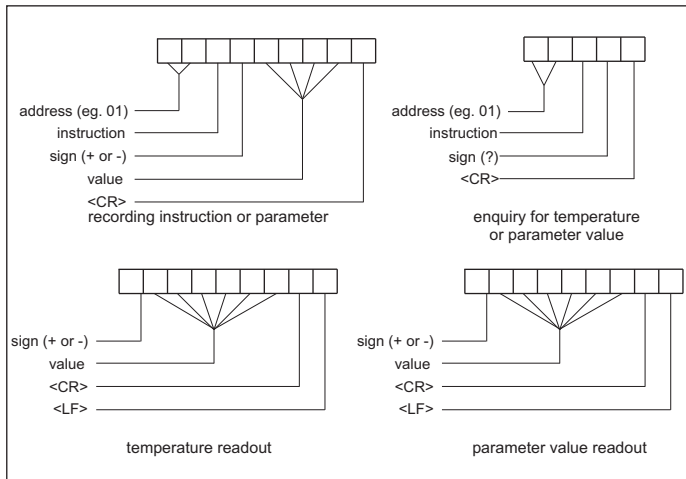
9.2. Parameter symbols

The meter accepts the following symbols of instructions:

A or **a** alarm mode 1,

B or **b** threshold 1 of the alarm 1,

C or **c** threshold 2 of the alarm 1,

D or **d** alarm mode 2,

E or **e** threshold 1 of the alarm 2,

F or **f** threshold 2 of the alarm 2,

P or **p** printing results,

   0 does not print

   1 prints results with the frequency determined by *RSCT* (see item **5.1**)

   2 prints results stored in the memory

- **R** or **r**   cyclic readout period,
- **S** or **s**   setting transmission rate,
  - *0* 600 bps
  - *1* 1 200 bps
  - *2* 2 400 bps
  - *3* 4 800 bps
  - *4* 9 600 bps
- **T** or **t**   temperature value (enquiry only),
- **U** or **u**   recording results in the memory,
  - *0* results are not recorded
  - *1* records in the memory 300 measurements and stops recording
  - *2* records in the memory consecutive results of measurements

10.   Making electrical connections

Functions of electrical terminals and the exemplary electrical wiring diagram are presented in the picture below.
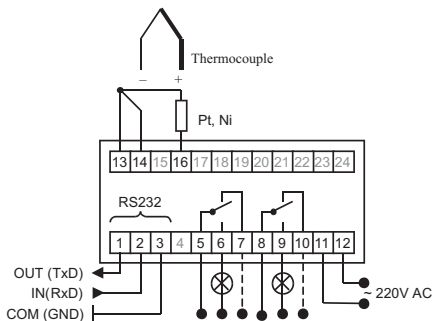
10.1 Power supply

Due to safety reasons the power supply cables should be fixed to terminals as the last ones, and should be disconnected from the power network prior to this operation.

10.2. Sensor

A thermocouple sensor should be connected to the meter through a compensatory cable suitable for the specific sensor type. Otherwise, varying in time compensation error will appear and it can reach significant values. The grade of the used thermocouple influences also the precision of temperature measurements. It especially concerns the range of higher temperatures.

In case of using a **thermoresisistor sensor** it is important to assure using the largest possible cross-section of conductors connecting the sensor to the meter. In the 3-wire method the sensor should be connected to the meter by three identical conductors. If the distance between the meter and the conductor is short it is admissible to connect these two objects by two conductors. Nevertheless errors introduced by this 2-wire method (1ºC for each 0,4 of conductor resistance) should be taken into account.

10.3. Alarm circuits

If the voltage of the power supply in the alarm circuit exceeds 24V then due to safety reasons electric connections in relay contact circuits can be executed only after disconnecting the power supply.

It should be remembered that the load of relay contacts should have resistive character, motors or condenser batteries are not admissible. For the latter cases intermediary contactors or other external relay elements should be used unconditionally. Taking into account the relay durability it is advisable to use an external contactor in case the output current exceeds 1 A. If the above recommendations are not observed relay contacts will wear out and lose their connecting properties fast.

10.4. Serial port

The serial port can be connected with a corresponding computer or a printer by the cable equipped with the special 9 or 25 pin *Cannon* connector. It depends on the computer (printer) design.

Only 3 pins are used, namely: input, output, and ground.

The connection between the meter and the connector is presented below:

Meter	1	2	3
connector 9 pin female	2	3	5
connector 25 pin female	3	2	7
	TxD	RxD	GND

11. Remarks concerning operational use of the meter

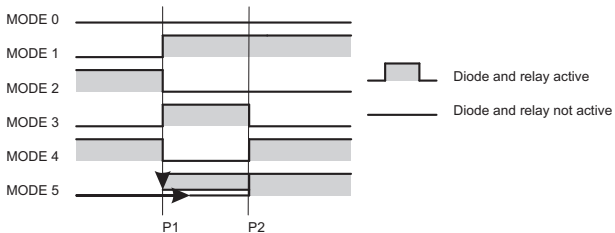The meter is a highly complicated electronic device. Its accuracy and reliability depend on its work environment.:

> unobstructed air flow should be assured around the closed part of meter casing

> placing the meter in vicinity of vibrating parts of machinery should be avoided, as vibrations can result in instantaneous errors in measurements

12. Technical data

Sensor work temperature range	J (Fe - CuNi)	[-100.0 .. +1000] °C
	K (NiCr - NiAl)	[-100.0 .. +1200] °C
	T (Cu-CuNi)	[-100.0 .. +230.0] °C
	R (PtRh13 - Pt)	[+200.0 .. +1600] °C
	S (PtRh10 - Pt)	[+200.0 .. +1600] °C
	B (PtRh30 - PtRh6)	[+400.0 .. +1800] °C
	N (NiCrSi - NiSi)	[-100.0 .. +1300] °C
	Pt100 (3-wire)	[-100.0 .. +850.0] °C
	Ni100 (3-wire)	[-60.0 .. +180.0] °C
Resolution of temperature display	0.1 [°C] or 1 [°C] for T < 1000 [°C]	
	1 [°C] for T > 1000 [°C]	
Temperature measurement error	< 0.2 [°C] 2 digits for T < 400.0 [°C]	
	< 0.4 [°C] 1 digit for 400.0 [°C] T < 700.0 [°C]	
	< 1.0 [°C] 1 digit for 700.0 [°C] T < 1000 [°C]	
	< 1.5 [°C] 1 digit for T > 1000 [°C]	
Minimum sampling period of sensor temperature	1 [sec.]	
Number of converter bits	16	
Result settling time	< 5 [sec.]	
Ranges of parameter settings	as in the table (see page 7)	
Factory settings of parameters	as in the table (see page 7)	
Alarm outputs	2 electromechanical relays	
Maximum peak current of relays	5 [A]	
Maximum constant current of relays	3 [A]	
Recommended current of relays	< 1 [A]	
Serial port	RS232 bi-directional	
Transmission parameters	8 data bits, one stop bit (remaining see the description - table, page 7)	

Power supply	220V +10% -15% 50..60Hz, 3VA
Ambient temperature	0 ..50 [°C]
Relative humidity	> 80 [%]
Weight	ok. 0.4 [Kg]
Dimensions h/w/d	96 x48 x 126 [mm]
Dimensions of installation window	92 x 43 [mm]

ALARM WORK MODES

NOTES