

# THERM MEASURING INSTRUMENT

## THERM 2420-1L

**Hand-held measuring instrument with display for thermocouples, types K, N, L, J, U, T, S, with 1 measuring input for miniature thermal connector, Maximum and minimum values and hold function**



### Technical features :

- ▶ Handy measuring instrument with built-in display
- ▶ 1 measuring input for sensor with miniature thermal connector
- ▶ 7 measuring ranges for thermocouples, types K, N, L, J, U, T, S, selectable
- ▶ Generously dimensioned 2-row static 7 / 16 segment display including units
- ▶ Easy and convenient to operate by means of 7 keys
- ▶ Measuring functions :  
Unit of temperature °C or °F, Measured value with cold junction compensation, thermal voltage mV, zero-setting, saving of maximum / minimum values, hold function
- ▶ Test functions :  
Segment monitoring, range monitoring, sensor breakage indication, battery voltage check and display

### Scope of delivery

Hand-held measuring instrument with built-in display, THERM 2420-1L with 1 measuring input for miniature thermal connector, LC display, 7 keys, including 3 AA alkaline batteries, operating instructions, and manufacturer's test certificate

### Technical data :

Measuring input:	For thermocouple via miniature flat connector
A/D converter:	delta-sigma, 15-bit resolution
Measuring ranges:	
NiCr-Ni(K)	-200 ... +1370 °C
NiCroSil-Nisil(N)	-200 ... +1300 °C
Fe-CuNi(L)	-200 ... +900 °C
Fe-CuNi(J)	-200 ... +950 °C
Cu-CuNi(U)	-200 ... +600 °C
Cu-CuNi(T)	-200 ... +400 °C
PtRh10-Pt(S)	0 ... 1760 °C
Resolution:	0,1K
Linearization accuracy:	
for thermocouples, types K, N, L, J, U, T :	±0.05K ±0.05% of measured value
type S :	±0.3K
Measuring rate:	2.5 mops (measuring operations per second)
System accuracy:	±0.1% of measured value ±3 digits
Nominal temperature:	22°C ±2K
Temperature drift:	0.01% / K
Cold junction compensation:	effective in range -30 to +80 °C (accuracy ± 0.2 K ± 0.01 K / °C)
Standard equipment:	
LC display: 7 segments:	Measured value 5 char., 15 mm Function 4½ characters, 9 mm
16 segments:	Units 2 characters, 9 mm 7 symbols
Keypad:	7 silicone keys
Power supply:	
Battery:	3 AA alkaline batteries
Current consumption:	approx. 10mA
Housing:	LxWxH 127 x 83 x 42 mm ABS (maximum 70 °C)
Operating temperature	-10 ... +60°C
Atmospheric humidity (ambient)	10 ... 90 % r.H. (non-condensing)

### Accessories:

Temperature sensor for liquids and gases	Order no. FTF15P
Temperature sensor for surfaces	Order no. FTF109PH
Temperature sensor for surfaces, angled head	Order no. FTF104PH
Spare battery, AA alkaline	Order no. ZB2000B1

**Order no. MT24201L**

## NiCr-Ni-sensor FTF 15 P



For immersion measurement

Meas. element: NiCr-Ni class 1 \*  
 Measuring tip: Operative range -200...+1100 °C  
 200x1.5 mm, sheathed line, Inconel  
 T<sub>90</sub>: \* 1.5 s  
 Cable: 1.4 m PVC  
 Connection: Miniature flat connector

L = 200 mm **Order no FTF15P**  
 including miniature flat connector

## NiCr-Ni sensor FTF 109 PH



For surface measurement

Meas. element: NiCr-Ni class 2 \*  
 Measuring tip: Operative range -50...+500 °C  
 Thermal ribbon, not electr. isolated  
 Measuring head approx. 15 mm diameter  
 T<sub>90</sub>: \* 1 s  
 Cable: appr. 1.5 m PVC  
 Connection: Miniature flat connector

L = appr. 180 mm **Order no FTF109PH**  
 including handle and miniature flat connector

## NiCr-Ni sensor FTF 104 PH



For surface measurement

Meas. element: NiCr-Ni class 2 \*  
 Measuring tip: Operative range -50...+500 °C  
 Thermal ribbon, not electr. isolated  
 Measuring head approx. 15 mm diameter  
 T<sub>90</sub>: \* 1 s  
 Cable: appr. 1.5 m PVC  
 Connection: Miniature flat connector

L = total approx. 180 mm,  
 90° angle, approx. 50 mm **Order no FTF104PH**  
 including handle and miniature flat connector

# THERM CONTROLLERS

## THERM Series Controllers and Panel Meters: Proven Design and Low Cost

Temperature is still an important measurable variable in industrial production and process control, in laboratories, development, manufacturing and quality assurance.

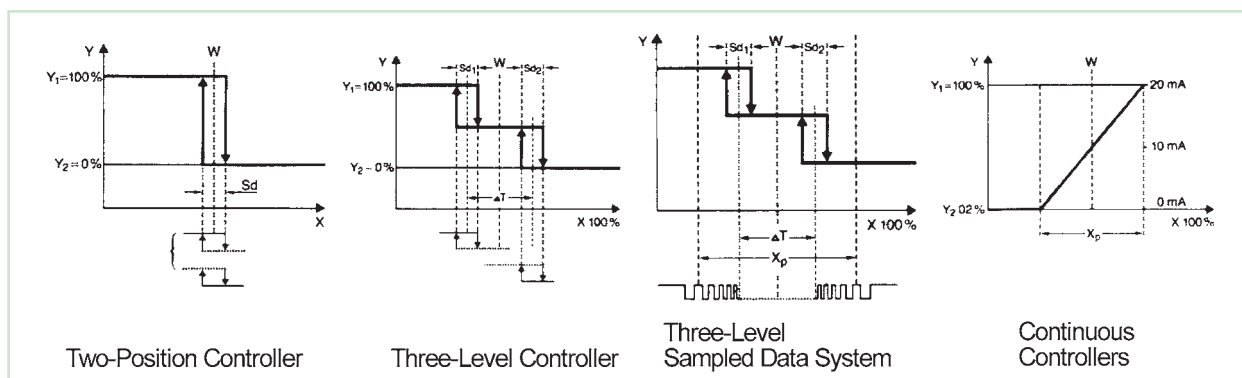
Therefore, we still have the THERM series measuring instruments available in our delivery program. For many fields of industrial temperature measurement, particularly in control engineering, they provide a solution that is optimal suited to the measuring task.

### Small Glossary of Control Engineering Terms:

Actual value x:	Instantaneous value of a sensor (instantaneous control variable).
Nominal value w:	Set control input.
Manipulated variable y:	Output signal (output variable, which is effective on the process controlled system).
Proportional band Xp:	Control engineering area in % of the measuring range, where the control variable causes a change of the manipulated variable.
P-control unit (P behaviour):	Causes a proportional change of the output variable, corresponding to the input variable.
I-control unit (I behaviour):	Causes modification speed of the output signal proportional to the time integral of the input signal (integral action time).
D-control unit (D behaviour):	Causes time-based differentiating behaviour of the output variable corresponding to the modification speed of the input signal (derivative action time Tv).
Delay time Tu:	With a step response it is the section that is cut by the tangent on the time axis in the turning point of the step response.
Deviation Xw:	Difference between control input (nominal value) and control variable (actual value).
Control amplitude:	Periodic control fluctuation around the nominal value.
Dead zone:	Neutral zone, where the output variable stays unaltered.
Switching hysteresis:	Difference between activation point and deactivation point of a switching contact Sd.
Step response:	Time-based variation of the output signal as a result of a step function at the input.
Limit value switch:	Limit values can be set analog or digital. Switch on/off at the set limit value.
Controller:	Controllers include special circuitry, which causes a two-output, three level action, three level step or a continuous control behaviour. A defined adjustable feedback behaviour allows a smooth approach of the nominal value, while an overshooting over the set nominal value can be avoided in most cases.
Two-step controller:	With control contacts for on/off function. Activation and deactivation points are separated by a pre-assigned switching hysteresis. The controllers are, as standard, equipped with a PD/PID feedback. Apart from the control contact the devices can be further equipped with additional limit value contacts.
Three-level controller:	With two coupled control contacts, which are effective on two separate output relays. Between the two contacts a 'dead zone' is located with its symmetrical centre being the point of the nominal value setting. The range of the dead zone is also adjustable. The devices do not provide a feedback behaviour.
Three-level step controller:	The arrangement of the control contacts corresponds to that of the three-level controllers. However, the output relays switch in a clocking way with decreasing intervals to approximate the actual value to the nominal value. The devices are equipped with a PI feedback.
Continuous controllers:	Equipped with a control output with its analog output variable being proportional to the change of the input signal. Within the proportional range a current signal of 0 to 20mA is provided as output. The controllers are, as standard, equipped with a PID feedback.

### The Right Controller For Any Task

Limit value switch:	Signaling or safety shut-off.
Two-step controller:	In all industrial fields, especially for heating systems.
Three-level controller:	Star-delta control and controls that require heating and cooling.
Three-level step controller:	Control of right/left run of servomotors or with control potentiometers etc.
Continuous controller:	Driving of Triac power output stages for continuous regulation of the electrical power of ohmic loads for a contactless, free from wear switching.



## Setting Range of the Feedback Behaviour of Controllers:

Model	standard *)	fast operating	slow operating
PD feedback	$x_p = 0.5 \dots 20\%$ $T_v = 7 \dots 80 \text{ s}$	$x_p = 0.5 \dots 20\%$ $T_v = 1 \dots 15 \text{ s}$	$x_p = 0.5 \dots 20\%$ $T_v = 60 \dots 200 \text{ s}$
PI feedback	$x_p = 0.5 \dots 20\%$ $T_n = 0.5 \dots 6 \text{ min}$	$x_p = 0.5 \dots 20\%$ $T_n = 4.5 \dots 70 \text{ s}$	$x_p = 0.5 \dots 20\%$ $T_n = 1 \dots 15 \text{ min}$
PID feedback	$x_p = 0.5 \dots 20\%$ $T_v = 7 \dots 80 \text{ s} / T_n = 0.5 \dots 6 \text{ min}$	$x_p = 0.5 \dots 20\%$ $T_v = 1 \dots 15 \text{ s} / T_n = 4.5 \dots 70 \text{ s}$	$x_p = 0.5 \dots 20\%$ $T_v = 60 \dots 200 \text{ s} / T_n = 1 \dots 15 \text{ min}$
PD/PID feedback	$x_p = 0.5 \dots 20\%$ $T_v = 7 \dots 80 \text{ s}$	$x_p = 0.5 \dots 20\%$ $T_v = 1 \dots 15 \text{ s}$	$x_p = 0.5 \dots 20\%$ $T_v = 60 \dots 200 \text{ s}$

\*) if no special note is included with the order the controller will be delivered with standard feedback function

## Measuring Ranges:

Type of Sensor	Meas. Range	Resolution	Linearisation Accuracy
NiCr-Ni (K)	-100.0 ... +199.9°C	0.1 K	<0.5% ± 1digit
Fe-CuNi (L)	-100 ... +1200°C	1 K	<0.5% ± 1digit
Fe-CuNi (J)	-100.0 ... +199.9°C	0.1 K	<0.5% ± 1digit
Fe-CuNi (J)	-100 ... +600°C	1 K	<0.5% ± 1digit
Cu-CuNi (U)	-100 ... +600°C	1 K	<0.5% ± 1digit
Cu-CuNi (T)	-100 ... +400°C	1 K	<0.5% ± 1digit
PtRh10-Pt (S)	+400 ... +1600°C	1 K	<0.5% ± 1digit
PtRh30-PtRh6 (B)	+400 ... +1600°C	1 K	<0.5% ± 1digit
Pt100 Ω 3 or 4-conductor	-150.0 ... +199.9°C	0.1 K	<0.5% ± 1digit
Pt1000 Ω 3-conductor	0 ... +600°C	1 K	<0.5% ± 1digit
Pt1000 Ω 3-conductor	-150.0 ... +199.9°C	0.1 K	<0.5% ± 1digit
NTC type C	0 ... +600°C	1 K	<0.5% ± 1digit
mA	0.0 ... 99.9°C	0.1 K	<0.5% ± 1digit
mV	0 ... 20 mA	0.01 mA	<0.5% ± 1digit
Volt	0 ... 1 V	0.01 V	<0.5% ± 1digit
	0 ... 10 V	0.1 V	<0.5% ± 1digit

# THERM CONTROLLERS

## Display Units, Limit Value Switches, Controllers THERM 4100/4200



### Technical Features:

- ▶ Analog linearisation. Various standard measuring ranges. Digital display of the actual value in red or green. Rear connectors with removable connector blocks.
- ▶ Limit value switches and controllers: Analog contact setting through slit potentiometer by pressing a key, which causes the nominal value to be displayed instead of the actual value. Adjustable feedbacks with normal (standard), fast or slow operation.
- ▶ Safety functions: Sensor breakage protection, meas. circuit monitoring through additional limit value channels. For limit value switches and controllers: automatic shut-off in case of a power failure.
- ▶ Various selective options allow for an optimal adaptation and, as a result, for infinite applications in industrial production and control engineering.

### Technical Data:

<b>Measuring input:</b>	terminal blocks, removable
Sensor power supply:	options: 24VAC, 12VAC, 12VDC, (max. 40mA)
Measuring method:	dual-slope integrating
Conversion rate:	3 measurements per second
Input impedance:	voltage input 100k $\Omega$ , current input 100 $\Omega$
System accuracy:	$\pm 1$ digit
Temperature drift:	0.05%/K
Cold junction compensation:	effective in range -10 to +50°C

### Equipment:

Display:	3 1/2-digit, 7-segment LED red (optional green), 13mm high
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### Outputs:

Limit val. switches & controllers:	center-zero relay 230V, 4A ohmic load
Switching hysteresis:	< 2 digits, or as specified
Continuous controllers:	proportional output signal 0 to 20mA for Triac power output stage
Analog output (option):	not in case of cont. controllers

### Power supply:

	230V 50–60Hz; optional: 110V 60Hz, 12VDC, 24VAC, 24VDC
Current consumption:	approx. 4.5VA

### Housing:

Dimensions:	4100: W 96x H 48x D 160mm, panel opening: 90 x 42.5mm 4200: W 96x H 96x D 160mm, panel opening: 90 x 90mm
Weight:	approx. 400–600g
Permiss. ambient temperature:	0 to 50°C
Storage temperature:	-30 to +70°C

### Options for Power Supply:

- DC voltage 12VDC
- DC voltage 24VDC
- AC voltage 24VAC, 50/60Hz
- AC voltage 110VAC, 50/60Hz

### Options for Analog Outputs:

- Analog output 5mV/°C
- Analog output 0 to 1V
- Analog output 0 to 10V
- Analog output 0 to 20mA
- Analog output 4 to 20mA

### Options for Sensor Power Supply

### Options for Additional Coupled Contacts

- Order no. OT4000U2
- Order no. OT4000U4
- Order no. OT4000U3
- Order no. OT4000U5

- Order no. OT4000R1
- Order no. OT4000R5
- Order no. OT4000R2
- Order no. OT4000R3
- Order no. OT4000R4

- on request
- on request

## Types

### Display Units:

Panel device 96 x 48mm	Order no. MT4190
Panel device 96 x 96mm with meas. point change-over switch 5-fold	Order no. MT42905
Meas. point change-over switch 5-fold, 96 x 48mm	Order no. UT41005

### Limit Value Switches:

Limit value switch 96 x 48mm, 1 limit value analog adjustable	Order no. MT4116
Limit value switch 96 x 48mm, 2 limit values analog adjustable	Order no. MT41161
Limit value switch 96 x 96mm, 1 limit value analog adjustable	Order no. MT4216
Limit value switch 96 x 96mm, 2 limit values analog adjustable	Order no. MT42161

### Two-Step Controllers:

Two-step controller 96 x 48mm, control contact analog adjustable	Order no. RT4126
Two-step controller 96 x 96mm, control contact analog adjustable	Order no. RT4226
Two-step controller 96 x 96mm, control contact analog adjustable, 1 additional limit value analog	Order no. RT42261

### Three-Level Controllers:

Three-level controller 96 x 48mm, control contact and dead zone analog adjustable	Order no. RT4136
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### Three-Level Step Controllers:

Three-level step controller 96 x 48mm, control contact and dead zone analog adjustable	Order no. RT4146
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### Continuous Controllers:

Continuous controller 96 x 48mm, control output analog adjustable	Order no. RT4156
Continuous controller 96 x 96mm, control output analog adjustable	Order no. RT4256
Continuous controller 96 x 96mm, control output analog adjustable, 1 additional limit value analog	Order no. RT42561

### Triac Power Output Stages:

Technical data: Input 4 to 20mA, approx. 250Ω; ohmic load  $\cos \phi = 1$ ; operating voltage 230V -14% +8%, 45 – 65Hz;  
Protection: fuse not integrated. The device must be externally protected according to the specified maximum current by using a fast-acting fuse.

Triac power output stage 12A, for 300 to 2000VA	Order no. ZB4000TR12
Triac power output stage 16A, for 350 to 2800VA	Order no. ZB4000TR16