

R2400

Electronic controller

Applications

The controller R2400 is a digital single-channel controller with microprocessor, in a compact case with front dimensions of 48 x 48 mm according to DIN 43700 for installation in panels, front panels, etc.

It excels by easy operation, high standard functionality and few versions.

The main fields of application are found in temperature control in machines for plastics processing and packaging industry, food processing, oven construction.

The controller R2400 is available in the following versions:

- two-state controller
- three-state controller
- step controller
- continuous controller

The controller R2400 is suited for controlled systems with the following characteristics:

Characteristics		
Tu	Delay time	1 s ... 10 min
Tg	Compensation time	1 min ... 10 h
Tg / Tu		> 5

Essential features

- Overshoot-free PDPI algorithm
- Second set point
- Set point ramp
- Self-optimization
- Alarm contact with startup suppression
- Monitor for the heating circuit
- Heating current monitor (with external transformer)
- Step controller with and without position readback
- Continuous controller with split range
- Continuous controller as switching controller with the controlled variable as continuous signal



Description

Actual value and set point are simultaneously digitally displayed. Light-emitting diodes signal the switching state of the switching outputs, the alarm output, manual mode and "second set point active".

The control parameters and the configuration values are entered via film keyboard and rotary knob. The configuration and parameter level can be protected against unauthorized changes.

A heating current monitor is possible as standard feature (except for marking A4). The heating current is acquired with the current transformer GTZ 4121. Display and evaluation are made on the controller. Violation of the set point of the heating current and/or non-equivalence cause an error message.

R2400

Electronic controller

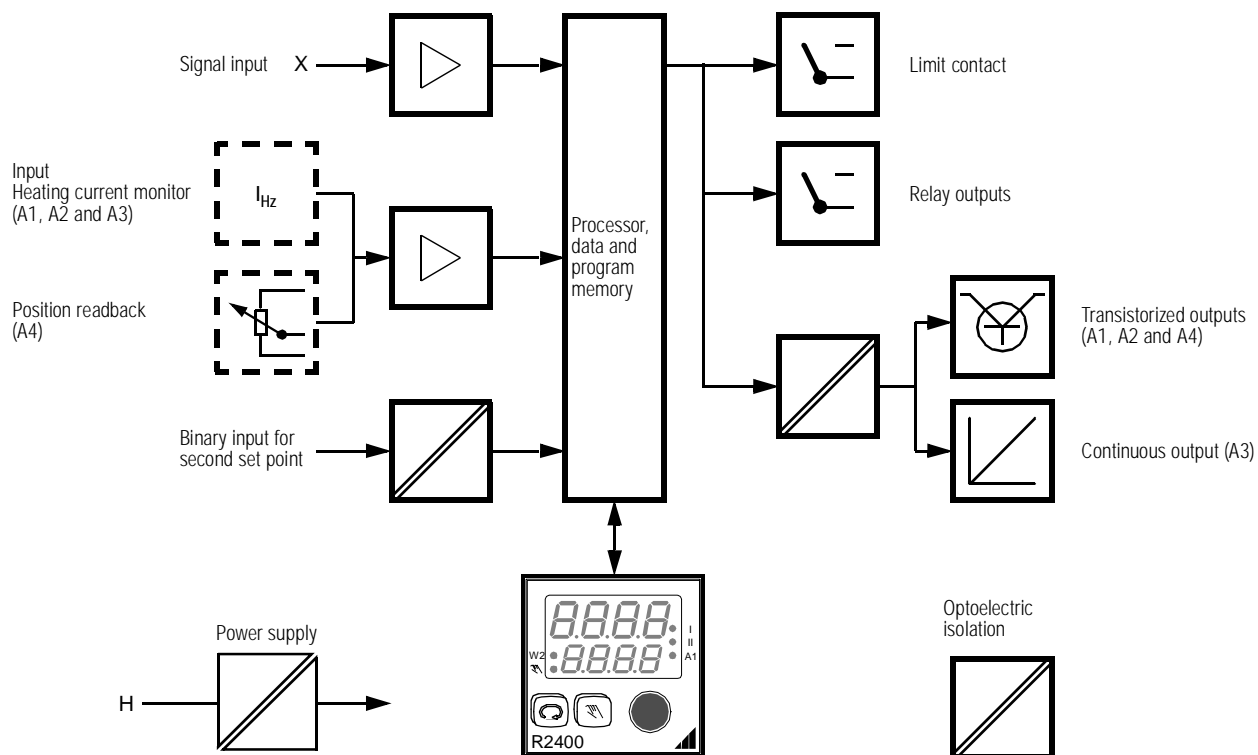


Figure 1, Block circuit diagram

Applied rules and standards

VDE 0411 T1 / IEC 1010-1 / DIN EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use
DIN EN 50081-2	Electromagnetic compatibility; generic emission standard
DIN EN 50082-2	Electromagnetic compatibility; generic immunity standard
DIN VDE 0106 T1	Electrical safety
VDI / VDE 3540 Sheet 2	Climatic classes for equipment and accessories
EN 60529	Degrees of protection provided by enclosures
DIN 3440	Temperature controller and temperature limit systems for heat production
CSA	Approval applied for
UL	Approval applied for

Signal inputs

Signal input	Transformer resolution 14 bits
Measuring ranges	See order code
Scanning cycle	0.5 s
Offset compensation	Possible by parameter entry

Configuration of the sensor input

Marking	Sensor	Selectable via keyboard
B1	Thermocouple Pt 100	See order code for measuring ranges °C / °F configurable
B2	DC voltage DC current	dead / live zero, 10 V / 20 mA Display range scalable

Thermocouple

Overload, continuous	AC sinusoidal 50 Hz / 3 V DC 1 V
Input resistance	> 50 kΩ
Cold junction	Compensation circuit built in
Error message	In the case of sensor breakage, wrong polarity (monitor for heating circuit) or temperature beyond measuring range

Resistance thermometer Pt 100

	Two-wire connection	Three-wire connection
Lead resistance (Forward/return wire)	0 ... 30 Ω can be balanced (with shorted sensor "on key stroke")	0 ... 30 Ω compensated
Overload, continuous	AC sinusoidal 50 Hz / 3 V DC 1 V	
Measuring current	approx. 0.2 mA	
Error message	In the case of breakage or short circuit of the sensor or temperature beyond measuring range	

DC voltage, DC current

	DC voltage	DC current
Measuring range	0/2 ... 10 V configurable	0/4 ... 20 mA configurable
Overload, continuous	100 V	60 mA DC
Input resistance / load	> 150 kΩ	< 50 Ω
Error message	With input variable beyond measuring range	With input variable beyond measuring range

Heating current monitor input (for version A1, A2 and A3)

Meas. range curr. transformer input GTZ 4121 000 R...	AC 0 ... 40 A
Measuring range heating current monitor input	DC 0 ... 10 V

Position readback input (for version A4)

Potentiometer nominal values	0.1 ... 1.0 kΩ
Measuring current	< 1.5 mA

Binary input for second set point

The second set point is activated via potential-free contact or potential-free electronic switch (optocoupler, etc.).

Open-circuit voltage	approx. 5 V
Short circuit current	approx. 1 mA

Second set point		
Active	Voltage drop across contact	< 2 V
Inactive	Residual current across contact	< 0.1 mA

Display

Controlled variable	
Display range	4-digit, digital
Height of numerals	10 mm

Master variable, heating current or manipulated variable	
Display range	4-digit, digital
Height of numerals	7.5 mm

Status and switching outputs	
	2+ 3 LED

Controlled variable

Marking	Measuring range	Display resolution
B1	All	1 °C / °F
B2	0 / 2 ... 10 V 0 / 4 ... 20 mA Scalable -1999 ... +9999 digit	1 digit

Position readback

	Measuring range	Display resolution
	Scalable 0 ... 100 %	1 %

Heating current

	Measuring range	Display resolution
	Scalable 0 ... 100,0 A	0.1 A

Operation

- Two keys for function selection
- Sinkable rotary knob for setting of values

Set points

Set point limitation	Upper and lower setting limit parameterizable
Second set point	Activated via external contact, value parameterizable on controller
Ramp function (separate for rise and fall)	Presetting of a gradual temperature change, in degrees per min. Activated when: – the auxiliary voltage is switched on – the actual set point is changed – the second set point is activated – changing from manual to automatic mode

R2400

Electronic controller

Control action

Configurable controller types

Two-state PDPI contr.	For heating
Two-state PDPI contr.	For cooling
Three-state PDPI contr.	
Three-state PDPI contr.	For constant switch-on time with variable switch-off time for the cooling algorithm
Continuous controller	
Continuous controller	With split range
Step controller	With and without position readback
Limit monitor	Two-state / three-state controller without time action
Positioner	

Self-optimization "On key stroke" from any operating state. Action on and manual change of the control parameters is possible.

Setting ranges of the control parameters

Display	Meaning	Setting range
<i>Pb I</i>	Proportional band switching output I	0.1 ... 999.9 %
<i>Pb II</i>	Proportional band switching output II (for three-state controller)	0.1 ... 999.9 %
<i>dbnd</i>	Deadband (for three-state controller and step controller)	0 ... MBU ¹⁾
<i>tu</i>	Delay time of the controlled system	off, 1... 9999 s
<i>tc</i>	Output cycle time	0.5 ... 600 s

¹⁾ MBU = range span

Outputs

Control outputs

Functions Switching output I (heat)
Switching output II (cool)

Output cycle Parameterizable on the range 0.5 ... 600 s

Output type Relay or transistorized output (selectable via DIP switch)

Relay output Potential-free normally-open contact (NOC)
Phase common to switching output I and II

Switching capacity AC/DC 250 V, 2 A, 500 VA / 50 W

Lifespan > 2•10⁵ switching cycles under nom. load

Interference protection Ext. RC elem. (100 Ω -47 nF) has to be connected to contactor

Transistorized output Suitable for commercially available solid state relays (SSR)

Switching state	Open-circuit voltage	Output current
Active (load ≤ 800 Ω)	< DC 15 V	10 ... 15 mA
Inactive	< DC 15 V	< 0.1 mA

Overload limit Short circuit, interruption continuous

Continuous controller

Functions Alternatively configurable
Regulation ratio Heat or Controlled Variable

Output variable Alternative
Current 0/4 - 20 mA, at < 450 Ω burden
Voltage 0/2 - 10 V, at > 550 Ω load

Transformer resolution 10 bits

Alarm output

Functions Alternatively configurable
low, high, low + high
relative / absolute
NOC / NCC
Startup suppression on/off
Potential-free normally-open contact (NOC)

Contact type Switching
capacity AC/DC 250 V, 2 A, 500 VA / 50 W
Lifespan > 2•10⁵ switching cycles under nom. load
Interference protection Ext. RC elem. (100 Ω - 47 nF) has to be connected to contactor

Heating current monitor

Heating current monitor Integrated

Acquisition of the heating current Via ext. current transformer Z 4121
(Scaling required for other external current transformers)

Technical data See data sheet Z4121

Entry of the nominal value of the heating current "on key stroke"

Error message at – Non-equivalence	Positioning signal 'off' + heating curr. 'on' Positioning signal 'on' + heating curr. 'off'
– Negative deviation from the current set point	Negative deviation from the set point of the heating current by more than 20 % with positioning signal 'on'
Signalling	Error message hard-wired to alarm output

Heating circuit monitor

Without external transformer, without additional parameters

Configurable Heating circuit monitor active / inactive

Error message at 100 % switched-on heater without rising temperature that is, with shorted thermocouple
heater stopped
sensor not in the heating circuit

Auxiliary voltage

Nom. value	Nominal range of use		Power consumption
	Voltage	Frequency	
AC 110 V	AC 95 V ... 121 V	48 Hz ... 62 Hz	Maximum 7 VA Typically 4,5 W
AC 230 V	AC 196 V ... 253 V		
AC 24 V	AC 21 V ... 26 V		

Accuracy

Input controlled variable	Typical error limit referred to MBU ¹⁾	Resolution referred to MBU
Thermocouple General B Type B > 600 °C	< 0.7 % < 0.7 %	< 0.02 % < 0.05 %
Resistance thermometer	< 0.7 %	< 0.02 %
DC voltage, DC current	< 0.5 %	< 0.02 %

¹⁾ Range span

	Error limit	
Cold junction	± 2 K	

	Error limit referred to measured value	Offset error
Input heating current	5 %	± 0.1 %
Position reedback	5 %	± 1 Ω

	Error limit referred to measured value	Resolution
Continuous output	< 1.5 %	0.1 %

Reference conditions

Reference variable	Reference condition
Ambient temperature Tref	23 °C ± 2 K
Cold junction temperature Tver	23 °C ± 2 K
Auxiliary voltage	Nom. value ± 1 %, for AC 50 Hz ± 1 % sinusoidal permissible common mode voltage to the electrically connected inputs 0 V DC / AC
Warm-up time	5 min (inputs in the measuring range)

Influence variables and variations

Influence variable	Nominal range of use	Maximum variation
Ambient temperature Tu	0 °C ... +50 °C	± 0,05 % MBU / K
Cold junction temperature Tver	0 °C ... +50 °C	0.1 K (Tver – Tref) / K
Lead resistance Thermocouple Pt 100 two-wire Pt 100 three-wire	RL = 0 ... 200 Ω RL = 0 ... 30 Ω RL = 0 ... 30 Ω	0.1 % MBU / 10 Ω 3 K / Ω (can be balanced) 0,1 % MBU / 10 Ω
Warm-up effect	≤ 5 min.	± 1 %

Electrical safety

Protection class	II, panel meter in the sense of DIN EN 61010-1 subclause 6.5.4
Degree of pollution	2, acc. to DIN EN 61010-1 subcl. 3.7.3.1 and/or IEC 664
Overvoltage category	II, according to DIN EN 61010 appendix J and/or IEC 664
Operating voltage	300 V according to DIN EN 61010

Radio interference suppression

acc. to DIN EN 50081-2
Measuring procedures EN 50011 limit class B

Immunity to interference

according to DIN EN 50082-2

Type of test	Specifications	Test severity level	Criterion
ESD	EN 61000-4-2	4 kV Contact discharge 8 kV Air path	B B
E-field	ENV 50140	10 V/m 80-1000 MHz	A
Burst	IEC 801-4	2 kV On all connection leads	B
HF	ENV 50141	10 V 0.15-80 MHz all connectors	A

Climatic suitability

Climatic suitability with reference to VDI/VDE 3540	3z / 0 / 50
Relative humidity, annual average, no dewing	75 %
Ambient temperature	Nominal range of use Function range Storage range
	0 °C ... + 50 °C 0 °C ... + 50 °C -25 °C ... + 70 °C

Mechanical configuration

Design type	Panel case of UL-VO listed plastic according to DIN 43700, side-by-side mounting possible without intermediate bars, except when using the accessory seal for bezel/panel (intermediate bar ≥ 10 mm)
Instrument module	Can be withdrawn without tools
Mounting position	Front vertical to maximum 45° declined to the rear
Protection type	IP 54 Front (with gasket and pressed rotary knob) IP 20 Case IP 20 Connectors
Weight	approx. 0.4 kg

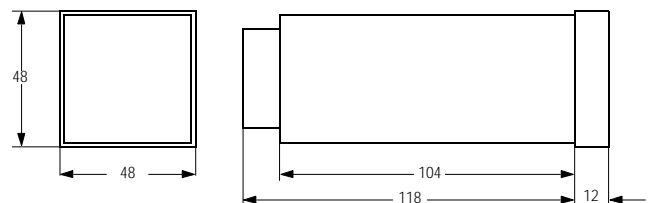


Figure 2, Case dimensions

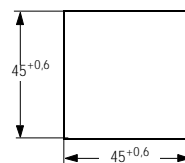


Figure 3, Panel cutout

R2400

Electronic controller

Electrical connection

Connection elements

Screw terminals suitable for stranded wire 1.5 mm² and/or twin-wire multi-core cable ends for 2 × 0.75 mm²

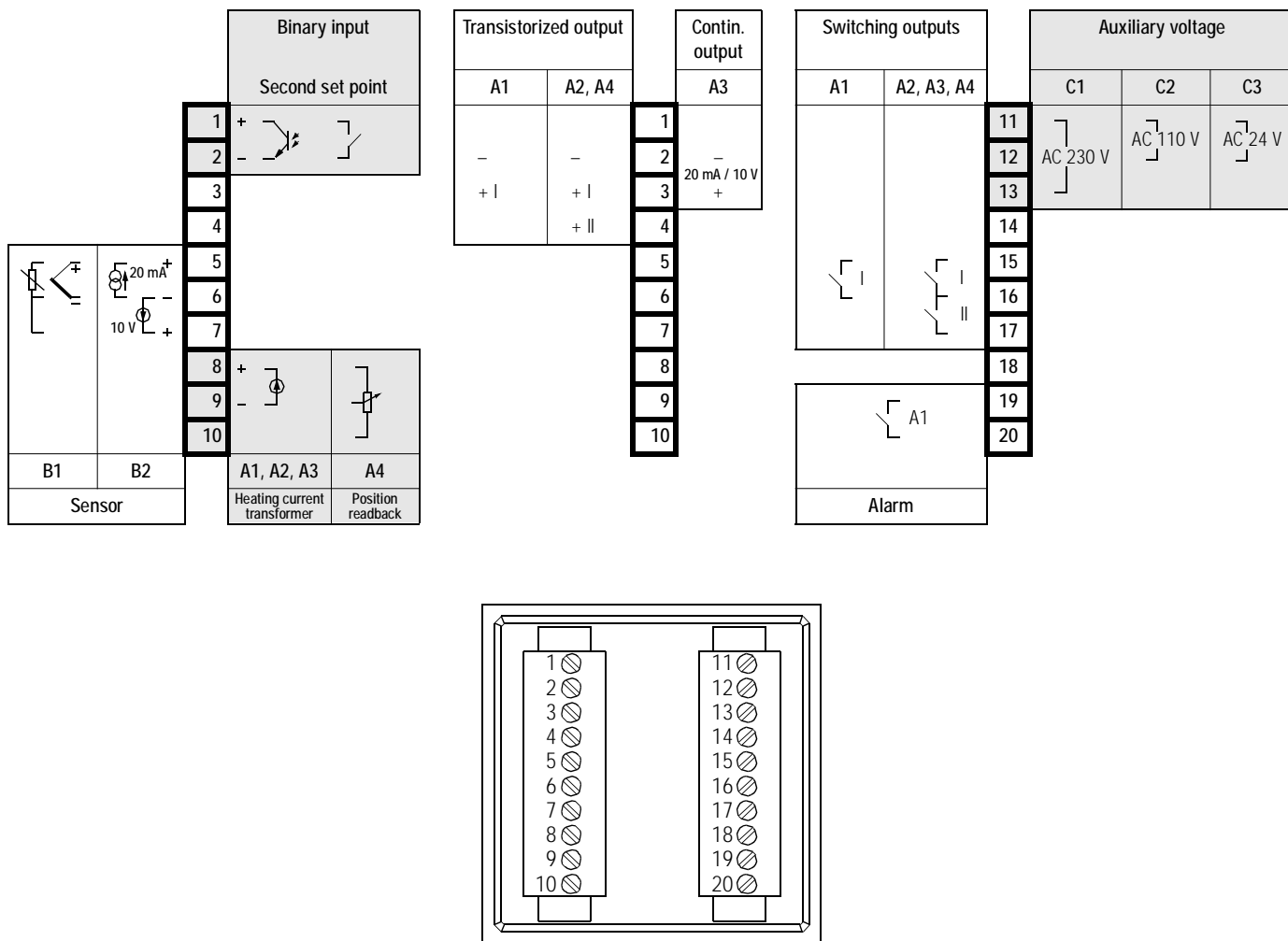


Figure 4, Location of the connection contacts

Scope of delivery

- Controller
- 2 Fasteners
- 1 seal for front panel
- Multi-lingual operating instructions

Order code

The following applies to determination of the order code:

Only one marking of like capital letters may be chosen.

If the capital letter of the marking is followed by zero numerals only, this marking may be omitted in the order code.

DESCRIPTION	MARKING
Electronic controller With self-optimization, limit relay, second set point Front dimensions 48 x 48 mm	R2400
Controller version	
Two-state controller with heating current monitor with relay output and transistorized output	A1
Three-state controller with heating current monitor / step controller with 2 relay outputs and 2 transistorized outputs	A2
Continuous controller / three-state controller with heating current monitor / step controller with continuous output and 2 relay outputs	A3
Step controller with position readback / three-state controller with 2 relay outputs and 2 transistorized outputs	A4
Measuring ranges	
Thermocouple, configurable	
Type J, L -18 ... 850 °C / 0 ... 1562 °F	
Type K -18 ... 1200 °C / 0 ... 2192 °F	
Type S, R -18 ... 1770 °C / 0 ... 3218 °F	
Type B 0 ... 1820 °C / 32 ... 3308 °F (precision specified from 600 °C)	B1
Type N -18 ... 1300 °C / 0 ... 2372 °F	
Resistance thermometer Pt 100	
- 100 ... 500 °C / -148 ... 932 °F	
Standard signal, configurable	
0 / 2 ... 10 V or 0 / 4 ... 20 mA	B2
Auxiliary voltage	
AC 230 V } C1 → C2, and/or C2 → C1 internal plug change possible	C1
AC 110 V }	C2
AC 24 V	C3
DC 24 V on request	C4
Configuration	
Standard setting	K0
Configuration according to customer's specifications	K9
Customer-specific front film	
On request	

Note: A copy of multi-lingual operating instructions with information on startup and operation is part of the supply.

Example for ordering

DESCRIPTION (clear text)	MARKING
Electronic controller Front dimensions 48 x 48 mm	R2400
Controller version Three-state controller with heating current monitor, 2 relay outputs and 2 transistorized outputs	A2
Measuring range Thermocouple	B1
Auxiliary voltage AC 230 V	C1
Configuration Standard setting	K0

See last page for accessories

R2400

Electronic controller

Accessories

DESCRIPTION	IDENT NUMBER		
Current transformer for mounting to top-hat rail for acquisition of the heating current			
With 3 inputs (1 three-phase consumer or 3 AC consumers)	GTZ 4121 000 R0001		
With 4 inputs (1 three-phase consumer + 1 AC consumer or 4 AC consumers)	GTZ 4121 000 R0002		
Solid state load relays for mounting to top-hat rail, for connection to transistorized outputs			
	280 V, 10 A	GTZ 4102 001 R0001	
	280 V, 25 A	GTZ 4102 001 R0002	
	280 V, 45 A	GTZ 4102 001 R0003	

	480 V, 10 A	GTZ 4102 002 R0001	
	480 V, 25 A	GTZ 4102 002 R0002	
	480 V, 40 A	GTZ 4102 002 R0003	

Heat sink for mounting to top-hat rail	Length 80 mm	GTZ 4102 003 R0001	
	160 mm	GTZ 4102 003 R0002	
	160 mm	GTZ 4102 003 R0003	

Protecting cover (contact protection)		GTZ 4102 004 R0001	