

R0300

Multi-channel controller

Applications

The multi-channel controller R0300 has been designed for use on temperatures control systems such as injection molding, extruding, textile processing, blow molding machines, and heating ovens.

The R0300 controller is intended for connection to SPC or computer and is available in the following controller types:

- Two-state/three-state controller
- Three-state step controller
- Continuous controller
- Hot-runner controller

The R0300 controller is suited for controlled systems with the following characteristics

Characteristics	Two-state controller, three-state controller	Step controller
Tu delay time	1 s ... 10 min	0 ... 10 min
Tg compensation time	1 min ... 10 h	10·Ty ... 10 h
Tg / Tu	> 5	> 10
Ty	–	10 s ... 300 s



Essential features

- 2 or 4 control channels
- PDPI control action with self-optimization
- Limit monitoring
- Second set point
- Individual variable, slave, differential control with version as two-channel controller
- Start-up circuit for hot-runner control
- Heating current monitor
- RS485 or TTY data interface
- Parameter setting and configuration of the controller via optional SC300 software

Description

The R0300 digital multi-channel controller simultaneously displays the control loop number, the actual value and the set point in digital form. In addition, it is possible to simultaneously display the deviation of all channels as two-colored bar graph.

Light-emitting diodes signal the switching state as well as a fault in the heating circuit.

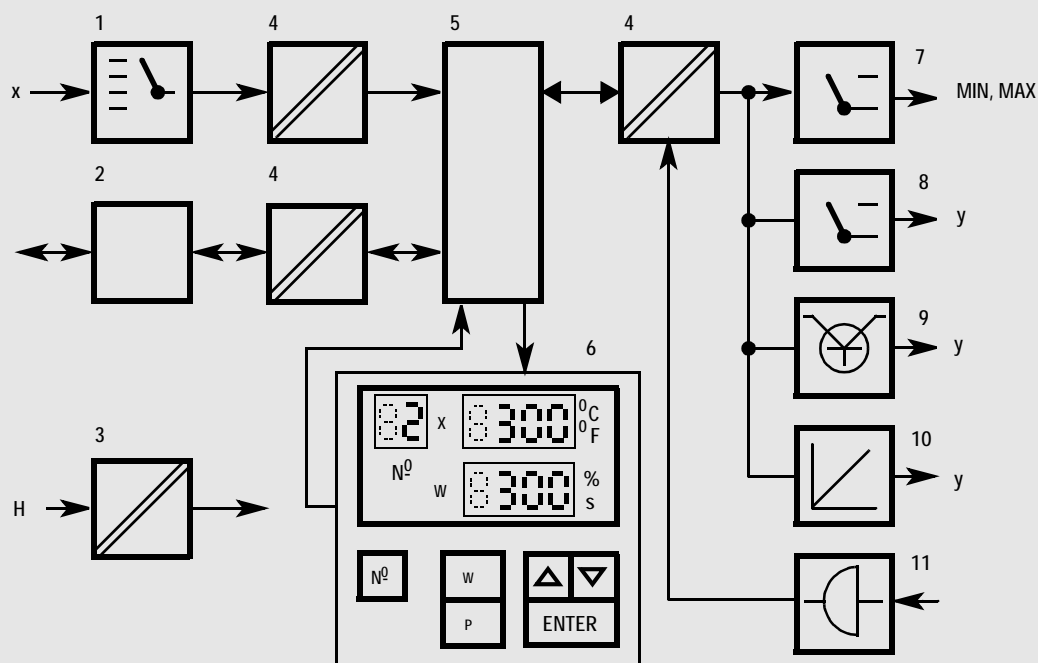
The controller characteristics are entered via a dust and water-proof film keyboard.

Optional operation of the controller via a PC menu prompting has advantages over the operation on the unit:

All controller settings are presented in clear form on one screen. All parameters can be changed from the keyboard. Several units can be operated centrally.

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- | | |
|--------------------------------------|---|
| 1 Signal inputs and multiplexer | 7 Limit outputs |
| 2 Data interface | 8 Relay outputs (switching points) |
| 3 Power supply | 9 Transistorized outputs (switching points) |
| 4 Optoelectric isolation | 10 Continuous outputs |
| 5 Processor, data and program memory | 11 Switching inputs |
| 6 Display and keyboard | |

Figure 1: Block circuit diagram R0300

Applied rules and standards

VDE 0160	Fitting of power systems with electronic equipment
VDE 0871	Radio interference suppression of radio frequency equipment
IEC 348	Safety requirements for electronic measuring apparatus
DIN 40 050	Classification of degrees of protection provided by enclosures
VDE/VDI 3540	Reliability of measuring and control equipment
DIN 43 700	Measurement and control instruments for panel mounting, nominal front and cut-out dimensions
DIN 43 718	Front panels and front frames of measurement and control equipment

Symbols and their meaning

Symbol	Meaning
X	Measured variable (actual value)
X1	Lower range limit
X2	Upper range limit
X2 - X1	Measuring span
W	Set point
Y	Continuous output
Ty	Positioning time of the servomotor
H	Auxiliary voltage
Hn	Nominal value of the auxiliary voltage

Technical Data

Signal inputs

4 electrically connected inputs of like type. All inputs have common isolation from the digital electronics by means of optocouplers (see figure 1).

Measuring ranges See order code

Scanning cycle 1 s (per channel)

DC voltage, DC current

	DC voltage	DC current
Input resistance	> 50 k Ω	< 55 Ω
Error message	With input variable beyond measuring range	With input variable beyond measuring range
Lower range limit	X1 = 0 or 2 V selectable	X1 = 0 or 4 mA selectable

Thermocouple

Lead resistance	0 ... 200 Ω
Error message	With sensor failure or temperature beyond measuring range
Cold junction	Compensation built-in, disconnectable

Resistance thermometer

	Two-wire connection	Three-wire connection
Lead resistance	10 Ω calibrated-in	0 ... 100 Ω
Error message	With failure or short circuit of sensor, or temperature beyond measuring range	

Input configuration

Marking	Sensor	Keyboard-selectable	
		Type J (IEC)	Type L (DIN)
B 01 / 02	Fe-CuNi	Type J (IEC)	Type L (DIN)
B 06	PtRh-Pt	Type S	Type R
B 07 ... 11	Pt 100	Two-wire connection +10 Ω calibrated-in	Three-wire connection
B 12	DC voltage	0 ... 10 V	2 ... 10 V
	DC current	0 ... 20 mA	4 ... 20 mA

Switching inputs

Activated via potential-free contact or potential-free electronic switch (optocoupler, etc.).

Symbol	Behavior when connecting ¹⁾ the terminal to \perp
HZ	Light-emitting diode flashes and signals heating current error, e.g. in connection with current transformer type 4990W-AD007
EXW	Second set point active
EXR	Control function with hot runner controller

Overload limit Short circuit with open input < I24 VI.

1) Connect with a jumper, a potential-free contact, or similar.

Display

Display range 4-digit

Display height 10 mm

Resolution of controlled variable and set point

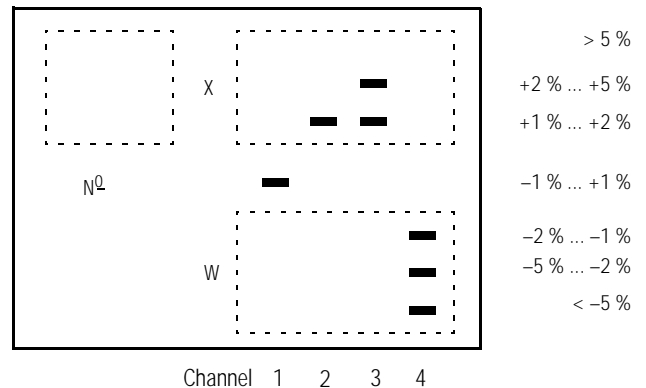
Marking	Unit	Resolution
B 07, B 10	$^{\circ}$ C or $^{\circ}$ F	0.1 degree
B 12 (freely scalable)	%, $^{\circ}$ C or $^{\circ}$ F	1 digit
B 01 ... B 06, B 08, B 09, B 11	$^{\circ}$ C or $^{\circ}$ F	1 degree

Deviation

Simultaneous display of all channels; activated by key stroke

Display element 7-segment displays

Display range \pm 1 ... 5 % in 7 steps



Regulation ratio

In manual and automatic mode; activated by key stroke

Set point

Set point limitation By channels, up and down (absolute)

2nd set point Activated by external contact, value settable on the unit individually for each channel.

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Control action	
Controller type	Two-state, three-state controller, three-state step controller, continuous controller or split-range controller. DDC (direct digital control)
Input structure	Fixed-value control Differential control (two-channel controller only) 2nd signal input has same measuring range as 1st signal input. Slave control (two-channel controller only) Input for external set point has same measuring range as signal input for controlled variable.
Control algorithm	Similar to PDPI
Time action	Disconnectable, in which case the unit can be used as limit value monitor. I and D element optionally disconnectable.
Self-optimization	Available as option, simultaneously running for the selected channels. Start via control panel. Optimizing run is shown. Manipulation and manual change of parameters is possible at any time.

Sensor error	Output of the last determined regulation ratio or output of a preset regulation ratio or disconnection of the control outputs (selectable).
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Permissible changing speed of the controlled variable $\Delta x/\Delta t$

Two-state, three-state, continuous controller	Three-state step controller
$\frac{X2 - X1}{0.5 \text{ min}} \leq \frac{\Delta x}{\Delta t} \leq \frac{X2 - X1}{5 \text{ h}}$	$\frac{X2 - X1}{5 \cdot T_y} \leq \frac{\Delta x}{\Delta t} \leq \frac{X2 - X1}{5 \text{ h}}$

Setting ranges of the control parameters

Display	Meaning	Setting range
Pb I	Proportional band 1st switching output	0.1 ... 500.0 %
Pb II	Proportional band 2nd switching output (for three-state controller)	0.1 ... 500.0 %
dbnd	Deadband (for three-state controller)	0 ... (X2 - X1)
ti	Integral action time	0 ... 5000 s
td	Derivative action time	0 ... 5000 s
tc	Output cycle time	1 ... 1000 s

Start-up circuit for hot runner

Clock	For drying of heating cartridges, the starting phase can be activated with a reduced regulation ratio for pulse group control.
Regulation phase	Can be limited on the 0 ... 100 % range during the ratio starting
Start-up circuit / control	Change-over via temperature threshold

Accuracy		
Input	Error limit referred to (X2 - X1)	
Thermocouple	X2 - X1 ≤ 600 °C	1.0 %
	X2 - X1 > 600 °C	0.5 %
Resistance thermometer	X2 - X1 ≤ 150 °C	1.0 %
	X2 - X1 > 150 °C	0.7 %
DC voltage, DC current	0.7 %	

Control constancy: typically ± 0.1 % referred to X2 - X1

Switching output	
Output cycle	Settable on the range 1 ... 1000 s
Output type	Relay or transistorized output at option. All outputs are isolated from the digital electronics by means of optocouplers.

Relay output

1 potential-free normally-open contact	
Switching capacity	AC / DC 250 V, 2 A, 500 VA / 50 W
Lifespan	>10 ⁷ duty cycles for the mechanical life >10 ⁶ duty cycles under nominal load

Transistorized output

All transistorized outputs electrically interconnected on ⊥. Suited for commercially available solid state relays (SSR).

Switching state	No-load voltage	Output current	
		Load 0 ... 2 kΩ	Load 0 Ω
Inactive	< DC 33 V	< 0.2 mA	
Active	< DC 33 V	> 10 mA	< 15 mA
Overload limit	Short circuit, continuously		
Manual/automatic	Change-over possible in configuration mode or via data interface. No position transmission.		

Continuous output

Output variable	DC 0 / 4 ... 20 mA; Load 0 ... 250 Ω or DC 0 / 2 ... 10 V; Load > 10 kΩ, short-circuit-proof Internal resistance < 100 Ω
Characteristic	Configurable, falling or rising
Split-range (Marking A13)	In this controller mode, the output of the regulation ratio is divided into a continuous and a time-proportional switching range. The change from continuous to switching output is automatically determined by the controller.
Manual/automatic	Change-over possible in configuration mode or via data interface.

Datenschnittstelle

Type	RS 485	TTY / 20 mA passive
Number of devices on the bus	Max. 32 devices in parallel	Max. 10 devices in series
Number of bus lines	3	2
Transmission speed	9600 bits/s	9600 bits/s

Parity	none
Number of data bits	8
Number of stop bits	1
Operating mode	Half-duplex
Character font	ASCII 0AH, 0DH, 20H ... 7FH

Monitoring functions

Limit monitoring

Function	One low and one high limit settable per channel
Action	Settable relative to set point or absolute.
Output	Common to all high limits is one NOC AC/DC 250 V, 2A, 500 VA/50 W as well as common to all low limits one NOC AC/DC 250 V, 2A, 500 VA/50 W each in OR operation of all channels.
Setting range	X1 ... X2
Switching action	Open-circuit current or closed-circuit current (option)
Switching difference	0.01 (X2 – X1)

Switching states of the limit contacts

Auxiliary voltage		Off	On	On	On
Setting Actual value X relative		Any	< W – AL L	> W – AL L < W + AL H	> W + AL H
Setting Actual value X absolute		Any	< AL L	> AL L < AL H	> AL H
Common low limit contact MIN	D1	Closed	Closed	Open	Open
Set with AL L	D2	Closed	Open	Closed	Closed
Common high limit contact MAX	D1	Open	Open	Open	Closed
Set with AL H	D2	Open	Closed	Closed	Open

Auxiliary voltage

Nominal values Hn	Nominal range of use
AC 24 V	AC 21 V ... 26 V
AC 110 V	AC 94 V ... 121 V
AC 120 V	AC 102 V ... 132 V
AC 220 V	AC 187 V ... 242 V
AC 230 V	AC 196 V ... 253 V
AC 240 V	AC 204 V ... 264 V

Nominal range of use of the frequency	48 Hz ... 62 Hz
Power consumption	< 24 VA, typically 10 W

Reference conditions

Reference quantity	Reference condition
Ambient temperature	23 °C ± 2 K
Cold junction temperature	23 °C ± 2 K
Auxiliary voltage	Hn ± 1 %, 50 Hz ± 1 %, sinusoidal

Influence quantities and variations

Influence quantity	Nominal range of use	Maximum variation referred to the measuring range of the controlled variable
Ambient temperature	0 °C ... +50 °C	± 0.05 %/K
Cold junction temperature	0 °C ... +50 °C	± 0.2 K/K
Lead resistance Pt 100 two-wire three-wire Thermocouple	RL = 0 ... 10 Ω RL = 0 ... 100 Ω RL = 0 ... 200 Ω	Can be balanced externally ± 0.1 % /10 Ω ± 0.5 % /100 Ω
Auxiliary voltage	Hn +10 %, -15 %	± 0.2 %
Variation due to warm-up	≤ 15 min	± 1 %

Electrical safety

Protection class	I
Insulation group	A C, with installation in case, panel, switching cabinet, etc. with protection type IP 54
Nominal insulation	Signal inputs, switching input, transistorized output Interface DC 36 V Auxiliary voltage, relay output AC 250 V
Radio interference suppression	Interference degree N, limit class B

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Climatic suitability

Climatic class	3z / 0 / 50 / 75 %; no dewing
Temperature range	
Functional	0 °C ... +50 °C
Storage	-25 °C ... +65 °C

Electrical connection

Connection elements	Insulated receptacles 1 x 6.3 x 0.8 or 2 x 2.8 x 0.8 per pin (not included with the supply)
Transistorized outputs 547 to 847	Each to ⊥ (pin 48)

Mechanical configuration

Type	Panel case, side-by-side mounting without intermediate bars, controller as instrument module pluggable in case
Fastening	With screw clamps according to DIN form B
Mounting position	Any
Protection type	IP 54, case sealed to panel by sealing ring (seal included with the supply) IP 20 for the terminals
Weight	≤ 1.5 kg

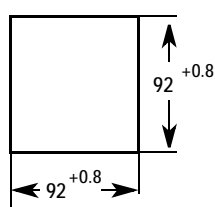


Figure 2:
Panel cut-out

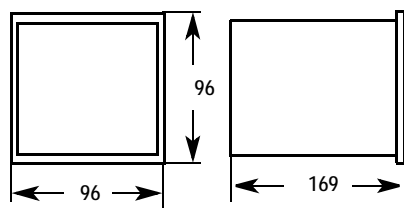


Figure 3:
Case dimensions

Assignment of the controller outputs

Marking	Number of channels	Controller type	Switching output I / II	Relay/transistorized outputs				Transistorized outputs			
				1	2	3	4	5	6	7	8
A01	2	Two-state controller	Relay	K1 I	K2 I						
A02, A22			Transistorized				K1 I	K2 I			
A03	4		Relay	K1 I	K2 I	K3 I	K4 I				
A04, A24			Transistorized				K1 I	K2 I	K3 I	K4 I	
A05	2	Three-state controller/ step controller	Relay / relay	K1 I	K2 I	K1 II	K2 II				
A06			Transistorized / relay	K1 II	K2 II			K1 I	K2 I		
A07	4		Relay / transistorized	K1 I	K2 I			K1 II	K2 II		
A08			Transistorized / transistorized					K1 I	K2 I	K1 II	K2 II
A09	4		Transistorized / relay	K1 II	K2 II	K3 II	K4 II	K1 I	K2 I	K3 I	K4 I
A10			Relay / transistorized	K1 I	K2 I	K3 I	K4 I	K1 II	K2 II	K3 II	K4 II
A11			Transistorized / transistorized	K1 II	K2 II	K3 II	K4 II	K1 I	K2 I	K3 I	K4 I
A12	2	Contin. controller	Continuous	K1St	K2St			K1 I	K2 I		
A13		Split-range controller	Continuous / transistorized	K1St	K2St			K1 I	K2 I	K1 II	K2 II

K1 ... K4 = channel 1 ... 4 I = 1st switching output II = 2nd switching output St = continuous output

Order code

To avoid inquiries when handling the order, your ordering information must be complete and unambiguous. The order for the units or parts can be placed either by giving all characteristics in clear text or by means of all markings and/or the Ident Number. When determining the order code, please note the following:

- The chosen marking column must be maintained.
- Only one marking of like capital letters or series of capital letters must be chosen.
- If the capital letters of the marking are followed by the numeral 9, additional information is required in clear text.
- If the capital letters of the marking are followed by zero numerals only, this marking may be omitted in the order code.

DESCRIPTION		MARKING			
Multi-channel controller	Front dimensions 96 x 96 mm	GTR0300			
Controller type	Two-state controller	2 channels relay output	A01		
		2 channels transistorized output	A02		
		4 channels relay output	A03		
		4 channels transistorized output	A04		
	Three-state controller / step controller	2 channels	1st switch. output Relay	2nd switch. output Relay	A05
			2 channels Transistorized	Relais	A06
		2 channels	Relay	Transistorized	A07
		2 channels	Transistorized	Transistorized	A08
		4 channels	Transistorized	Relay	A09
		4 channels	Relay	Transistorized	A10
		4 channels	Transistorized	Transistorized	A11
Continuous controller	2 channels		A12		
	2 channels	Additionally with switching transistorized output	A13		
Hot-runner controller	2 channels transistorized output		A22		
	4 channels transistorized output		A24		
Measuring range	Thermocouple Type J / L	X1 ... X2 / X1 ... X2			
		0 ... 300 °C / 32 ... 572 °F	B01		
	Type K	0 ... 600 °C / 32 ... 1112 °F		B02	
		0 ... 400 °C / 32 ... 752 °F		B03	
		0 ... 800 °C / 32 ... 1472 °F		B04	
	Type S / R	0 ... 1200 °C / 32 ... 2192 °F		B05	
0 ... 1600 °C / 32 ... 2912 °F			B06		
Resistance thermometer Pt 100	Two-wire or three-wire connection	0 ... 100 °C / 32 ... 212 °F	B07		
		0 ... 300 °C / 32 ... 572 °F	B08		
	0 ... 600 °C / 32 ... 1112 °F	B09			
	- 50 ... 100 °C / -58 ... 212 °F	B10			
	- 100 ... 200 °C / -148 ... 392 °F	B11			
DC voltage	DC current	0/2 ... 10 V	B12		
		0/4 ... 20 mA			

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DESCRIPTION		MARKING
Auxiliary voltage / nominal range of use	AC 21 ... <u>24</u> ... 26 V	C1
	AC 94 ... <u>110</u> ... 121 V	C2
	AC 102 ... <u>120</u> ... 132 V	C3
	AC 187 ... <u>220</u> ... 242 V	C4
	AC 196 ... <u>230</u> ... 253 V	C5
	AC 204 ... <u>240</u> ... 264 V	C6
Limit value monitor	None	D0
	MIN and MAX, open-circuit current	D1
	MIN and MAX, closed-circuit current	D2
Self-optimizing	No	E0
	Yes	E1
Data interface	None	F0
	Type RS 485	F1
	Type TTY/20 mA	F2
Operating Instructions	None	K1
	German	K0
	English	K2
	French	K3
	Spanish	K4

Example for ordering

Description (clear text)	Marking
Multi-channel controller 96 x 96 mm	R0300
Controller type two-state controller, 2 channels, relay output	A01
Measuring range resistance thermometer Pt 100 0 °C ... 100 °C	B07
Auxiliary voltage AC 196 V ... 253 V	C5

Accessories

Description		IDENT NUMBER
Current transformer, type 0 ... 40 A	4 channels with integrated evaluation	4990W-AD007
Balancing resistor AW 10	For Pt 100, two-wire connection Minimum ordering quantity 5 each	GTY 2560 003 R01
Configuration program SC 300	For IBM-compatible PC, German and English	GTZ 4801 000 R0001
Relay	For mounting to top-hat rail for connection to transistorized outputs	GHR 1568 001 R0001