R0300
Multi-channel controller

3-349-292-03
1/8.04

Application

The multi-channel controller R0300 has been designed for use on temperature control systems such as injection moulding, extruding, textile processing, blow moulding machines, and heating ovens. The R0300 controller is intended for connection to PLC or computer and is available in the following controller types:

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

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

Characteristics	Two-step controller, three-step 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

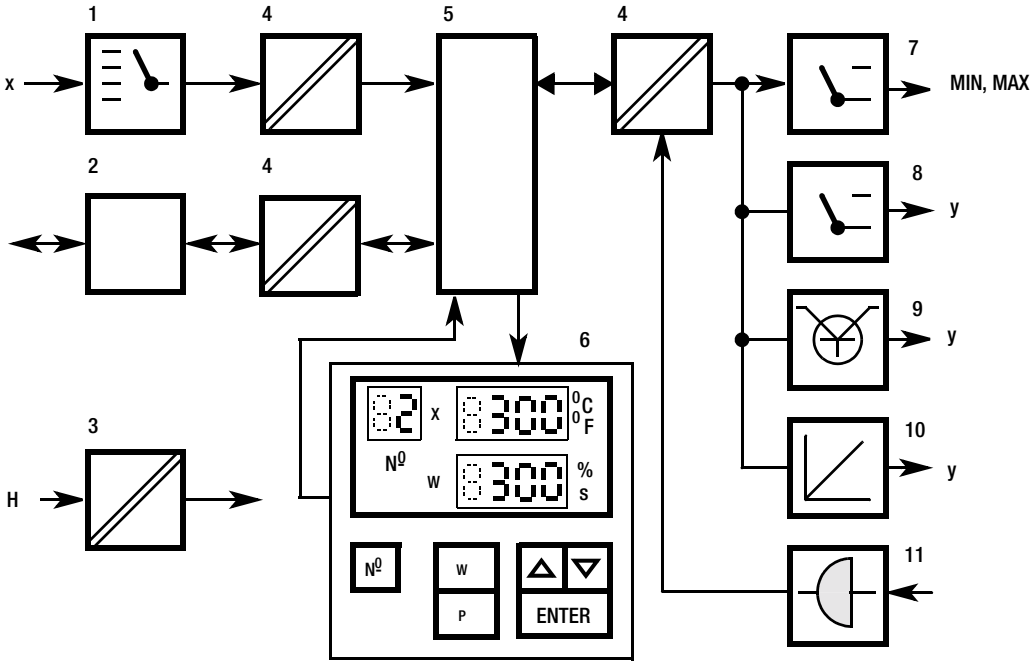
- 2 or 4 control channels
- PDPI control action with self-optimization
- Limit monitoring
- 2nd setpoint
- Individual variable, slave, differential control with version as two-channel controller
- Start-up circuit for hot-runner control
- Heating current monitor
- RS485 or TTY data interface
- Parameter 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 setpoint 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 disturbance in the heating circuit.
The controller characteristics are entered via a dust and waterproof film keyboard.
Optional operation of the controller via a PC menu offers some advantages as opposed to operation at 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.

R0300
Multi-channel controller



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

Figure 1: Block circuit diagram R0300

Applicable Regulations and Standards

VDE 0160	Fitting of heavy current systems with electronic equipment
DIN EN 61326 VDE 0843 Part 20	Electrical equipment for measurement, control and laboratory use – EMC requirements
IEC 348	Regulations for electronic measuring instruments and controllers
EN 60529	Degrees of protection provided by enclosures (IP Code)
DIN 40 050	Protection types; Protection against foreign matter and water for electrical equipment
DIN 43 700	Enclosures and panel cut-outs for measuring instruments with displays and accessories
DIN 43 718	Front frames for measuring instruments with displays

Symbols and their Meaning

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

Characteristic Values

Signal inputs

4 identical electrically connected inputs. All inputs have common isolation from the digital electronic system by means of optocouplers (see Figure 1).	
Measuring ranges	See order information
Scanning cycle	1 s (per channel)

DC voltage, direct current

	DC voltage	Direct current
Input resistance	> 50 kΩ	< 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	in the even of broken sensor or if temperature is beyond measuring range
Cold junction	Built-in compensation, disconnectable

Resistance thermometer

	Two-wire connection	Three-wire connection
Lead resistance	10 Ω calibrated	0 ... 100 Ω
Error message	in the event of broken sensor or short circuit of the sensor or if temperature is beyond measuring range	

Input configuration

Code	Sensor	Selectable via keyboard	
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	Three-wire connection
B 12	DC voltage Direct current	0 ... 10 V 0 ... 20 mA	2 ... 10 V 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 ⊥
HZ	LED flashes and signals heating current error, e.g. in connection with current transformer module 4990W-AD007
EXW	2nd setpoint active
EXR	Control function with hot-runner controller

Overload limit	Short circuit up to open input < I24 VI.

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

Display

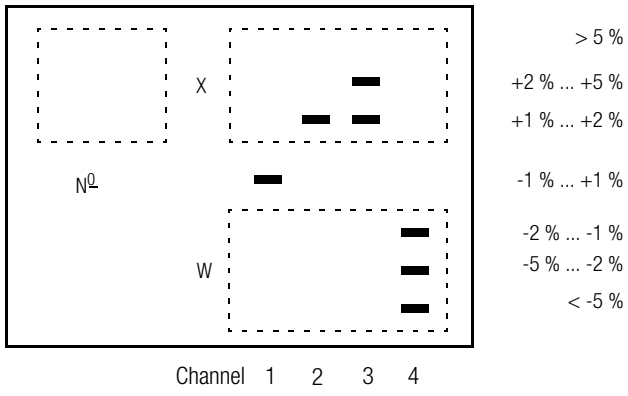
Display range	4-digit
Display height	10 mm

Resolution of controlled variable and setpoint

Code	Measuring unit	Resolution
B 07, B 10	°C or °F	0.1 degree
B 12 (freely scalable)	%, °C or °F	1 digit
B 01 ... B 06, B 08, B 09, B 11	°C or °F	1 degree

Deviation

Simultaneous display of all channels; activated by key stroke	
Display element	7-segment displays
Display range	± 1 ... 5 % in 7 steps



Regulation ratio

In manual and automatic mode; activated by key stroke

Setpoint

Setpoint limitation	By channels, up and down (absolute)
2nd setpoint	Activated by external contact, value configurable at the unit individually for each channel

R0300
Multi-channel controller

Control action

Controller type	Two-step, three-step, three-step step-action, continuous-action or split range controller, hot-runner controller
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 setpoint 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 transducer. I and D element optionally disconnectable.
Self-optimization	Available as option, simultaneously running for the selected channels. Start via control panel. Optimizing sequence is displayed. Intervention and manual change of parameters is possible at any time.

Sensor error	Output of the latest determined regulation ratio or output of a preset regulation ratio or disconnection of the control outputs (selectable).

Permissible changing speed of the controlled variable $\Delta x/\Delta t$

Two-step-, three-step-, continuous-action controller	Three-step step-action controller
$\frac{X2 - X1}{0.5\ min} \le \frac{\Delta x}{\Delta t} \le \frac{X2 - X1}{5\ h}$	$\frac{X2 - X1}{5 \cdot Ty} \le \frac{\Delta x}{\Delta t} \le \frac{X2 - X1}{5\ h}$

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 start-up phase can be activated with a reduced regulation ratio for pulse group control.
Regulation ratio	Can be limited in the 0 ... 100 % range during the start-up phase
Start-up circuit / control	Change-over via temperature threshold

Accuracy

Input	Error limit in relation 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, direct current	0.7 %

Control constancy: typically ±0.1 % in relation to X2 – X1

Switching output

Output cycle	Configurable in the range 1 ... 1000 s
Output type	Relay or transistor output on option. All outputs are isolated from the digital electronic system 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	$>10^7$ switching cycles for the mechanical life $>10^6$ switching cycles under nominal load

Transistor output

All transistor outputs are 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, continuous
Manual/automatic	Change-over possible in configuration mode or via data interface. No position readback.

Continous-controller 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 curve	Configurable, falling or rising
Split-range (Code A13)	In this controller mode, the output of the regulation ratio is divided into a continuous and a time-proportional switching range. The transition from continuous to switching output is automatically determined by the controller.
Manual/automatic	Change-over possible in configuration mode or via data interface.

Data interface

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

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

Monitoring functions

Limit monitoring

Function	One low and one high limit configurable per channel
Action	Configurable relative to setpoint or absolute.
Output	One joint NOC for all upper limit values AC/DC 250 V, 2 A, 500 VA/50 W as well as one joint NOC for all lower limit values AC/DC 250 V, 2 A, 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 relative	Actual value X	Any	< W – AL L	> W – AL L < W + AL H	> W + AL H
Setting absolute	Actual value X	Any	< AL L	> AL L < AL H	> AL H
Jojnt lower limit contact MIN	D1	Closed	Closed	Open	Open
Set with AL L	D2	Closed	Open	Closed	Closed
Joint upper limit contact MAX	D1	Open	Open	Open	Closed
Set with AL H	D2	Open	Closed	Closed	Open

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 variables and influence errors

Influence variable	Nominal range of use	Maximum influence error in relation 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 %
Influence due to warm-up	≤ 15 min	±1 %

Electrical safety

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

R0300
Multi-channel controller

Ambient conditions

Annual mean relative humidty, no condensation	75%
Ambient temperature	
– Nominal range of use	0 °C ... +50 °C
– Operating range	0 °C ... +50 °C
– Storage range	–25 °C ... +70 °C

Mechanical Design

Design type	Panel housing, side-by-side mounting without intermediate bars, controller as plug-in module in housing
Fastening	with screw clamps per DIN form B
Mounting position	any
Protection type	IP 54, housing sealed towards panel by seal ring (seal ring included in the scope of supply) IP 20 for the terminals
Weight	≤ 1.5 kg

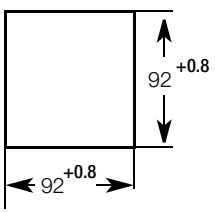


Figure 2:
Panel cut-out

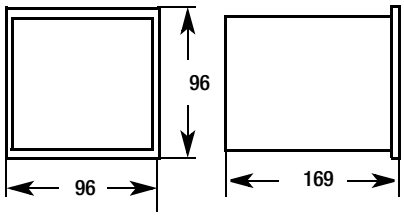
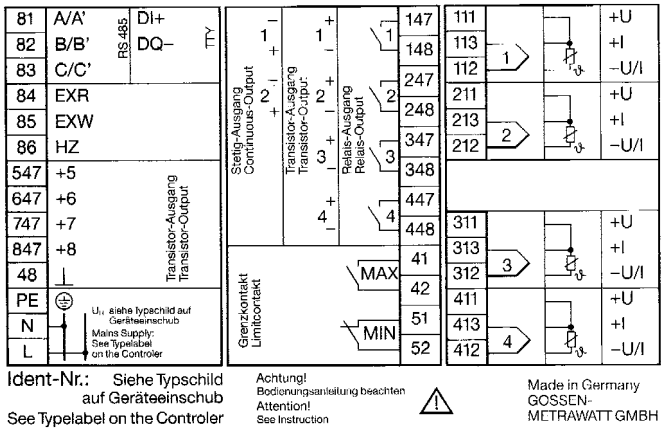


Figure 3:
Housing dimensions

Electrical Connection

Connection elements	insulated flat-pin plugs 1 x 6.3 x 0.8 oder 2 x 2.8 x 0.8 per pin (not part of the scope of supply)
Transistor outputs 547 to 847	Each to ⊥ (pin 48)



Assignment of controller outputs

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

Order information

To facilitate the processing of your order, we would appreciate it if you would furnish us with complete and unambiguous order details. The order for the units or parts can be placed either by quoting all features in plain text or by indicating all codes and/or the article number. When determining the order code, please note the following:	• The selected code column must be maintained. • Only one code of identical capital letters or sequence of capital letters may be chosen. • If the capital letters of the code are followed by the numeral 9, additional information is required in plain text. • If the capital letters of the code are followed by zero numerals only, this code may be omitted in the order details.

Designation					Article no./ Feature	
Multi-channel controller	**Front dimensions 96 x 96 mm**				**GTR0300**	
Controller type	Two-step controller	2 channels relay output			A01	
		2 channels transistor output			A02	
		4 channels relay output			A03	
		4 channels transistor output			A04	
	Three-step controller/ Step-action controller		1st switching output	2nd switching output		
		2 channels	Relay	Relay	A05	
		2 channels	Transistor	Relay	A06	
		2 channels	Relay	Transistor	A07	
		2 channels	Transistor	Transistor	A08	
		4 channels	Transistor	Relay	A09	
		4 channels	Relay	Transistor	A10	
		4 channels	Transistor	Transistor	A11	
	Continuous-action controller	2 channels			A12	
		2 channels	additionally with switching transistor output		A13	
	Hot-runner controller	2 channels Transistor output			A22	
		4 channels Transistor output			A24	
Measuring range	Thermocouple		X1 ... X2 /	X1 ... X2		
	Type J / L		0 ... 300 °C /	32 ... 572 °F	B01	
			0 ... 600 °C /	32 ... 1112 °F	B02	
	Type K		0 ... 400 °C /	32 ... 752 °F	B03	
			0 ... 800 °C /	32 ... 1472 °F	B04	
			0 ... 1200 °C /	32 ... 2192 °F	B05	
	Type S / R		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 Direct current		0/2 ... 10 V 0/4 ... 20 mA		B12	

R0300
Multi-channel controller

Designation		Feature
Auxiliary voltage /	AC 21 ... 24 ... 26 V	C1
Nominal range of use	AC 94 ... 110 ... 121 V	C2
	AC 102 ... 120 ... 132 V	C3
	AC 187 ... 220 ... 242 V	C4
	AC 196 ... 230 ... 253 V	C5
	AC 204 ... 240 ... 264 V	C6
Limit transducer	none	D0
	MIN and MAX, open-circuit current	D1
	MIN and MAX, closed-circuit current	D2
Self-optimization	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

Order example

Designation (plain text)	Article number / Feature
Multi-channel controller 96 x 96 mm	R0300
Controller type two-step 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

Designation		Article number / Feature
Balancing resistor AW 10	for Pt 100, two-wire connection	GTY 2560 003 R01
Configuration program SC 300	for configuration and parameter configuration (only under DOS, available free of charge at www.gossenmetrawatt.com)	

http://www.instrumentation2000.com

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