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JUMO dTRON 304/308/316 plast Compact Controller for the plastics industry

**JUMO dTRON 316 plast
Type 703045/ ...**

**JUMO dTRON 308 plast
Type 703046/ ...**

**JUMO dTRON 304 plast
Type 703048/ ...**

Brief description

The JUMO dTRON 300 plast series of controllers consists of three freely programmable instruments in different DIN formats for controlling temperature and other process variables, to suit the special applications of the plastics industry. Such applications include extruders, injection-molding machinery, tempering equipment and hot-channel systems.

The high-contrast, multicolor LC display for process value, setpoint and operator prompting contains two four-digit 7-segment displays, two single-character 16-segment displays, display of the active setpoints, six status indicators, and displays for the unit, ramp function and manual operation.

Simple operation through 4 keys. The instruments can be used as 2-state, 3-state, modulating or continuous controllers. The controller software includes a hot-channel warm-up ramp function, control loop and output level monitoring, two autotuning (self-optimization) procedures, a math and logic module, as well as 4 limit comparators.

Linearizations for the usual transducers are stored, and a customer-specific linearization table can be programmed.

A setup program is available for user-friendly configuration from a PC.

An RS422/485, a PROFIBUS-DP or current interface can be used to integrate the instruments into a data network.

The electrical connection is made at the back, via screw terminals.

The possible input and output configurations are shown in the following block diagram. The option boards are universally applicable for all instruments in the series.
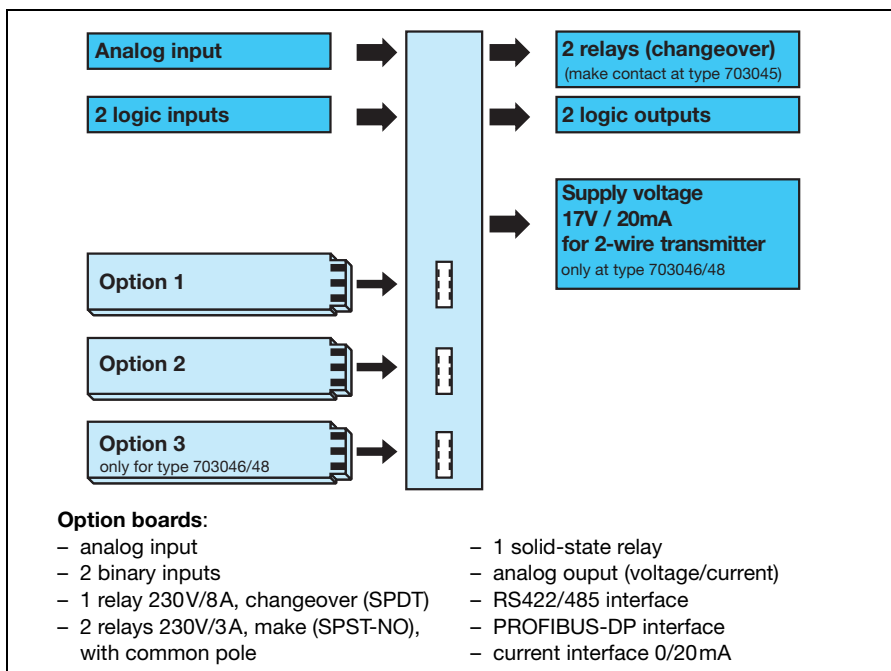
Block structure

Option boards:
– analog input
– 2 binary inputs
– 1 relay 230V/8A, changeover (SPDT)
– 2 relays 230V/3A, make (SPST-NO), with common pole
– 1 solid-state relay
– analog ouput (voltage/current)
– RS422/485 interface
– PROFIBUS-DP interface
– current interface 0/20mA

Key features

■ Control loop monitoring

■ Output level monitoring

■ Hot-channel warm-up ramp

■ Heater current monitoring

■ Modbus master function

■ Boost function

■ Four programmable setpoints, two parameter sets

■ Math and logic module

■ Two autotuning procedures

■ Fast, user-friendly configuration through the setup program with program editor

■ RS422/485 interface

■ PROFIBUS-DP interface

■ Current interface 0/20mA (as per Euromap)

Approvals/marks of conformity (see technical data)

Autotuning

Standard features include the tried and tested autotuning facility, which makes it possible for the controller to be matched to the control loop by a user who is not a control-technology expert.

This functions by evaluating the response of the control loop to specific changes in the output level. Either an oscillatory method or a step-response test can be selected. The step-response test is used, for example, in the plastics industry or in processes where the oscillatory method cannot be employed. The controller parameters that are calculated are: proportional band, reset time, derivative time, cycle time and filter time constant.

Customer-specific linearization

In addition to the linearizations for the usual transmitter outputs, a customer-specific linearization can be created. The programming is carried out in the setup program, in the form of a table of values or a formula.

User data

Parameters which frequently have to be changed by the user can be combined at the user level, under "User data" (only through the setup program).

Math and logic module

Order details: Extra code 214
The math module makes it possible to combine values such as setpoints, output levels and measurements from the analog inputs into a mathematical formula.

The logic module can, for instance, be used to logically combine binary inputs and limit comparators with one another.

Up to two math or logic formulae can be entered through the setup program, and the results of the calculations can be presented at the outputs or used for internal purposes.

Special types of controller

Order details: Extra codes 217, 218, 219
The instrument can be operated as a difference, humidity or ratio controller.

Binary functions

– Start boost function
– Start/cancel autotuning
– Change to manual mode
– Hold/cancel ramp
– Controller off
– Setpoint switching
– Parameter set switching
– Key/level inhibit
– Text display
– Display off
– Acknowledge limit comparators
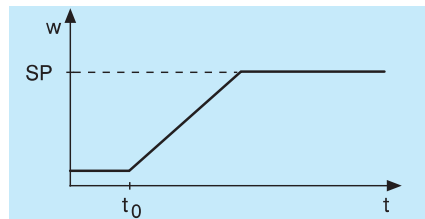– Program start/hold/cancel
– Timer start/stop

Several binary functions can be combined with one another (only through the setup program).

Functions of the outputs

– Analog input variables
– Math
– Process value
– Setpoint
– Ramp end value
– Control deviation
– Output level
– Controller outputs
– Limit comparators
– Control contacts
– Binary inputs
– Logic formula
– Program end
– Timer signals
– Program/automatic signal

Ramp function

Either a rising or a falling ramp function can be used (increase or decrease in the setpoint). The setpoint value SP changed at time t_0 is the final value for the ramp. The ramp starts with the setpoint at time t_0. The slope of the ramp can be programmed; the sign of the slope is given by the relationship between the setpoint at time t_0 and the SP value. When the supply voltage is switched on, the ramp function starts with the momentary process value.

Displays and controls

(1)	**7-segment display** (factory setting: process value)
	four-digit, red; decimal place is configurable
	(automatic adjustment on display overflow)
(2)	**Active setpoint** (factory setting: SP1)
	SP1, SP2, SP3, SP4 (SP=setpoint); green;
(3)	**7-segment display** (factory setting: setpoint)
	four-digit, green; decimal place is configurable;
	also used for operator prompting (display of parameter and level symbols)
(4)	**Keys**
(5)	**Indication**
	yellow, for
	- switch status of binary outputs 1 — 6 (display lights up = on)
	- ramp/program function is active
	- manual operation is active
(6)	**16-segment display for the unit °C/°F and text**
	two-digit, green; symbols for h, min and %
	additional display options through the setup program

Timer

A timer is available for time-dependent control. The status of the timer can be switched through to the binary outputs or internally processed for the activation or de-activation of time-dependent processes.

Setup program (accessory)

The setup program for configuring the instrument is available in English, French, German, and other languages. Using a PC, you can create and edit sets of data, and transfer them to the controller or read them out from the instrument. The data sets are stored and managed.
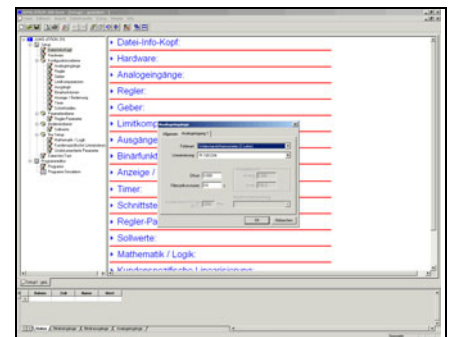
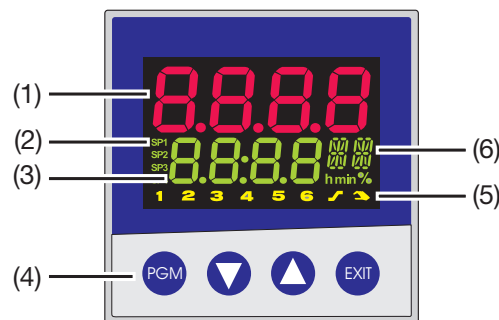The setup program can be expanded through additional program modules.

Program editor
For the easy creation of programs.

Start-up
To check the control behavior.

Program function

A setpoint profile can be implemented with a maximum of 8 program segments. The settings for the segment setpoints and segment times are carried out at the user level. The time scale can be configured as mm:ss or hh:mm (s = seconds, h = hours).

A program-end signal can be generated, and the program can be halted or canceled.

Further functions can be defined through the setup program (start at process value, cyclical program handling, segment-by-segment assignment of parameter sets and four control contacts). The program profile can also be visualized.

Warm-up ramp for hot channel

The warm-up ramp for hot-channel equipment is used, for example, for the gentle operation of ceramic heater elements. Damage can be avoided by allowing moisture to evaporate slowly from the hygroscopic heater elements during the warm-up phase.
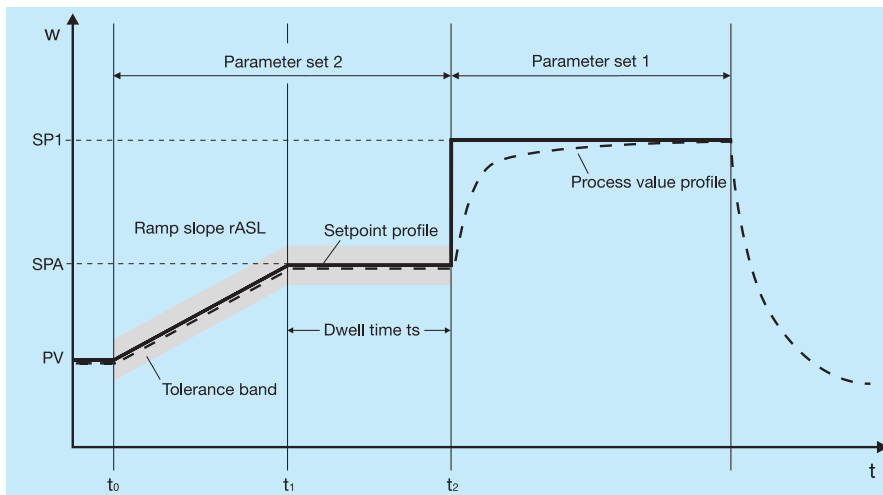
Boost function

Time- or event-controlled setpoint boost, for example for tool nozzle retraction during the production process. The temperature of the zones is raised by an adjustable value for an adjustable time period, via the binary function (factory setting: binary input 1 (pushbutton)).

Reduction function

The temperature of the zones can be lowered to a quiescent-state setpoint during the production process, for cleaning or changing tools. Ex-factory, this is carried out via binary input 2, but can also be activated through a different signal.

Control loop monitoring

Control loop monitoring is used to check whether the process reacts as expected during commissioning and the approach phase. What is checked is how the process value changes with respect to changes in the output level.

In addition, control loop monitoring also detects any polarity reversal of the operating sense (heating ON, process value falls).

If the (adjustable) conditions are not fulfilled, an alarm will be triggered.

Output level monitoring

This functions serves to monitor the control loop during operation. Output level monitoring is available for checking whether the output level (in a stabilized condition) moves within definable limits (monitoring band) about an average output level. The average output level is calculated by the instrument by means of an adjustable determination time ty. If the output level goes outside the monitoring band, an alarm signal is initialized. This serves to indicate a heating failure or changes to the sensor, for instance.

Interfaces

RS422/RS485 interface

The serial interface is used for communication with higher-level (supervisory) systems.

The Modbus protocol is used for transmission.

PROFIBUS-DP

The PROFIBUS-DP interface can be used to integrate the controller into a fieldbus system operating according to the PROFIBUS-DP standard. This PROFIBUS variant is especially designed for communication between automation systems and decentralized peripheral devices at the field level, and optimized for speed.

Data transmission is made serially, using the RS485 standard.

GSD generator, the project-planning tool that is supplied with the package (GSD = Gerätestammdaten, i.e. device data), is used to make a selection of device characteristics for the controller, to create a standardized GSD file that is used to integrate the controller into the fieldbus system.

Current interface

Serial interface with 0/20 mA as per Euromap. Communication takes place through the Modbus or Arburg protocol.

Modbus master

The instrument can be used as an independent master within a Modbus network. This enables the transmission of data to all the devices (slaves (max. 32)) in the Modbus network, either by a key stroke or through the binary function. The slaves must all be devices of the same type. The configuration is performed through the Setup program.
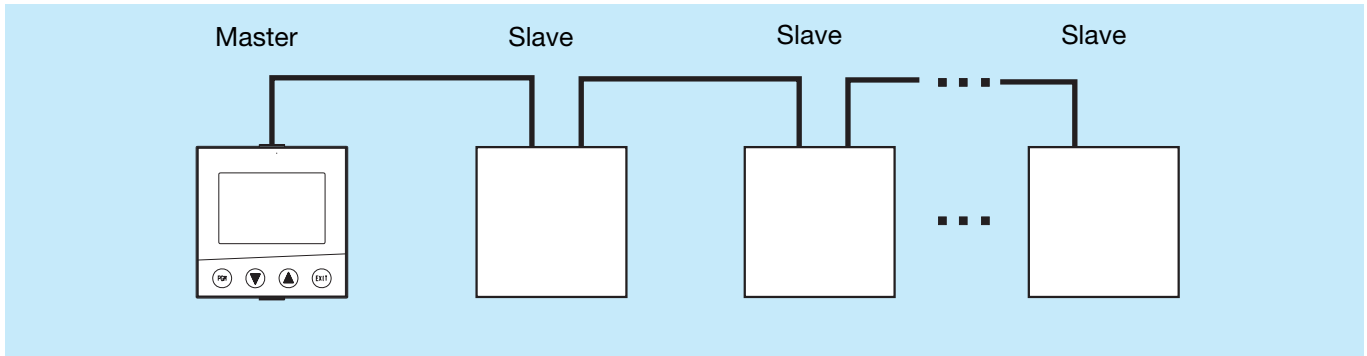
Parameter level

All parameters and their meanings are listed in the table below. Some parameters may be missing or meaningless for a particular type of controller. Two parameters sets can be stored, to handle special applications.

Parameter	Value range	Factory setting	Meaning
Proportional band	0 to 9999 digits	0 digits	Size of the proportional band 0 means that the controller structure is out of action!
Derivative time	0 to 9999 sec	80 sec	Influences the differential component of the controller output signal
Reset time	0 to 9999 sec	350 sec	Influences the integral component of the controller output signal
Cycle time	0 to 999.9 sec	20.0 sec	When using a switched output, the cycle time should be chosen so that the energy flow to the process is as continuous as is practicable without overloading the switching elements.
Contact spacing	0 to 999.9 digits	0.0 digits	The spacing between the two control contacts for 3-state or modulating controllers
Switching differential	0 to 999.9 digits	1.0 digits	Hysteresis for switching controllers with proportional band = 0
Actuator time	5 to 3000 sec	60 sec	Actuator time range used by the control valve for modulating controllers
Working point	-100 to +100%	0%	The output level for P and PD controllers (if x = w then y = Y0).
Output level limiting	0 to 100%	100%	Maximum output level
	-100 to +100 %	-100%	Minimum output level

Technical data

Input for thermocouple

Designation		Measuring range	Measuring accuracy	Ambient temperature error
Fe-Con L		-200 to + 900°C	≤0.25%	100 ppm /°C
Fe-Con J	EN 60584	-200 to +1200°C	≤0.25%	100 ppm /°C
Cu-Con U		-200 to + 600°C	≤0.25%	100 ppm /°C
Cu-Con T	EN 60584	-200 to + 400°C	≤0.25%	100 ppm /°C
NiCr-Ni K	EN 60584	-200 to +1372°C	≤0.25%	100 ppm /°C
NiCr-Con E	EN 60584	-200 to +1000°C	≤0.25%	100 ppm /°C
NiCrSi-NiSi N	EN 60584	-100 to +1300°C	≤0.25%	100 ppm /°C
Pt10Rh-Pt S	EN 60584	0 to 1768°C	≤0.25%	100 ppm /°C
Pt13Rh-Pt R	EN 60584	0 to 1768°C	≤0.25%	100 ppm /°C
Pt30Rh-Pt6Rh B	EN 60584	0 to 1820°C	≤0.25% within range 300 to 1820°C	100 ppm /°C
W5Re-W26Re C		0 to 2320 °C	≤0.25%	100 ppm /°C
W3Re-W25Re D		0 to 2495 °C	≤0.25%	100 ppm /°C
W3Re-W26Re		0 to 2400 °C	≤0.25%	100 ppm /°C
Cold junction		Pt100, internal		

Input for resistance thermometer

Designation		Connection circuit	Measuring range	Measuring accuracy		Ambient temperature error
				3-/4-wire	2-wire	
Pt100 (factory setting)	EN 60751	2-wire / 3-wire / 4-wire	-200 to +850°C	≤0.05%	≤0.4%	50 ppm / °C
Pt500	EN 60751	2-wire / 3-wire / 4-wire	-200 to +850°C	≤0.2%	≤0.4%	100 ppm /°C
Pt1000	EN 60751	2-wire / 3-wire / 4-wire	-200 to +850°C	≤0.1%	≤0.2%	50 ppm /°C
KTY11-6		2-wire	-50 to +150°C		≤2.0%	50 ppm /°C
Sensor lead resistance		30Ω max. per lead for 3-wire/4-wire circuit				
Measuring current		approx. 250µA				
Lead compensation		Not required for 3-wire or 4-wire circuit. With a 2-wire circuit, the lead resistance can be compensated in software by a correction of the process value.				

Input for standard signals

Designation	Measuring range	Measuring accuracy	Ambient temperature error
Voltage	0(2) — 10V 0 — 1V input resistance $R_{IN} > 100k\Omega$	≤0.05% ≤0.05%	100 ppm / °C 100 ppm / °C
Current	0(4) — 20mA, voltage drop ≤ 1.5V	≤0.05%	100 ppm / °C
Heating current	0 — 50mA AC	≤1%	100 ppm / °C
Resistance transmitter	min. 100Ω, max. 4kΩ	≤0.5%	100 ppm / °C

Binary inputs

Floating contacts	

Measuring circuit monitoring

In the event of a fault, the outputs move to a defined (configurable) status.

Sensor		Overrange / underrange	Probe or lead short-circuit	Probe or lead break
Thermocouple		•	-	•
Resistance thermometer		•	•	•
Voltage	2 — 10V	•	•	•
	0 — 10V	•	-	-
	0 — 1V	•	-	-
Current	4 — 20mA	•	•	•
	0 — 20mA	•	-	-
Resistance transmitter		-	-	•

• = recognized   - = not recognized

Outputs

Relay, changeover (SPDT) at type 703046/48
    contact rating
    contact life
	
	5A at 230V AC resistive load
	350,000 operations at rated load / 750,000 operations at 1A

Relay, changeover (SPDT), option
    contact rating
    contact life
	
	8A at 230VAC resistive load
	100,000 operations at rated load / 350,000 operations at 3A

Relay, make (SPST-NO) at type 703045
    contact rating
    contact life
	
	3A at 230VAC resistive load
	150,000 operations at rated load / 350,000 operations at 1A

Relay, make (SPST-NO), option
    contact rating
    contact life
	
	3A at 230VAC resistive load
	350,000 operations at rated load / 900,000 operations at 1A

Logic output	0/12V / 30mA max. (sum of all output currents) or 0/18V / 25mA max. (sum of all output currents)

Solid-state relay, option
    contact rating
    protection circuitry
	
	1A at 230V
	varistor

Voltage (option)
    output signals
    load resistance
    accuracy
	
	0 — 10V / 2 — 10V
	$R_{load} \geq 500\Omega$
	$\leq 0.5\%$

Current (option)
    output signals
    load resistance
    accuracy
	
	0 — 20mA / 4 — 20mA
	$R_{load} \leq 500\Omega$
	$\leq 0.5\%$

Supply voltage for 2-wire transmitter for type 703046/48 voltage	electrically isolated, not stabilized 17V at 20mA, 25V with no load

Controller

Controller type	2-state controller (factory setting), 3-state controller, modulating controller, continuous controller
Controller action	P/PD/PI/PID
A/D converter	dynamic resolution up to 16-bit
Sampling cycle time	50msec, 90msec, 150msec, 250msec (factory setting: 250 msec)

Electrical data

Supply voltage (switch-mode PSU)	110 — 240V AC -15/+10%, 48 — 63Hz 20 — 30V AC/DC, 48 — 63Hz
Electrical safety	Type 703045: to EN 61010, Part 1 Type 703046/48: to EN 60730 overvoltage category III, pollution degree 2
Power consumption	Type 703045: 8VA max. Type 703046/48: 13VA max.
Data backup	EEPROM
Electrical connection	at the back, via screw terminals, conductor cross-section up to 2.5mm^2 with core ferrules (length: 10mm)

Electromagnetic compatibility
    interference emission
    interference immunity
	EN 61326-1
	Class B
	to industrial requirements

Housing

Housing type	plastic housing for panel mounting to IEC 61554
Depth behind panel	90 mm
Ambient/storage temperature range	0 to 55°C / -30 to +70°C
Climatic conditions	rel. humidity $\leq 90\%$ annual mean, no condensation
Operating position	horizontal
Enclosure protection	to EN 60529, front IP65 / back IP20
Weight (fully fitted)	Type 703045: approx. 220g Type 703046: approx. 380g Type 703048: approx. 490g

Interface

Modbus

Interface type	RS422/485
Protocol	Modbus, Modbus Integer, Modbus Master
Baud rate	4800, 9600, 19200, 38400
Device address	0 — 255
Max. number of stations	32

PROFIBUS-DP

Device address	0 — 255

Current interface

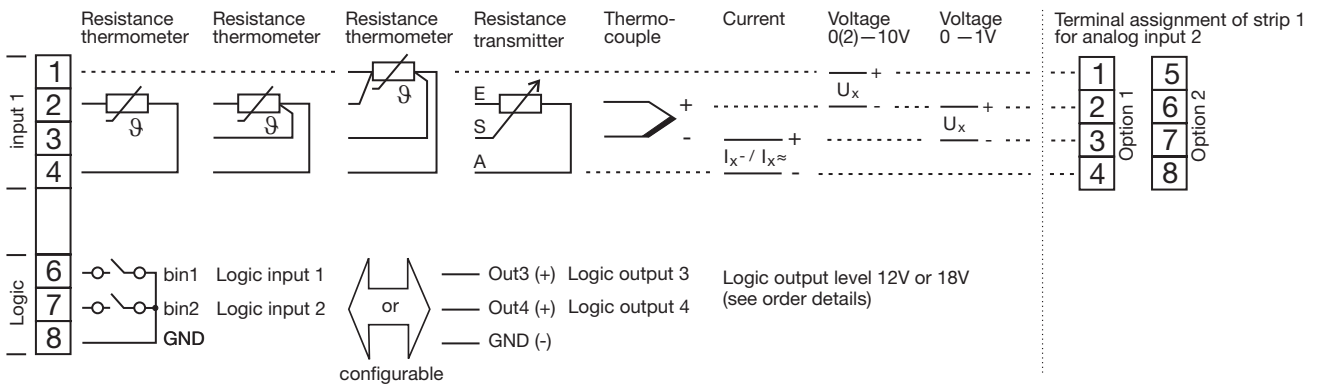| Interface type	current 0/20mA
Protocol	Arburg
Baud rate	4800, 9600, 19200, 38400
Device address	0 — 255
Max. number of stations	depending on the current source or their voltage supply; voltage drop per device: approx. 2.5V at 20mA

Approvals/marks of conformity

Mark of conformity	Testing laboratory	Certificates/certification numbers	Test basis	valid for
c UL us	Underwriters Laboratories	E 201387	UL 61010-1 CAN/CSA-C22.2 No. 61010-1	dTRON 304 plast dTRON 308 plast

Connection diagram, type 703045
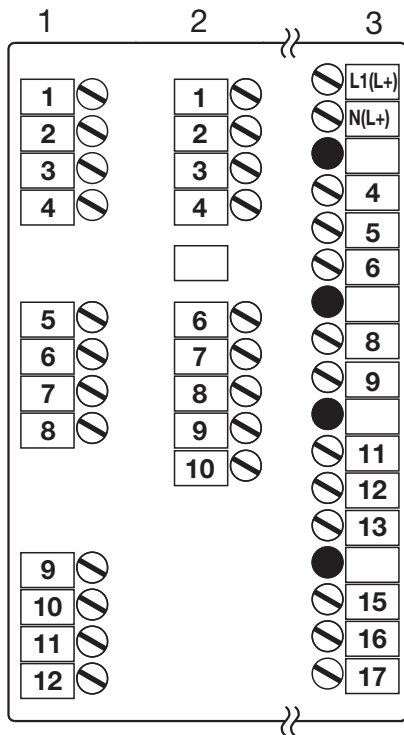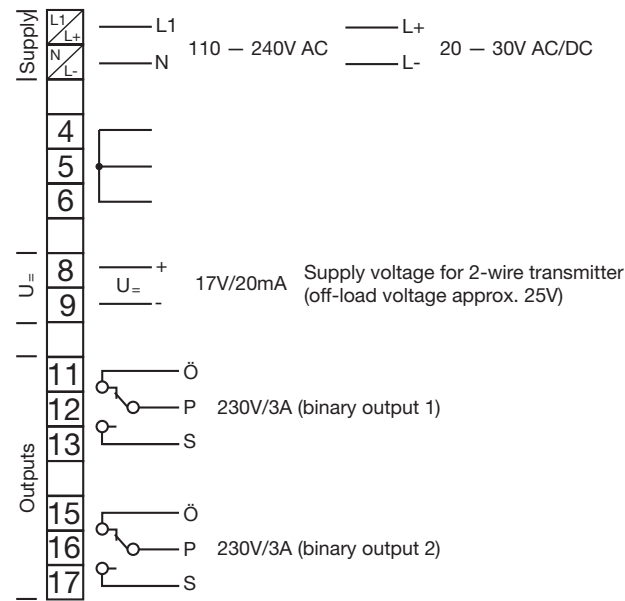

Terminal strip 3

Supply: L1/L+ — L1, N/L- — N 110 — 240V AC   L+ / L- 20 — 30V AC/DC

Outputs:
- 3, 4, 5: P / S — 230V/3A (logic output 1)
- 6, 7, 8: P / S — 230V/3A (logic output 2)

Terminal strip 2

| Resistance thermometer | Resistance thermometer | Resistance thermometer | Resistance transmitter | Thermo-couple | Current | Voltage 0(2)—10V | Voltage 0 — 1V | Terminal assignment of strip 1 for analog input 2 |

input 1: 1, 2, 3, 4

Logic:
- 6: bin1 — Logic input 1
- 7: bin2 — Logic input 2
- 8: GND

— Out3 (+) Logic output 3
— Out4 (+) Logic output 4
— GND (-)
configurable / or

Logic output level 12V or 18V (see order details)

Terminal strip 1

	Analog input	2 logic inputs	Analog output	Relay (changeover)	2 relays (make)	Solid-state relay	PROFIBUS	RS422	RS485	Current interface
Option 1	1	3		Ö	5		VP (+5 V)	RxD +		
	2 Analog input 2 connection as for analog input 1	4	U_x / I_x +	P			RxD/TxD-P (B)	RxD -		I in
	3	GND	-	S	8		RxD/TxD-N (A)	TxD +	RxD/TxD +	I out
	4	Logic input 3+4	Analog output 5	Logic output 5	Logic output 5+8	Logic output 5	DGND	TxD -	RxD/TxD -	
Option 2	5	5		(not possible)	(not possible)		VP (+5 V)	RxD +		
	6 Analog input 2 connection as for analog input 1	6	U_x / I_x +				RxD/TxD-P (B)	RxD -		I in
	7	GND	-				RxD/TxD-N (A)	TxD +	RxD/TxD +	I out
	8	Logic input 5+6	Analog output 6			Logic output 6	DGND	TxD -	RxD/TxD -	

Connection diagram, type 703046/48

Terminal strip 3

110 — 240V AC	20 — 30V AC/DC

17V/20mA Supply voltage for 2-wire transmitter (off-load voltage approx. 25V)

230V/3A (binary output 1)

230V/3A (binary output 2)

Terminal strip 2

Logic output level 12V or 18V (see order details)
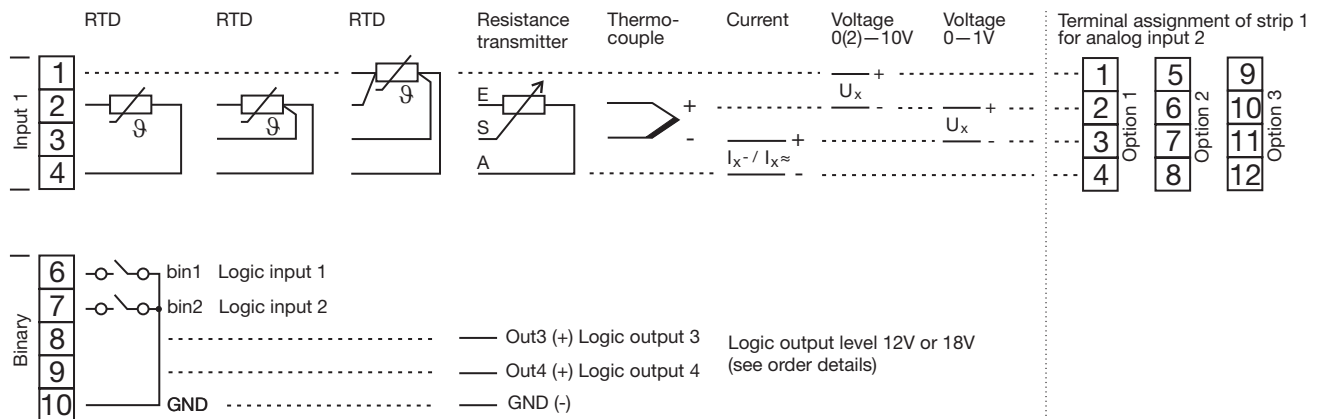
Terminal strip 1
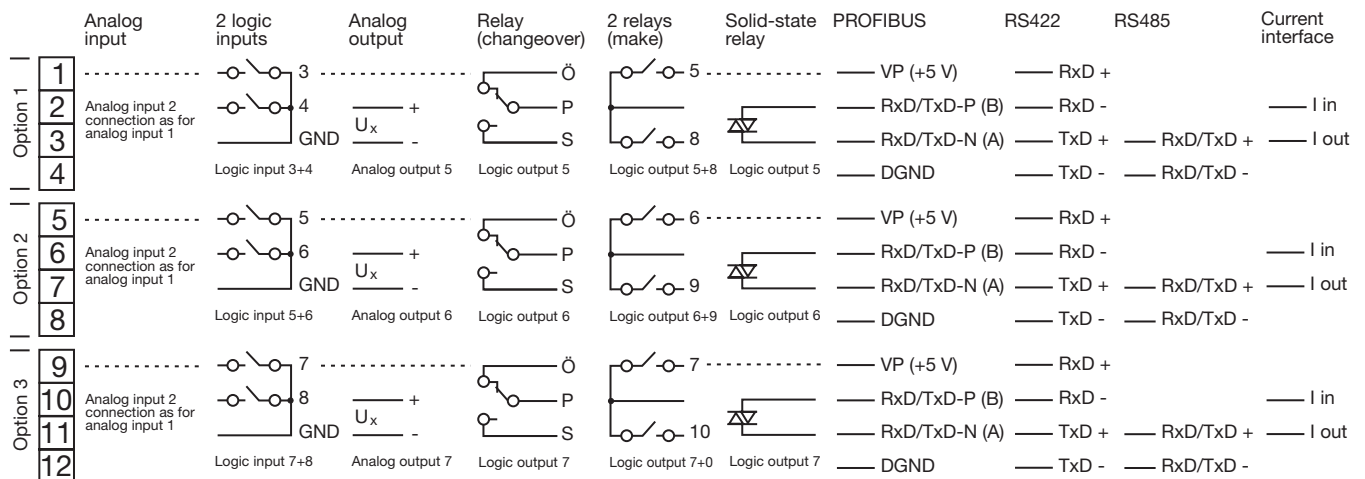
Dimensions

Type 703045
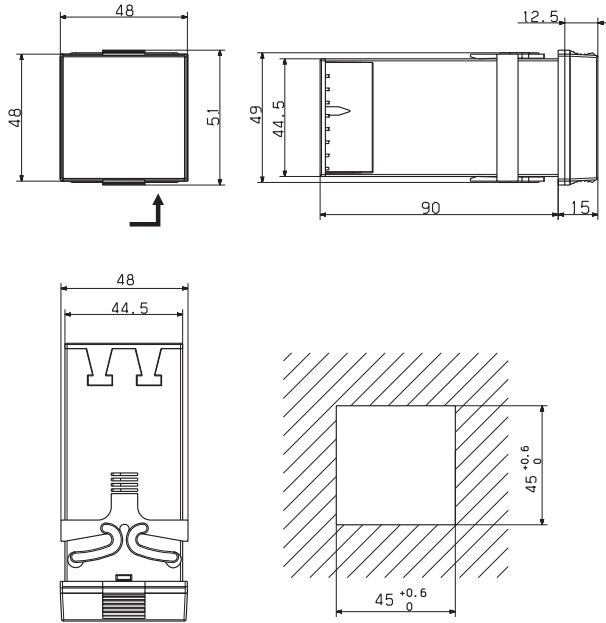
Type 703046
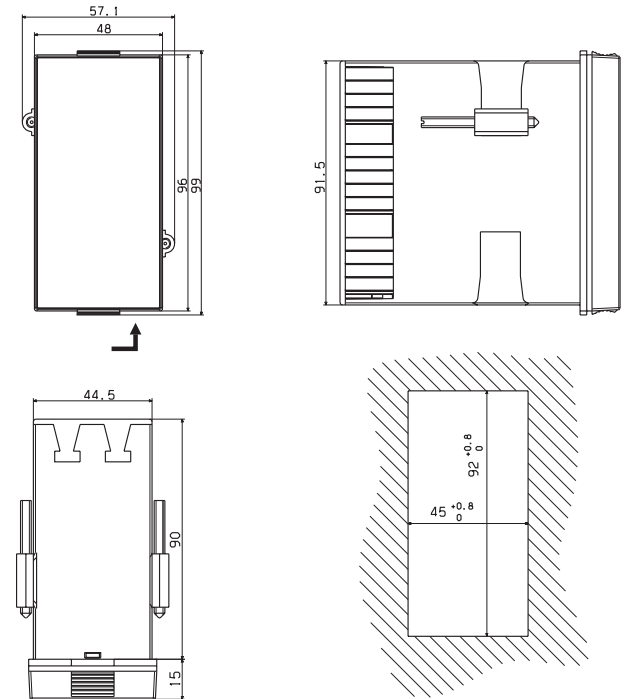
Type 703048
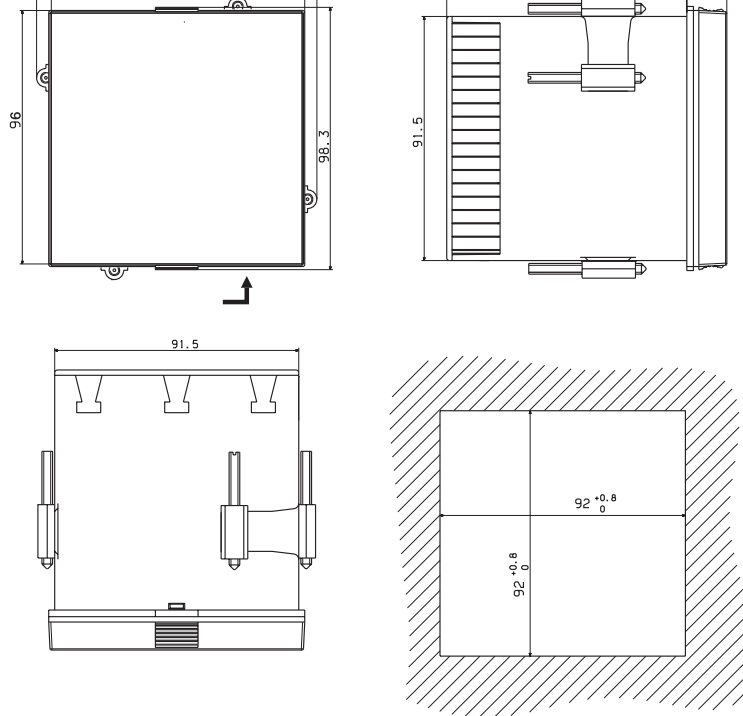
Side-by-side mounting		
Minimum spacing of panel cut-outs		
Type	horizontal	vertical
without setup plug:		
703045	11 mm	30 mm
703046	11 mm	30 mm
703048	11 mm	30 mm
with setup plug (see arrow):		
703045	11 mm	65 mm
703046	11 mm	65 mm
703048	11 mm	65 mm

Order details

	Basic type
703045	JUMO dTRON316 plast, 48mm x 48mm format incl. analog input, 2 relays and 2 binary inputs or 2 logic outputs
703046	JUMO dTRON308 plast, 48mm x 96mm format (portrait format) incl. analog input and 2 binary inputs, 2 relays and 2 logic outputs
703048	JUMO dTRON304 plast, 96mm x 96mm format incl. analog input and 2 binary inputs, 2 relays and 2 logic outputs

			Basic type extensions
2			Basic type 2
			Version
	8		Standard, with factory settings
	9		Programming to customer specification
			Logic outputs (2 are available as standard)
		1	0 / 12V
		2	0 / 18V

				Type 703046/48	Type 703045 (no option 3)		
1	2	3	Option slots	Max. number	Max. number	Option 1	Option 2
0	0	0	not used			X	X
1	1	1	Analog input 2 (universal)	1	1	X	X
2	2	2	Relay (changeover)	2	1	X	-
3	3	3	2 relays (make contact)	2	1	X	-
4	4	4	Analog output	2	2	X	X
5	5	5	2 logic inputs	2	1	X	X
6	6	6	Solid-state relay 1A	2	2	X	X
7	7	7	RS422/485 interface	1	1	X	X
8	8	8	Profibus-DP interface	1	1	X	X
9	9	9	Current interface 0/20mA	1	1	X	X

X = allowed in this option slot, - = not allowed in this option slot

		Supply
2	3	110 — 240V AC -15/+10%, 48 — 63Hz
2	5	20 — 30V AC/DC, 48 — 63Hz

			Extra codes
0	0	0	none
2	1	4	Math and logic module
2	1	7	Ratio controller
2	1	8	Difference controller
2	1	9	Humidity controller

703046 / 2 8 1 – 1 4 0 – 2 3 / 0 0 0

Scope of delivery: - controller
- seal
- mounting brackets
- Operating Manual B70.3046.0 in DIN A6 format

1 mini-CD with the demo setup software and pdf documents in DIN A4 format (operating manual and additional documentation) can be ordered separately. The individual documents and programs are downloadable from www.jumo.net (the software can be enabled for a charge).