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JUMO safetyM STB/STW Ex Safety Temperature Limiter and Safety Temperature Monitor According to DIN EN 14597

Brief description

The compact and freely configurable JUMO safetyM STB/STW Ex can now also enable early and reliable detection of risks in Ex-areas which could potentially result in personal injuries, environmental damage, or destruction of the production plant and production materials. The devices are marked as follows:

1-sensor variant



II (1) (2) (3) G (b1) [Ex ia Ga] [e pz] IIC
 II (1) (2) (3) D (b1) [Ex ia Da] [p Dc] IIIC

2-sensor variant



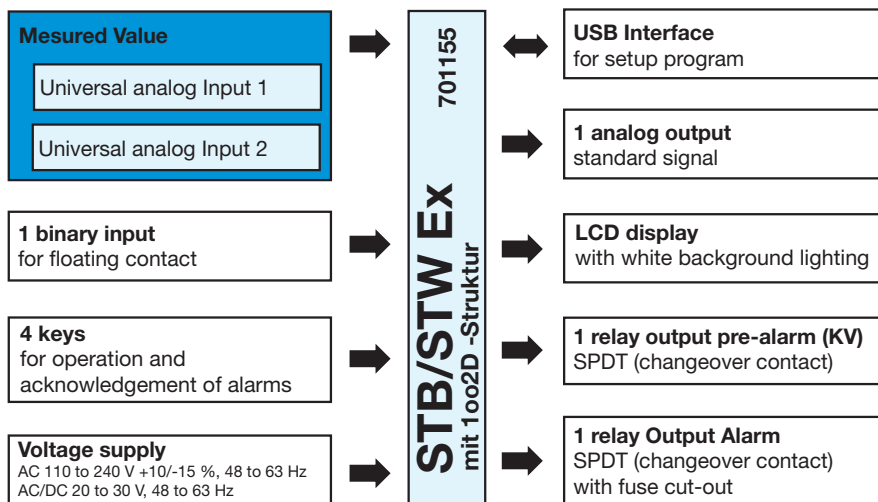
II (1) (1) (2) G (b2) [Ex ia Ga] [e py] IIC
 II (1) (1) (2) D (b2) [Ex ia Da] [p Db] IIIC

The primary task of safety temperature limiters is to reliably monitor thermal processes and to switch plants to a safe operational state in the event of malfunctions. Along with the existing approvals according to DIN 14597, SIL 3, PL e (Performance Level), GL, the device also has approval according to ATEX and can therefore also be used in Ex-areas, whereupon the device itself has to be arranged outside the Ex-area.

The inputs are intrinsically safe [Ex ia] so that relevant probes can be connected directly. Barriers are no longer required. The device is also certified according to DIN EN 50495 and DIN EN 13463-6 as a monitoring device for potential ignition sources (iPL 2) as specified in the ATEX directive and can be used to monitor potentially explosive atmospheres containing gas or dust. The 1oo2D structure also meets the stringent requirements of DIN EN 61508 and DIN EN 13849. The 1oo2D structure ensures reliable detection of faults, meaning that the device concept can also be used for applications subject to the new Machinery Directive 2006/42/EC.

Along with the keypad, the clear and well structured back-lit display with plain text provides quick and straight-forward configuration directly on the device. The clear menu structure ensures easy operation, which in turn shortens commissioning time. All safety-relevant process values are displayed and the most important functions are represented by simple icons.

Block diagram



Type 701155/ ...1

Special features

- 1oo2D structure for high degree of process reliability
- LCD display with background lighting and plain text display for more simplified operation
- Setup program for configuration and archiving via USB interface
- Digital input filter with adjustable filter time constant
- Pre-alarm absolute, adjustable as a margin from the limit value or window function
- Wide voltage supply range from AC 110 to 240 V +10 % /-15 % or AC/DC 20 to 30 V
- Can be configured as safety temperature limiter (STB) or safety temperature monitor (STW)
- 12 linearizations can be set
- Internal and external unlocking possible
- Approvals for DIN EN 14597, SIL, PL e (Performance Level e), GL

Approvals/approval marks (see "Technical data")



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Technical data

Analog inputs

RTD temperature probe

Designation	Measuring range	Accuracy 2/3-wire circuit ¹	Ambient temperature influence
Pt100 DIN IEC 60751:2008	-200 to +850 °C	0.5 % / 0.1 %	50 ppm/K
Pt1000 DIN IEC 60751:2008	-200 to +850 °C	0.5 % / 0.1 %	50 ppm/K
Connection type	Maximum lead wire resistance 2-wire circuit 15 Ω, 3-wire circuit 30 Ω		
Measuring rate	210 ms		
Error tolerance time	≤ 5 s: time taken into account for all diagnostic tests		
Input filter	Digital filter, 2nd order; filter constant can be set from 0 to 100 s		
Special features	Individual probe Pt100 2-wire, display can also be programmed in °F		

Thermocouples

Designation	Measuring range	Accuracy ¹	Ambient temperature influence
Fe-CuNi "L" DIN 43710: 1985-12	-200 to +900 °C	0.4 %	100 ppm/K
Fe-CuNi "J" DIN EN 60584-1:1996-10	-200 to +1200 °C	0.4 %	100 ppm/K
Cu-CuNi "U" DIN 43710:1985-12	-200 to +600 °C	0.4 %	100 ppm/K
Cu-CuNi "T" DIN EN 60584-1:1996-10	-200 to +400 °C	0.4 %	100 ppm/K
NiCr-Ni "K" DIN EN 60584-1:1996-10	-200 to +1372 °C	0.4 %	100 ppm/K
Pt10Rh-Pt "S" DIN EN 60584-1:1996-10	-50 to +1768 °C	0.4 %	100 ppm/K
Pt13Rh-Pt "R" DIN EN 60584-1:1996-10	-50 to +1768 °C	0.4 %	100 ppm/K
Pt30Rh-Pt6Rh "B" DIN EN 60584-1:1996-10	0 to 1820 °C	0.4 % ²	100 ppm/K
NiCrSi-NiSi „N“ DIN EN 60584-1:1996-10	-100 to +1300 °C	0.4 % ²	100 ppm/K
W3Re-W25Re "D" ASTM E1751M-09 (bis 2315 °C): 2009	0 to 2495 °C	0.4 %	100 ppm/K
W5Re-W26Re „C“ ASTM E230M-11: 2011	0 to 2315 °C	0,4 %	100 ppm/K
Cold junction	Pt100 internal		
Cold junction accuracy	±1 K		
Sampling rate	210 ms		
Error tolerance time	≤ 5 s: time taken into account for all diagnostic tests		
Input filter	Digital filter, 2nd order; filter constant can be set from 0 to 100 s		

1. The accuracy refers to the maximum extent of the measuring range.

2. The accuracy is guaranteed above 300° C

Direct current

Measuring range	Accuracy	Ambient temperature influence
4 to 20mA, voltage drop < 2 V	0.2 %	150 ppm/K
Scaling	Can be freely programmed within the limits	
Sampling rate	210 ms	
Error tolerance time	≤ 5 s: time taken into account for all diagnostic tests	
Input filter	Digital filter, 2nd order; filter constant can be set from 0 to 100 s	
Special features	Individual probe 4 to 20 mA	

Analog output

	Type of signal	Accuracy	Residual ripple	Load influence	Temperature influence	Load resistance
Current	4 to 20 mA	≤ 0.5 %	± 0.5 % at 300 Ω	± 0.05 mA / 100 Ω	150 ppm/K	≤ 500 Ω
	0 to 20 mA					
Voltage	2 to 10 V	≤ 0.5 %	± 0.5 %	± 15 mV	150 ppm/K	≥ 500 Ω
	0 to 10 V					

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Binary input

Connection	Function
1 potential-free contact	Unlocked, key lock, level inhibit can be configured

Relay outputs

Relay output KV	Relay (changeover contact) without contact protection 30000 switching operations at a switching capacity of 250 V, 3 A, 50 Hz (resistive load) or maximum DC 30 V, 3 A. Minimum current: DC 12 V, 100 mA.
Relay output alarm	Relay (changeover contact) Contact protection circuit: fuse cut-out 3.15 AT, installed in the N/O contact arm 30000 switching operations at a switching capacity of 230 V, 3 A, 50 Hz (resistive load) or up to DC 30 V, 3 A. Minimum current DC 12 V, 100 mA.

Measuring circuit monitoring

	RTD temperature probe in 3-wire circuit and double thermocouples	Thermocouples	Current 4 to 20 mA
Overrange and underrange	Is detected LED K1, K2, KD, and KV are lit; ">>>>" flashes in the display for overrange, "<<<<" for underrange.		
Probe/cable break	Is detected LED K1, K2, KD, and KV are lit; ">>>>" flashes in the display; relay output "Alarm" is inactive		LED K1, K2, KD, and KV are lit; ">>>>" flashes in the display; relay output alarm is inactive
Probe short circuit	Is detected LED K1, K2, KD, and KV are lit "<<<<" flashes in the display; relay output alarm is inactive	Is detected by difference monitoring of the analog inputs	LED K1, K2, KD, and KV are lit; "<<<<" flashes in the display; relay output alarm is inactive

Voltage supply

Voltage supply	AC/DC 20 to 30V, 48 to 63 Hz	AC 110 to 240V +10% /-15%, 48 to 63 Hz
Power consumption, Power loss	max. 12 W	max. 12 W
Power consumption, Power loss for the following mode: Analog output 10mA; background lighting Display off; Relay output "Alarm" on; Relay output pre-alarm off; Sensor: 2xPt100	5 W	5 W

Test voltages according to EN 60730, part 1

Input and output against voltage supply	
- With a voltage supply AC 110 to 240 V +10 % /-15 %	3.7 kV / 50 Hz
- With a voltage supply AC/DC 20 to 30 V, 48 to 63 Hz	3.7 kV / 50 Hz

Electrical safety

	Clearances / creepage distances
Mains voltage to electronic components and probes	≥ 6 mm / ≥ 8 mm
Mains voltage to relays	≥ 6 mm / ≥ 8 mm
Relays to electronic components and probes	≥ 6 mm / ≥ 8 mm
Electrical safety	According to DIN EN 14597 (DIN EN 60730-2-9) Overvoltage category III, pollution degree 2
Protection rating I	With internal isolation from SELV electrical circuits

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Environmental influences

Ambient temperature range	0 to +55 °C
Storage temperature range	-30 to +70 °C
Temperature influence	$\leq \pm 0.005 \% / K$ dev. from $23 \times C^1$ for RTD temperature probes $\leq \pm 0.01 \% / K$ dev. from $23 \times C^1$ for thermocouples and current
Terminal temperature Range	<p>If the temperature range of -10 °C to +80 °C is exceeded or undercut, the device shows the error message "Terminal temperature Range".</p> <p>The output changes to a safe state (quiescent current principle).</p> <p>The message can only be acknowledged, if the temperature is back again in the valid range.</p>
Resistance to climatic conditions	85 % rel. humidity without condensation (3K3 with extended temperature range according to DIN EN 60721-3-3)
EMC	According to DIN EN 14597 and standards from the standard series DIN EN 61326
Interference emission	Class B
Interference immunity	Evaluation criteria FS according to DIN EN 14597, regulation and control devices (RS)

1. All specifications refer to the measuring range end value

Case

Material	Polycarbonate
Flammability class	UL 94 V0
Electrical connection	On the front via screw terminals up to 2.5 mm ²
Mounting	On 35 mm DIN rail acc. to EN 60715
Installation position	vertical
Weight	Approx. 230 g
Protection type	IP 20 according to DIN EN 60529

Approvals/approval marks

Approval marks	Testing agency	Certificate / certification numbers	Inspection basis	Valid for
DIN	DIN CERTCO	STB/STW 1228	DIN EN 14597	All device versions
SIL2, SIL3	TÜV Nord (German Technical Inspection Agency)	SEBS-A.143631/14-2, V1.0	DIN EN 61508	All device versions
PL e			DIN EN ISO 13849	All device versions
GL	Germanischer Lloyd	36 790-11HH	Testing submitted	All device versions
Pressure Equipment Directive	TÜV Nord (German Technical Inspection Agency)	1045P0038/15/D0046	Pressure Equipment Directive 97/23/EG	All device versions
ATEX	TÜV Nord (German Technical Inspection Agency)	TÜV 11 ATEX 556139 X	Directive 94/9/EG	All device versions

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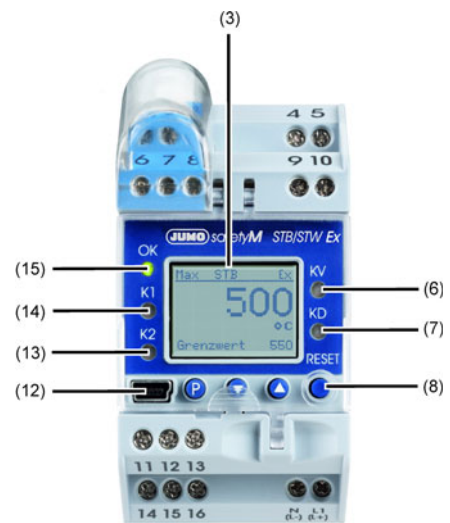
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Display and operating elements

Legend	Comment
3	LCD display Black/white with background lighting 96 x 64 pixels
6	LED KV (yellow) Is lit if the pre-alarm is triggered
7	LED KD (yellow) Is lit if the diagnostic processor has performed a switch-off
8	Keys (can only be operated when the transparent hood is folded upward) Increase value, Decrease value Programming RESET
12	Setup interface
13	LED K2 (red)^a Is always simultaneously lit with K1 when errors occur on analog input 1 or 2 or in the event of limit value exceedance
14	LED K1 (red)^a Is always simultaneously lit with K2 when errors occur on analog input 1 or 2 or in the event of limit value exceedance
15	LED OK Green: valid range Off: error occurred



a. The exceedance of the limit value is indicated by the installed LEDs K1 and K2 (red) for each channel, and the safety relevant relay output alarm (terminal 14 and 16) switches the system to an operational safe status (alarm range).

Galvanic isolation

Test Voltages:		
(1) Analog inputs		(2) Relay output alarm
(3) Binary input		(4) Pre-alarm relay output
(5) Setup interface		
(6) Display		
(7) Analog output		
(8) Voltage supply		

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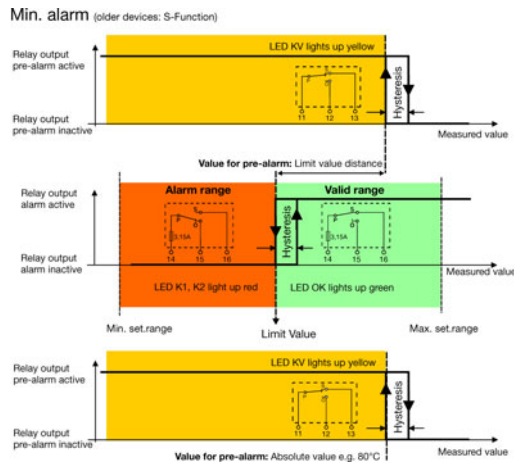
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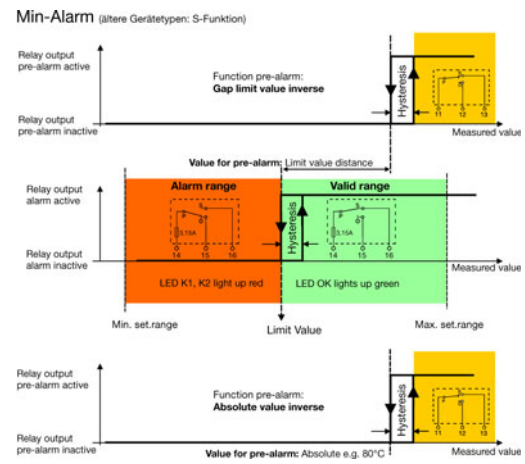


Switching behavior of the relay output pre-alarm

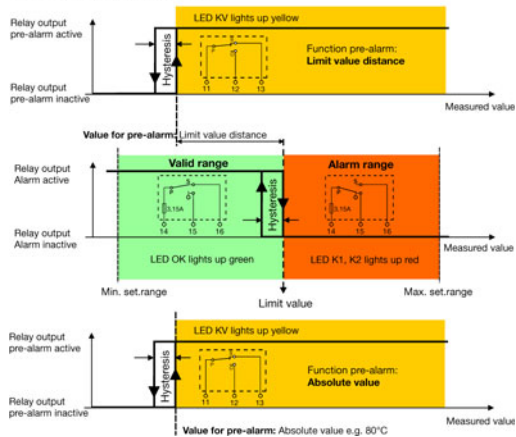
Absolute value or Limit val. dist. direct



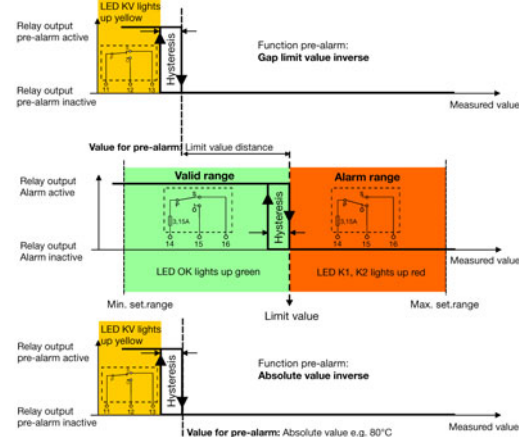
Absolute value or Limit val. dist. inverse



Max. alarm (older devices: O-Funktion)



Max. alarm (older devices: O-Funktion)



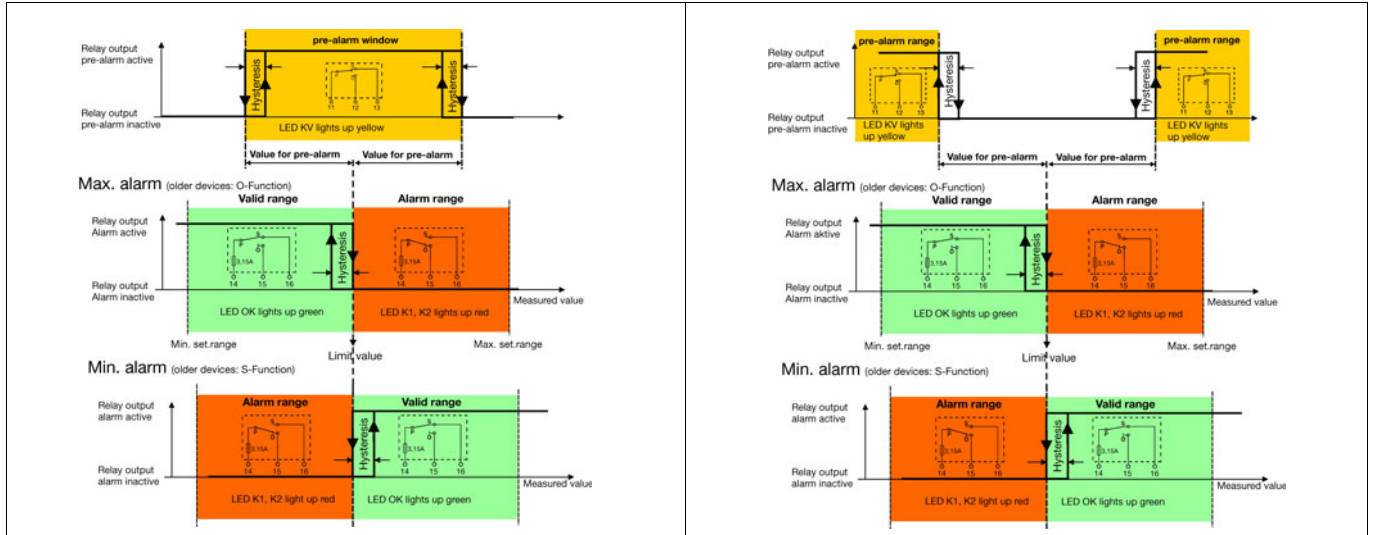
Window direct (it is irrelevant if Min-Alarm or Max-Alarm is set)

Window inverse (it is irrelevant if Min-Alarm or Max-Alarm is set)

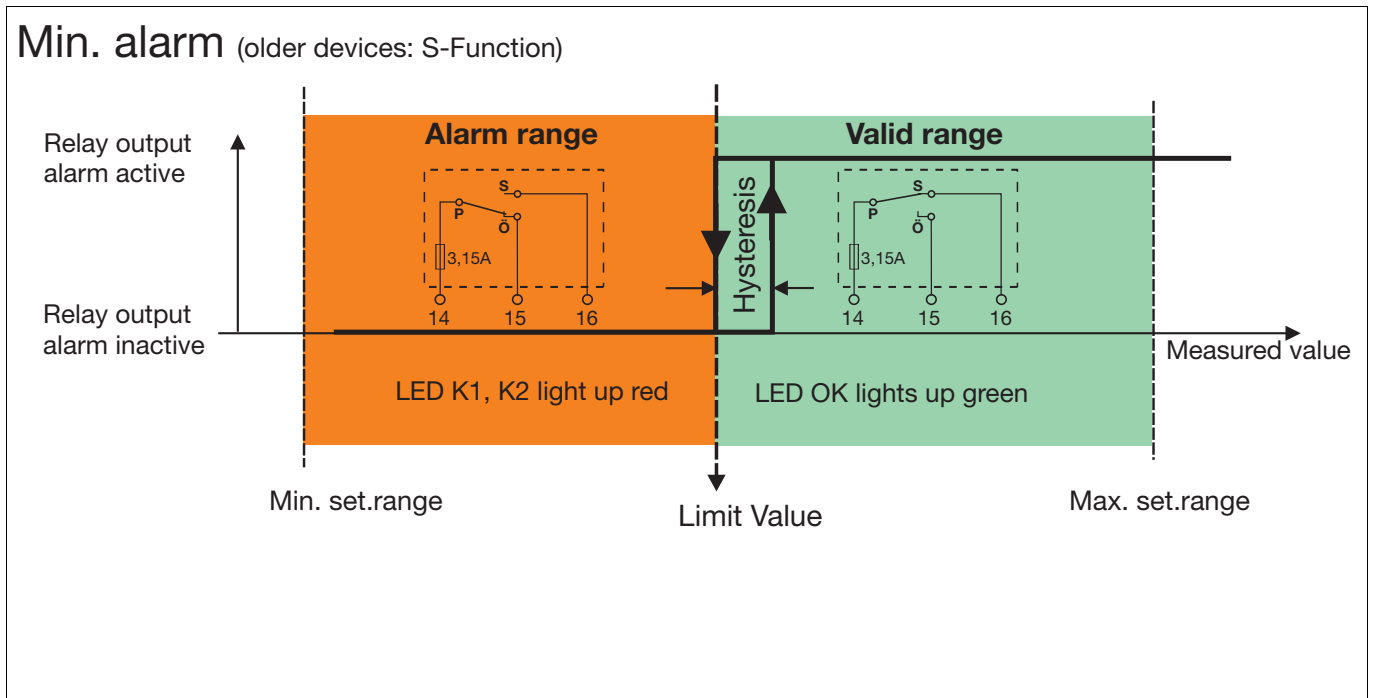
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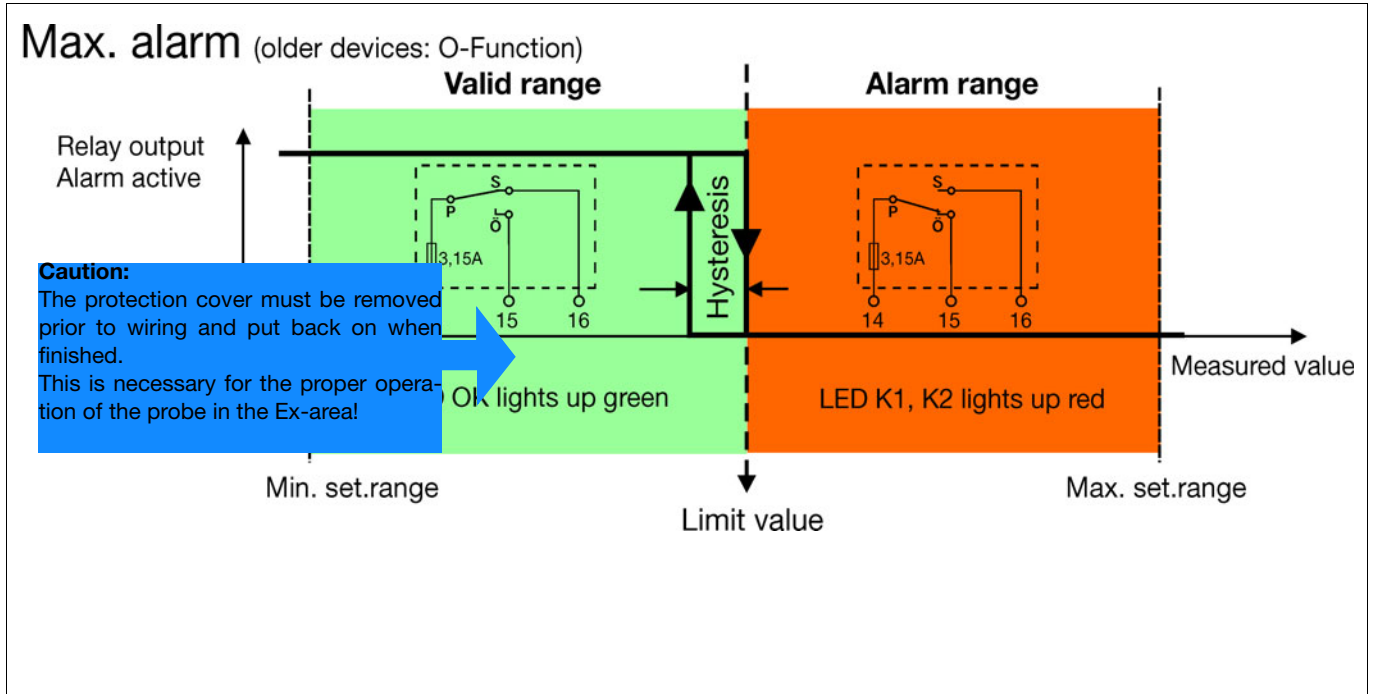


Switching behavior min. alarm






Switching behavior max. alarm (factory set)



Connection diagram

The connection diagram in the data sheet provides preliminary information about the connection possibilities. For the electrical connection only use the installation instructions or the operating manual. The knowledge and the correct technical execution of the safety information/instructions contained in these documents are mandatory for installation, electrical connection, and startup as well as for safety during operation.

The connection is made via screw terminals. 	Lead	Admissible cross section
	1-wire	≤ 2.5 mm ²
	Fine-strand, with ferrule	≤ 1.5 mm ²
Tightening torque of the screws: max. 0.5 Nm		

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Legend:	Comment	Screw terminals	Screw terminals
1, 2		Analog input 1 (E1)	Analog input 2 (E2)
	Thermocouple / Double thermocouple		
	When double-thermowells are connected to the measuring circuits (E1) and (E2) they have to be isolated. That means that both thermowells have no electrical connection to the protection fitting and furthermore no galvanically connection against each other (isolated assembly).		
	RTD temperature probe in 2-wire circuit		
	Enter the lead wire resistance for RTD temperature probes in 2-wire circuit when using greater line lengths. Setup program: <i>analog inputs</i>		
	RTD temperature probe Pt100/Pt1000 in 3-wire circuit		
RTD temperature probe Pt100 in 2-wire circuit, single sensor for both analog inputs			
Caution: When only one probe (SIL2) is connected, the temperature limiter device is reduced from SIL3 to SIL2! However, the internal 2-channel structure (1oo2D) in the device still remains. Both channels measure the same sensor due to the simplified external wiring.			
(4) to 20 mA			
(4) to 20 mA for both analog inputs			
Caution: When only one probe (SIL2) is connected, the temperature limiter device is reduced from SIL3 to SIL2! However, the internal 2-channel structure (1oo2D) in the device still remains. Both channels measure the same current signal due to the simplified external wiring.			
4	Binary input Connection to a potential-free contact	Ground	
5	Analog output: 0 to 20 mA 4 to 20 mA (factory set) 0(2) to 10 V		
9	Voltage supply Acc. to nameplate	AC: L1 line conductor N neutral conductor 	DC: (L+) (L-)
10	Relay output alarm (zero-current state) Relay (changeover contact) with fuse cut-out		

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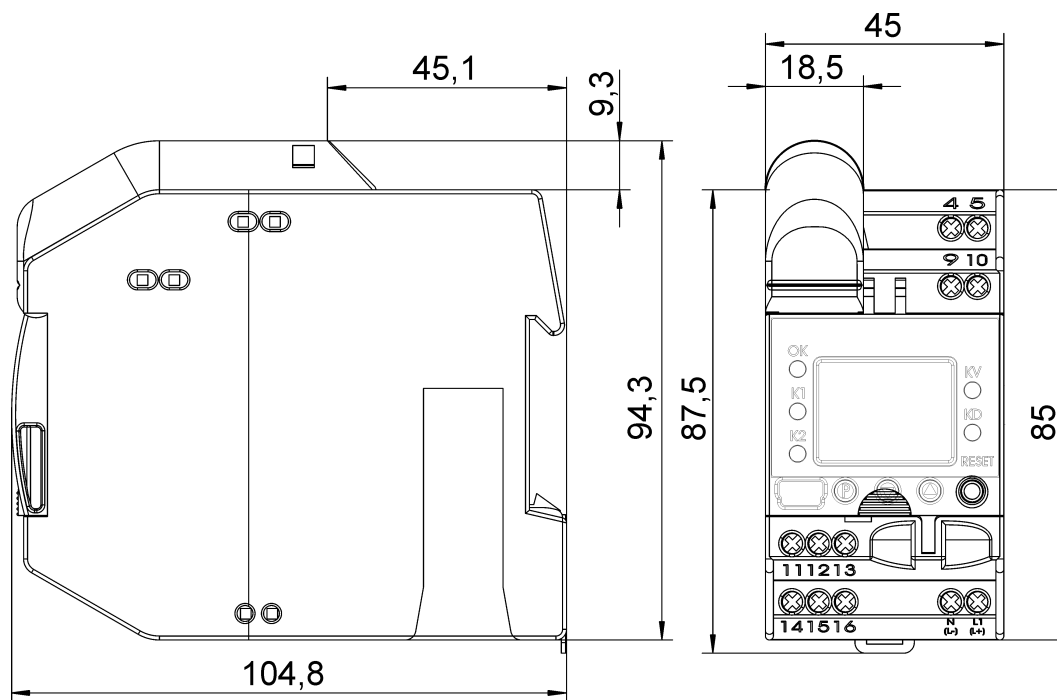
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Legend:	Comment	Screw terminals	Screw terminals
11	Relay output pre-alarm (KV) Relay (changeover contact)		

Dimensions

Type 701155/...



Important probe information in the following tables

The following should be noted:

A safe galvanic isolation between sensor and the case does not exist. As a result, the sensor connections are to be considered grounded for the safety assessment.

Among other things the EN 60079-0 requires of the EPL Ga that the mass fraction of aluminum must be less than 10 % for the production of metallic casing. The terminal head of the probes used by JUMO contains more than 10 % aluminum. Therefore the terminal head for the use of EPL Ga (zone 0) must be secured by a suitable impact protection. The impact protection must securely prevent friction sparks, contact-breaking sparks, and impact sparks. Otherwise the risk of ignitable sparks exists.

No other precautions have to be taken when used in EPL Gb (zone 1).

DIN-approved probes for the operating-medium air

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Note: because of the high response accuracy, the use of thermowells (immersion sleeves) is not admissible.

Current type designation	Probe type	Temperature range	Nom. length mm	Process connection
RTD temperature probe data sheet 902006				
902006/65-228-1003-1-15-500-668/922	1 × Pt100	-170 to +700 °C	500	
902006/65-228-1003-1-15-710-668/922			710	
902006/65-228-1003-1-15-1000-668/922			1000	
902006/55-228-1003-1-15-500-254/922	1 × Pt100	-170 to +700 °C	500	
902006/55-228-1003-1-15-710-254/922			710	
902006/55-228-1003-1-15-1000-254/922			1000	
902006/65-228-2003-1-15-500-668/922	2 × Pt100	-170 to +700 °C	500	Stop flange displaceable
902006/65-228-2003-1-15-710-668/922			710	
902006/65-228-2003-1-15-1000-668/922			1000	
902006/55-228-2003-1-15-500-254/922	2 × Pt100	-170 to +700 °C	500	Displaceable screw connection G1/2
902006/55-228-2003-1-15-710-254/922			710	
902006/55-228-2003-1-15-1000-254/922			1000	
Thermocouples data sheet 901006				
901006/65-547-2043-15-500-668/922	2 × NiCr-Ni, type "K"	-35 to +800 °C	500	Stop flange displaceable
901006/65-547-2043-15-710-668/922			710	
901006/65-547-2043-15-1000-668/922			1000	
901006/65-546-2042-15-500-668/922	2 × Fe-CuNi, type "L"	-35 to +700 °C	500	
901006/65-546-2042-15-710-668/922			710	
901006/65-546-2042-15-1000-668/922			1000	
901006/66-550-2043-6-500-668/922	2 × NiCr-Ni, type "K"	-35 to +1000 °C	500	
901006/66-550-2043-6-355-668/922			355	
901006/66-550-2043-6-250-668/922			250	
901006/66-880-1044-6-250-668/922	1 × PT10Rh-PT, type "S"	0 to 1300 °C	250	
901006/66-880-1044-6-355-668/922			355	
901006/66-880-1044-6-500-668/922			500	
901006/66-880-2044-6-250-668/922	2 × PT10Rh-PT, type "S"	0 to 1300 °C	250	Stop flange displaceable
901006/66-880-2044-6-355-668/922			355	
901006/66-880-2044-6-500-668/922			500	

Current type designation	Probe type	Temperature range	Nom. length mm	Process connection
901006/66-953-1046-6-250-668/922	1 × PT30Rh-PT6Rh, type "B"	600 to 1500 °C	250	
901006/66-953-1046-6-355-668/922			355	
901006/66-953-1046-6-500-668/922			500	
901006/66-953-2046-6-250-668/922	2 × PT30Rh-PT6Rh, type "B"	600 to 1500 °C	250	
901006/66-953-2046-6-355-668/922			355	
901006/66-953-2046-6-500-668/922			500	

DIN-approved probes for operating medium water and oil

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Note: because of the high response accuracy, **the use of thermowells** (immersion sleeves) **is not admissible**.

Current type designation	Probe type	Temperature range	Nom. length mm	Process connection
RTD temperature probe data sheet 902006				
902006/10-226-1003-1-9-250-104/922	1 × Pt100	-40 to +480 °C	250	Screw connection G1/2
902006/10-226-2003-1-9-250-104/922	2 × Pt100		250	
902006/54-227-2003-1-15-710-254/922	2 × Pt100	-170 to 550 °C	65 to 670	Displaceable screw connection G1/2
902006/54-227-1003-1-15-710-254/922	1 × Pt100		65 to 670	
902006/10-402-1003-1-9-100-104/922	1 × Pt100	-170 to 400 °C	100	Screw connection G1/2
902006/10-402-2003-1-9-100-104/922	2 × Pt100		100	
Thermocouples data sheet 901006				
901006/54-544-2043-15-710-254/922	2 × NiCr-Ni, type "K"	-35 to 550 °C	65 to 670	Displaceable screw connection G1/2
901006/54-544-1043-15-710-254/922	1 × NiCr-Ni, type "K"		65 to 670	
901006/54-544-2042-15-710-254/922	2 × FeCuNi, type "L"		65 to 670	
901006/54-544-1042-15-710-254/922	1 × FeCuNi, type "L"		65 to 670	

Note: because of the high response accuracy, **only use thermowells** (immersion sleeves) **that are included** in the scope of delivery.

Current type designation	Probe type	Temperature range	Nom. length mm	Process connection
RTD temperature probe data sheet 902006				
902006/53-505-2003-1-12-190-815/922	2 × Pt100	-40 to +400 °C	190	
902006/53-507-2003-1-12-100-815/922	2 × Pt100 (arranged beneath each other in the sheath)	-40 to +480 °C	100	
902006/53-507-2003-1-12-160-815/922			160	
902006/53-507-2003-1-12-190-815/922			190	
902006/53-507-2003-1-12-220-815/922			220	
902006/53-507-1003-1-12-100-815/922	1 × Pt100	-40 to +480 °C	100	Weldable sleeve
902006/53-507-1003-1-12-160-815/922			160	
902006/53-507-1003-1-12-220-815/922			220	
902006/53-505-1003-1-12-190-815/922	1 × Pt100	-40 to +400 °C	190	
902006/53-505-3003-1-12-100-815/922	3 × Pt100	-40 to +400 °C	100	
902006/53-505-3003-1-12-160-815/922			160	
902006/53-505-3003-1-12-220-815/922			220	
902006/40-226-1003-1-12-220-815/922	1 × Pt100	-170 to +480 °C	220	Weldable sleeve
902006/40-226-1003-1-12-160-815/922			160	
902006/40-226-1003-1-12-100-815/922			100	
Thermocouples data sheet 901006				
901006/53-543-1042-12-220-815/922	1 × Fe-CuNi type "L"	-35 to 480 °C	220	Weldable sleeve
901006/53-543-2042-12-220-815/922	2 × Fe-CuNi type "L"		220	

DIN-approved probes for the operating medium air, water, and oil

Note: because of the high response accuracy, **the use of thermowells** (immersion sleeves) **is not admissible**.

Current type designation	Probe type	Temperature range	Nom. length mm	Process connection
RTD temperature probe data sheet 902006				
902006/10-390-1003-1-8-250-104/22	1 × Pt100	max. 300 °C	250	Screw-in thread G1/2
Thermocouples data sheet 901006				
901006/45-551-2043-2-xxxx-11-xxxx	2 × NiCr-Ni, type "K"	max. 1150 °C	50 to 2000	

Important information: the probes described in data sheets 901006 and 902006 are also certified for the Pressure Equipment Directive

Protective, regulation, and control devices

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Safety temperature monitor STW¹

The safety temperature monitor is a device that is automatically reset when activated once the sensor temperature has fallen below or risen above the set limit value by an amount equal to the switching differential. Possible settings: monitoring for limit value overrange or underrange.

Mode of operations:
 Minimum requirements: 2B, 2K, 2P
 Additional requirements: 2N, 2D

Safety temperature limiter STB¹

The safety temperature limiter is a device that is permanently locked after responding. Manual reset using the RESET key is possible once the probe temperature has fallen below / has exceeded the limit value by the amount of the switching differential. Possible settings: monitoring for overrange or underrange.

Mode of operations:
 Minimum requirements: 2B, 2J, 2V, 2K, 2P and adjustable with special tools
 Additional requirements: 2N, 2F, 2D

¹ For more detailed explanation, see DIN EN 14 597.

Connection possibilities of the sensors

The JUMO safetyM STB/STW evaluation device structure is basically identical. Various possibilities to connect the sensors are available. These possibilities are listed in the following table along with the achievable SIL level:

Variant	Connected sensors	Architecture		Achievable SIL			
		Sensor system	Logics				
1	1 x Pt100 in 2-wire circuit individual sensor	1oo1	1oo2D	2			
1a	2x Pt100/1000 2-wire circuit	1oo2	1oo2D	3			
2	2x Pt100/1000 3-wire circuit	1oo2	1oo2D	3			
3	2x thermocouple	1oo2	1oo2D	3			
4	1x Pt100/1000 2-wire and 3-wire circuit 1x thermocouple	1oo2	1oo2D	3			
5	STB/STW 70.1150 without sensor system 1oo2D architecture no probe or use 4 to 20 mA (means that the sensor is not taken into account for the calculation).	Sensors connected by the system user Architecture acc. to connection 1oo1 or 1oo2	1oo2D	SIL of the used sensor (HW only)	The systematic capability (SC) of the used sensor	Max. achievable SIL of the system with 1oo1 sensor system architecture	Max. achievable SIL of the system with 1oo2 sensor system architecture
				1	1	1	1
				1	2	1	2
				2	2	2	2
				2	3	2	3
			3	3	3	3	

Important information:

Variants 1 to 4 were evaluated with JUMO probes according to data sheets 901006 and 902006. For variant 5 no sensor system was included. In this case, the user selects the sensor system. For this reason, the user is responsible for evaluating the achievable SIL.

If the used SIL-capable sensor consists of hardware and software (e.g. transmitter), the maximum SIL that can be achieved – irrespective of the architecture – is the one according to which the sensor software was developed (so, for example, if the sensor software has SIL2, the max. achievable SIL is 2).

The possibility to connect passive sensors such as double thermocouples or Pt100/1000 sensors means that the sensors do not necessarily require a SIL qualification. In this case, the specification of the failure rates for the passive sensors is sufficient for the SIL qualification of the overall system. The user of the system must always determine the PFD_{avg} and/or PFH value of the overall safety chain to evaluate the achieved SIL.

Failure rates and SFF for 701155...23 (AC 230 V)

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Table 1:

Variant	λ_s [Fit]	λ_{dd} [Fit]	λ_{dd} [Fit]	SSF	PFH (1/h)	PFD _{avg}
1	985.14	306.75	32.93	96 %	5.18 e ⁻⁹	2.29 e ⁻⁴
1a	985.14	306.75	32.93	96 %	1.66 e ⁻⁹	7.29 e ⁻⁵
2	988.1	303.79	32.93	96 %	1.66 e ⁻⁹	7.29 e ⁻⁵
3	1001.55	324.85	36.68	96 %	1.71 e ⁻⁹	7.46 e ⁻⁵
4	1007.61	341.89	38.58	96 %	1.73 e ⁻⁹	7.55 e ⁻⁵
5	1000.95	318.38	31.75	96 %	1.54 e ⁻⁹	6.74 e ⁻⁵

Failure rates and SFF for 701155...25 (AC/DC 24 V)

Table 2:

Variant	λ_s [Fit]	λ_{dd} [Fit]	λ_{dd} [Fit]	SSF	PFH (1/h)	PFD _{avg}
1	919.23	306.82	34.24	96 %	7.22 e ⁻⁹	3.19 e ⁻⁴
1a	919.23	306.82	34.24	96 %	3.71 e ⁻⁹	1.63 e ⁻⁴
2	886.19	303.86	34.24	96 %	3.71 e ⁻⁹	1.63 e ⁻⁴
3	947.18	325.86	37.89	96 %	3.75 e ⁻⁹	1.64 e ⁻⁴
4	953.24	350.21	40.59	96 %	3.85 e ⁻⁹	1.69 e ⁻⁴
5	938.89	323.57	36.89	96 %	3.68 e ⁻⁹	1.61 e ⁻⁴

Important information:

Variants 1 to 4 were evaluated with JUMO probes according to data sheets 901006 and 902006.

For variant 5 no sensor system was included (only the JUMO safetyM STB/STW Ex).

In this case, the user selects the sensor system.

The PFH and PFD_{avg} values were calculated with the assumption that the time to restore the system is 8 h (MTTR = 72 h). Furthermore, the calculation was based on a lifetime of 10 years (T₁ = 10 y). The Common Cause Factor was determined according to the tables of DIN EN 61508 for sensor systems and logic.

Achievable PL

Variant	Connected sensors	Sensor system architecture	Logic architecture	Achievable PL		
1	1x Pt100 2-wire circuit	1oo1	1oo2D	PLd		
1a	2x Pt100/1000 2-wire circuit	1oo2	1oo2D	PLe		
2	2x Pt100/1000 3-wire circuit	1oo2	1oo2D	PLe		
3	2x thermocouple	1oo2	1oo2D	PLe		
4	1x Pt100/1000 2-wire and 3-wire circuit 1x thermocouple	1oo2	1oo2D	PLe		
5	STB/STW 701155 without sensor system 1oo2D architecture. No probe or use of the input 4 to 20 mA (means that the sensor is not taken into account for the calculation).	Sensors connected by the system user architecture acc. to connection 1oo1 or 1oo2	1oo2D	PL of the used sensor MTFF _d = 100 years	Max. achievable PL of the system with 1oo1 sensor system architecture DC ₇₀₁₁₅₅ ≥ 90 %	Max. achievable PL of the system with 1oo2 sensor system architecture DC ₇₀₁₁₅₅ ≥ 90 %
				PLb	PLd	PLe
				PLc	PLd	PLe
				PLd	PLd	PLe
				PLe	PLe	PLe

Important information:

Variants 1 to 4 were evaluated with JUMO probes according to data sheets 901006 and 902006. For variation 5 no sensor system was included (only the JUMO safetyM STB/STW). In this case, the user selects the sensor system. For this reason, the user is responsible for evaluating the achievable PL.

Calculations DIN EN ISO 13849-1 Performance Level - low voltage 230 V

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Table 3:

Variant	MTTF _d	DC _{avg}	CCF	PL
1	100 years ³ (336 years)	90 %	80	PLd
1a	100 years ³ (336 years)	90 %	80	PLe
2	100 years ³ (339 years)	90 %	80	PLe
3	100 years ³ (316 years)	90 %	80	PLe
4	100 years ³ (312 years)	90 %	80	PLe
5	100 years ³ (326 years)	91 %	80	See table achievable PL

Calculations DIN EN ISO 13849-1 Performance Level - extra low voltage (ELV) 24 V

Table 4:

Variant	MTTF _d	DC _{avg}	CCF	PL
1	100 years ³ (335 years)	90 %	80	PLd
1a	100 years ³ (335 years)	90 %	80	PLe
2	100 years ³ (338 years)	90 %	80	PLe
3	100 years ³ (314 years)	90 %	80	PLe
4	100 years ³ (304 years)	90 %	80	PLe
5	100 years ³ (317 years)	90 %	80	See table achievable PL

3. The MTTF_d value of a partial system must be limited to 100 years according to the DIN EN ISO 13849-1 requirements.

ATEX identification

1-sensor variant:

II (1) (2) (3) G (b1) [Ex ia Ga] [e pz] IIC
 II (1) (2) (3) D (b1) [Ex ia Da] [p Dc] IIIC

Standard designation according to EN 60079-0
 Explosion group II C gases, low ignition energy such as hydrogen
 III C conductive dusts

Standard designation according to EN 50495 ¹⁾
 e: temperature monitoring unit with SIL 2 and HFT from 0 for category 2 based
 on ignition protection type "e" increased safety according to EN 60079-7

pz: minimum overpressure monitoring for static overpressure
 encapsulation with SIL 2 and HFT from 0 for category 3 based on
 the ignition protection type "p" overpressure encapsulation according to
 EN 60079-2

p Dc: minimum overpressure monitoring for static overpressure
 encapsulation with SIL 2 and HFT from 0 for category 3 based on
 the ignition protection type "pD" according to EN 61241-4 equivalent to
 "pz" according to EN 60079-2)

Standard designation according to standard series EN 60079 for electrical devices
 ia: related equipment according to ignition protection "i" intrinsically safe according to
 EN 60079-11,
 "ia" (2-failsafe) for category 1
 "EPL" (Equipment Protection Level)
 Ga (gases) for category 1
 Da (dust) for category 1

Standard designation according to standard series EN 13463 for non-electrical devices
 "b1" ignition source monitoring according EN 13463-6 with IPL 1 (Ignition
 Prevention Level) for category 2

Standard designation

Category according to ATEX directive 94/9/EG
 G: gas explosion protection; D: dust explosion protection

Safety device according to EN 50495 for category 3 applications for
 ignition protection type static overpressure encapsulation type "pz" according to EN 60079-2

Safety devices according to EN 50495 for category 2 applications for
 ignition protection type increased safety "e" nach EN 60079-7
 Safety device according to EN 13463-6 for category 2 applications for ignition protection:
 ignition source monitoring of non-electrical ignition dangers "b1" according to EN 13463-6

Related equipment for intrinsic safety according to EN 60079-11 for category 1
 Applications for ignition protection type intrinsic safety "ia"

Guidelines designation for device group II (non-firedamp endangered mine workings)

Designation explosionproof according to ATEX directive 94/9/EG

¹⁾ The monitored electrical equipment is not a potential ignition source in standard operation

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2-sensor variant:

	II (1) (1) (2) G	(b2) [Ex ia Ga] [e py] IIC
	II (1) (1) (2) D	(b2) [Ex ia Da] [p Db] IIIC
<p>Standard designation according to EN 60079-0 Explosion group II C gases, low ignition energy such as hydrogen III C conductive dusts</p> <hr/> <p>Standard designation according to EN 50495 ¹⁾ e: temperature monitoring unit with SIL 2 and HFT from 0 for category 2 based on ignition protection type "e" increased safety according to EN 60079-7</p> <p>py: minimum overpressure monitoring for static overpressure encapsulation with SIL 2 and HFT from 1 for category 2 based on the ignition protection type "p" overpressure encapsulation according to EN 60079-2</p> <p>p Db: minimum overpressure monitoring for static overpressure encapsulation with SIL 2 and HFT from 0 für category 2 based on the ignition protection type "pD" according to EN 61241-4 (equivalent to "py" according to EN 60079-2)</p> <hr/> <p>Standard designation according to standard series EN 60079 for electrical devices ia: related equipment according to ignition protection "i" intrinsically safe according to EN 60079-11, "ia" (2-failsafe) for category 1 "EPL" (Equipment Protection Level) Ga (gases) for category 1 Da (dust) for category 1</p> <hr/> <p>Standard designation according to standard series EN 13463 for non-electrical devices "b2" ignition source monitoring according EN 13463-6 with IPL 2 (Ignition Prevention Level) for category 1</p> <hr/> <p>Standard designation</p> <p>Category according to ATEX directive 94/9/EG G: gas explosion protection; D: dust explosion protection</p> <hr/> <p>Safety device according to EN 50495 for category 2 applications for ignition protection type static overpressure encapsulation type "py" according to EN 60079-2</p> <hr/> <p>Safety devices according to EN 50495 for category 1 applications for ignition protection type increased safety "e" nach EN 60079-7 Safety device according to EN 13463-6 for category 1 applications for ignition protection: ignition source monitoring of non-electrical ignition dangers "b2" according to EN 13463-6</p> <hr/> <p>Related equipment for intrinsic safety according to EN 60079-11 for category 1 Applications for ignition protection type intrinsic safety "ia"</p> <hr/> <p>Guidelines designation for device group II (non-firedamp endangered mine workings)</p>		
<p>Designation explosionproof according to ATEX directive 94/9/EG</p>		

¹⁾ The monitored electrical equipment is not a potential ignition source in standard operation

Setup program

When using the device to monitor minimum excess pressure for static pressurization based on the ignition protection category "p" according to EN 60079-2 then the setup program is required for the display of the "Pa" pressure unit.

Scope of delivery

1 JUMO safetyM STB/STW Ex in the ordered version
1 operating manual b701155.0

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Order details

(1) model	
701155	STB / STW with ATEX approval
(2) configuration	
8	with factory settings
9	programming to customer specification
(3) language	
01	German
02	English
03	French
(4) basic type extension	
0251	Safety temperature monitor (O-function)
0252	Safety temperature monitor (N.O.-funct.)
0253	Safety temperature limiter (O-function)
0254	Safety temperature limiter (N.O.-funct.)
(5) measuring input	
1003	1x Pt100 2-wire
1053	1x 4...20mA
2001	2x Pt100 3-wire
2003	2x Pt100 2-wire
2005	2x Pt1000 2-wire
2006	2x Pt1000 3-wire
2036	2x W5Re-W26Re "C"
2037	2x W3Re-W25Re "D"
2039	2x Cu-CuNi "T"
2040	2x Fe-CuNi "J"
2041	2x Cu-CuNi "U"
2042	2x Fe-CuNi "L"
2043	2x NiCr-Ni "K"
2044	2x Pt10Rh-Pt "S"
2045	2x Pt13Rh-Pt "R"
2046	2x Pt30Rh-Pt6Rh "B"
2048	2x NiCrSi-NiSi "N"
2053	2x 4...20mA
(6) power supply	
23	AC 110..240V +10/-15% 48..63Hz
25	AC/DC 20..30V 48..63Hz
(7) output	
001	0..20mA continue
005	4..20mA continue
040	0..10V analog
070	2..10V analog
(8) GL approval	
000	without approvals
062	with GL approval
(9) extra code	
000	without approval
059	with SIL, PL, IPL approval

Order code

(1) (2) (3) (4) (5) (6) (7) (8) (9)
 / - - - - / , ,

Accessories

Article	Sales no.
Setup program, multilingual	70/00548742
USB cable	70/00506252
External unlocking button RT	70/97097865