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

Brief description

The compact and user configurable JUMO safety**M** 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 primary task of safety temperature limiters is to reliably monitor thermal processes and to switch plants to a safe operating status in the event of malfunctions. Along with the existing approvals according to DIN 14597, SIL 3, PL e (Performance Level), DNV, the device also has approval according to ATEX and can therefore also be used for measurements in Ex areas. However, the device itself has to be installed 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 ISO 80079-37 as an ignition source monitoring device (iPL 2) as specified in the ATEX directive and can be used to monitor potentially explosive atmospheres containing gas or dust. The device concept 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 backlight display with plain text provides quick and straightforward configuration directly on the device. The clear menu structure ensures easy operation, which in turn shortens startup times. All safety relevant process values are displayed and the most important functions are shown by simple pictograms.



Type 701155/ ...044/059

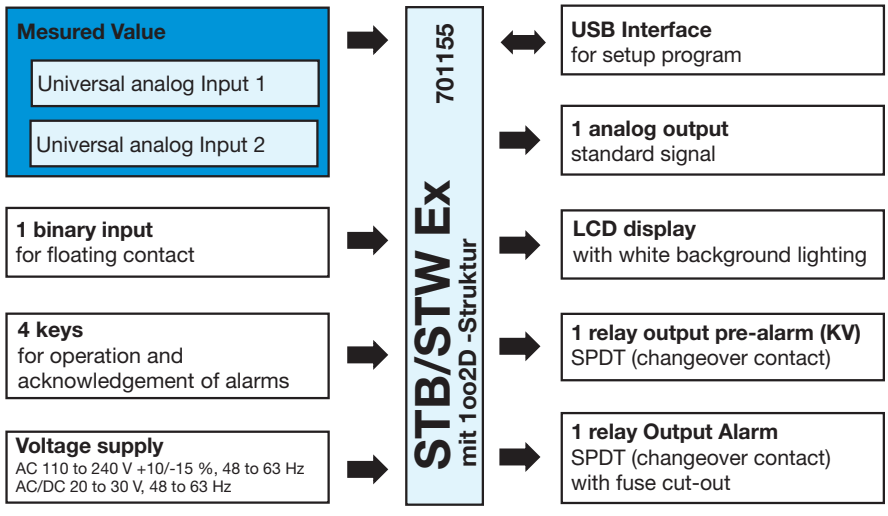


Type 701155/ ...045/059

Special features

- 1oo2D structure for a high degree of process reliability
- LCD display with backlight 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 or adjustable as a margin from the limit value
- Wide voltage supply range from AC 110 to240 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), DIN, ATEX, EAC and optionally DNV

Block diagram



Approvals/approval marks (see "Technical data")

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Technical data

Analog inputs

RTD temperature probe

Designation	Measuring range	Accuracy Two/three-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 line resistance in two-wire circuit: 15 Ω; three-wire circuit: 30 Ω		
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 Pt100 two-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 (up to 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 measuring range.

Direct current

Measuring range	Accuracy	Ambient temperature influence
4 to 20 mA, 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

	Signal type	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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Digital input

Connection	Function
1 potential-free contact	Unlocking, keyboard 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 AC 250 V, 3 A, 50 Hz (resistive load) or maximum DC 30 V, 3 A. Minimum current: DC 12 V, 100 mA
Alarm relay output	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 AC 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 three-wire circuit and double thermocouples	Thermocouples	Current 4 to 20 mA
Out of range	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; alarm relay output is inactive		LED K1, K2, KD, and KV are lit; ">>>>" flashes in the display; alarm relay output is inactive
Probe short circuit	Is detected LED K1, K2, KD, and KV are lit "<<<<" flashes in the display; alarm relay output is inactive	Is detected by difference monitoring of the analog inputs	LED K1, K2, KD, and KV are lit; "<<<<" flashes in the display; alarm relay output is inactive

Voltage supply

Voltage supply	AC/DC 20 to 30 V, 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 operating mode Analog output 10 mA; display backlight off; alarm relay output switched on; pre-alarm relay switched 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 of AC 110 to 240 V +10 % /-15 %	3.7 kV/50 Hz
- With a voltage supply of 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
Site altitude	maximum 2000 m above MSL
Temperature influence	≤ ±0.005 %/K dev. from 23 °C[1] for RTD temperature probes
	≤ ± 0.01 %/K dev. from 23 °C[1] for thermocouple, current
Terminal temperature range	If the temperature range between -10 °C and +80 °C is exceeded or not reached, the device displays the "Terminal temperature" error message. The output changes to a safe state (quiescent current principle). The message can only be acknowledged if the temperature has moved back into the valid range.
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 standards 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

Housing

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

Approvals

	Designation	DIN
	Testing agency	DIN CERTCO
	Certifikate no.	STB/STW1228
	Inspection basis	DIN EN 14597
	Valid for	All device versions
	Designation	SIL2, SIL3
	Testing agency	TÜV Nord
	Certifikate no.	SEBS-A.102606/16-2 V1.0
	Inspection basis	DIN EN 61508, DIN EN 60730-2-9, DIN EN 14597
	Valid for	All device versions
	Designation	PL e
	Testing agency	TÜV Nord
	Certifikate no.	SEBS-A.102606/16-2 V1.0
	Inspection basis	DIN EN ISO 13849-1
	Valid for	All device versions
	Designation	DNV
	Testing agency	DNV
	Certifikate no.	TAA000017J
	Inspection basis	DNV rules for classification - Ships, offshore units, and high speed and light craft
	Valid for	Only devices with extra code 062

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	Designation	ATEX „i“
	Testing agency	TÜV Nord
	Certifikate no.	TÜV 11 ATEX 556139 X
	Inspection basis	Directive 2014/34/EU
	Valid for	Devices with blue terminals, Ignition protection level 044
	Designation	ATEX „e“ und „t“
	Testing agency	Eurofins / Electrosuisse Product Testing AG
	Certifikate no.	SEV 17 ATEX 0161 X
	Inspection basis	Directive 2014/34/EU
	Valid for	Devices with black terminals, Ignition protection level 045
	Designation	IECEx „i“
	Testing agency	TÜV Nord
	Certifikate no.	IECEx TUN 15.0036X
	Inspection basis	IEC 60079-0, IEC 60079-11, IEC 80079-36, IEC 80079-37
	Valid for	Devices with blue terminals, Ignition protection level 044
	Designation	IECEx „e“ and „t“
	Testing agency	Eurofins Electrosuisse Product Testing AG
	Certifikate no.	IECEx SEV 22.0016X
	Inspection basis	IEC 60079-0, IEC 60079-7, IEC 60079-31, IEC 80079-36, IEC 80079-37
	Valid for	Devices with black terminals, Ignition protection level 045
	Designation	EAC Ex
	Testing agency	Профи-Тест
	Certifikate no.	No. TC RU C-DE.HB07.B.00119/20
	Inspection basis	TP TC 012/2011
	Valid for	Only devices with extra code 240
	Designation	UKCA
	Testing agency	Bureau Veritas
	Certifikate no.	EPS 22 UKEX 2 108 X
	Inspection basis	EN IEC 60079-0:2018, EN IEC 60079-11:2012, EN 50495:2010 EN ISO 80079-36:2016, EN ISO 80079-37:2016
	Valid for	Devices with blue terminals, Ignition protection level 044, extra code 085
	Designation	UKCA
	Testing agency	Bureau Veritas
	Certifikate no.	EPS 22 UKEX 1 107 X
	Inspection basis	EN IEC 60079-0:2018, EN IEC 60079-7:2015/A1 :2018, EN 60079-31 :2014 EN ISO 80079-36:2016, EN ISO 80079-37:2016 EN 50495:2010, EN 60079-1 :2014
	Valid for	Devices with black terminals, Ignition protection level 045, extra code 085

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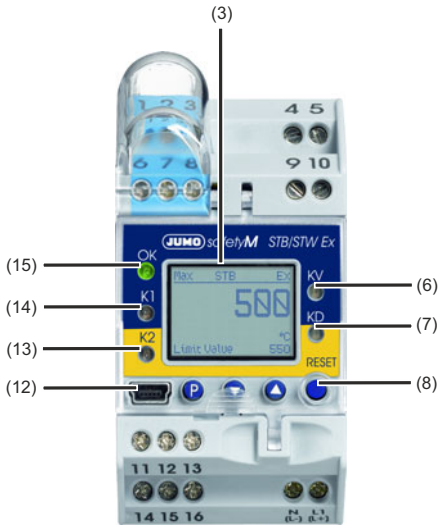
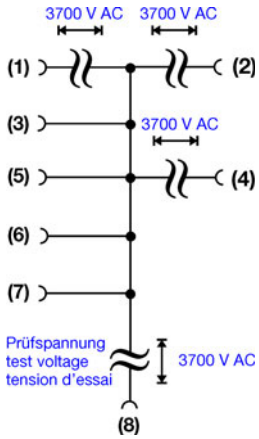
Display and control elements

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)** [1] 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)**[1] 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	

1. The limit value exceedance 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 a safe operating status **(alarm range)**.

Galvanic isolation

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

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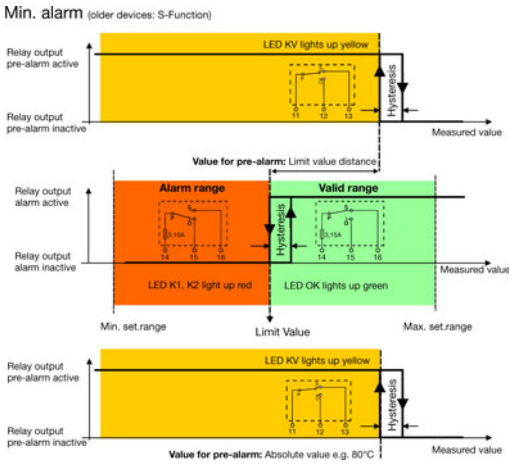
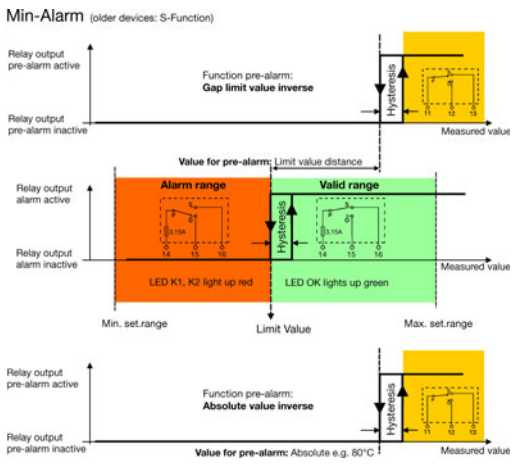
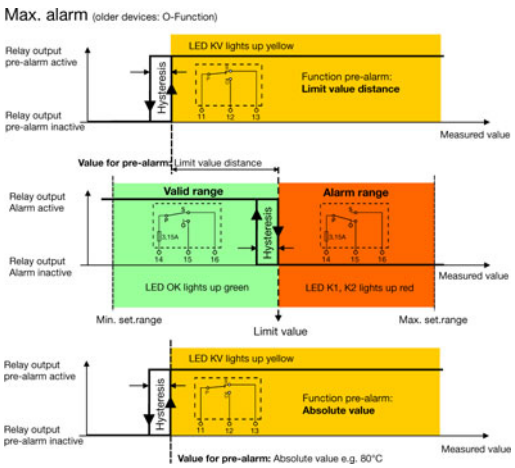
Switching behavior of pre-alarm relay output

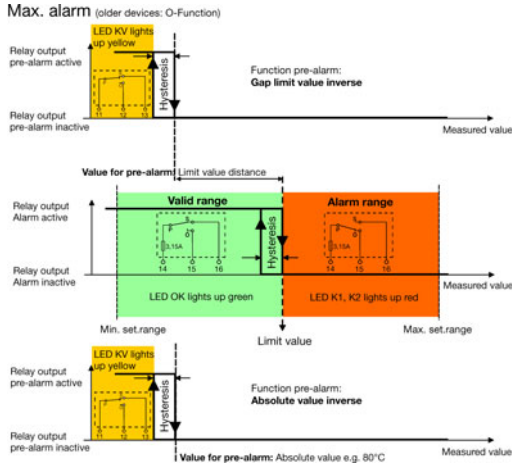
Absolute value or distance from the direct limit value



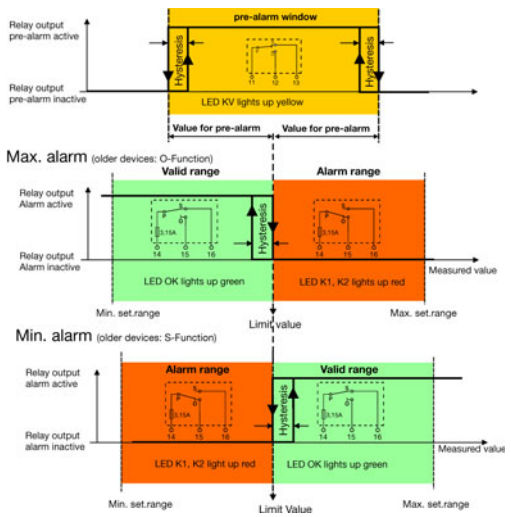
Absolute value or distance from the inverse limit value



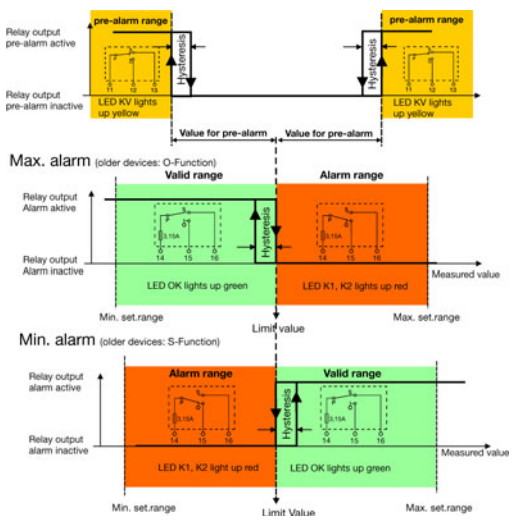




Direct window (independent of the min. or max. alarm setting)



Inverse window (independent of the min. or max. alarm setting)



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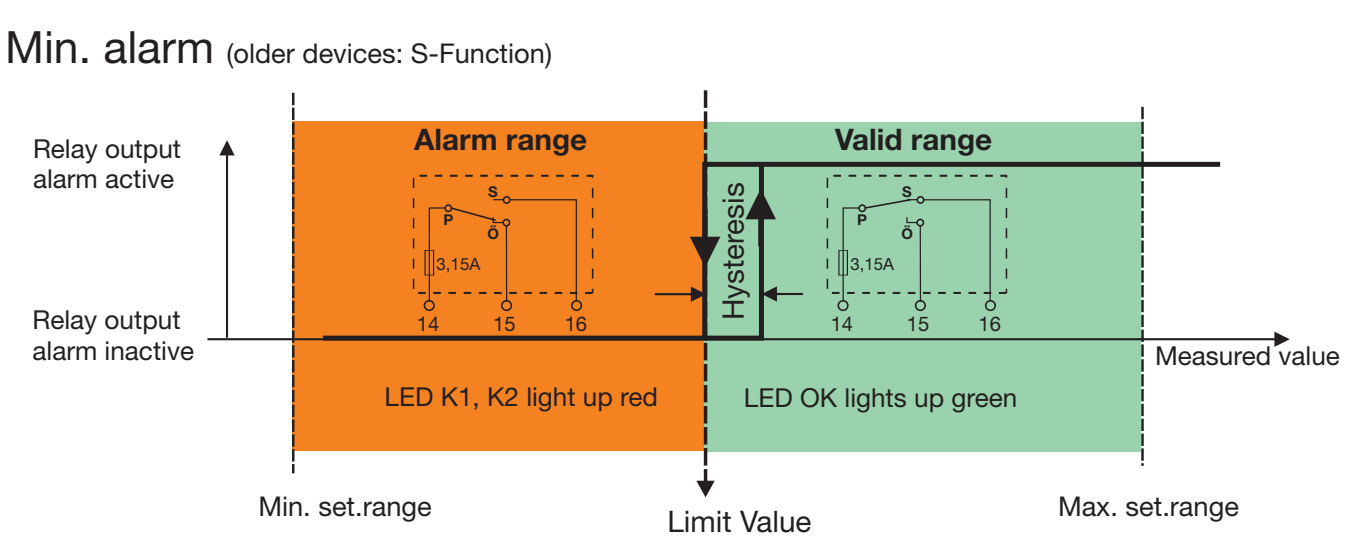
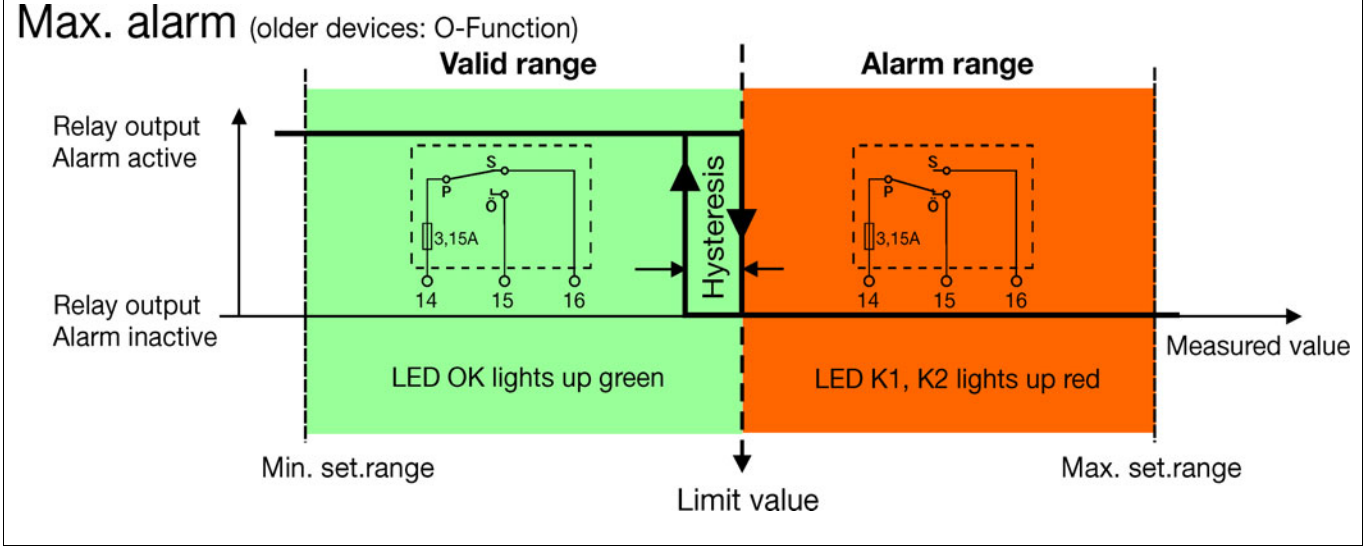
Switching behavior of min. alarm



Switching behavior of max. alarm (default setting)



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Connection diagram

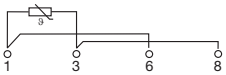
The connection diagram in the data sheet provides preliminary information about the connection options. For the electrical connection, only use the installation instructions or the operating manual. The knowledge and the correct technical execution of the safety information and warnings contained in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

The connection is made via screw terminals.

Caution:
The cover cap must be removed prior to wiring and put back on when finished. This is necessary for the proper operation of the probes in the Ex-area!



Wire	Admissible cross section
One-wire	≤ 2.5 mm²
Fine-strand, with ferrule	≤ 1.5 mm²
Tightening torque of the screws: max. 0.5 Nm	

Legend	Comment	Screw terminals	Screw terminals
1, 2		**Analog input 1 (E1)**	**Analog input 2 (E2)**
	Thermocouple / **Double thermocouple**		
	⚠ When connecting double thermocouples, the measuring circuits (E1) and (E2) must be isolated. That means that both thermocouples have no electrical connection to the protection fitting and furthermore no electrical connection to each other (isolated assembly).		
	RTD temperature probe in two-wire circuit		
	☝ Enter the line resistance for RTD temperature probes in two-wire circuit when using greater line lengths. Setup program: *edit => analog inputs*		
	RTD temperature probe Pt100/Pt1000 in three-wire circuit		
	RTD temperature probe Pt100 in two-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		

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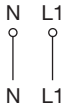
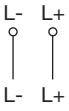
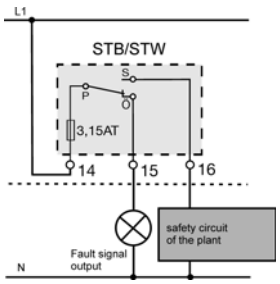
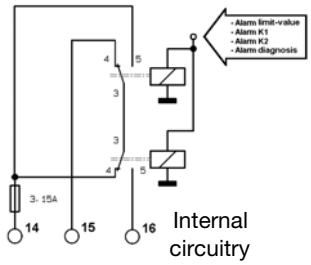
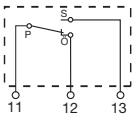
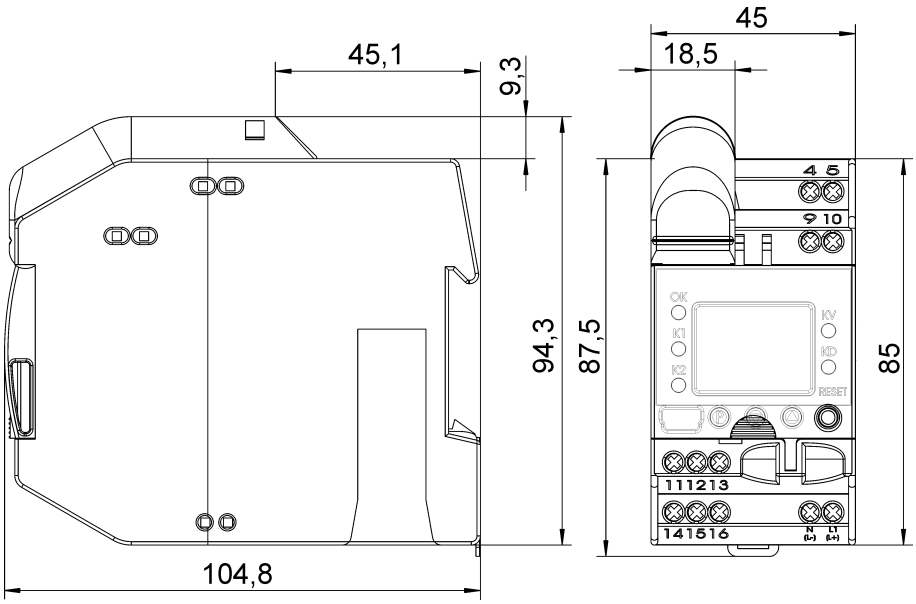
Legend	Comment	Screw terminals	Screw terminals
	(4) to to 20 mA for both analog inputs		
	Caution: When only one probe (SIL2) is connected, the temperature limiter device is reduced from **SIL3 to SIL2**! However, the internal 2-channel structure (1oo2D) in the device still remains. Both channels measure the same current signal due to the simplified external wiring.		
4	**Digital input** Connection to a potential-free contact	Ground 	
5	**Analog output:** 0 to 20 mA 4 to 20 mA (default setting) 0(2) ... 10 V		
9	**Voltage supply** According to nameplate	**AC:** L1 line conductor N neutral conductor 	**DC:** (L+) (L-) 
10	**Alarm relay output (zero-current state)** Relay (changeover contact) with fuse cut-out		
11	**Pre-alarm relay output (KV)** Relay (changeover contact)		

Dimensions

Type 701155/...



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Important probe information in the following tables

The following should be noted:
There is no reliable galvanic isolation between the probe and housing. As a result, the sensor connections are to be considered grounded for the safety evaluation.
Among other things, EN 60079-0 requires for the EPL Ga that the mass fraction of aluminum must be less than 10 % for the manufacturing of metallic housings. The terminal head of the probes used by JUMO contains more than 10 % aluminum. The terminal head must therefore be secured by suitable impact protection for the use of EPL Ga (zone 0). The impact protection must securely prevent friction sparks, contact-breaking sparks, and impact sparks. Otherwise there is a risk of ignitable sparks. No other precautions have to be taken when used in EPL Gb (zone 1).

Probes for air

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

Type designation	Probe Type	Temperature range	xxx = Nom. length in mm	Process connection
RTD temperature probe data sheet 902006				
902006/65-228-1003-1-15-xxx-668/922	1 x Pt100	-170 ... +700°C	500, 710, 1000	movable compression clamp
902006/55-228-1003-1-15-xxx-254/922	1 x Pt100	-170 ... +700°C	500, 710, 1000	movable compression clamp G1/2
902006/65-228-2003-1-15-xxx-668/922	2 x Pt100	-170 ... +700°C	500, 710, 1000	movable compression clamp
902006/55-228-2003-1-15-xxx-254/922	2 x Pt100	-170 ... +700°C	500, 710, 1000	movable compression clamp G1/2
Thermocouples data sheet 901006				
901006/65-547-2043-15-xxx-668/922	2 x NiCr-Ni, Type „K“	-35 ... +800°C	500, 710, 1000	movable compression clamp
901006/65-546-2042-15-xxx-668/922	2 x Fe-CuNi, Type „L“	-35 ... +700°C	500, 710, 1000	
901006/66-550-2043-6-xxx-668/922	2 x NiCr-Ni, Type „K“	-35 ... +1000°C	250, 355, 500	
901006/66-880-1044-6-xxx-668/922	1 x PT10Rh-PT, Type „S“	0 ... 1300°C	250, 355, 500	
901006/66-880-2044-6-xxx-668/922	2 x PT10Rh-PT, Type „S“	0 ... 1300°C	250, 355, 500	movable compression clamp
901006/66-953-1046-6-xxx-668/922	1 x PT30Rh-PT6Rh, Type „B“	600 ... 1500°C	250, 355, 500	
901006/66-953-2046-6-xxx-668/922	2 x PT30Rh-PT6Rh, Type „B“	600 ... 1500°C	250, 355, 500	

Probes for water and oil

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

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 x Pt100	-40 ... +480°C	250	G1/2 compression clamp
902006/10-226-2003-1-9-250-104/922	2 x Pt100		250	
902006/54-227-2003-1-15-710-254/922	2 x Pt100	-170 ... 550°C	65...670	movable G1/2 compression clamp
902006/54-227-1003-1-15-710-254/922	1 x Pt100		65...670	
902006/10-402-1003-1-9-100-104/922	1 x Pt100	-170 ... 400°C	100	G1/2 compression clamp
902006/10-402-2003-1-9-100-104/922	2 x Pt100		100	
902006/10-402-1003-1-9-150-104/922	1 x Pt100		150	
902006/10-402-2003-1-9-150-104/922	2 x Pt100		150	
902006/10-402-1003-1-9-200-104/922	1 x Pt100		200	
902006/10-402-2003-1-9-200-104/922	2 x Pt100		200	
Thermocouples data sheet 901006				
901006/54-544-2043-15-710-254/922	2 x NiCr-Ni, Type „K“	-35 ... 550°C	65...670	movable G1/2 compression clamp
901006/54-544-1043-15-710-254/922	1 x NiCr-Ni, Type „K“		65...670	
901006/54-544-2042-15-710-254/922	2 x FeCuNi, Type „L“		65...670	
901006/54-544-1042-15-710-254/922	1 x FeCuNi, Type „L“		65...670	

Note: Because of the response accuracy, only use thermowells (pockets) that are **included in the scope of delivery**

Type designation	Probe type	Temperature range	Nom. length mm	Process connection
RTD temperature probe data sheet 902006				

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Type designation	Probe type	Temperature range	Nom. length mm	Process connection
902006/53-505-2003-1-12-190-815/922	2 x Pt100	-40 ... +400 °C	190	weld-in sleeve
902006/53-505-1003-1-12-190-815/922	1 x Pt100	-40 ... +400 °C	190	
902006/53-507-2003-1-12-100-815/922	2 x Pt100 (im Schutzrohr untereinander angeordnet)	-40 ... +480 °C	100, 160, 190, 220	
902006/53-507-1003-1-12-100-815/922	1 x Pt100	-40 ... +480 °C	100, 160, 220	
902006/53-505-3003-1-12-100-815/922	3 x Pt100	-40 ... +400 °C	100, 160, 220	
902006/40-226-1003-1-12-220-815/922	1 x Pt100	-170 ... +480°C	100, 160, 220	
Thermocouples data sheet 901006				
901006/53-543-1042-12-220-815/922	1 x Fe-CuNi Type „L“	-35 ... 480°C	220	weld-in sleeve
901006/53-543-2042-12-220-815/922	2 x Fe-CuNi Type „L“		220	

Probes for air, water, and oil

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

Type designation	Probe type	Temperature range	Nom. length	Process connection
RTD temperature probe data sheet 902006				
902006/10-390-1003-1-8-250-104/922	1 x Pt100	max. 300°C	Nom. length: 250 mm	Screw-in thread G1/2
Thermocouples data sheet 901006				
901006/45-551-2043-2-EL-11-AL/922	2 x NiCr-Ni, Type „K“	max. 1150°C	50 < EL < 2000 1000 < AL < 20000	

Protective, regulation, and control devices

Safety temperature monitor STW[1]
The safety temperature monitor is a device that is automatically reset after responding if 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 fulfilled: 2N, 2D

Safety temperature limiter STB[1]
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 fulfilled: 2N, 2F, 2D

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

Connection possibilities of the sensors

The JUMO safety**M** STB/STW evaluation device structure is basically identical. Various possibilities are available for sensor connection. These possibilities are listed in the following table along with the achievable SIL level:

Variant	Connected sensors	Architecture		Achievable SIL
		Sensor technology	Logic	
1	1 × Pt100 two-wire circuit, single sensor	1oo1	1oo2D	2
1a	2x Pt100/1000 two-wire circuit	1oo2	1oo2D	3

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Variant	Connected sensors	Architecture		Achievable SIL			
		Sensor technology	Logic				
2	2x Pt100/1000 three-wire circuit	1oo2	1oo2D	3			
3	2x thermocouple	1oo2	1oo2D	3			
4	1x Pt100/1000 two-wire and three-wire circuit 1x thermocouple	1oo2	1oo2D	3			
5	STB/STW 70.1150 without 1oo2D sensor technology architecture: No probe or use of 4 to 20 mA (means that the sensor is not taken into account for calculation).	Sensors connected by the plant operator: architecture according to connection 1oo1 or 1oo2	1oo2D	SIL (architecture) of the sensor used (HW only)	Systematic compatibility (SC) of the sensor used	Max. achievable SIL of the system with 1oo1 sensor technology architecture	Max. achievable SIL of the system with 1oo2 sensor technology architecture
				1	1	1	1
				1	2	1	2
				2	2	2	2
				2	3	2	3
				3	3	3	3

Note:
Variants 1 to 4 were evaluated with JUMO probes according to data sheets 901006 and 902006. For variant 5 no sensor technology was included. In this case, the plant operator selects the sensor technology. For this reason, the plant operator 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 SIL 2, the max. achievable SIL is 2).
The possibility to connect passive sensors such as double thermocouples or Pt100/Pt1000 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 plant operator must always determine the PFD_{avg} and/or PFH value of the overall safety chain to determine the achieved SIL.

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

Table 1:

Variant	λ_s [FIT]	λ_{dd} [FIT]	λ_{du} [FIT]	SFF	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_{du} [FIT]	SFF	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 %	$3.68\ e^{-9}$	$1.61\ e^{-4}$

Note:
Variants 1 to 4 were evaluated with JUMO probes according to data sheets 901006 and 902006.
For variant 5, no sensor technology was included (only the JUMO safety**M** STB/STW Ex).
In this case, the plant operator selects the sensor technology.
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 (T_1 = 10 y). The Common Cause Factor was determined according to the tables of DIN EN 61508 for sensor technology and logic.

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Achievable PL

Variant	Connected sensors	Sensor technology architecture	Logic architecture	Achievable PL		
1	1x Pt100 two-wire circuit	1oo1	1oo2D	PLd		
1a	2x Pt100/1000 two-wire circuit	1oo2	1oo2D	PLe		
2	2x Pt100/1000 three-wire circuit	1oo2	1oo2D	PLe		
3	2x thermocouple	1oo2	1oo2D	PLe		
4	1x Pt100/1000 two-wire and three-wire circuit 1x thermocouple	1oo2	1oo2D	PLe		
5	STB/STW 701155 without 1oo2D sensor technology 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 plant operator; architecture according to connection 1oo1 or 1oo2	1oo2D	PL of the used sensor $MTTF_d$ = 100 years	Max. achievable PL of the system with 1oo1 sensor technology architecture $DC_{701155} \geq 90$ %	Max. achievable PL of the system with 1oo2 sensor technology architecture $DC_{701155} \geq 90$ %
				PLb	PLd	PLe
				PLc	PLd	PLe
				PLd	PLd	PLe
				PLe	PLe	PLe

Note:

Variants 1 to 4 were evaluated with JUMO probes according to data sheets 901006 and 902006. For variant 5, no sensor technology was included (only the JUMO safety**M** STB/STW). In this case, the plant operator selects the sensor technology. For this reason, the plant operator is responsible for evaluating the achieved PL.

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

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 for 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 for 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 marking, ignition protection type "i"

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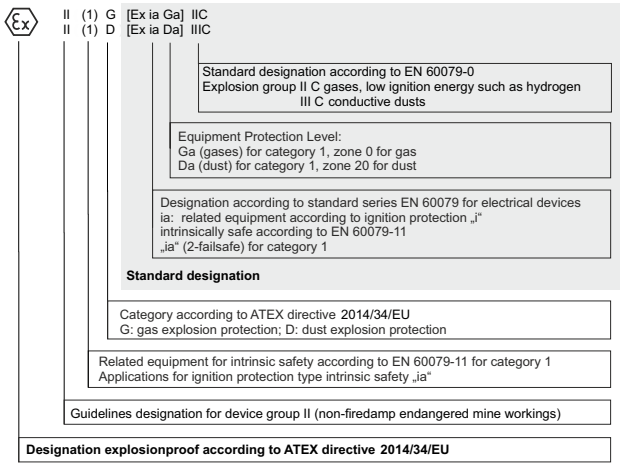
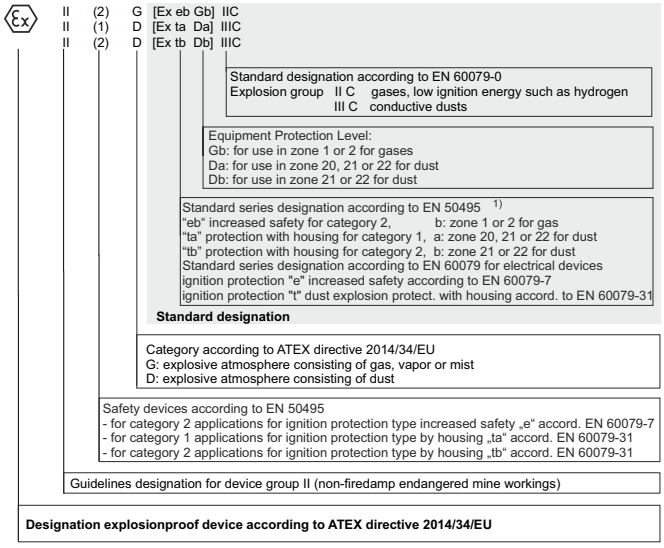
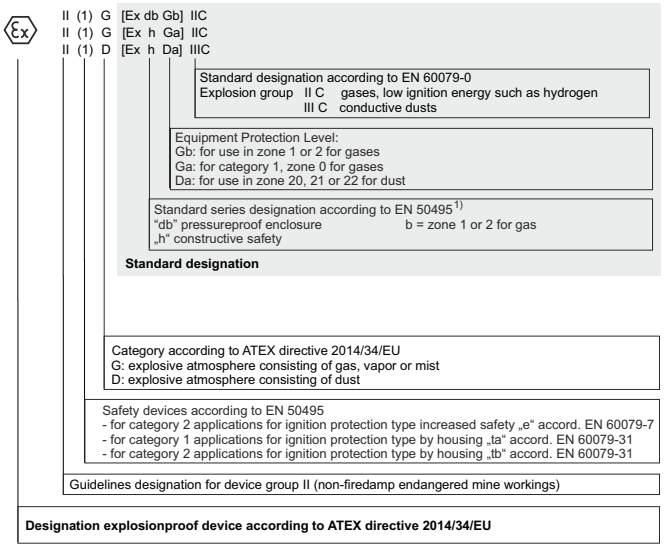




1.) The monitored electrical equipment does not represent a potential ignition source during normal operation



1.) The monitored electrical equipment does not represent a potential ignition source during normal operation

Probe arrangement in the Ex-area "i"

The STB/STW 701155 has the following maximum output data at the intrinsically safe inputs:				
U_o = 6.0 V	I_o = 41.2 mA	P_o = 61.8 mW	C_o = 36.3 µF	L_o = 20 mH

The specified energy values are available as a total amount per device. The distribution to the inputs is not defined.

Example: double Pt100 with protection tube constant 80 K/W: temperature increase of 80 K/W x 61.8 mW = 4.9 K.
If a separate temperature increase for dust is specified in the technical data sheet from JUMO, this means that the protection fitting is completely covered in dust.

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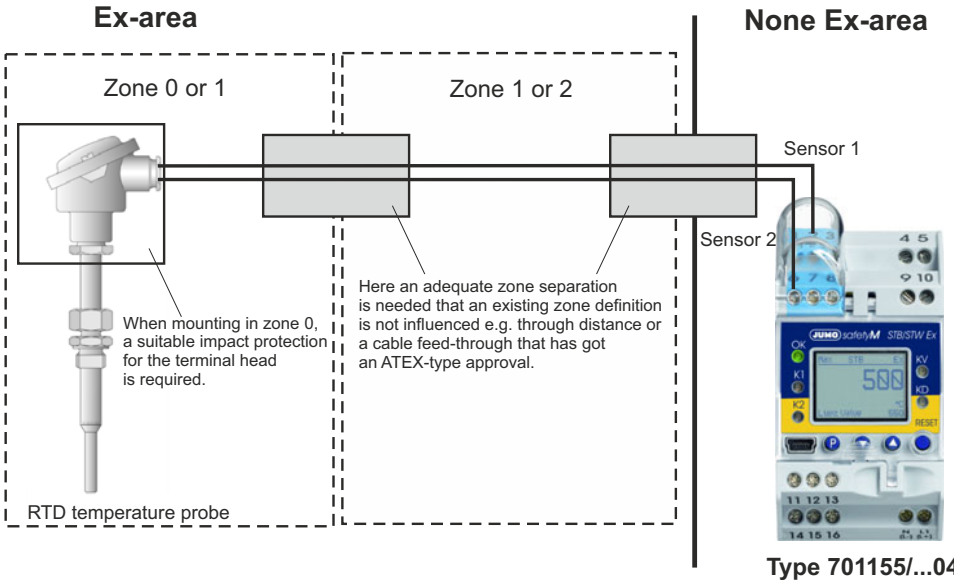
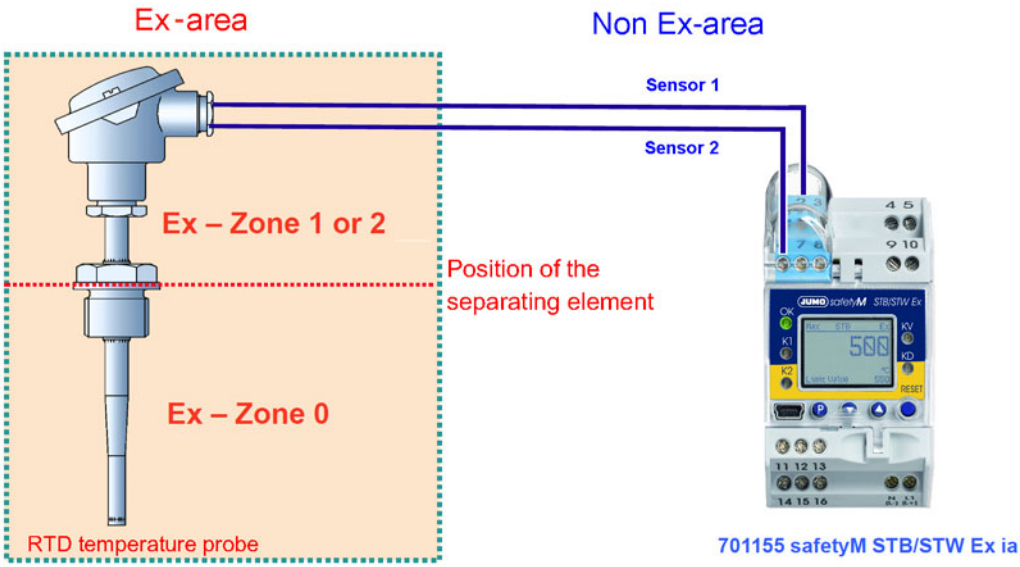


Type 701155/...044

Note:
The sensor technology specified in Page 11 does not have zone separation.
The type of zone separation as well as the cable selection must be implemented or selected in such a way that the defined zone classifications and their requirements continue to be in place.

Use of a probe with EPL "Gb" with a separation element (DIN EN 60079-26). The figure shows a probe with active zone separation according to DIN EN 60079-26. Mounting of the terminal head in zone 0 is not permitted.
However, use in zone 0 is permitted below the separation element. The same requirements as in the above figure apply for the zone classification.



701155 safetyM STB/STW Ex ia

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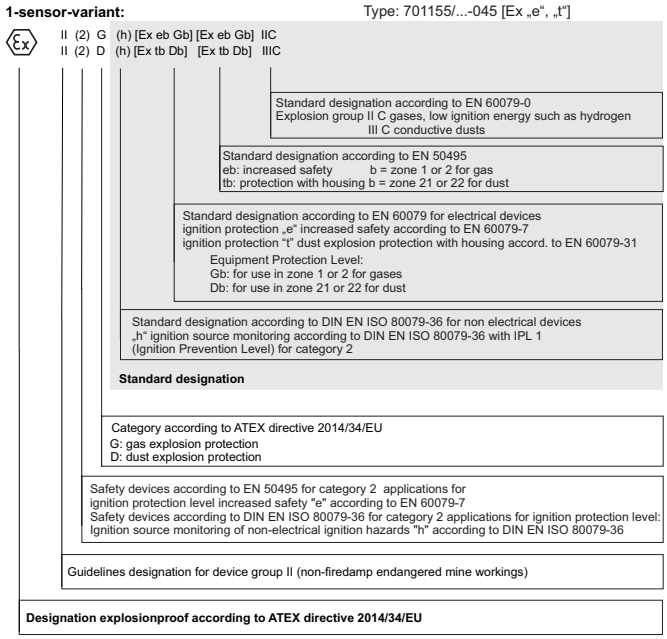
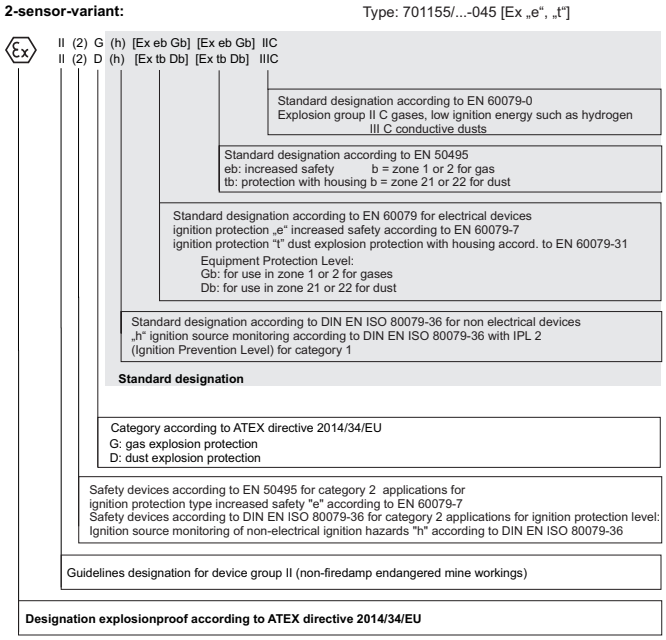
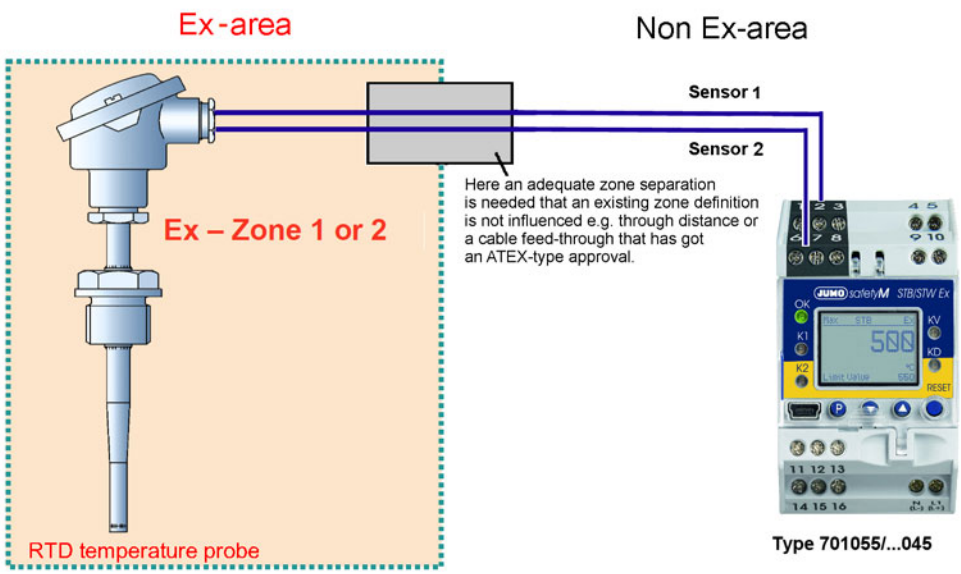
ATEX identification marking, ignition protection type "e" and "t"





Probe arrangement in the Ex-area "e" and "t"



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IECEx identification marking

[Ex ia Ga] IIC
Associated apparatus which is set up outside the gas atmosphere but the intrinsically safe electrical circuit "ia" (protection through double protective measures) leads into zone 0.

[Ex ia Da] IIIC
Associated apparatus which is set up outside the dust atmosphere but the intrinsically safe electrical circuit "ia" (protection through double protective measures) leads into zone 20.

Explanation

[Ex ia Ga] IIC
[Ex ia Da] IIIC
Standard designation according to IEC 60079-0
Explosion group II C gases, low ignition energy such as hydrogen
III C conductive dusts

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

[Ex h Ga] IIC Associated apparatus which is set up outside the gas atmosphere
[Ex h Da] IIIC Associated apparatus which is set up outside the dust atmosphere

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

Equipment Protection Level:
Ga (gases) for category 1, zone 0 for gas
Da (dust) for category 1, zone 20 for dust

Designation according to standard series EN 80079-37 for non-electrical devices
“h”: related equipment according to ignition protection “h” for category 1

[Ex eb Gb] IIC resp. [Ex db Gb] IIC Associated equipment, which is installed outside the gas atmosphere but the circuit (protection by 1 protective measure) leads into zone 1.
[Ex tb Db] IIIC Associated equipment, which is installed outside the dust atmosphere but the circuit (protection by 1-protection measures) leads into zone 21.
[Ex h Gb] IIC
[Ex h Db] IIIC

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

Equipment Protection Level:
Gb: for use in zone 1 or 2 for gases
Db: (dust) for category 1, zone 21 for dust

Standard designation series to EN 60079-7 protection due to increased safety „e“
and standard designation EN 60079-1 device protection due to flameproof enclosure „d“
“e“ increased safety for category 2, „b“ zone 1 or 2 for gases
Standard designation series EN 60079-31 Equipment dust explosion protection by housing „t“
„t“ dust explosion protection by housing „t“, „b“ zone 21 for dust
Standard marking according to standards series to EN 80079-37 for non-electrical devices
„h“ Associated equipment according to type of protection „h“ für cartegory 1

Scope of delivery

1 JUMO safety**M** STB/STW Ex in the ordered version
1 operating manual
ATEX cover cap for measuring inputs

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Order details

	Basic type
701155	Safety temperature limiter/monitor (STB)/(STW) according to DIN EN 14597 with SIL, PL, and IPL approval
	Version
8	Default setting
9	Configured according to customer specifications
	National language
01	German (default setting)
02	English
03	French
	Switching behavior
0251	Safety temperature monitor max. alarm (opening function)
0252	Safety temperature monitor min. alarm (closing function)
0253	Safety temperature limiter max. alarm (opening function)
0254	Safety temperature limiter min. alarm (closing function)
	Measurement input[1] **(programmable)**
1003	1x Pt100 in two-wire circuit
2001	2x Pt100 in three-wire circuit (default setting)
2003	2x Pt100 in two-wire circuit
2005	2x Pt1000 in two-wire circuit
2006	2x Pt1000 in three-wire circuit
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"
1053	1x 4 to 20 mA
2053	2x 4 to 20 mA
	Voltage supply
23	AC 110 to 240 V +10 % /-15 %, 48 to 63 Hz
25	AC/DC 20 to 30 V, 48 to 63 Hz
	Ignition protection type
044	[Ex ia] associated apparatus, installation outside the Ex-area
045	[Ex eb, tb] associated apparatus, "eb" for gas, "tb" for dust, installation outside the Ex-area
	Analog output (configurable)
001	0 to 20 mA
005	4 to 20 mA (default setting)
040	0 to 10 V
070	2 to 10 V
	Extra code
059	SIL, PL, IPL approval is always present
062	DNV approval
085	UKEX-Zulassung
240	EAC-Zulassung

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1. The first digit on the measurement input means single probe "1" or double probe "2"

Accessories

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