JUMO safetyM STB/STW Ex

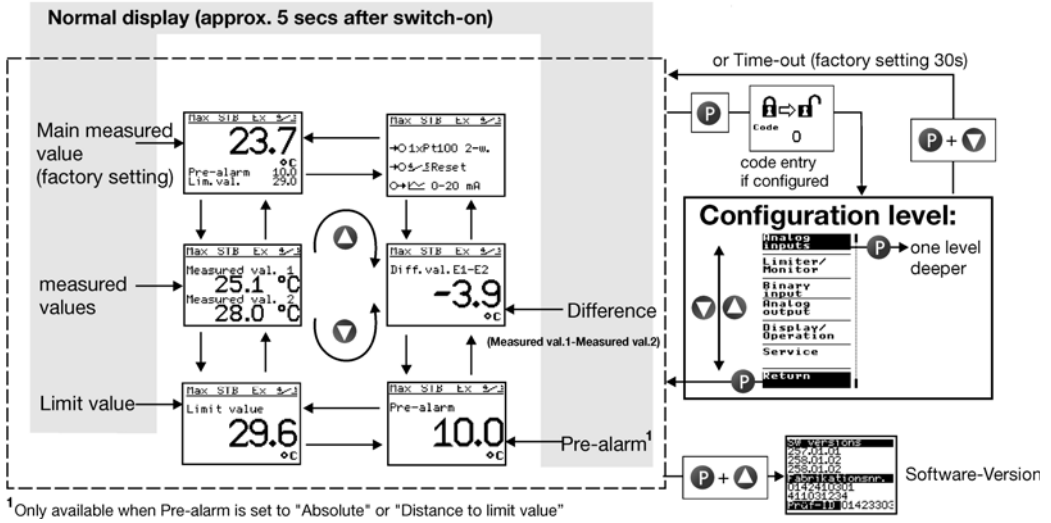
Safety temperature limiter, safety temperature monitor
according to DIN EN 14597 and ATEX

B 701155.0
Operating manual
(English translation of the original German manual)

JUMO

2013-04-01 /00542382

Operating overview



[1] Only available when Pre-alarm is set to "Absolute" or "Distance to limit value"

Inhalt

Inhalt

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1 Brief description

The device is tested according to ATEX directive 94/9/EG as associated equipment with intrinsically safe output.
It meets the requirements of the following identification markings:

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 device is also certified for use according to DIN EN 50495 and DIN EN 13463-6 as an ignition source monitor as specified in the ATEX directive.

The compact and freely configurable STB/STW 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 plants 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, SIL3, PL e (Performance Level), GL, the device also has approval according to ATEX and can therefore also be used in Ex-areas.

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 device concept also meets the stringent requirements of DIN EN 61508 and DIN EN 13849. The 1oo2D structure ensures reliable detection of errors, meaning that the device concept can also be used for applications subject to the new Machinery Directive 2006/42/EC.

The measured value at the analog input can be recorded by various probes or standard signals.
The rise of the measured value above the limit value is indicated by the installed LEDs K1 and K2 (red) for each channel, and the installed alarm relay output switches the system to safe operating status **(alarm range)**.

1.1 Safety temperature monitor (STW)

The STW is a safety-component device according to the Machinery Directive which, when activated, resets automatically 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.

⇨ Chapter 8.3.2 "Switching behavior"

1.2 Safety temperature limiter (STB)

The STB is a safety-component device according to the Machinery Directive which is permanently locked after activation. Manual reset using the ● key is only possible once the probe temperature has fallen below / has exceeded the limit value by the amount of the switching differential. Possible settings: monitoring for limit value overrange or underrange.

⇨ Chapter 8.3.2 "Switching behavior"

The transparent, sealable protective cover prevents unauthorized operation.

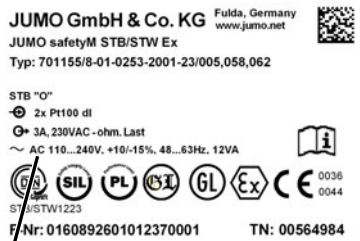
The ● key is still accessible.

1.3 Safety information

Symbol	Meaning	Explanation
	Important information:	This symbol is used to draw your attention to **something particular**.
	Caution	This symbol is used when **damage to equipment or data** may occur if the instructions are disregarded or not followed correctly!
	Caution	This symbol is used when **danger to personnel** may occur if the instructions are disregarded or not followed correctly!
	Read	This text contains important information which must absolutely be read before proceeding. Manipulations not described in the operating manual or expressly forbidden will jeopardize your warranty rights.
⇨	Reference	This symbol refers to additional information in other manuals, chapters, or sections.
abc[1]	Footnote	Remarks at the end of a page that **refer to** specific text passages and are marked with a number placed in superscript.
*	Instructions	This symbol indicates that an **action to be performed** is described. The individual steps are marked by this asterisk.

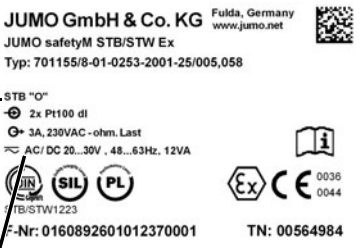
2 Identifying the device version

The rating plate is glued laterally to the device.



Voltage supply AC 110 to 240 V:

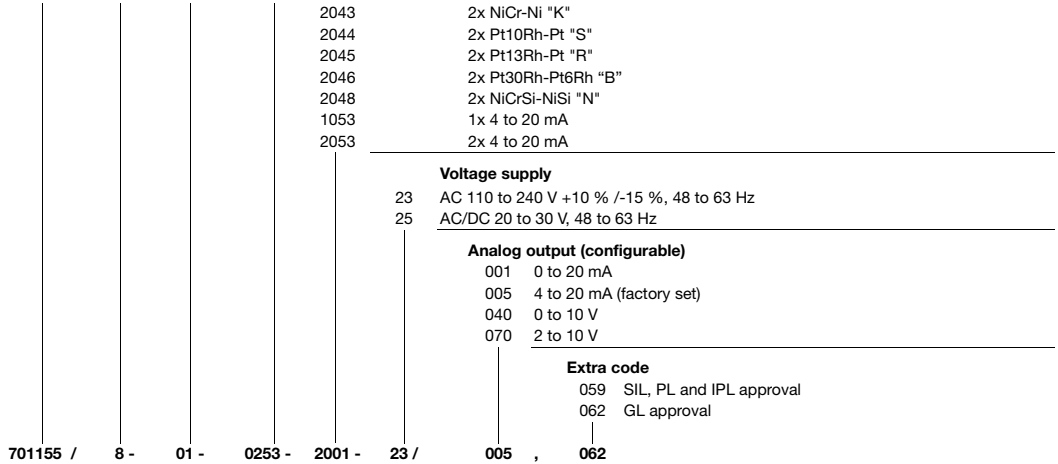
Switching beha:



Voltage supply AC/DC 20 to 30 V:

The voltage supply that is connected must correspond to the voltage specified on the nameplate!

					Basic type
701155					Safety temperature limiter / -monitor (STB) / (STW) according to DIN EN 14597
					Version
	8				Factory set
	9				Configured acc. to customer specifications
					National language
		01			German (set at factory)
		02			English
		03			French
					Switching behavior
			0251		Safety temperature monitor max. alarm [inverse, opening function]
			0252		Safety temperature monitor min. alarm [direct, closing function]
			0253		Safety temperature limiter max. alarm [inverse, opening function] (set at factory)
			0254		Safety temperature limiter min. alarm [direct, closing function]
					Measuring input[1] (programmable)
				1003	1x Pt100 in 2-wire circuit
				2001	2x Pt100 in 3-wire circuit (set at factory)
				2003	2x Pt100 in 2-wire circuit
				2005	2x Pt1000 in 2-wire circuit
				2006	2x Pt1000 in 3-wire circuit
				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”



1. The first number on the measuring input means single probe "1" or double probe "2"

2.1 Scope of delivery

- JUMO safety**M** STB/STW Ex in the ordered version
- Operating Manual B701155.0
- Cover cap ATEX for measuring input

2.2 Device software versions

Diagnostics module version: 257.01.01
Analog channel 1 version: 258.01.02
Analog channel 2 version: 258.01.02

2.3 Fabrication number

The fabrication number is displayed on the device.

* Press P + ▲ keys

Setup:
The first 8 digits are the production order number: 01424103
Digit 9 and 10 manufacturing site Fulda: 01
Digit 11 (second row) hardware version: 4
Digit 12 and 13 year: 20**11**
Digit 14 and 15 calendar week: 03
Digit 16 to 19 consecutive number: 1234

2.4 Service addresses

Phone support Germany:
Phone: +49 661 6003-9135
Fax: +49 661 6003-881899
E-mail: service@jumo.net

Austria:
Phone: +43 1 610610
Fax: +43 1 6106140
E-mail: info@jumo.at

Switzerland:
Phone: +41 44 928 24 44
Fax: +41 44 928 24 48
E-mail: info@jumo.ch

This operating manual is the translation of the **German manual**.

It is valid for the following hardware and software versions:

Diagnostics module as of version: 257.01.01
Analog channel 1 as of version: 258.01.02
Analog channel 2 as of version: 258.01.02

Hardware version 0

* Press P + △ keys

Keep the operating manual in a place that is accessible to all users at all times.

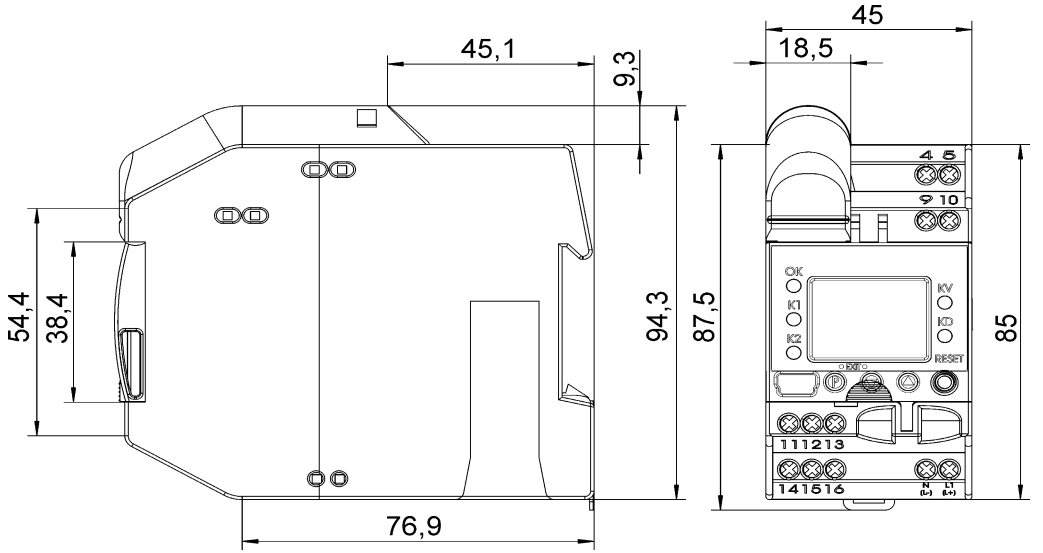
All necessary settings are described in this operating manual. Manipulations that are not described in the operating manual or expressly forbidden will jeopardize your warranty rights and may annual the safety function!

Any interference with the inside of the device is prohibited!

Repairs may be only performed by JUMO in the company's headquarters in Fulda.
If you have any problems, please contact the nearest subsidiary or the head office.

3 Mounting

3.1 Dimensions



3.2 Mounting site, DIN rail mounting

⚠ The device is not suitable for installation in potentially explosive areas.
The device is clipped to a 35 mm DIN rail (DIN EN 60715) from the front and locked into place by pressing downwards.

⇨ The climatic conditions at the mounting site must meet the requirements specified in the technical data.

Chapter 9 "Technical data"

❏ The mounting site should be vibration-free as much as possible to prevent the screw-connections from working loose!

❏ The mounting site should be free from aggressive media (e.g. acids and lyes) as well as free from dust, flour, or other suspended matter as much as possible to prevent blocking of the cooling slots!

3.3 Close mounting

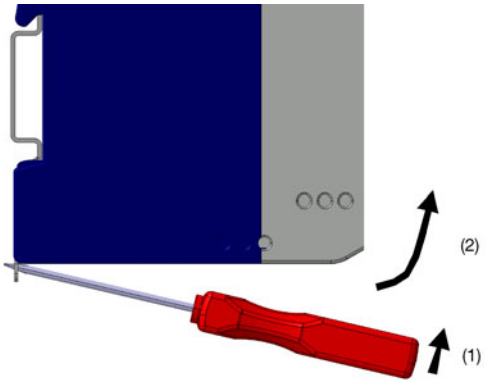
❏ Maintain the minimum distance of 20 mm to the top and the bottom.

1. So that the release slot can still be accessed with a screwdriver from the bottom.
2. So that when dismounting, the device can be swiveled upwards and removed from the DIN rail.

❏ Several devices can be mounted right next to one another without a minimum distance.

3.4 Dismounting

* Place screwdriver in release catch and press upwards (1).
* Swivel screwdriver and case upwards at the same time when removing it from the DIN rail (2).



3.5 Galvanic isolation

(1) Analog inputs

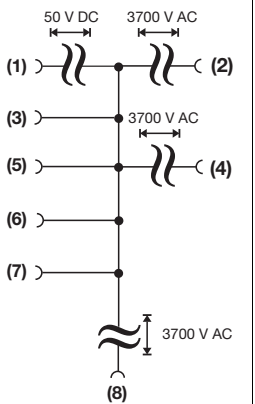
(3) Binary input

(5) Setup interface

(6) Display

(7) Analog output

(8) Voltage supply



(2) Relay output alarm

(4) Pre-alarm relay output

3.6 Use of the setup interface

- The USB setup interface is only designed for service use over a limited period (such as the transfer of setup data or during startup).
- The USB setup interface is not suited for perpetual operation in a hard-wired plant because the monitoring function is de-activated during data transfer with the setup program!

4 Electrical connection

4.1 Installation notes

- ❏ Checking to see if the safety temperature limiter is installed in a manner appropriate to the application (temperature measurement) and that it is operated within the admissible plant parameters.
- ❏ The device is intended to be installed in switch cabinets, machines, or plants.
  Ensure that the customer's fuse rating does not exceed 20 A.
- ❏ Isolate the device on all poles prior to starting service or repair work.
- ❏ All incoming and outgoing lines without a connection to the mains supply must be laid with shielded and twisted cables. Connect the screen on the device to ground.
- ❏ Do not lay the input and output cables close to components or lines through which current is flowing.
- ❏ Do not connect any additional loads the screw terminals for the voltage supply of the device supply.
- ❏ Both the choice of cable material for the installation as well as the electrical connection of the device must conform to the local requirements of VDE 0100 "Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V" or the appropriate regulations for the country.
- ❏ Suitable measures must be taken to protect the relay circuit.
  The maximum contact rating is 230 V/3 A (ohmic load).
- ❏ The electromagnetic compatibility conforms to the standards and regulations cited in the technical data.
  ⇨ Chapter 9 "Technical data"
- ❏ For startup we recommend that a trial run of the plant up to the temperature shutoff at the set limit is carried out.

⚠ **Hybrid mixtures:**
If a dangerous atmosphere could occur at the mounting site – an atmosphere that is potentially explosive due to a mixture of gases, steam, or mist and at the same time through combustible dusts – then the safety-related characteristic parameters of the gases, steam, or mist and the combustible dusts can change.
In such cases the suitability of the intended device is to be checked by an appropriate office.

The electrical connection and the configuration settings up to the startup must only be carried out by qualified personnel.

The approval according to DIN EN 14597 is only valid when the correct probe with DIN approval is set in the configuration level and if the probe is connected.

The limit value to be monitored must lie in the accepted temperature range of the DIN probe!

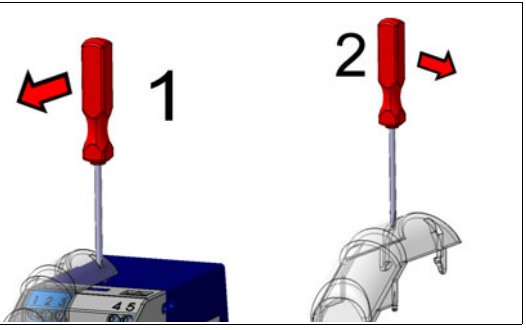
⇨ Chapter 9.13 "Probes for the operating medium air"

⇨ Chapter 9.15 "Probes for air, water, and oil"

The monitoring function is deactivated while data is transmitted over the setup program.

⇨ Chapter 13 "What to do, if ..."

4.2 Removing the cover cap

1	* Stick the screwdriver in the right opening of the cover cap and pry up to the left.	
2	* Hold the cover cap and pry up the second catch in the left opening to the right.	

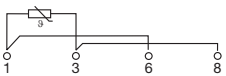
4.3 Connection diagram

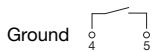
The connection is made via screw terminals.

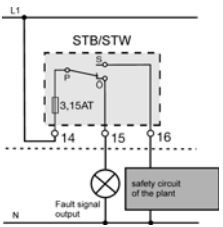
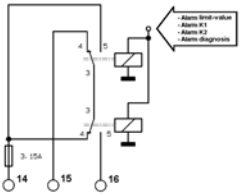
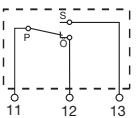
Caution:
The cover cap must be removed prior to wiring and put back on when finished.
This is necessary for the proper operation of the probe in the Ex-area!

Lead	Admissible cross section
1-wire	$\leq$ 2.5 mm^2
Fine-strand, with ferrule	$\leq$ 1.5 mm^2

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**		
	RTD temperature probe Pt100/Pt1000 in 2-wire circuit		
	Enter the lead wire resistance for RTD temperature probes in 2-wire circuit when using greater line lengths. ⇨ Setup program: *edit => analog inputs*		
	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.		

Legend	Comment	Screw terminals	Screw terminals
	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		
5	**Analog output:** 0 to 20 mA 4 to 20 mA (factory set) 0(2) to 10 V		
⚠	Caution The analog output is **not part of the safety function!**		
9	**Voltage supply** Acc. to nameplate	**AC:** L1 line conductor N neutral conductor 	**DC:** (L+) (L-) 

Legend	Comment	Screw terminals	Screw terminals
10	**Relay output alarm (zero-current state)** Relay (changeover contact) with fuse cut-out		 Internal circuitry
11 Caution The pre-alarm relay output **is not part of the safety function!**	**Relay output for pre-alarm (KV)** Relay (changeover contact)		

4.4 Checking wiring of the intrinsically safe electrical circuit

Caution:
The cover cap that is removed prior to wiring must be put back into place after wiring is complete so that the catches snap back into place!
This is necessary for the proper operation of the probe in the Ex-area!

All screw terminals in the case must be screwed down with the maximum tightening torque of 0.5 Nm. This does not apply to needed connections.

- Fine-strand lines in ferrules can be inserted up to 1.5 mm^2. Single-wire lines in ferrules can be inserted up to 2.5 mm^2. After insertion, the screws are tightened.
- Switch on device and test whether the measured value of your choice (e.g. temperature or pressure) is displayed without any problems.
- Place the cover cap back in its position and make sure it is securely in place.

5 Startup of the device

5.1 Display and control elements

✱ When the voltage supply is set up, a testing routine starts during which all LEDs blink and the backlit display shows white pixels for 2 s and black pixels for 2 s.

After the testing routine is complete the device shows a main measured value (factory set).

⇨ If an alarm or error message appears, refer to Chapter 11 "Alarm messages".

5.2 Setting the display after device is switched on

⇨ Chapter 8.6.4 "Normal display"

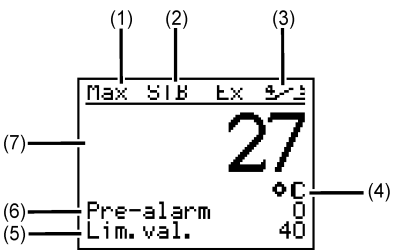
The main measured value appears on the screen in German (this is factory set). The example shows a screen layout in which the maximum value of a safety temperature limiter of 70 °C with a pre-alarm of 60 °C is monitored.

☞ If the main measured value for "Power ON" lies within the hysteresis then the pre-alarm and alarm relay outputs are set to inactive.

(1) Switching behavior

(2) Device function

(3) Binary input



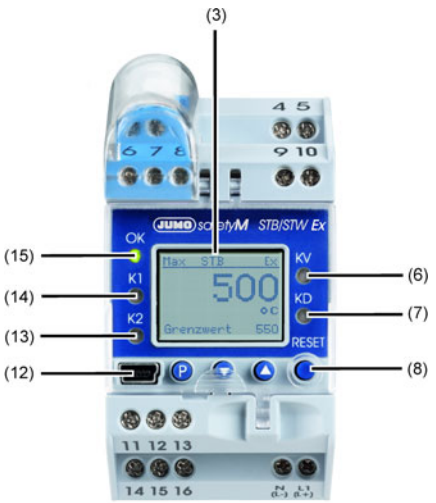
(7) Main measured value

(6) Pre-alarm

(5) Limit value

(4) Temperature unit

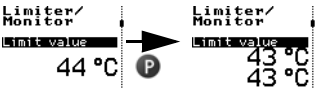
Legend	Comment
3	**LCD display** Black/white with background lighting 96 x 64 pixels.
6	**LED KV (yellow)** Is lit if the pre-alarm is triggered.
7	**LED KD (yellow)** Is lit if the diagnostic processor has performed a switch-off.
8	**Keys** (can only be operated when the transparent hood is folded upward) ▲ Value increase / previous parameter ▼ Value reduction / previous parameter P Programming ● RESET
12	**Setup interface**
13	**LED K2 (red)** Is lit for all errors.
14	**LED K1 (red)** Is lit for all errors.
15	**LED OK** Green: valid range Off: error occurred



5.3 Selecting and editing parameters (plausibility requirement for input values)

The values are displayed in the normal display.

To edit a value – such as the limit value – perform steps 1 to 4

1	(P) Press		The first "Analog inputs" menu item is highlighted in black. The vertical line to the right shows the current position.
2	Select limiter/monitor with (▼) Switch to submenu with (P)		
3	Press (▼) 2x until limit value appears Press (P) (limit value blinks)		
4	Set value of your choice with (▼) or (▲) Acknowledge with (P) (limit value appears twice)		The limit value flashes twice for checking purposes
5	Briefly press (P) to confirm. The value are adopted and saved.		Back to normal display: Use (P) or (▼), "Return" menu item, or automatically after timeout.

If no key is pressed for 30 seconds (timeout) then the device automatically returns to normal display and the value is not stored. The duration of the timeout can be configured.

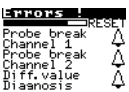
⇨ See operating overview on the first inner page of this manual.

5.4 Canceling edit

P + ▼ are used to cancel editing and the previous value remains.

5.5 Acknowledging alarms using the reset key (for temperature limiter STB only)

* Press ● and hold

Check marks appear behind the errors.		An alarm is no longer pending and is acknowledged as soon as the bar has run to the end (3 s).
A bell is displayed behind the errors.		The alarm condition is still pending and cannot be acknowledged.

5.6 Acknowledgement of alarms using the binary input (for temperature limiter STB only)

The binary input can be configured so that one can, for example, unlock alarms over a potential-free contact.

The function only responds to the switching edge from "open" to "closed" state.

In that case the contact has the same behavior as the "Reset" key.

⇨ Chapter 8.4.1 "Function"

5.7 Functional test

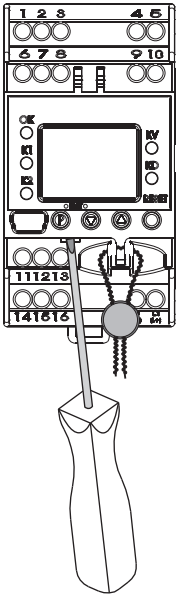
After the electrical connection in Chapter 4.3 you should proceed with the following steps for your safety:

- ✱ Set the limit value that the plant must not exceed or drop below.
- ✱ When all parameters are in the valid range, press the RESET key until the green LED OK is lit.
- ✱ Simulate a limit value exceedance **without installing the sensors in the potentially explosive area at first** and check if the alarm relay output permanently switches off the plant. When the measured value is back in the valid range, the K1 and K2 LEDs must light up red.
- ✱ Manually set the device back by using RESET until the OK LED lights up again.

⇨ Chapter 5.5 "Acknowledging alarms using the reset key (for temperature limiter STB only)"

⇨ Chapter 7.4.2 "Probe arrangement in the Ex-area"

5.8 Seal device



The device settings must not be changed under operating conditions.
A lead-sealed see-through cover is therefore placed on top to prevent unintentional or unauthorized adjustment.

Two holes are provided to the left and right of the see-through cover through which wire can be guided for lead sealing to connect the cover to the case. The wire ends are secured with the seal.

Opening see-through cover for close-density mounting:
A screwdriver can be used to pry open the see-through cover.

6 Safety Manual

6.1 Brief description

The safety temperature limiter **(STB)** and safety temperature monitor **(STW)** enable early and reliable detection of risks which could potentially result in personal injuries, environmental damage, or destruction of the production plant and production materials.
Its task is to reliably monitor process variables such as temperature or pressure and to switch the plants to an operationally safe status in the event of malfunctions.
The measured value at the analog input can be recorded by various probes or standard signals.
Even when using double sensors (1oo2) only one physical measuring point is monitored at the measuring point.
Limit value exceedance is indicated by the installed LEDs K1 and K2 (red) for each channel, and the installed alarm relay output switches the plant to safe operating status **(alarm range)**.

The SIL3 requirements of DIN EN 61508 and PL d DIN EN ISO 13849 are met by a device concept that has a 1oo2D structure which ensures reliable detection of errors.

The JUMO safety**M** STB/STW Ex has been tested in accordance with ATEX directive 94/9/EC as associated apparatus with an intrinsically safe input.
It meets the requirements of the following identification markings:

The JUMO safety**M** STB/STW Ex has also been certified according to DIN EN 50495 and DIN EN 13463-6 for use in monitoring ignition sources pursuant to the ATEX directive.

6.2 Safety temperature monitor (STW)

The safety temperature monitor is a device that is automatically reset when activated once the probe 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.

Modes of operation:

- Minimum requirements: 2B, 2K, 2P
- Additional requirements met: 2N, 2D

6.2.1 Safe operating status STW

The safe status is when the alarm relay output between terminals 14 and 16 is switched off (closed-circuit principle).

6.3 Safety temperature limiter (STB)

The safety temperature limiter is a device that is permanently locked after responding.
Manual reset using the ● 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.

Modes of operation:

- Minimum requirements: 2B, 2J, 2V, 2K, 2P, and adjustable with special tools
- Additional requirements met: 2N, 2F, 2D

6.3.1 Safe operating status STB

The safe status is when the alarm relay output between terminals 14 and 16 is switched off (closed-circuit principle).

This status is maintained until manual unlocking in the valid range of the JUMO safety**M** STB/STW Ex.

The transparent, sealable protective cover prevents unauthorized operation.

The ● key for manual unlocking can be accessed with the aid of a tool.

6.4 Relevant standards

Failure of the devices could affect the safety of persons and/or the safety of the environment.

Certification according to IEC 61508 is provided due to the worldwide use of these systems.

The JUMO safety**M** STB/STW Ex temperature monitoring unit with extra code "058" meets the requirements:

- For safety function to SIL3 according to DIN EN 61508 Parts 1 to 7:
  Functional safety of electrical/electronic/programmable electronic safety-related systems
- DIN EN 61511 Parts 1 to 3:
  Functional safety – safety instrumented systems for the process industry sector
- DIN EN 14597:2005-12:
  Temperature control devices and temperature limiters for heat generating systems
- DIN EN 60730-2-9:

Automatic electrical controls for household and similar use – Part 2–9: Particular requirements for temperature sensing controls

- EN 61326
- DIN EN ISO 13849-1 PLe
- UL 60730-2-9
- According to the Pressure Equipment Directive

6.5 Validity of the safety manual

The evaluation described in this Safety Manual in terms of functional safety and display of certificates applies to the specified versions of temperature monitoring units including probe versions.

Specifications that do not take the sensor system into consideration are identified as such.

6.6 Connection possibilities of the sensors (SIL)

The JUMO safety**M** STB/STW Ex evaluation unit is always structured in the same way. Various possibilities are available for sensor connection. These possibilities are listed in the following table along with the achievable SIL level:

Table 1: Achievable SIL

Variant	Connected sensors	Sensor system architecture	Logic architecture	Achievable SIL		
1	1x Pt100 2-wire circuit	1oo1	1oo2D	SIL2		
1a	2x Pt100/1000 2-wire circuit	1oo2	1oo2D	SIL3		
2	2x Pt100/1000 3-wire circuit	1oo2	1oo2D	SIL3		
3	2x thermocouple	1oo2	1oo2D	SIL3		
4	1x Pt100/1000 2-wire + 3-wire circuit 1x thermocouple	1oo2	1oo2D	SIL3		
5	STB/STW 701155 without sensor system 1oo2D architecture No probe or use of 4 to 20 mA This means the sensor is not taken into account in the calculation.	Sensors connected by the plant operator; architecture acc. to connection 1oo1 or 1oo2	1oo2D	SIL of the used sensor (HW only)	Max. achievable SIL of the system with 1oo1 sensor system architecture	Max. achievable SIL of the system with 1oo2 sensor system architecture
				SIL1	SIL1	SIL2
				SIL2	SIL2	SIL3
				SIL3	SIL3	SIL3

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 safety**M** STB/STW Ex). In this case, the plant operator selects the sensor system. 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 SIL2, the max. achievable SIL is 2).

The possibility of connecting passive sensors such as dual thermocouples or Pt100/1000 sensors means that the sensors do not necessarily require an SIL qualification. In this case, the specification of the failure rates for the passive sensors is sufficient

for the SIL qualification of the overall plant. The plant operator must always determine the PFD_{avg} and/or PFH value of the overall safety chain to evaluate the achieved SIL.

Requirements regarding proof-check interval and lifetime apply only in terms of functional safety.

Requirements as specified by DIN EN 14597 are defined in this Operating Manual B701155.0 and are independent of the requirements of this Safety Manual.

Temperature probes

Admissible measuring ranges must be observed for devices with approval according to DIN EN 14597 and SIL certification. If other temperature probes than those described by JUMO data sheets 90.1006 and 90.2006 are used, their recording and suitability for use must be verified.

6.7 Standards and definitions

Table 2: Terms and abbreviations according to DIN EN 14597

Abbreviation	Explanation
Type 2	Mode of operation for which the manufacturing variation and migration of the operating value, operating duration, or operating procedure has been checked.
Type B	Micro disconnection in operation, corresponding contact disconnection at at least one pole to provide functional reliability.
Type D	A free trip mechanism that also cannot be closed temporarily for as long as the error persists.
Type F (STB)	A mode of operation in which, after the RS has been installed, it can only be reset with the aid of a tool.
Type J (STB)	A free trip mechanism with contacts that cannot be prevented from opening and which may not function as an automatically resetting RS if the means of resetting is held in the "Reset" or "On" position.
Type K	A probe mode of operation in which a probe break or a disconnection between the probe head and the switching head does not cause the operating value to increase.
Type N	A mode of operation in which the operating value does not increase as a result of a leak in the probe or in the parts that connect the probe and switching head. This mode is intended for use with electrical error models.
Type V (STB)	A lockout that can only be reactivated through a manual reset.
Type P	A mode of operation that is effective following a specified test through a change in temperature, as specified in 17.101 of DIN EN 60730-2-9.

Table 3: Terms and abbreviations according to DIN EN 61508 and DIN EN 61511

Name	Description
Actuator	Part of a safety instrumented system that intervenes in the process to achieve a safe state.
EUC	EUC (equipment under control) Equipment, machine, apparatus, or plant used for manufacturing, shaping materials, for transport, medical purposes, or other activities.
E / E / PE	Electrical/electronic/programmable electronic (E/E/EP): based on electrical (E) and/or electronic (E) and/or programmable electronic (PE) technology
Failure	End of the ability of a functional unit to perform a required function.
Diagnostic coverage	Partial reduction in the probability of dangerous hardware failures due to the use of automatic diagnostic tests.
Error	A non-normal condition that can cause a reduction or the loss of the ability of a functional unit to perform a required function.
Functional safety	A part of overall safety related to the EUC and EUC control system that depends on the correct function of the E/E/EP safety-relevant system, safety-relevant systems based on other technology, and external equipment for risk reduction.
Functional unit	Unit consisting of hardware or software or both that is suitable for performing a specified task.
Dangerous failure	A failure with the potential of placing the safety-related system in a dangerous state or a state without functional capability.
Safe failure	A failure without the potential of placing the safety-related system in a dangerous state or state without functional capability.
Hazard	Potential source of damage
Security	Absence of unjustifiable risks

Table 3: Terms and abbreviations according to DIN EN 61508 and DIN EN 61511

Name	Description
Safety function	A function that is performed by an E/E/PE safety-related system, safety-related system based on other technology, or external equipment for reducing risk with the goal of achieving or maintaining a safe state for the EUC taking into consideration a specified dangerous event
Safety integrity	The probability that a safety-related system will perform the required safety function under all specified conditions within a specified period of time according to requirements.
Safety Integrity Level (SIL)	One of four discrete levels for specifying the requirement for safety integrity of the safety functions assigned to the E/E/PE safety-related system. Safety Integrity Level 4 represents the highest level of safety integrity, while Safety Integrity Level 1 represents the lowest.
Safety-related system	A system that - performs necessary safety functions that are required to reach or maintain a safe state for the EUC and - is designed by itself or with other E/E/PE safety-related systems, safety-related systems based on other technology, or external equipment for risk reduction to achieve the necessary safety integrity for the required safety functions.
Safety Instrumented System (SIS)	Safety instrumented system to perform one or more safety-related functions. An SIS consists of sensor(s), logic system, and actuator(s).
Lambda: λ	Failure rate per hour
Lambda dangerous: λ_D	Rate of dangerous failures per hour
Lambda Δangerous Δetect: λ_{DD}	Rate of detected dangerous failures per hour
Lambda Δangerous Υndetect: λ_{DU}	Rate of undetected dangerous failures per hour
Lambda: λ_S	Rate of safe failures per hour

Table 3: Terms and abbreviations according to DIN EN 61508 and DIN EN 61511

Name	Description
Lambda: λ_{SD}	Rate of detected safe failures per hour
Lambda: λ_{SU}	Rate of undetected safe failures per hour
BPCS	Basic Process Control System
DC	**D**iagnostic **C**overage
FIT	Failures In Time (1×10^{-9} per h)
HFT	Hardware Fault Tolerance
PFD	Probability of Failure on Demand
PFD_{avg}	Average Probability of Failure on Demand
MooN	Architecture with M out of N channels
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
SFF	Safe Failure Fraction
SIL	Safety Integrity Level

6.8 Safety-related parameters related to the temperature monitoring unit

The following parameters were calculated by means of an FMEDA component under the following conditions:

- Error models corresponding to requirements of DIN EN 61508 for conformity with SIL2 or SIL3
- Failure rate of components according to the RDF 2000 UTE C 80-810 standard and SN 29500
- Sensors were combined as a subsystem in the following 6 variants:

6.8.1 Failure rates and SSF for type 701155/X-XX-025X-XXXX-23... (AC 230 V)

Table 4:

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}

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 safety**M** STB/STW Ex).
In this case, the plant operator selects the sensor system.

6.8.2 Failure rates and SFF for type 701155/X-XX-025X-XXXX-25 (AC/DC 24 V)

Table 5:

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 %	$3.68\ e^{-9}$	$1.61\ e^{-4}$

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 safety**M** STB/STW Ex).
In this case, the plant operator 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 (T_1 = 10 y). The Common Cause Factor was determined according to the tables of DIN EN 61508 for sensor systems and logic.

6.9 Determining the Safety Integrity Level (SIL)

The achievable Safety Integrity Level is determined by the following safety-related parameters:

- Average probability of dangerous failures of a safety function on demand (PFD_{avg}),
- Hardware fault tolerance (HFT) and
- Safe failure fraction (SFF).

The specific safety-related parameters for the measuring system of the JUMO safetyM STB/STW Ex can be found in the table in the "Safety-related parameters" chapter.

The following table shows how the "Safety Integrity Level" (SIL) depends on the "average probability of dangerous failures of a safety function of the entire safety-related system" (PFD_{avg}) according to DIN EN 61508. The "low demand mode" is considered, i.e. the demand rate for the safety-related system averages once a year.

Table: High demand table PFH

Table 6: High demand table PFH

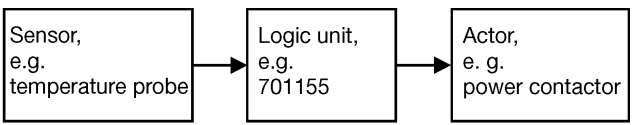
Safety Integrity Level (SIL)	Operating mode with high demand rate PFH (high demand mode)
4	$\geq 10^{-9}$ to $< 10^{-8}$
3	$\geq 10^{-8}$ to $< 10^{-7}$
2	$\geq 10^{-7}$ to $< 10^{-6}$
1	$\geq 10^{-6}$ to $< 10^{-5}$

Table 7: Low demand table PFD

Safety Integrity Level (SIL)	Operating mode with low demand rate PFD_{avg} (low demand mode)
4	$\geq 10^{-5}$ to $< 10^{-4}$
3	$\geq 10^{-4}$ to $< 10^{-3}$
2	$\geq 10^{-3}$ to $< 10^{-2}$
1	$\geq 10^{-2}$ to $< 10^{-1}$

The sensor, logic unit, and actuator together form a safety-related system that performs a safety function. The "average probability of dangerous failures of the entire safety-related system" (PFD_{avg}) is usually divided up into the sensor, logic unit, and actuator subsystems according to the following diagram.

Figure 1:



Typical subdivision of the "average probability of dangerous failures of a safety function on demand" (PFD_{avg}) into subsystems

The specifications related to functional safety in this Safety Manual include sensor systems (resistance temperature probes, thermocouples), logic unit (701155), and (as signal contact) the relay output in the JUMO safetyM STB/STW Ex system.

The actuator (for example a power contactor) is plant-related and must be taken into consideration separately according to the standard for the safety loop.

6.9.1 Safety integrity of the hardware

According to DIN EN 61508, a distinction must be made between systems of type A and systems of type B.

A subsystem can be considered to be type A if, for the components required to achieve the safety function,

- the failure behavior of all components used is sufficiently defined and
- the behavior of the subsystem can be fully determined under failure conditions and
- reliable failure data from experience in the field exists for the subsystem to show that the assumed failure rates for detected and undetected dangerous failures are achieved.

A subsystem can be considered to be type B if, for the components required to achieve the safety function,

- the failure behavior of at least one of the components used is not sufficiently defined or
- the behavior of the subsystem cannot be fully determined under failure conditions or
- no sufficiently reliable failure data from experience in the field exists for the subsystem to support the utilized failure rates for detected and undetected dangerous failures.

The JUMO safetyM STB/STW Ex corresponds to a type B system.
The following table shows the achievable Safety Integrity Level (SIL) in dependency on the safe failure fraction (SFF) and the hardware fault tolerance (HFT) for safety-related type B subsystems.

Table 8: For JUMO safetyM STB/STW Ex

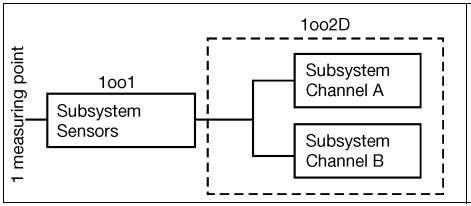
Safe failure fraction (SFF)	Hardware fault tolerance (HFT) for type B		
	0	1	2
< 60 %	Not allowed	SIL1	SIL2
60 to < 90 %	SIL1	SIL2	SIL3
90 to < 99 %	SIL2	SIL3	SIL4
≥ 99 %	SIL3	SIL4	SIL4

6.9.2 Safety-relevant system features

Device versions differ in the following architectures:

The evaluation unit of the JUMO safetyM STB/STW Ex in the STW and STB versions is implemented as 1oo2D architecture.

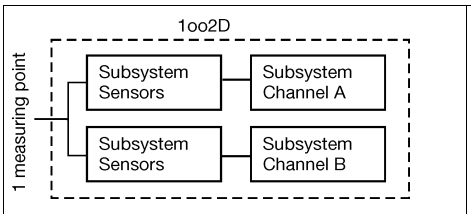
Figure 2: The types with a single sensor are executed in one-channel sensor systems (1oo1)



The following are monitored:

- Probe break
- Probe short circuit
- Random hardware failure in one channel

Figure 3: The variants with two sensors are consistently structured with two channels.



The following are monitored:

- Probe break in sensor system subsystem
- Probe short-circuit in sensor system subsystem
- Reverse voltage polarity of the probes
- Random hardware failure in one channel

Systems have a lifetime of ten years.

The proof check for SIL2 and SIL3 certified systems is also ten years.

If the temperature is above/below the admissible limits, the system switches to the safe state without delay. Premature switching is admissible if a malfunction is detected.

Table 9:

Safety feature	**Requirement / comment**	
SIL The sensor system is included in the SIL evaluation	SIL2	SIL3
Operating mode concerning safety function	Operating mode with lower and higher demand rate possible on a customer-specific basis	
Safety-critical inputs	Temperature sensor inputs 4 to 20 mA current loop	
Safety-relevant inputs	Setup and parameterization	
Safety-critical output	Alarm contact limit value	
Subsystem type	Type B	
Safety architecture (JUMO safetyM STB/STW Ex logic unit)	1oo2D	
Safety architecture (sensor system)	SIL2 1oo1	SIL3 1oo2
Hardware fault tolerance (JUMO safety**M** STB/STW Ex logic unit)	HFT=1	
Hardware fault tolerance (sensor system)	SIL2: HFT=0	SIL3: HFT=1
Safe failure fraction	SIL2 sensor system HFT=0: 90 % to < 99 %	SIL3 sensor system HFT=1: 90 % to < 99 %
CCF	Calculation according to DIN EN 61508 Part 7 Appendix D or DIN EN ISO 13849-1 Table F.1 min. 65 %	

Table 9:

Safety feature	Requirement / comment	
Average failure probability of a safety function on demand (overall system)	SIL2: Low demand: $PFD_{avg} < 10^{-2}$ High demand: $PFH < 10^{-6}$	SIL3: Low demand: $PFD_{avg} < 10^{-3}$ High demand: $PFH < 10^{-7}$
Interval for repeat test	No repeat test	
Planned operating duration	10 years	
Architecture according to DIN EN ISO 13849-1	Sensor system, one-channel: Cat. 2	Sensor system, two-channel: Cat. 3
$MTTF_d$-DC_{avg} according to DIN EN ISO 13849-1 Table K.1	PL d: ≥ 62 years DC_{avg} ≥ 60 %	PL e: ≥ 62 years DC_{avg} ≥ 90 %
Mode of operation and software class according to DIN EN 14597	The JUMO safetyM STB/STW Ex possesses the following modes of operation: 2B, 2D, 2F, 2K, 2J, 2V, 2N, 2P software class C	

6.10 Determining the achieved Performance Level (PL)

The following safety-related parameters are required to determine the Performance Level of components/devices:

As further parameters to be observed, operational aspects such as the demand rate and/or the test rate of the safety function can also influence the resulting PL.

Excerpt from DIN EN ISO 13849-1:2008-12

☞ This excerpt contains references to the complete standard DIN EN ISO 13849-1:2008-12, which are therefore not reproduced in this chapter.

Table 10: Terms and abbreviations according to DIN EN ISO 13849

Formula symbol or abbreviation	Description	Definition or location
PL (a, b, c, d, e)	Description for the Performance Level	Table 3
AOPD	Active Opto-electronic Protective Device (e.g. light barrier)	Appendix H
B, 1, 2, 3, 4	Description for the categories	Table 7
B_{10d}	Number of cycles in which a dangerous failure occurred in 10 % of a random sample of the observed pneumatic or electromechanical components that are subject to wear (mean time to dangerous failure)	Appendix C
Cat.	Category	3.1.2
CC	Current converter	Appendix I
CCF	**C**ommon **C**ause **F**ailure	3.1.6
DC	**D**iagnostic **C**overage	3.1.26
DC_{avg}	Average diagnostic coverage	E.2
F, F1, F2	Frequency and/or duration of the exposure to danger	A.2.2
FB	Function block	4.6.3
FVL	Programming language with unlimited language range	3.1.35
FMEA	Failure Modes and Effects Analysis	7.2
I, I1, I2	Input device, e.g. sensor	6.2
i, j	Index for counting	Appendix D
I/O	Inputs/outputs	Table E.1
i_{ab}, i_{bc}	Fasteners	Image 4

Table 10: Terms and abbreviations according to DIN EN ISO 13849

Formula symbol or abbreviation	Description	Definition or location
K1A, K1B	Contactors	Appendix I
L, L1, L2	Logic	6.2
LVL	Programming language with limited language range	3.1.34
M	Motor	Appendix I
MTTF	Mean time to failure	Appendix C
$MTTF_c$	Mean time to critical failure	3.1.25
$MTTF_d$	Mean time to dangerous failure	
n, N, $\overline{N}$	Number of units	6.3, D.1
N_{low}	Number of SRP/CS with PL_{low} in an SRP/CS combination	6.3
O, O1, O2, OTE	Output device, e.g. drive unit	6.2
P, P1, P2	Possibility of avoiding the danger	A.2.3
PES	Programmable Electronic System	3.1.22
PL	Performance Level	3.1.23
PLC	Programmable Logic Controller	Appendix I
PL_{low}	Lowest Performance Level of an SRP/CS in an SRP/CS combination	6.3
PL_f	Required Performance Level	3.1.24
r_a	Demand rate	3.1.30
RS	Rotary encoder	Appendix I
S, S1, S2	Severity of violation	A.2.1

Table 10: Terms and abbreviations according to DIN EN ISO 13849

Formula symbol or abbreviation	Description	Definition or location
SW1A, SW1B, SW1	Position switch	Appendix I
SIL	Safety Integrity Level	Table 4
SK (Cat.)	Category (B, 1, 2, 3, 4), structure as basis to achieve a certain PL	
SRASW	Safety-Related Application Software	4.6.3
SRESW	Safety-Related Embedded Software	4.6.2
SRP	Safety-Related Part	General
SRP/CS	**S**afety-**R**elated **P**art of (a) **C**ontrol **S**ystem(s)	3.1.1
Sub-PL/Sub-SIL	PL or SIL at subsystem level. A subsystem is a system that – based on a subtask – already adequately performs a safety function (for example, an input module that reliably records the inputs).	
TE	Test facilities	6.2
T_M	Functional life	3.1.28
T_M	Functional life, designated **M**ission **T**ime	
T_{10d} value	Reference value for a preventative exchange (10 % of the B10d value). At this value, a dangerous failure has already occurred for approx. 63 % of all components. In this case, the standard DIN EN ISO 13849-1:12006 recommends replacement.	

6.11 Connection possibilities of the sensors (PL)

The JUMO safety**M** STB/STW Ex evaluation unit is always structured in the same way. Various possibilities are available for sensor connection. These possibilities are listed in the following table along with the achievable PL level:

Table 11: 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 4 to 20 mA This means the sensor is not taken into account in the calculation.	Sensors connected by the plant operator 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 $DC_{701155} \geq 90$ %	Max. achievable PL of the system with 1oo2 sensor system architecture $DC_{701155} \geq 90$ %
				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 variant 5 no sensor system was included (only the JUMO safety**M** STB/STW Ex). In this case, the plant operator selects the sensor system. For this reason, the plant operator is responsible for evaluating the achievable PL.

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

Table 12:

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 above table

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

Table 13:

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 above table

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

6.11.3 Contribution to risk minimization through the control system

The objective of compliance with the overall draft procedure for the machine is to achieve the safety objectives (see 4.1 in DIN EN 13849-1). The draft of the SRP/CS to provide the required risk minimization is an integral part of the overall draft procedure for the machine. The SRP/CS provides the safety function(s) with a PL that achieves the required risk minimization. Through the provision of safety functions, either as an inherently safe part of the construction or as the control of a protective guard or protective device, the design of the SRP/CS is part of the risk minimization strategy. This is an iterative process and is depicted in figures 1 and 3 in DIN EN 13849-1.

The features of each safety function (see section 5 in DIN EN 13849-1) and the required Performance Level must be described and documented in the specification of the safety requirements.

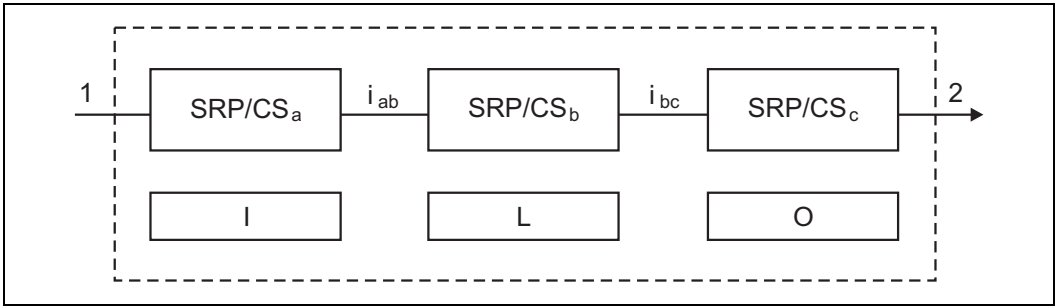
In this part of DIN EN ISO 13849, the Performance Levels are defined in the form of the probability of a dangerous failure per hour. Five Performance Levels (a to e) are specified with defined areas of the probability of a dangerous failure per hour (see table).

Table 14:

Performance Level (PL)	**Average probability of a dangerous failure per hour 1/h**
a	$\geq 10^{-5}$ to $< 10^{-4}$
b	≥ 3 Þ 10^{-6} to $< 10^{-5}$
c	$\geq 10^{-6}$ to $< 3 \times 10^{-6}$
d	$\geq 10^{-7}$ to $< 10^{-6}$
e	$\geq 10^{-8}$ to $< 10^{-7}$
NOTE: in addition to the average probability of a dangerous failure per hour, further measures are required to achieve the PL.	

Schematic representation of a combination of safety-related parts of controls for processing a typical safety function

Figure 4:



I Input

L Logic

O Output

1 Start event, e.g. manual actuation of a key, opening of a protective guard, interruption of the beam of an AOPD

2 Drive unit of the machine, e.g. motor brake

6.12 Performance Level

For application in this part of DIN EN ISO 13849, the capability of safety-related parts to perform a safety function is expressed through the determination of a Performance Level.

The PL must be assessed for each selected SRP/CS and/or SRP/CS combination that performs a safety function. The PL of the SRP/CS must be determined by assessing the following aspects:

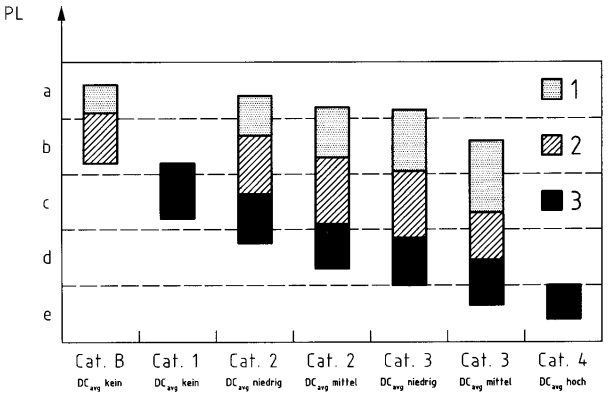
- The $MTTF_c$ value of individual components (see Appendices C and D)
- The DC (see Appendix E)
- The CCF (see Appendix F)
- The structure (see section 6)
- The behavior of the safety function under failure conditions (see section 6)
- Safety-related software (see 4.6 and Appendix J)
- Systematic failures (see Appendix G)
- The capability of performing a safety function under predictable ambient conditions

6.13 Relationship between the Performance Level (PL) and the Safety Integrity Level (SIL)

PL	SIL (IEC 61508-1, for information) high/continual operating mode
a	No equivalent
b	1
c	1
d	2
e	3

The following table shows the procedure for selecting the categories in combination with $MTTF_d$ for each channel and the DC_{avg} to achieve the required PL for each safety function.

Table 15: Relationship between the categories DC_{avg}, $MTTF_d$ of each channel and PL



PL Performance Level

1 $MTTF_d$ of each channel = low

2 $MTTF_d$ of each channel = medium

3 $MTTF_d$ of each channel = high

The diagram above shows the different possible combinations for assessing the category with DC_{avg} (horizontal axis) and the $MTTF_d$ of each channel (bars). The bars in the diagram show the three $MTTF_d$ areas of each channel (low, medium, and high) that can be selected to achieve the required PL.

Before the simplified procedure from the diagram shown is applied (which shows the results of different Markov models on the basis of intended architectures from section 6), the category of the SRP/CS and the DC_{avg} and the $MTTF_d$ of each channel must have been determined (see section 6 and Appendices C to E).

For categories 2, 3, and 4, sufficient measures against failures due to combined failures must be fulfilled (see Appendix F). Taking these parameters into account, the diagram represents a graphical procedure for determining the PL achieved by the SRP/CS. The combination of categories (including failures due to combined failures) and DC_{avg} determines which bar to choose in Figure 5. One of the three differently shaded areas of the relevant bar must be chosen according to the $MTTF_d$ of each channel.

The vertical position of these areas determines the achieved PL, which can be read off the vertical axis. If the area covers two or three possible PLs, the achieved PL is specified in Table 7. For information on accurate selection of the PL on the basis of the precise value of the $MTTF_d$ for each channel, see Appendix K.

6.14 Other applicable device documentation

For the JUMO safetyM STB/STW Ex the measures, values, and requirements specified in this Operating Manual regarding installation, electrical connection, function, and startup must be observed.

6.15 Behavior during operation and in the event of a fault

Behavior during operation and the event of a fault is described in the Operating Manual.

A functional test must be performed after startup, repairs on the safety system, or a change in safety-related parameters.
If an error is detected during a functional test, measures must be taken to once again ensure the functional capability of the safety system. This can be done by replacing the logic unit, for example.
Appropriate documentation of tests that are performed is recommended.

6.16 Regular tests

No test is required for SIL2 and SIL3 certified systems since the proof check equals the lifetime.
Each is ten years.

☞ After the lifetime expires, the systems no longer meet the requirements according to their SIL certification.

6.16.1 Recommended tests for temperature probes

To ensure safe and reliable operation of the temperature probe, the following service and maintenance work must be performed:
The following tests are recommended at certain intervals:

- Every 12 months, the leakage resistance of the measuring circuit must be measured against the protection fitting (for thermocouples: only for the insulated measuring circuit; in the case of multiple measuring circuits, the insulation test must also be performed between the individual measuring circuits). The minimal leakage resistance at room temperature should be 100 MΩ at 100 V.

- Damage and corrosion of temperature probes – protection tubes
- Corrosion and correct positioning of the contacts and terminals of cable connections
- Seals of terminal heads and cable ducts
- Interruptions due to "knocking" on the temperature probe/measuring insert

Since the maximum operating temperature influences the drift behavior, the temperature probe should be recalibrated or replaced at certain intervals to ensure reliable and precise temperature measurement.
The testing intervals are listed in the table below:

Table 16: Testing intervals

Maximum operating temperature	Pt - RTD temperature probes	Thermocouples
200 °C	5 years	5 years
550 °C	2 years	5 years
700 °C	1 year	2 years
1000 °C		Base metal 1 year
		Noble metal 2 years
1500 °C		1 year

☞ The testing intervals specified here are recommendations that must be adapted to the special conditions at the operating location and,
if necessary, the user should perform the tests more regularly.

6.17 Intrinsic safety according to DIN EN 60079-11

⇨ Chapter 7 "ATEX"

6.18 Monitoring of potential ignition sources according to DIN EN 50495 and DIN EN 13463-6

⇨ Chapter 7 "ATEX"

6.19 Certificates

TÜV NORD

Certificate

No. SAS-0190/2006-3, V2.0

TÜV Nord Systems GmbH & Co. KG hereby certifies

JUMO GmbH & Co.KG
Moritz-Juchheim-Straße 1
36039 Fulda

that the products (see next page for typelist)

"Electronic Safety Temperature Monitor/Limiter STB/STW 701155"

is capable for safety related applications up to SIL 3, up to PL e respectively and meets the requirements listed in the following standards.

DIN EN 61508-1-/-2-/-3:2011
DIN EN 14597:2005
DIN EN 60730-2-9: 2011
DIN EN ISO 13849-1: 2008

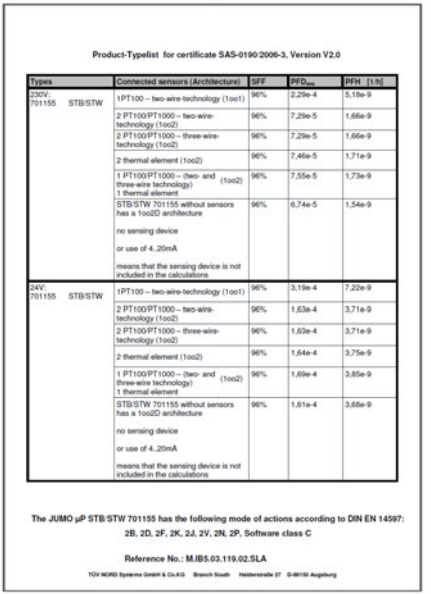
The certification is based on the report SAS-0190/2006-3TB-3 in the valid version. This certificate entitles the holder to use the pictured Safety Approved mark.

Expire date: 2017-01-18
Reference No.: M.IB5.03.119.02.SLA

Augsburg, 2012-01-18

Dr. I. Hofer

TÜV NORD Systems GmbH & Co.KG Branch South Halderstraße 27 D-86150 Augsburg



Product-Typelist for certificate SAS-0190/2006-3, Version V2.0

Types		Connected sensors (Architecture)	SFF	PFD_{avg}	PFH [1/h]
230V: 701155	STB/STW	1PT100 – two-wire-technology (1oo1)	96%	2,29e-4	5,18e-9
		2 PT100/PT1000 – two-wire-technology (1oo2)	96%	7,29e-5	1,66e-9
		2 PT100/PT1000 – three-wire-technology (1oo2)	96%	7,29e-5	1,66e-9
		2 thermal element (1oo2)	96%	7,46e-5	1,71e-9
		1 PT100/PT1000 – (two- and three-wire technology) (1oo2) 1 thermal element	96%	7,55e-5	1,73e-9
		STB/STW 701155 without sensors has a 1oo2D architecture no sensing device or use of 4..20mA means that the sensing device is not included in the calculations	96%	6,74e-5	1,54e-9
24V: 701155	STB/STW	1PT100 – two-wire-technology (1oo1)	96%	3,19e-4	7,22e-9
		2 PT100/PT1000 – two-wire-technology (1oo2)	96%	1,63e-4	3,71e-9
		2 PT100/PT1000 – three-wire-technology (1oo2)	96%	1,63e-4	3,71e-9
		2 thermal element (1oo2)	96%	1,64e-4	3,75e-9
		1 PT100/PT1000 – (two- and three-wire technology) (1oo2) 1 thermal element	96%	1,69e-4	3,85e-9
		STB/STW 701155 without sensors has a 1oo2D architecture no sensing device or use of 4..20mA means that the sensing device is not included in the calculations	96%	1,61e-4	3,68e-9

The JUMO µP STB/STW 701155 has the following mode of actions according to DIN EN 14597:
2B, 2D, 2F, 2K, 2J, 2V, 2N, 2P, Software class C

Reference No.: M.IB5.03.119.02.SLA

TÜV NORD Systems GmbH & Co.KG Branch South Halderstraße 27 D-86150 Augsburg

DIN CERTCO
Gesellschaft für Konformitätsbewertung mbH

ZERTIFIKAT

Der Firma

JUMO GmbH & Co. KG
Moritz-Juchheim-Str. 1
36039 Fulda
DEUTSCHLAND

wird für das Produkt

Temperaturregel- und Begrenzungseinrichtungen für Wärmeerzeugungsanlagen

vom Typ

JUMO STB/STW 701155/...

die Konformität mit

DIN EN 14597:2005-12
Zertifizierungsprogramm Temperaturregel- und -begrenzungseinrichtungen für wärmeerzeugende Anlagen (Stand: 2009-01)

bestätigt und das Nutzungsrecht für das Zeichen

DIN Geprüft

in Verbindung mit der unten genannten Registernummer erteilt.

Registernummer: STB/STW1228

Dieses Zertifikat ist gültig bis 2016-11-30.

Weitere Angaben siehe Anhang.
DIN CERTCO Gesellschaft für Konformitätsbewertung mbH
Alboinstraße 56, 12103 Berlin

2012-01-19
Dipl.-Ing. (FH) Dipl.-Wi.-Ing. Sören Schulz
- Leiter der Zertifizierungsstelle -

Anhang

zum Zertifikat mit der Registernummer STB/STW1228 vom 2012-01-19

Technische Angaben

Bauart:	elektronischer Sicherheitstemperaturwächter und Sicherheitstemperaturbegrenzer
Grenzwertbereich:	programmierbar
Einstellbereich:	innerhalb der Grenzen beliebig programmierbar
Schaltdifferenz:	0...100 programmierbar
Betriebsmedium an Fühler:	Wasser, Luft, Öl
zul Umgebungstemperatur an Fühler:	- 200 °C ... 2495 °C
Betriebstemperatur:	0 ... 55 °C
Spannungsversorgung:	AC/DC 20 ... 30V, 48 ... 63Hz AC 110...240V, +10/-15%, 48 ... 63Hz

Prüflaboratorium / Überwachungsstelle

TÜV NORD
Systems GmbH & Co. KG
Prüflab. für Feuerungsanlagen
Am TÜV 1
30519 Hannover

Prüfbericht(e)

SAS-190-2006TB-3 von 2011-11-07

TÜV NORD

ZERTIFIKAT

EG-Baumusterprüfung
nach Richtlinie 97/23/EG

Zertifikat-Nr.: 07 202 4834 Z 5077/3/H rev.03

Name und Anschrift des Herstellers:	**JUMO GmbH & Co. KG** **Moritz-Juchheim-Straße 1** **D-36039 Fulda**

Hiermit wird bescheinigt, dass das unten genannte EG-Baumuster die Anforderungen der Richtlinie 97/23/EG erfüllt.

Geprüft nach Richtlinie 97/23/EG:	**EG-Baumusterprüfung (Modul B)**
Prüfbericht-Nr.:	**4834P50773H, 1837P0026/7/01, 1321P0050/1/01 und SAS-190-2006TB2, 1321P0020/2/01 und SAS-190-2006TB3**
Beschreibung des Baumusters:	**Elektronische Temperaturwächter, -begrenzer und Sicherheitstemperaturwächter, -begrenzer** **Baumusternummer TB/TW/STB/STW109107** **Typ: 701130/...** **Baumusternummer STB/STW1223** **Typ: 701150/...** **Baumusternummer STB/STW1228** **Typ: 701155/...**
Fertigungsstätte:	**JUMO GmbH & Co. KG** **Moritz-Juchheim-Straße 1** **D-36039 Fulda**
Gültig bis	**31. Januar 2013**

Hamburg, 17. April 2012

Zertifizierungsstelle für Druckgeräte der TÜV NORD Systems GmbH & Co. KG

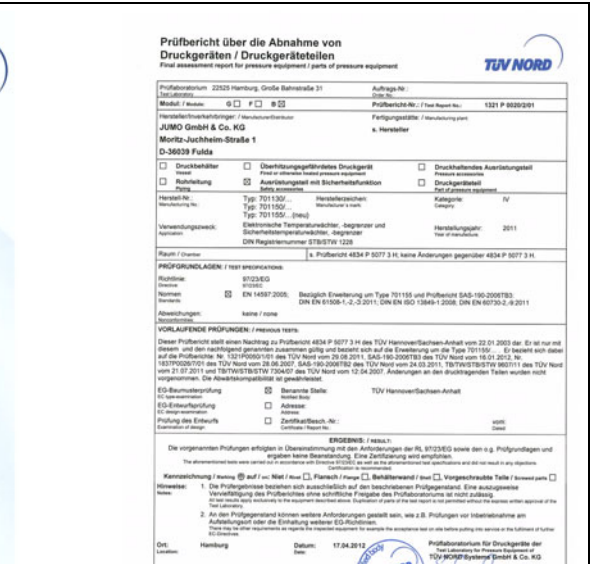
i. A. Wirl

Benannte Stelle, Kennnummer 0045

TÜV Nord Systems GmbH & Co. KG
Große Bahnstraße 31
D-22525 Hamburg
Germany

Tel. +49-(0) 8557-1427
Fax +49-(0) 8557-2187
e-mail siuckmann@tuev-nord.de

Mitglied der CECO



TÜV NORD

Prüfbericht über die Abnahme von Druckgeräten / Druckgerätеteilen

Final assessment report for pressure equipment / parts of pressure equipment

Prüflaboratorium 22525 Hamburg, Große Bahnstraße 31 Test Laboratory	Auftrags-Nr.: Order No.:
Modul / Module: G F B	Prüfbericht-Nr.: / Test Report No.: **1321 P 0020/2/01**
Hersteller/Inverkehrbringer: / Manufacturer/Distributor: **JUMO GmbH & Co. KG** **Moritz-Juchheim-Straße 1** **D-36039 Fulda**	Fertigungsstätte: / Manufacturing plant: **s. Hersteller**

☐ Druckbehälter / Vessel ☐ Überhitzungsgefährdetes Druckgerät / Fired or otherwise heated pressure equipment ☐ Druckhaltendes Ausrüstungsteil / Pressure accessories

☐ Rohrleitung / Piping ☒ Ausrüstungsteil mit Sicherheitsfunktion / Safety accessories ☐ Druckgerätеteil / Part of pressure equipment

Herstell-Nr.: / Manufacturing No.:	Typ: 701130/... Typ: 701150/... Typ: 701155/...(neu)	Herstellerzeichen: / Manufacturer's mark:	Kategorie: / Category: IV
Verwendungszweck: / Application:	Elektronische Temperaturwächter, -begrenzer und Sicherheitstemperaturwächter, -begrenzer DIN Registriernummer STB/STW 1228		Herstellungsjahr: / Year of manufacture: 2011

Raum / Chamber: s. Prüfbericht 4834 P 5077 3 H, keine Änderungen gegenüber 4834 P 5077 3 H.

PRÜFGRUNDLAGEN: / TEST SPECIFICATIONS:

Richtlinie: / Directive:	97/23/EG 97/23/EC	
Normen / Standards:	☒ EN 14597:2005;	Bezüglich Erweiterung um Type 701155 und Prüfbericht SAS-190-2006TB3: DIN EN 61508-1,-2,-3:2011, DIN EN ISO 13849-1:2008, DIN EN 60730-2,-9:2011
Abweichungen: / Nonconformities:	keine / none	

VORLAUFENDE PRÜFUNGEN: / PREVIOUS TESTS:

Dieser Prüfbericht stellt einen Nachtrag zu Prüfbericht 4834 P 5077 3 H des TÜV Hannover/Sachsen-Anhalt vom 22.01.2003 dar. Er ist nur mit diesem und den nachfolgend genannten zusammen gültig und bezieht sich auf die Erweiterung um die Type 701155/... Er bezieht sich dabei auf die Prüfberichte: Nr. 1321P0050/1/01 des TÜV Nord vom 29.08.2011, SAS-190-2006TB3 des TÜV Nord vom 18.01.2012, Nr. 1837P0026/7/01 des TÜV Nord vom 28.06.2007, SAS-190-2006TB2 des TÜV Nord vom 24.03.2011, TB/TW/STB/STW 960711 des TÜV Nord vom 21.07.2011 und TB/TW/STB/STW 730407 des TÜV Nord vom 12.04.2007. Änderungen an den drucktragenden Teilen wurden nicht vorgenommen. Die Abwärtskompatibilität ist gewährleistet.

EG-Baumusterprüfung / EC type-examination:	☒	Benannte Stelle: / Notified Body:	TÜV HannoverSachsen-Anhalt
EG-Einzelprüfung / EC design-examination:	☐	Adresse: / Address:	
Prüfung des Enturfs / Examination of design:	☐	Zertifikat/Besch.-Nr.: / Certificate / Report No.:	vom / Dated

ERGEBNIS: / RESULT:

Die vorgenannten Prüfungen erfolgten in Übereinstimmung mit den Anforderungen der RL 97/23/EG sowie den o.g. Prüfgrundlagen und ergeben keine Beanstandung. Eine Zertifizierung wird empfohlen.

The aforementioned tests were carried out in accordance with Directive 97/23/EC as well as the aforementioned test specifications and did not result in any objections. Certification is recommended.

Kennzeichnung / Marking: auf / on: Niet / Rivet ☐, Flansch / Flange ☐, Behälterwand / Shell ☐, Vorgeschraubte Teile / Screwed parts ☐

Hinweise: / Notes:

1. Die Prüfergebnisse beziehen sich ausschließlich auf den beschriebenen Prüfgegenstand. Eine auszugsweise Veröffentlichung des Prüfberichtes ohne schriftliche Freigabe des Prüflaboratoriums ist nicht zulässig. All test results apply exclusively to the equipment described above. Duplication of parts of the test report is not permitted without the express written approval of the Test Laboratory.
2. An den Prüfgegenstand können weitere Anforderungen gestellt sein, wie z.B. Prüfungen vor Inbetriebnahme am Aufstellungsort oder die Einhaltung weiterer EG-Richtlinien. There may be other requirements as regards the inspected equipment for example the acceptance test on site before putting into service or the fulfilment of further EC-Directives.

Ort: / Location: Hamburg Datum: / Date: 17.04.2012

Prüflaboratorium für Druckgeräte der / Test Laboratory for Pressure Equipment of TÜV NORD Systems GmbH & Co. KG

i. A. Lüdemann

Anlagen: / Annexes: Benannte Stelle, Kennnummer 0045 / Notified Body, Ident No. 0045

Seite 1 von 1

JUMO GmbH & Co. KG
Moritz-Juchheim-Straße 1
36039 Fulda, Germany

Telefon: +49 661 6003 - 0
E-Mail: mail@jumo.net
Internet: www.jumo.net

JUMO

EG Konformitätserklärung

EC Declaration of Conformity / Déclaration CE de conformité

Dokument-Nr. *Document No. / Document n°*: CE 483

Hersteller *Manufacturer / Etabli par*: JUMO GmbH & Co. KG

Anschrift *Address / Adresse*: Moritz-Juchheim-Straße 1, 36039 Fulda

Produkt	Beschreibung	STB/STW Sicherheitstemperaturbegrenzer, Sicherheitstemperaturwächter
Product / Produit	Typ/ Serie	JUMO safetyM STB/STW Ex / 701155
	Typenblatt-Nr.	701155

Wir erklären in alleiniger Verantwortung, dass das bezeichnete Produkt die Schutzanforderungen der Europäischen Richtlinien erfüllt.
We hereby declare in sole responsibility that the designated product fulfills the safety requirements of the European directives.
Nous déclarons sous notre seule responsabilité que le produit remplit les directives européennes.

Richtlinie *Directive / Directive*		Datum der Erstanbringung des CE-Zeichens auf dem Produkt *Date of first application of the CE mark to the product / Date de 1ère application du sigle CE sur le produit*
2004/108/EG	[EMV-Richtlinie]	2012
2006/42/EG	[Maschinenrichtlinie]	2012
94/9/EG	[Explosionsschutz-Richtlinie-ATEX]	2012
97/23/EG	[Druckgeräterichtlinie, Modul B+D]	2012

EG-Baumusterprüfbescheinigung
Type examination / Tests échantillon

Register Nr. STB/STW 1228 (DIN 14597) — Bescheinigung TÜV 11 ATEX 556139 X
Zertifikat Nr. 07 202 4634 Z 507/13/H (DGRL)

Angewendete Normen
Standards applied / Normes appliquées

EN 61326-1	Ausgabe: 2006	EN 60079-26	Ausgabe: 2007
EN 61326-3-1	Ausgabe: 2008	EN 60079-11	Ausgabe: 2007
EN 14597	Ausgabe: 2005	EN 50495	Ausgabe: 2010
EN 60730-1	Ausgabe: 2008	EN 61241-11	Ausgabe: 2006
EN 60730-2-9	Ausgabe: 2010	EN 13463-6	Ausgabe: 2005
EN 60079-0	Ausgabe: 2009	AD 2000 Merkblätter	

Anerkannte Qualitätssicherungssysteme der Produktion
Recognized quality assurance systems used in production / Organisme notifié agréé

nach Richtlinie 94/9/EG Modul D — */ Directive 94/9/EC Module D / Directive européenne 94/9/CE module D*
TÜV NORD CERT GmbH, Am TÜV 1, D 30519 Hannover, Germany
Kennnummer 0044, Mitteilungsnummer TÜV 99 ATEX 1454 Q.
Identification No. 0044, Notification No. TÜV 99 ATEX 1454 Q / N° d'identification 0044, N° de signification TÜV 99 Atex 1454 Q

nach Richtlinie 97/23/EG Modul D — */ Directive 97/23/EC Module D / Directive européenne 97/23/CE module D*
TÜV SÜD Industrie Service GmbH, Dudenstraße 28, 68167 Mannheim, Germany
Kennnummer 0036, Zertifikat Nr. DGR-0036-QS-989-11
Identification No. 0036, Certificate No. DGR-0036-QS-989-11 / N° d'identification 0036 , N° de certificat DGR-0036-QS-989-11

Aussteller: *Issued by: / Etabli par:* — Firma / *Company / Société*: JUMO GmbH & Co. KG, Fulda

Ort, Datum: *Place, date / Lieu, date*: Fulda, 2012-11-13

Rechtsverbindliche Unterschrift
Legally binding signature
Signature juridiquement valable

Geschäftsbereichsleitung Vertrieb und Produktion
Head of Division Sales and Production
Direction du département Vente et Production

ppa. Wolfgang Vogl

TÜV NORD

(1) **EG-Baumusterprüfbescheinigung**

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen, **Richtlinie 94/9/EG**

(3) **Bescheinigungsnummer:** **TÜV 11 ATEX 556139 X**

(4) für das Gerät: Sicherheitstemperaturbegrenzer STB/STW 701155

(5) des Herstellers: JUMO GmbH & Co. KG

(6) Anschrift: Moritz-Juchheim-Straße 1
36039 Fulda
Deutschland

Auftragsnummer: 8000556139

Ausstellungsdatum: 31.10.2012

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser EG-Baumusterprüfbescheinigung festgelegt.

(8) Die TÜV NORD CERT GmbH bescheinigt als benannte Stelle Nr. 0044 nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaften vom 23. März 1994 (94/9/EG) die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie. Das Ergebnis der Prüfung ist im vertraulichen Prüfbericht Nr. 12 203 556139 festgelegt.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit:

EN 60079-0:2009	**EN 60079-11:2007**	**EN 61241-11:2006**
EN 60079-26:2007	**EN 50495:2010**	**EN 13463-6:2005**

(10) Falls das Zeichen "X" hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf Konzeption und Prüfung des festgelegten Gerätes gemäß Richtlinie 94/9/EG. Weitere Anforderungen dieser Richtlinie gelten für die Herstellung und das Inverkehrbringen dieses Gerätes. Diese Anforderungen werden nicht durch diese Bescheinigung abgedeckt.

(12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:

II (1) (2) (3) G (b1) [Ex ia Ga] [e pz] IIC und II (1) (2) (3) D (b1) [Ex ia Da] [p Dc] IIIC
bzw.
II (1) (1) (2) G (b2) [Ex ia Ga] [e py] IIC und II (1) (1) (2) D (b2) [Ex ia Da] [p Db] IIIC

TÜV NORD CERT GmbH, Langemarckstraße 20, 45141 Essen, benannt durch die Zentralstelle der Länder für Sicherheitstechnik (ZLS), Ident. Nr. 0044, Rechtsnachfolger der TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

Der Leiter der benannten Stelle

Schwedt

Geschäftsstelle Hannover, Am TÜV 1, 30519 Hannover, Fon +49 (0)511 986 1455, Fax +49 (0)511 986 1590

Diese Bescheinigung darf nur unverändert weiterverbreitet werden.
Auszüge oder Änderungen bedürfen der Genehmigung der TÜV NORD CERT GmbH

(13) **ANLAGE**

(14) **EG-Baumusterprüfbescheinigung Nr. TÜV 11 ATEX 556139 X**

(15) Beschreibung des Gerätes

Bei dem Gerät handelt es sich um einen Sicherheitstemperaturbegrenzer und Sicherheitstemperaturwächter, der als zugehöriges, eigensicheres Betriebsmittel ausgeführt ist. Die eigensicheren Ausgangsstromkreise zum Anschluss an Widerstandsthermometer (PT100 und PT1000) sowie an Thermoelemente oder zur Messung eines Einheitssignalstromes (4...20 mA) sind zum Einsatz in Bereichen mit explosionsfähiger Gas- oder Staubatmosphäre vorgesehen.

Technische Daten

Zulässiger Bereich der Umgebungstemperatur: -20 °C bis +55 °C

Für Typ STB/STW 701155 / * - ** - ** - **** - 23 / *** , ***

Versorgungsstromkreis..... U_N = 110 bis 240 V AC +10% / -15%, 48 bis 63 Hz
(Klemmen N und L1) U_M = 250 V

Für Typ STB/STW 701155 / * - ** - ** - **** - 25 / *** , ***

Versorgungsstromkreis..... U_N = 20 bis 30 V DC oder AC, 48 bis 63 Hz
(Klemmen L- und L+) U_M = 250 V

Für alle Typen

Ausgangsstromkreis..... U_O = 6 V
(Klemmen 1, 2, 3 und 6, 7, 8) I_O = 41,2 mA
P_O = 61,8 mW

Binäranschluss..... U_M = 250 V
(Klemmen 4 und 5)

Analogausgang..... U_M = 250 V
(Klemmen 9 und 9)

Relaisausgang..... U_N = 250 V
(Klemmen 11, 12, 13) I_{max} = 3 A

Relaisausgang..... U_N = 250 V
(Klemmen 14, 15, 16) I_{max} = 3 A

Maximal zulässige, externe Anschlusswerte bei getrenntem Auftreten von Induktivität und Kapazität:
L_o = 20 mH
C_o = 36,3 µF

Die maximal zulässigen Kombinationen von externen Anschlusswerten, bei gleichzeitigem Auftreten von Induktivität und Kapazität, für Gasgruppe IIC, sind der nachfolgenden Tabelle zu entnehmen.

L_o [mH]	0,2	0,1	0,05	0,01
C_o [µF]	0,2	1,1	2,2	7,3

Für die unten gelisteten Temperaturfühler, die als einfache elektrische Betriebsmittel anzusehen sind und die mit dem Gerät betrieben werden können, sind die Grenzwerte für die maximal zulässige Obergrenze der Umgebungstemperatur, für die entsprechende Temperaturklasse, der nachfolgenden Tabelle zu entnehmen.

	Obergrenze der Medien- und Umgebungstemperatur für Anwendungen die Geräte der Kategorie 2 erfordern		Obergrenze der Medien- und Umgebungstemperatur für Anwendungen die Geräte der Kategorie 1 erfordern	
Temperaturklasse	Temperaturfühler mit PT100	Temperaturfühler mit Thermo-element	Temperaturfühler mit PT100	Temperaturfühler mit Thermo-element
T1	432,5 °C	439,1 °C	342,5 °C	349,1 °C
T2	282,5 °C	289,1 °C	222,5 °C	229,1 °C
T3	187,5 °C	194,1 °C	147,5 °C	154,1 °C
T3	122,5 °C	129,1 °C	95,5 °C	102,1 °C
T5	87,5 °C	94,1 °C	67,5 °C	74,1 °C
T6	72,5 °C	79,1 °C	55,5 °C	62,1 °C

Folgende Temperaturfühler des Herstellers, mit PT100 Widerstandsthermometer, können mit dem Gerät betrieben werden:

Typenbezeichnung des Herstellers	Platzhalter xxx
902006/65-228-1003-1-15-xxx-668/922 902006/55-228-1003-1-15-xxx-254/922 902006/65-228-2003-1-15-xxx-668/922 902006/55-228-2003-1-15-xxx-254/922	500, 710 und 1000
902006/10-402-1003-1-9-xxx-104/922 902006/10-402-2003-1-9-xxx-104/922	100
902006/10-226-1003-1-9-xxx-104/922 902006/10-226-2003-1-9-xxx-104/922	250
902006/54-227-1003-1-15-xxx-254/922 902006/54-227-2003-1-15-xxx-254/922	710
902006/53-505-2003-1-12-xxx-815/922 902006/53-505-1003-1-12-xxx-815/922	190
902006/53-507-2003-1-12-xxx-815/922	100, 160, 190 und 220

TÜV NORD

Anlage EG-Baumusterprüfbescheinigung Nr. TÜV 11 ATEX 556139 X

902006/53-507-1003-1-12-xxx-815/922 902006/53-505-3003-1-12-xxx-815/922 902006/40-226-1003-1-12-xxx-815/922	100, 160 und 220

Folgende Temperaturfühler des Herstellers, mit Thermoelement, können mit dem Gerät betrieben werden:

Typenbezeichnung des Herstellers	Platzhalter xxx
901006/65-547-2043-15-xxx-668/922 901006/65-546-2042-15-xxx-668/922	500, 710 und 1000
90.1006/66-550-2043-6-xxx-668/922 90.1006/66-880-1044-6-xxx-668/922 90.1006/66-880-2044-6-xxx-668/922 90.1006/66-953-1045-6-xxx-668/922 90.1006/66-953-2045-6-xxx-668/922	250, 355 und 500
901006/54-554-2043-15-xxx-254/922 901006/54-554-1043-15-xxx-254/922 901006/54-554-2042-15-xxx-254/922 901006/54-554-1042-15-xxx-254/922	710
901006/53-543-1042-12-xxx-815/922 901006/53-543-2042-12-xxx-815/922	220

(16) Prüfungsunterlagen sind im Prüfbericht Nr. 12 203 556139 und 12 203 398437 aufgelistet.

(17) Besondere Bedingung

Schaltarbeiten an den eigensicheren Stromkreisen dürfen nur vorgenommen werden, während das Gerät, einschließlich aller Zuleitungen, spannungslos geschaltet ist.

Das Gerät, einschließlich aller Zuleitungen, darf nur unter Spannung gesetzt werden, wenn die Abdeckung der eigensicheren Stromkreise ordnungsgemäß montiert wurde.

Als Sicherheitseinrichtung für die Mindestdrucküberwachung bei statischer Überdruckkapselung ist ausschließlich die STB-Variante (Sicherheitstemperaturbegrenzer) des Gerätes zulässig.

Der Abschaltgrenzwert ist in Abhängigkeit von der Applikation so einzustellen, dass unter Berücksichtigung von Genauigkeit, Fehlertoleranzzeiten des Gerätes und (falls zutreffend) Druck- oder Temperaturnachläufen kein gefahrbringender Zustand eingenommen werden kann.

Die Sicherheitsrelevanten Einstellungen des Gerätes sind (z. B. durch Verplomben oder passwortgeschützte Eingabe) gegen unautorisierte Veränderung zu schützen.

TÜV NORD

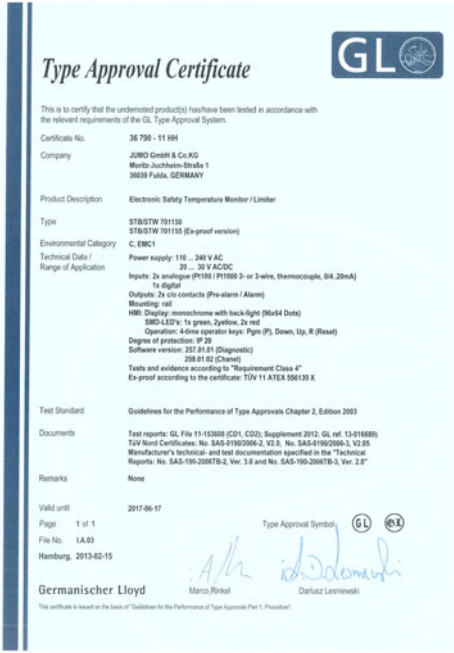
Anlage EG-Baumusterprüfbescheinigung Nr. TÜV 11 ATEX 556139 X

Bei der Verwendung des Gerätes in der Variante STW (Sicherheitstemperaturwächter) ist nach der Abschaltung durch den Sicherheitstemperaturbegrenzer sicherzustellen, dass ein automatischer Wiederanlauf des überwachten Betriebsmittels durch eine übergeordnete Steuerung vermieden wird.

Wird das Gerät in der einkanaligen Gerätevariante zur Überwachung nicht elektrischer Zündquellen verwendet und wird im Anforderungsfall eine Warnmeldung ausgegeben, so sind vom Anwender unverzüglich Maßnahmen zum Erreichen des sicheren Zustandes einzuleiten.

(18) Grundlegende Sicherheits- und Gesundheitsanforderungen

keine zusätzlichen



Type Approval Certificate

This is to certify that the undernoted product(s) has/have been tested in accordance with the relevant requirements of the GL Type Approval System.

Certificate No.	**36 790 - 11 HH**
Company	**JUMO GmbH & Co.KG** **Moritz-Juchheim-Straße 1** **36039 Fulda, GERMANY**
Product Description	**Electronic Safety Temperature Monitor / Limiter**
Type	**STB/STW 701150** **STB/STW 701155 (Ex-proof version)**
Environmental Category	**C, EMC1**
Technical Data / Range of Application	**Power supply: 110 ... 240 V AC** **20 ... 30 V AC/DC** **Inputs: 2x analogue (Pt100 / Pt1000 2- or 3-wire, thermocouple, 0/4..20mA)** **1x digital** **Outputs: 2x c/o contacts (Pre-alarm / Alarm)** **Mounting: rail** **HMI: Display: monochrome with back-light (96x64 Dots)** **SMD-LED's: 1x green, 2yellow, 2x red** **Operation: 4-time operator keys: Pgm (P), Down, Up, R (Reset)** **Degree of protection: IP 20** **Software version: 257.01.01 (Diagnostic)** **258.01.02 (Chanel)** **Tests and evidence according to "Requirement Class 4"** **Ex-proof according to the certificate: TÜV 11 ATEX 556139 X**
Test Standard	**Guidelines for the Performance of Type Approvals Chapter 2, Edition 2003**
Documents	**Test reports: GL File 11-153608 (CD1, CD2); Supplement 2012: GL ref. 13-016689)** **TüV Nord Certificates: No. SAS-0190/2006-2, V2.0; No. SAS-0190/2006-3, V2.05** **Manufacturer's technical- and test documentation specified in the "Technical Reports: No. SAS-190-2006TB-2, Ver. 3.0 and No. SAS-190-2006TB-3, Ver. 2.0"**
Remarks	**None**
Valid until	**2017-06-17**

Page **1 of 1**

Type Approval Symbol GL ex

File No. **IA.03**

Hamburg, 2013-02-15

Germanischer Lloyd

Marco Rinkel

Dariusz Lesniewski

This certificate is issued on the basis of "Guidelines for the Performance of Type Approvals Part 1, Procedure".

7 ATEX

7.1 Intended use

The JUMO safety**M** STB/STW Ex is a safety device according to Directive 94/9 EC, Chapter 1, Article 1, Paragraph (2), which is designed to measure temperatures directly through a resistance probe or thermocouple probe, and other physical measurands such as pressure, with an appropriate transmitter and 4 to 20 mA current input.
The specifications and requirements in this Operating Manual must be observed accordingly. All of the following specifications relating to probes or sensor systems refer to the probes listed in Chapter 9.13 to 9.15. If other probes are used, their suitability must be verified.

☞ **Important information**:
Thermocouples should be evaluated with at least the requirements of EN 60584 or DIN 43710. RTD temperature probes should be evaluated with at least the requirements of EN 60751. Parameter values such as response rate, temperature stability, age drift, self-heating behavior, failure rates, fault models, etc. should likewise be taken into account.

The JUMO safetyM STB/STW Ex is associated apparatus that may only be used outside of the Ex zone.
Another use or one that goes beyond the specified use - with respect to use in potentially explosive areas - is not considered to be an intended use.

Liability for resulting damages cannot be assumed.

The JUMO safety**M** STB/STW Ex has been constructed in accordance with the applicable standards and guidelines and relevant safety regulations. Nevertheless, incorrect use may lead to bodily injury or property damage.

To prevent risks, the JUMO safetyM STB/STW Ex may only be used:

- For the intended use
- When in good order and condition
- In accordance with this Operating Manual

DANGER!
Ex approval becomes null and void in the case of non-intended use of the JUMO safetyM STB/STW Ex or non-compliance with the safety requirements of this Operating Manual.

7.1.0.1 Installation regulations

If electrical apparatus is used in plants and ambient conditions with greater safety requirements, the obligations of the applicable installation regulations according to EN 60079-14 "Explosive atmospheres – Part 14: Electrical installations design, selection and erection" are to be considered along with other applicable requirements.

7.2 Identification markings according to ATEX directive 94/9/EC:

7.2.1 For the 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

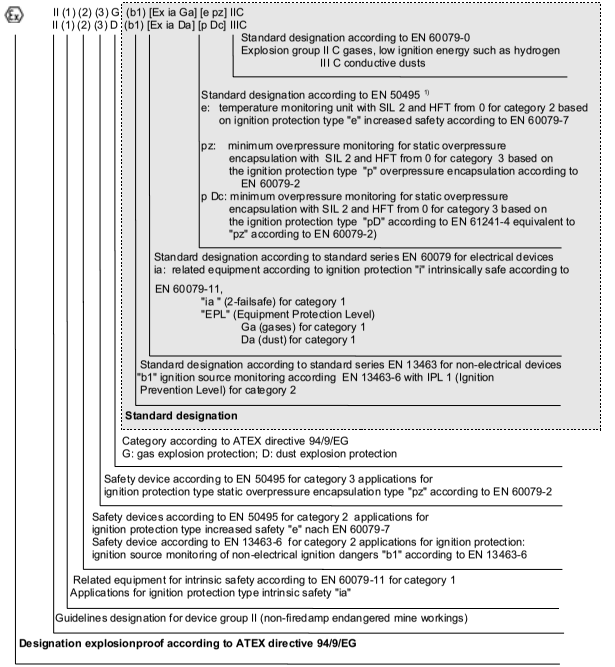
7.2.2 For the 2-sensor variant:

II (1) (1) (2) G (b2) [Ex ia Ga] [e py] IIC

II (1) (1) (2) D (b2) [Ex ia Da] [p Db] IIIC

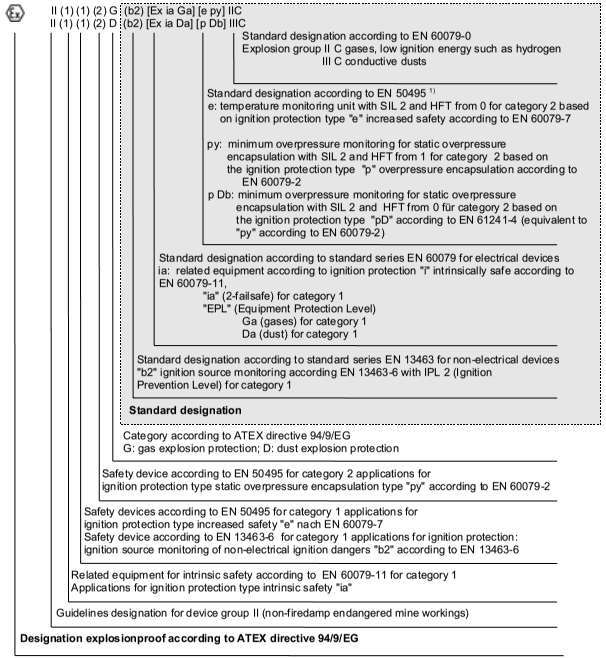
Figure 5: Explanation of the printed characters:

1-sensor variant:



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

2-sensor variant:



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

7.3 Meaning of the letter X in the type test certificate

The specific circumstances for which the X is added to the end of the test report numbers are as follows:

- Switching operations may be performed on the intrinsically safe electrical circuits only when the JUMO safetyM STB/STW Ex, including all supply lines, is de-energized.
- The JUMO safety**M** STB/STW Ex, including all supply lines, may be energized only when the cover cap of the intrinsically safe electrical circuits has been properly fitted.

⇨ Chapter 4.2 "Removing the cover cap"

- The probes from JUMO based on JUMO data sheets 901006 and 902006 that are included in the ATEX test report do not feature reliable isolation of the sensor from the fitting. As a result, the sensor connections are to be considered grounded for the safety assessment according to ATEX. This means that the user must ensure that during connection of the intrinsically safe electrical circuit through integration in the local potential (e.g. potential equalization or FB), the intrinsic safety of the JUMO safety**M** STB/STW Ex is not reversed.
- The probe connection heads of the considered probes do not meet the requirements for material composition from EN 60079-0 for EPL Ga. Therefore, corresponding impact protection must be provided at the site for use in EPL Ga.

⇨ Chapter 9.12 "Important information for the probes in Chapter 9.13 to Chapter 9.15"

- Only the STB (safety temperature limiter) variant of the JUMO safety**M** STB/STW Ex is admissable for use as a safety device for minimum overpressure monitoring with static pressurized enclosure.
- The switch-off limit value must be set in accordance with the application so that no dangerous state can arise when taking into account accuracy, fault tolerance of the JUMO safety**M** STB/STW Ex, and (if applicable) pressure or temperature overshoot.
- The safety-relevant settings of the JUMO safety**M** STB/STW Ex must be protected against unauthorized changes (e.g. with sealed or password-protected inputs).
- For use of the JUMO safety**M** STB/STW Ex in the STW (safety temperature monitor) variant, it must be ensured that after a switch-off by the temperature limiter an automatic restart of the monitored equipment is prevented by a higher-level control system.

- If the JUMO safety**M** STB/STW Ex is used in the single-channel device variant to monitor non-electrical ignition sources and a warning is issued on demand, the user must take immediate measures to achieve a safe status.

7.4 Associated intrinsically safe electrical apparatus according to EN 60079-11

7.4.1 Function of intrinsic safety

The intrinsically safe ignition protection "i" makes use of the fact that a certain amount of energy is required to ignite a potentially explosive atmosphere. This depends on the composition of the potentially explosive atmosphere.
If it is made impossible for this energy level to be exceeded in an electrical circuit, meaning that neither sparks from switching nor thermal effects can cause ignition under certain test conditions and when certain safety margins are observed, the electrical circuit is intrinsically safe.

7.4.1.1 Definitions for intrinsic safety

An intrinsically safe electrical circuit is an electrical circuit in which neither a spark nor a thermal effect occurring under the conditions specified in EN 60079-11 – which include uninterrupted operation and certain fault conditions – can cause ignition of a specific potentially explosive atmosphere.

The energy in the electrical circuit is therefore limited so that it never reaches a sufficient level to cause ignition. This applies to sparking and to thermal effects. The test conditions with specific potentially explosive atmospheres are specified. The tests cover uninterrupted operation and specified fault conditions.

7.4.1.2 Electrical apparatus:

Electrical apparatus is the collective term for electrical components and electrical circuits or parts of electrical circuits that are generally found in a single case.

7.4.1.3 Intrinsically safe electrical apparatus:

Electrical apparatus in which all electric circuits are intrinsically safe.

7.4.1.4 Associated electrical apparatus

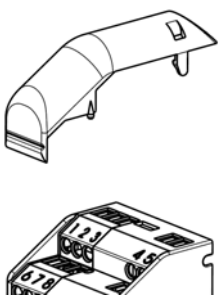
Electrical apparatus in which not all electrical circuits are intrinsically safe. In terms of construction, the non-intrinsically safe

electrical circuits cannot have an effect on the intrinsically safe electrical circuits.
Brackets are used for the identification marking of the associated apparatus: e.g. II (1) G [Ex ia] II C.
Associated electrical apparatus can be used in potentially explosive areas if appropriate protection is provided (ignition protection according to EN 60079-0). If there is insufficient protection, the apparatus must be used outside of the potentially explosive area.

Example:
The JUMO safety**M** STB/STW Ex is not in a potentially explosive area, but it is connected to a thermocouple that is in a potentially explosive area. Only the input electrical circuit of the JUMO safety**M** STB/STW Ex is intrinsically safe.

The screw terminals that are marked blue and the connected lines are protected with a cover cap.

Figure 6: Cover cap



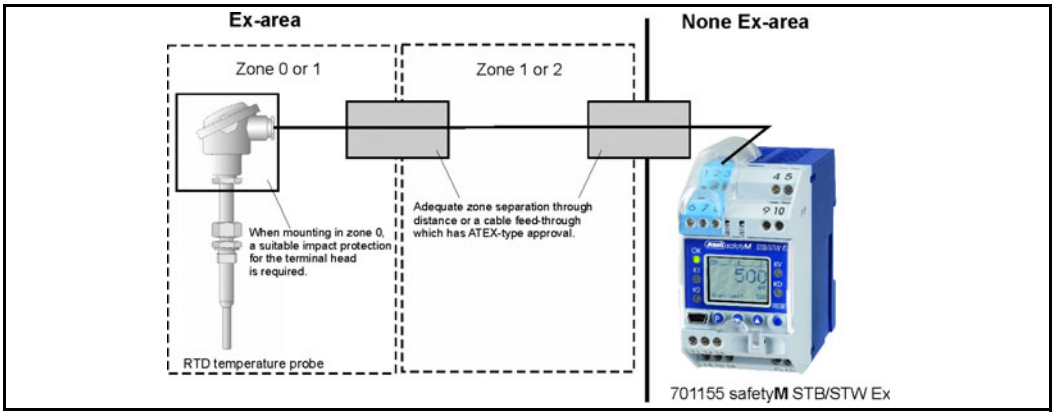
⇨ Chapter 4.2 "Removing the cover cap"

7.4.2 Probe arrangement in the Ex-area

The JUMO safety**M** STB/STW Ex 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

Figure 7:



The sensor system specified in Chapter 9.13 and Chapter 9.14 does not have zone separation.

⇨ Please also note the information in Chapter 9.12.

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.

7.4.3 Explanation of probe temperature classes

The listed probes can be used in temperature classes T1 to T6.

Table 17: Temperature classes

Temperature class	Maximum surface temperature of apparatus[1]	Ignition temperature of the flammable materials
T1	450 °C	> 450 °C
T2	300 °C	> 300 < 450 °C
T3	200 °C	> 200 < 300 °C
T4	135 °C	> 135 < 200 °C
T5	100 °C	> 100 < 135 °C
T6	85 ?	> 85 < 100 °C

Temperature classes

Item 26.5.1.3 in EN 60079-0:2009 stipulates a safety margin for type-tested devices of Group II (potentially explosive gas atmospheres excluding mines susceptible to firedamp) of 10 K for the highest measured surface temperature for T1 and T2, and 5 K for T3, T4, T5, and T6.

In the case of RTD temperature probes, a measuring current flows through the sensor element, which causes a rise in temperature. In addition, a fault in the JUMO safety**M** STB/STW Ex means that the sensor circuit may introduce a maximum output of 61.8 mW to the probe. This also applies to the thermocouple probes.
The maximum rise in temperature was determined through measurements.
The following values represent the worst case scenario and apply for all probes:
The maximum temperature rise of Pt100 probes is **7.5 K**.
The maximum temperature rise of thermocouple probes is **0.9 K**.

1. The following safety margins must also be observed:
   Category 1: Acc. to EN 1127-1:2011 Item 6.4.2 (hot surfaces), the surface temperatures of all devices ... for use in zone 0..., that may come into contact with potentially explosive atmospheres, … must not exceed 80 % of the ignition temperature.
   This means the temperature class, minus 20 %.
   As described above, in temperature classes T1 and T2, 10 °C must be deducted and in temperature classes T3 to T6, 5 °C must be deducted.

Example:
A thermocouple is to be used in temperature class T4 (maximum temperature 135 °C, limit is to be reduced 5 K for safety);
T_S Highest admissable temperature at the probe tip

T_S = 130 °C – 0.9 °C

T_S = **129.1 °C**

The maximum temperature (measured or medium temperature) at the probe tip must therefore not exceed a value of 129.1 °C.

The following table presents a summary of the calculations for all temperature classes:

Table 18:

	Media and ambient temperature for applications requiring devices of category 2		**Media and ambient temperature for applications requiring devices of category 1**	
	Sensor with PT100	**Sensor with thermocouple**	**Sensor with PT100**	**Sensor with thermocouple**
T1	439.1 °C	432.5 °C	349.1 °C	342.5 °C
T2	289.1 °C	282.5 °C	229.1 °C	222.5 °C
T3	194.1 °C	187.5 °C	154.1 °C	147.5 °C
T4	129.1 °C	122.5 °C	102.1 °C	95.5 °C
T5	94.1 °C	87.5 °C	74.1 °C	67.5 °C
T6	79.1 °C	72.5 °C	62.1 °C	55.5 °C

7.5 Safety device according to EN 50495

The standard EN 50495, which was harmonized within the scope of directive 94/9/EC, formulates requirements for electrical apparatus that performs one or more safety function(s) in terms of explosion protection. Discretely constructed and complex safety devices, of which the protective function is controlled via software are evaluated using measures in EN 50595. EN 50495 uses the Safety Integrity Level (SIL) of EN 61508 to define the required safety level for monitoring potential ignition sources.
The requirement of EN 50495:2010 in Appendix E must be observed, which states: *If a device contains more than one potential ignition source, appropriate measures are to be taken for each of these individual ignition sources. Combined apparatus must conform to the relevant standard EN 60079-0 and/or EN 61241-0 with regard to the category to be achieved.*

The JUMO safety**M** STB/STW Ex is installed outside of the apparatus in areas that are not potentially explosive. For example, it monitors the temperature of a warehouse using a probe attached to the apparatus, which is viewed as a potential ignition source in the apparatus. The probe lines that extend into the potentially explosive area are intrinsically safe and the JUMO safety**M** STB/STW Ex is therefore identified as "associated apparatus" accordingly.

⇨ Chapter 7.2 "Identification markings according to ATEX directive 94/9/EC:"

An increase in the fault tolerance (HFT) and therefore an increase in the device category of the combined apparatus with the help of the JUMO safetyM STB/STW Ex is only admissable if, other than the ignition risk that is controlled by the JUMO STB/STW, no other ignition risks are present and the higher device category does not make any additional requirements for the combined apparatus.

Safety devices for non-electrical apparatus that are included in EN 13463-6 (ignition protection "b") are not covered by EN 50495 (see Chapter 7.6 of this Operating Manual).

7.5.1 Temperature monitoring unit based on ignition protection "e" – increased safety according to EN 60079-7

7.5.1.1 Function of increased safety

Ignition protection for which additional measures are taken in order to use an increased degree of safety to prevent the possibility of the occurrence of inadmissibly high temperatures or sparks or electric arcs at or in parts of electrical apparatus where these would not occur in standard operation.

7.5.1.2 Application in the 1-sensor variant

As shown in Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)" of this Operating Manual, the JUMO safety**M** STB/STW Ex evaluation unit is always structured in the same way and its architecture always has a 1oo2D structure. If only one passive sensor is connected, this corresponds to variant 1 of Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)".
According to Chapter 6.9.2 "Safety-relevant system features" in this Operating Manual, the "sensor system" subsystem therefore has a 1oo1 architecture and an HFT of 0. In conjunction with the monitored apparatus as combined apparatus, this variant therefore meets the safety requirements according to EN 50495 for systems that are used in category 2 (zone 1) if the monitored apparatus does not represent an ignition source in standard operation. The requirements in Table 1 of EN 50495 apply.
The limit value must be determined according to the relevant use and/or application. The value must be set so that no dangerous state can occur when all relevant factors such as response time and, if applicable, temperature overshoot of the monitored apparatus including the JUMO safety**M** STB/STW Ex are taken into account.
To prevent unintended changes to the set parameters, the JUMO safety**M** STB/STW must be sealed according to Chapter 5.8 of this Operating Manual or a keypad lock or level inhibit must be used according to Chapter 8.4.

7.5.1.3 Application in the 2-sensor variant

If two passive sensors are connected, this corresponds to variants 1a, 2, 3, and 4 of Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)". According to Chapter 6.9.2 "Safety-relevant system features" in this Operating Manual, the "sensor system" subsystem therefore has a 1oo2 architecture and an HFT of 1. In conjunction with the monitored apparatus as combined apparatus, these variants therefore meet the safety requirements according to EN 50495 for systems that are used in category 1 (zone 0) if the monitored apparatus does not represent an ignition source in standard operation. The requirements in Table 1 of EN 50495 apply.
The limit value must be determined according to the relevant use and/or application. The value must be set so that no danger-

ous state can occur when all relevant factors such as response time and, if applicable, temperature overshoot of the monitored apparatus including the JUMO safetyM STB/STW 70155 are taken into account.
To prevent unintended changes to the set parameters, the JUMO safetyM STB/STW must be sealed according to Chapter 5.8 of this Operating Manual or a keypad lock or level inhibit must be used according to Chapter 8.4.

7.5.1.4 Application of temperature transmitters

The safety features for use of temperature transmitters are described according to variant 5 in Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)". The required features based on EN 50495 must be identified accordingly for the temperature transmitter. The requirements from Table 1 of EN 50495 apply. The signal is fed in via the 4 to 20 mA input. Setting is according to Item 8.2.2 onwards.
The limit value must be determined according to the relevant use and/or application. The value must be set so that no dangerous state can occur when all relevant factors such as response time and, if applicable, temperature overshoot of the monitored apparatus including the JUMO safetyM STB/STW 70155 and temperature transmitter are taken into account.
To prevent unintended changes to the set parameters, the JUMO safetyM STB/STW must be sealed according to Chapter 5.8 of this Operating Manual or a keypad lock or level inhibit must be used according to Chapter 8.4.

7.5.2 Minimum overpressure monitoring for static pressurized enclosure on the basis of ignition protection "p", pressurized enclosure according to EN 60079-2

7.5.2.1 Function of the static pressurized enclosure

Ignition protection in which the formation of a potentially explosive atmosphere inside a case is prevented by an inert protective gas that maintains an internal overpressure greater than the external atmosphere. This ignition protection prevents the ignition source from coming into contact with the potentially explosive atmosphere.

7.5.2.2 Safety device for static pressurized enclosure

Fulfillment of the requirements of EN 60079-2 for the JUMO safetyM STB/STW as a safety device for static pressurized enclosure for ignition protection type "py" or "pz" (gas atmospheres) or "p Db" and "p Dc" (dust atmospheres) (each with a corresponding number of sensors) has been verified by TÜV NORD CERT GmbH. Application for static pressurized enclosure is only admissible in the function as "STB", as EN 60079-2, Section 8.5 on safety devices (for static pressurized enclosure) stipulates:

"*The automatic safety devices shall only be capable of being reset by the use of a tool or a key.*"

The requirements of EN 60079-2 are met for the relevant ignition protection.

Definition from EN 60079-2 for type py:
Pressurized enclosure that reduces the equipment protection level (EPL) within the pressurized case from Gb to Gc.
Definition from EN 60079-2 for type pz:
Pressurized enclosure that reduces the equipment protection level (EPL) within the pressurized case from Gc to "non-hazardous".

Dust markings "p Dc" and "p Db" are made on the basis of EN 60079-0:2009.
The requirements of EN 60079-2 for "py" and "pz" are equivalent to ignition protection "pD" in EN 61142-4:2006 (static pressurized enclosure for potentially explosive dust atmospheres).
The allocation for gas and dust atmospheres is as follows:

Dust	Gas
"p Dc"	"pz"
"p Db"	"py"

7.5.2.3 Application as safety device for static pressurized enclosure

The safety features for use of pressure transmitters are described according to variant 5 in Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)". The required features based on EN 50495 must be identified accordingly for the pressure transmitter. The requirements from Table 1 of EN 50495 apply. The signal is fed in via the 4 to 20 mA input. The pressure signal can be displayed by parameterizing the current signal.

⇨ See Chapter 10.5

The alarm relay output in Chapter 4.3 "Connection diagram", no. 10 in the key, is then used according to EN 60079-2 to implement the protective measures determined by the user if the overpressure falls below the minimum value specified by the user.

The limit value must be determined according to the relevant use and/or application. The value must be set so that no dangerous state can occur when all relevant factors such as response time and pressure gradient of the monitored pressure system including the JUMO safetyM STB/STW and the pressure transmitter are taken into account.

To prevent unintended changes to the set parameters, the JUMO safetyM STB/STW must be sealed according to Chapter 5.8 of this Operating Manual or a keypad lock or level inhibit must be used according to Chapter 8.4.

7.6 Monitoring of potential ignition sources "b" according to EN 13463-6

7.6.1 Function of the ignition source monitoring

Equipment in a non-electrical device that can be used with installation of sensors to identify developing operating statuses that could potentially trigger ignition of the surrounding atmosphere. Before the potential ignition source can become active, appropriate preventive measures are implemented. These preventive measures may be implemented automatically through a direct connection between the sensors and the ignition protection system or, in the case of the 1-sensor variant (ignition prevention level 1 (IPL 1)), manually upon issue of a warning to the device operator.

7.6.2 Ignition prevention level (IPL)

EN 13463-6 contains two ignition prevention levels: IPL 1 and IPL 2. The application of the ignition prevention levels is shown in Table 1 of EN 13463-6. Use of IPL 1 and IPL 2 depends on the category and the occurrence of potential ignition sources. In accordance with this, in category 1 (zone 0) for example, potential ignition sources must be monitored during a predictable fault with IPL 2. If the potential ignition source becomes dangerous only during an uncommon fault, ignition prevention level IPL 1 is sufficient. Monitoring of a potential ignition source that may be dangerous in standard operation is not admissable for category 1. In this case, the concept for the apparatus must be revised. The required ignition prevention level must be determined according to Table 1 of EN 13463-6.

7.6.3 Identification marking

An ignition prevention system that is delivered separated from the apparatus to be monitored must be marked with (b1) or (b2) according to EN 13463-6. Here, (b1) indicates IPL 1 and (b2) indicates IPL 2.

7.6.4 Application in the 1-sensor variant

As shown in Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)" of this Operating Manual, the JUMO safety**M** STB/STW Ex evaluation unit is always structured in the same way and its architecture always has a 1oo2D

structure. If only a passive sensor is connected, this corresponds to variant 1 of Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)". This version meets the requirements for IPL 1 and is marked with (b1) accordingly. EN 13463-6 requires that automatic restart of monitored apparatus must not take place without a reset of the JUMO safety**M** STB/STW Ex. For this reason, for application of the JUMO safetyM STB/STW Ex as STW, higher level control must be ensured so that an automatic restart is not possible. In the case of application as STB, locking is integrated into the JUMO safetyM STB/STW Ex.
The limit value must be determined according to the relevant use and/or application. The value must be set so that no dangerous state can occur when all relevant factors such as response time and, if applicable, temperature overshoot of the monitored apparatus including the JUMO safety**M** STB/STW Ex are taken into account.
To prevent unintended changes to the set parameters, there is an option to seal the JUMO safety**M** STB/STW Ex according to Chapter 5.8 of this Operating Manual or to use a keypad lock or level inhibit according to Chapter 8.4.

7.6.5 Application in the 2-sensor variant

If two passive sensors are connected, this corresponds to variants 1a, 2, 3, and 4 of Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)". This version meets the requirements for IPL 2 and is marked with (b2) accordingly. EN 13463-6 requires that automatic restart of monitored apparatus must not take place without a reset of the JUMO safety**M** STB/STW Ex. For this reason, for application of the JUMO safety**M** STB/STW Ex as STW, higher level control must be ensured so that an automatic restart is not possible. In the case of application as STB, locking is integrated into the JUMO safetyM STB/STW Ex.
The limit value must be determined according to the relevant use and/or application. The value must be set so that no dangerous state can occur when all relevant factors such as response time and, if applicable, temperature overshoot of the monitored apparatus including the JUMO safety**M** STB/STW Ex are taken into account.
To prevent unintended changes to the set parameters, there is an option to seal the JUMO safety**M** STB/STW Ex according to Chapter 5.8 of this Operating Manual or to use a keypad lock or level inhibit according to Chapter 8.4.

7.6.6 Application of transmitters

The safety features for use of transmitters are described according to variant 5 in Table 1: "Achievable SIL" in Chapter 6.6 "Connection possibilities of the sensors (SIL)". The required features based on EN 13463-6 must be identified accordingly for

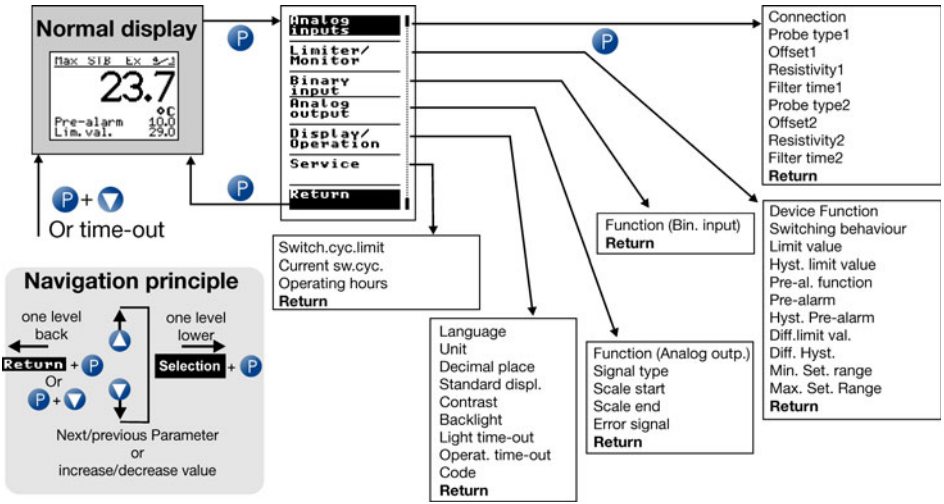
the transmitter. The requirements from Table 1 of EN 13463-6 apply. The signal is fed in via the 4 to 20 mA input.

⇨ Setting is according to Chapter 8.2.2 onwards

The limit value must be determined according to the relevant use and/or application. The value must be set so that no dangerous state can occur when all relevant factors such as response time and, if applicable, measurand overshoot of the monitored apparatus including the JUMO safety**M** STB/STW Ex and transmitter are taken into account.
To prevent unintended changes to the set parameters, there is an option to seal the JUMO safety**M** STB/STW Ex according to Chapter 5.8 of this Operating Manual or to use a keypad lock or level inhibit according to Chapter 8.4.

8 Configuration level

8.1 Navigation principle



All the parameters are freely accessible ex works, but they can be locked via the setup program.

⇨ Chapter 10.3 "Forgotten the code?"

Parameters of the configuration level which are not required are automatically hidden depending on the setting.

8.2 Analog inputs

8.2.1 Connection		Comment
Two sensors		This setting is provided for dual probes or for two different probes. Each of the two analog inputs is monitored separately for a probe break or probe short-circuit.
Single Pt100 in 2-wire circuit		**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.
Single 4 to 20 mA		**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.

■ Factory setting

8.2.2 Probe type 1 For analog input1	Comment	Setting range for limit value: (can be restricted via the setup)	Limits for underrange/ overrange
Pt100 DIN EN 60751	In 3-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
Pt1000 DIN EN 60751	In 3-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
Pt100 DIN EN 60751	In 2-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
Pt1000 DIN EN 60751	In 2-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
W3Re-W25Re "D"	Thermocouple	-1999 to +9999 °C	-5 to +2500 °C
Cu-CuNi "T"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-205 to +405 °C
Fe-CuNi "J"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-205 to +1205 °C
Cu-CuNi "U"	Thermocouple DIN 43710	-1999 to +9999 °C	-205 to +605 °C
Fe-CuNi "L"	Thermocouple DIN 43710	-1999 to +9999 °C	-205 to +905 °C
NiCr-Ni "K"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-205 to +1377 °C
Pt10Rh-Pt "S"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-5 to +1773 °C
Pt13Rh-Pt "R"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-5 to +1773 °C
Pt30Rh-Pt6Rh "B"	Thermocouple DIN EN 60584	-1999 to +9999 °C	295 to 1825 °C
NiCrSi-NiSi "N"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-105 to +1305 °C
4 to 20 mA	Standard signal	-1999 to +9999 °C	3.6 to 21 mA

■ Factory setting

Parameter	Comment	Value range (factory setting in **bold**)
8.2.3 Offset 1	Using Offset1, a measured value at the analog input can be corrected by the value entered over the entire measuring range.	-999.9 to **0.0** to +999.9
8.2.4 Resistivity 1	**Analog-input1 lead wire resistance in 2-wire circuit** This value is used to compensate the resistance of the probe line and depends on the line length. Enter the ohmic resistance of the probe line here to achieve the best possible temperature measurement.	**0.0** to 30.0 ohm
8.2.5 Filter time 1	**Time constant of the digital input filter 2nd order for analog input 1** If the input signal changes suddenly, approx. 26 % of the change is recorded following a period that corresponds to the filter time constant dF (2 × dF: approx. 59 %; 5 × dF: approx. 96 %). Value 0 means: filter switched off If the filter time is long: - Interfering signals are better absorbed - Measured value display responds more slowly to changes	0.0 to **0.6** to 100 sec
8.2.6 Scaling start 1	**Important information:** This setting only occurs if the sensor type 1 was set to 4 to 20 mA. Here, the user selects which value (i.e. pressure) should be displayed at 4 mA.	-9999 to **0** to +9999
8.2.7 Scaling end 1	Here, the user selects which value (i.e. pressure) should be displayed at 20 mA.	-9999 to **100** to +9999

8.2.8 Probe type 2 For analog input2	Comment	Setting range for limit value: (can be restricted via the setup)	Limits for underrange/ overrange
Pt100 DIN EN 60751	In 3-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
Pt1000 DIN EN 60751	In 3-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
Pt100 DIN EN 60751	In 2-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
Pt1000 DIN EN 60751	In 2-wire circuit	-1999 to +9999 °C	-205 °C / +855 °C
W3Re-W25Re "D"	Thermocouple	-1999 to +9999 °C	-5 to +2500 °C
Cu-CuNi "T"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-205 to +405 °C
Fe-CuNi "J"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-205 to +1205 °C
Cu-CuNi "U"	Thermocouple DIN 43710	-1999 to +9999 °C	-205 to +605 °C
Fe-CuNi "L"	Thermocouple DIN 43710	-1999 to +9999 °C	-205 to +905 °C
NiCr-Ni "K"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-205 to +1377 °C
Pt10Rh-Pt "S"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-5 to +1773 °C
Pt13Rh-Pt "R"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-5 to +1773 °C
Pt30Rh-Pt6Rh "B"	Thermocouple DIN EN 60584	-1999 to +9999 °C	295 to 1825 °C
NiCrSi-NiSi "N"	Thermocouple DIN EN 60584	-1999 to +9999 °C	-105 to +1305 °C
4 to 20 mA	Standard signal	-1999 to +9999 °C	3.6 to 21 mA

■ Factory setting

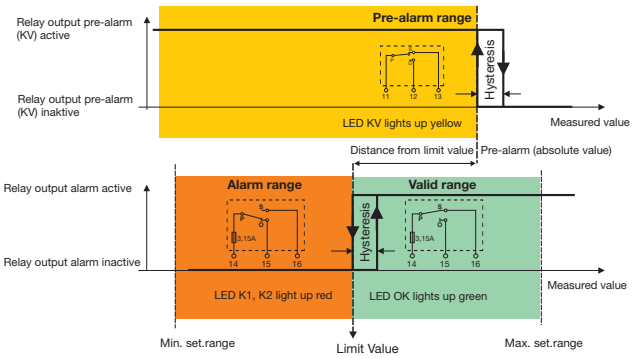
Parameter	Comment	Value range (factory setting in **bold**)
8.2.9 Offset 2	Using Offset2, a measured value at the analog input can be corrected by the value entered over the entire measuring range.	-999.9 to **0.0** to +999.9
8.2.10 Resistivity 2	**Analog-input2 lead wire resistance in 2-wire circuit** This value is used to compensate the resistance of the probe line and depends on the line length. Enter the ohmic resistance of the probe line here to achieve the best possible temperature measurement.	**0.0** to 30.0 ohm
8.2.11 Filter time 2	**Time constant of the digital input filter 2nd order for analog input 2** If the input signal changes suddenly, approx. 26 % of the change is recorded following a period that corresponds to the filter time constant dF (2 × dF: approx. 59 %; 5 × dF: approx. 96 %). Value 0 means: filter switched off If the filter time is long: - Interfering signals are better absorbed - Measured value display responds more slowly to changes	0.0 to **0.6** to 100 sec
8.2.12 Scaling start 2	**Important information:** This setting only occurs if the sensor type 2 was set to 4 to 20 mA. Here, the user must select which value (e.g. pressure) should be displayed at 4 mA.	-9999 to **0** to +9999
8.2.13 Scaling end 2	Here, the user must select which value (e.g. pressure) should be displayed at 20 mA.	-9999 to **100** to +9999

8.3 Limiter/monitor

Parameter	Comment	Value range (factory setting in **bold**)
8.3.1 Device function	Safety temperature limiter **(STB) initial startup**: Regardless of the switching status of the alarm relay output prior to power failure, the STB remains locked when power returns. The purpose of this factory setting is to ensure that the device will be in a safe switched-off state when the voltage supply is switched on for the first time. After this initial startup, the device function can be set to STB or STW.	**STB initial startup,** STB, STW
	Safety temperature limiter **STB:** The device must be manually reset using the keypad or the binary input as soon as the main measured value is back within the valid range.	
	Safety temperature monitor **STW:** The device is automatically reset as soon as the main measured value is back within the valid range.	

Parameter	Comment	Value range (factory setting in **bold**)
8.3.2 Switching behavior	**Min. alarm:** If the value falls below the limit value, the alarm relay output switches OFF. LEDs K1 and K2 light up red and the measured values flash on the display.	**Max. alarm,** min. alarm

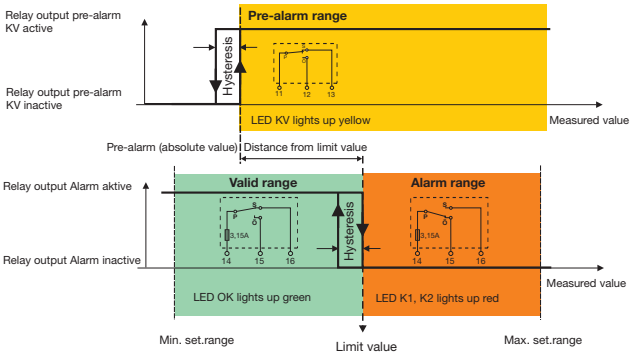
Min. alarm (older devices: direct or S-Function)



In the safety temperature limiter (**STB**) setting, this condition remains even when the main measured value is back in the valid range. Only when the "Reset" key is pressed or a switch is activated when the binary input is respectively configured will the alarm relay output switch ON again and the OK LED light up green.
In the safety temperature monitor (**STW**) setting, the alarm relay output automatically switches back to ON as soon as the main measured value is back within the valid range.

Parameter	Comment	Value range (factory setting in **bold**)
	Max. alarm: If the value exceeds the limit value, the alarm relay output switches OFF. LEDs K1 and K2 light up red and the measured values flash on the display.	

Max. alarm (older devices: inverse or O-Function)



In the safety temperature limiter (**STB**) setting, this condition remains even when the main measured value is back in the valid range. Only when the "Reset" key is pressed or a switch is activated when the binary input is respectively configured will the alarm relay output switch ON again and the OK LED light up green.
In the safety temperature monitor (**STW**) setting, the alarm relay output automatically switches back to ON as soon as the main measured value is back within the valid range.

Parameter	Comment	Value range (factory setting in **bold**)
8.3.3 Limit value, hysteresis	**Limit value alarm:** If this value is exceeded or not reached, this affects the alarm relay output depending on the switching behavior.	-200 to **0** to +850 Depends on setting range min. and max.
	Hysteresis limit value: Difference between the switch-off and switch-on threshold, e.g. for rising and falling temperatures.	0 to **2** to 100
8.3.4 Pre-alarm function ☞ The pre-alarm responds according to its setting to the main measured value and also to the diagnostic functions registered via the KD LED. A pre-alarm is triggered according to which measured value exceeds or falls below the pre-alarm first.	**No function** Pre-alarm relay output is inactive	**No function**, Absolute value, Limit val. diff.
	Absolute value: Pre-alarm relay output is triggered if the value for the pre-alarm is exceeded.	
	Limit val. diff.: Here, the set value for the pre-alarm is used on a basis that is relative to the limit value. If, for example, a pre-alarm of 10 K is entered, the pre-alarm relay output always switches at 10 K before the limit value, regardless of how the limit value is set.	
⚠	Caution The pre-alarm function **is not part of the safety function!**	
8.3.5 Pre-alarm, hysteresis	**Pre-alarm:** The value that triggers the pre-alarm relay output as an absolute value or relative to the limit value.	-9999 to **0** to +9999
	Pre-alarm hysteresis: Difference between the switch-off and switch-on threshold, e.g. for rising and falling temperatures.	0 to **2** to 100

Parameter	Comment	Value range (factory setting in **bold**)
8.3.6 Limit value difference, hysteresis	**Limit value difference monitoring:** If the value of the temperature difference of the analog input 1-2 is exceeded, the alarm relay output is switched.	0 to **50** to 100
	Hysteresis difference monitoring: Difference between the switch-off and switch-on threshold, e.g. for rising and falling differential values.	0 to **2** to 100
Important information: If, for example, temperature differences arise as a result of the spatial arrangement of a dual probe, an alarm may be triggered by the concurrency monitoring even though the temperature being monitored has not yet been exceeded. In this case, the difference monitoring limit value can be adjusted accordingly.		
8.3.7 Setting range min. (formerly ALHI) This is the lower limit of the setting range for the limit value.	This value may not be lower than the lower end of the connected probe or unit signal measuring range. It may also not be set higher than the setting for the **alarm limit value**.	-9999 to **-200** to limit value °C
8.3.8 Setting range max. (formerly ALLO) This is the upper limit of the setting range for the limit value.	This value may not be greater than the higher end of the connected probe or unit signal measuring range. It may also not be set lower than the setting for the **alarm limit value**.	Limit value to **850** to 9999 °C

The admissible limits for DIN approved probes:

⇨ Chapter 9.12 "Important information for the probes in Chapter 9.13 to Chapter 9.15" and

⇨ Chapter 9.14 "Probes for water and oil"

8.4 Binary input

Parameter	Comment	Value range (factory setting in **bold**)
8.4.1 Function	This sets the function that should be controlled by the binary input.	
	The binary input does not have a function	No function
	The binary input performs a reset as described in Chapter 8.3.1 "Device function" The function only responds to the switching edge from "open" to "closed" state.	Unlocking
	Protection against unauthorized key operation	Key lock
	Configuration level is locked.	Level inhibit

■ Factory setting

8.5 Analog output

Parameter	Comment	Value range (factory setting in **bold**)
8.5.1 Function	Here, the measured value that is to be shown at the analog output is set.	**Main measured value** Measured value1 Measured value2 Difference
	Main measured value: With the max. alarm switching behavior, the greater of the two measured values is shown; with the min. alarm, the lower of the two measured values is shown.	
	Measured value1: Measured value of analog input 1 (E1) is shown	
	Measured value2: Measured value of analog input 2 (E2) is shown	
	Difference: E1-E2 is shown The signal that should be output by the analog output can be set with scaling start and end.	
8.5.2 Signal type	4 to 20 mA	**4 to 20 mA** 0 to 20 mA 2 to 10 V 0 to 10 V
	0 to 20 mA	
	2 to 10 V	
	0 to 10 V	
8.5.3 Scaling start	⇨ Figure in Chapter 8.5.6	-9999 to **-200** to +9999
8.5.4 Scaling end	⇨ Figure in Chapter 8.5.6	-9999 to **800** to +9999

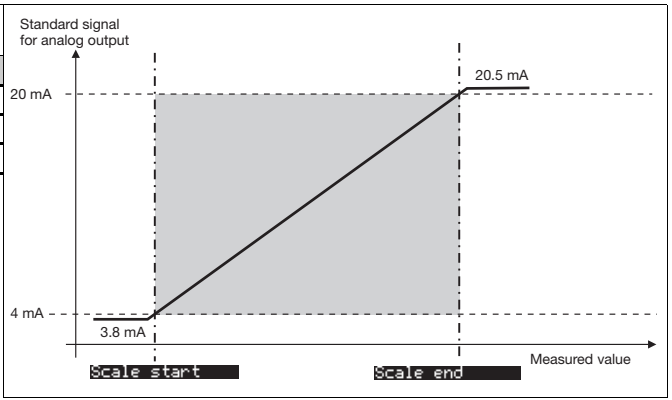
Parameter	Comment	Value range (factory setting in **bold**)
8.5.5 Error signal	If, for the measured value 1 or 2, the value is exceeded, not reached, or a diagnostic error occurs, the current or voltage value set on the analog output is output as a so-called error signal.	
	For signal type 4 to 20 mA	**3.4** or 21.2 mA
	For signal type 0 to 20 mA	**0** or 21.2 mA
	For signal type 2 to 10 V	**1.7** or 10.4 V
	For signal type 0 to 10 V	**0** or 10.4 V

8.5.6 Behavior when leaving the scaling range

The standard signal range of the analog output is limited as follows according to the recommendation of Namur NE 43:

Signal type	Lower limit	Upper limit
0: 4 to 20 mA	3.8 mA	20.5 mA
1: 0 to 20 mA	0 mA	20.5 mA
2: 2 to 10 V	1.8 V	10.2 V
3: 0 to 10 V	0 V	10.2 V

■ Factory setting



⚠	Caution	The analog output is **not part of the safety function**.

8.6 Display/operation

Parameter	Comment	Value range (factory setting in **bold**)
8.6.1 Language	German	**German**, English, French
	English	
	French	
8.6.2 Unit	A unit for the measured value can be assigned here.	**°C**, °F, %, text
	°C	
If the unit is changed to °F, the measured value is converted. All other values referring to the measured value (e.g. limit value) remain unchanged.	°F	
	%	
	Text: Via the setup program, 2 characters can be entered here for another unit, e.g. Pa (Pascal).	
8.6.3 Decimal place	No decimal place	**No decimal place,** One decimal place
	One decimal place	
8.6.4 Normal display	This sets the view that appears after the voltage supply is switched on. ⇨ Chapter "Operating overview"	**Main measured value**, measured values, limit value, pre-alarm, difference
	Main measured value	
	Measured values	
	Limit value	
	Pre-alarm	
	Difference	

Parameter	Comment	Value range (factory setting in **bold**)
8.6.5 Contrast	**Screen contrast:** Difference in brightness between black and white pixels	0 to **5** to 10
8.6.6 Backlight	Here, the background lighting of the display is set.	Off, **On**, During operation
	Off: Always switched off	
	On: Always switched on	
	During operation: The background lighting is only switched on when the keys are operated and it lights up until the time for the time-out light has expired.	
8.6.7 Time-out light	Here, a waiting period for the switch-off of the background lighting is set.	**0** to 100 sec
8.6.8 Time-out operation	Here, a waiting period is set for the return from the configuration to normal display.	**0** to 100 sec
8.6.9 Code	To protect against unauthorized manipulations, a code can be set here for locking the configuration level. 0 means: code request switched off ☞ If the code is forgotten, a new code can be transferred to the device via the setup program. ⇨ Chapter 10.3 "Forgotten the code?"	**0** to 9999

8.7 Service

Parameter	Comment	Value range (factory setting in **bold**)
8.7.1 Limit switching cycle	**Limit value for relay switching cycles** Here, the limit value for the admissible relay switching cycles is set. If the counter value for **Current switching cycles** is greater than this value, the display values flash and the alarm relay output drops out. If "0" is set the function is inactive.	**0** to 99999
8.7.2 Current switching cycles	**Relay switching cycle counter** Here, the switching cycles for the relay are only counted if the top **limit value for relay switching cycles** is not set to "0" and is thus inactive. The value can then be adjusted as required and therefore adapted accordingly to the plant. The switching cycle counter remains at 99999.	**0** to 99999
8.7.3 Operating hours	**Operating hours counter** The counter adds up the operating hours during which the device was connected to the voltage supply. The value cannot be changed and can be used as a measure of how long the device was actually in operation after leaving the factory.	**0** to 99999

9 Technical data

9.1 Analog inputs

RTD temperature probes

Description	Measuring range	Accuracy 2/3-wire circuit[1]	Ambient temperature influence
Pt100 DIN EN 60751	-200 to +850 °C	0.5 % / 0.1 %	50 ppm/K
Pt1000 DIN EN 60751	-200 to +850 °C	0.5 % / 0.1 %	50 ppm/K
Connection type	2-wire, 3-wire circuit	Maximum lead wire resistance 30 Ω	
Sampling rate	210 ms		
Fault 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

Description	Measuring range	Accuracy[1]	Ambient temperature influence
Fe-CuNi "L" DIN 43710	-200 to +900 °C	0.4 %	100 ppm/K
Fe-CuNi "J" DIN EN 60584	-200 to +1200 °C	0.4 %	100 ppm/K
Cu-CuNi "U" DIN 43710	-200 to +600 °C	0.4 %	100 ppm/K
Cu-CuNi "T" DIN EN 60584	-200 to +400 °C	0.4 %	100 ppm/K

NiCr-Ni "K" DIN EN 60584	-200 to +1372 °C	0.4 %	100 ppm/K
NiCrSi-NiSi "N" DIN EN 60584	-100 to +1300 °C	0.4 %	100 ppm/K
Pt10Rh-Pt "S" DIN EN 60584	0 to +1768 °C	0.4 %	100 ppm/K
Pt13Rh-Pt "R" DIN EN 60584	0 to +1768 °C	0.4 %	100 ppm/K
Pt30Rh-Pt6Rh "B" DIN EN 60584	300 to 1820 °C	0.4 %	100 ppm/K
W3Re-W25Re "D"	0 to 2495 °C	0.4 %	100 ppm/K
Cold junction	Pt100 internal		
Cold junction accuracy	±1 K		
Sampling rate	210 ms		
Fault 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 values refer 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	
Fault 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	

9.2 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					

9.3 Binary input

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

9.4 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 up to 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 AC 230 V/3 A, 50 Hz (resistive load) or up to DC 30 V/3 A. Minimum current DC 12 V/100 mA.

9.5 Measuring circuit monitoring

	RTD temperature probe in 3-wire circuit and dual thermocouples	**Thermocouples**	**Current 4 to 20 mA**
Overrange and underrange	Is detected LEDs K1, K2, KD, and KV are lit; ">>>>" flashes in the display for overrange, "<<<<" for underrange		
Probe and cable break	Is detected LEDs K1, K2, KD, and KV are lit; ">>>>" flashes in the display; alarm relay output is inactive		LEDs K1, K2, KD, and KV are lit; ">>>>" flashes in the display; alarm relay output is inactive
Probe short circuit	Is detected LEDs 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 ⇨ Chapter 8.3.6 "Limit value difference, hysteresis"	LEDs K1, K2, KD, and KV are lit; "<<<<" flashes in the display; alarm relay output is inactive

9.6 Voltage supply

Voltage supply	AC/DC 20 to 30 V, 48 to 63 Hz AC 110 to 240 V, +10/-15 %, 48 to 63 Hz
Power consumption	12 VA
Power loss	< 12 W

9.7 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

9.8 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

9.9 Environmental influences

Ambient temperature range	0 to +55 °C
Storage temperature range	-30 to +70 °C
Temperature influence	≤ ±0.005 %/K dev. from 23 °C[1] for RTD temperature probes
	≤ ±0.01 %/K dev. from 23 ×C[1] for thermocouple and current
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

9.10 Case

Material	Polycarbonate
Flammability class	UL 94 V0
Electrical connection	On the front via screw terminals up to max. 2.5 mm^2 Maximum tightening torque of the screws: 0.5 Nm
Mounting	On 35 mm DIN rail according to DIN EN 60715
Installation position	Any
Weight	Approx. 230 g
Protection type	IP20 according to DIN EN 60529

9.11 Approvals/approval marks

Approval mark	Testing agency	Certificates/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)	SAS-0190/2006-3, V2.0	DIN EN 61508	All device versions
PL e			DIN EN ISO 13849	All device versions
GL	Germanischer Lloyd	36 790-11HH		All device versions
Pressure Equipment Directive	TÜV Nord (German Technical Inspection Agency)	07 202 4834 Z 5077/3/H	Pressure Equipment Directive 97/23/EC	All device versions
ATEX	TÜV Nord (German Technical Inspection Agency)	TÜV 11 ATEX 556139 X	Directive 94/9/EC	All device versions

9.12 Important information for the probes in Chapter 9.13 to Chapter 9.15

The following should be noted:

- There is no safe isolation between the sensor and the fitting. As a result, the sensor connections are to be considered grounded for the safety assessment.
- Among other requirements, EN 60079-0 stipulates that for EPL Ga, the mass fraction of aluminum must be less than 10 % for the production of metallic cases. The probe terminal head used by JUMO contains more than 10 % aluminum. Therefore the terminal head must be secured with a suitable impact protection for the use of EPL Ga (zone 0). The impact protec-

tion 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).

9.13 Probes for the operating medium air

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	

9.14 Probes for 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				
902006/10-226-1003-1-9-250-104/922	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	

9.15 Probes for 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 threat 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	

Probe short circuit can only be detected with a dual thermocouple.

The probes according to data sheets 901006 and 902006 are also certified for the Pressure Equipment Directive.

10 Setup program

The program and the connection cable are available as accessories and offer the following possibilities:

- Simple and easy-to-use parameterization and archiving via PC
- Easy parameter duplication for identical types of devices

10.1 Minimum hardware and software requirements:

- Microsoft[1] Windows 2000, XP, VISTA, 7-32, 7-64
- 200 MB HDD
- 1 GB RAM

✱ Connect the device to the PC using the USB cable

10.2 Displaying the device software version

✱ Simultaneously press the P and ▲ keys and hold down

This version is also recognized by the setup program and displayed under *Info* ⟹ *Information about setup*.

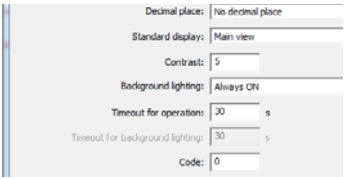
The software versions of the device and the setup program must be compatible as otherwise an error message will appear.

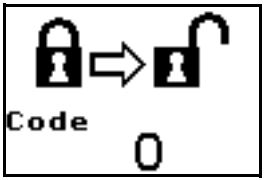
1. Microsoft is a registered trademark of Microsoft Corporation

10.3 Forgotten the code?

If you forget the code, it can be read out via the USB interface and the setup program.

✱ Use *Data transfer* ⟹ *from device*.





The read-out code now appears in the setup program.

It can now be retained or changed.

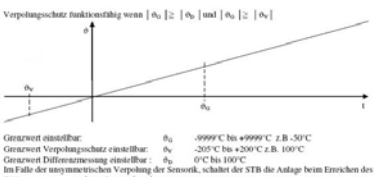
If "0" is set and transferred to the device, the code request is deactivated and the configuration level is freely accessible.

10.4 Special function: thermocouple reverse voltage protection

If the voltage of a thermocouple is reversed, measured values are shown that do not correspond to reality, for example as negative values are shown instead of the anticipated positive temperatures.

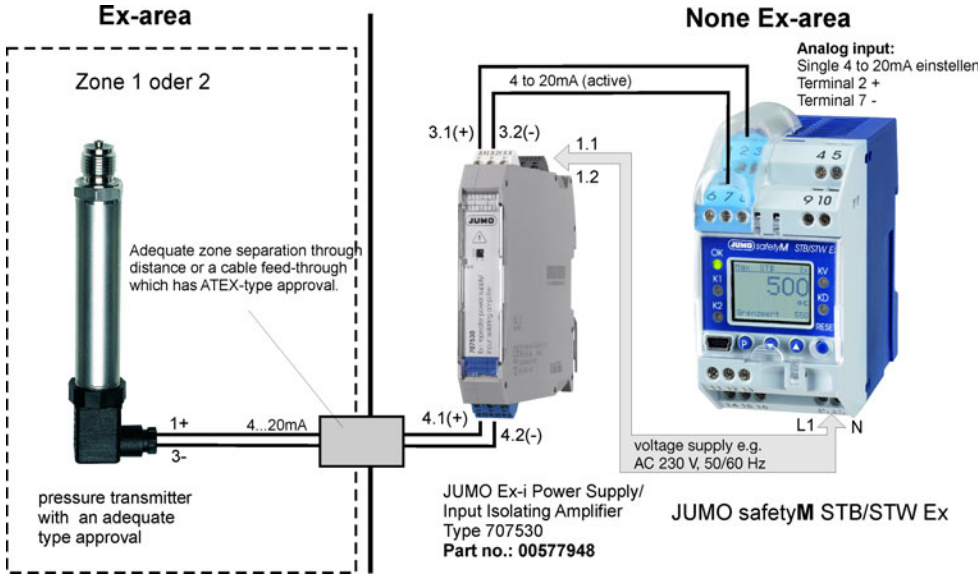
This may mean that the set limit value is never achieved. For this purpose, an additional limit value is defined and is set at -200 °C ex works. The alarm relay is triggered when this limit value is not met.

This value must be chosen carefully so that potential reverse voltage can be determined.

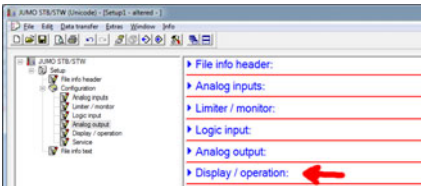
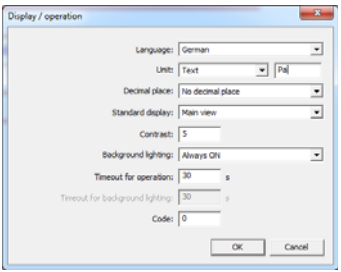


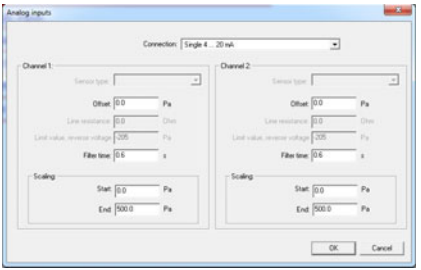
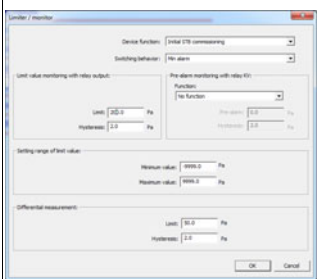
10.5 Pressure signal display via current input

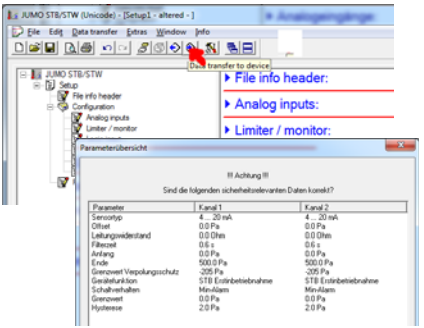
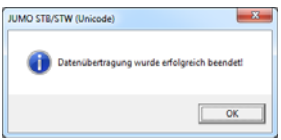
The pressure signal is connected to the JUMO safety**M** STB/STW Ex with a pressure transmitter as a standard signal of 4 to 20 mA via a supply isolating amplifier.



10.5.1 Pressure signal configuration via setup program

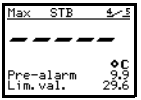
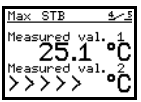
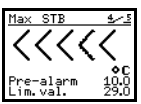
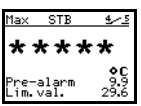
Step	Action	Description
1	✱ Connect the device to the PC via USB and start the setup program	
2	✱ In the Display/Operation menu, set **Text and Pa** for Unit: and confirm with OK.	

Step	Action	Description
3	✱ In the Analog input menu, set **Single 4 to 20 mA**. Further input fields for scaling appear. ✱ For both channels, enter **Start: 0** and **End: 500** and confirm with OK.	
4	✱ In the Limiter/Monitor menu, set **STB** or **Initial STB commissioning**. Set Switching behavior: to **Min. alarm** and confirm with OK. ✱ Enter the required **limit value** (in Pa) and **hysteresis**.	

Step	Action	Description
5	✱ **Transfer the data to the device** An overview of the parameters appears	
6	✱ Following successful data transfer **disconnect** the **USB connection**.	
7	The device now shows a pressure between 0 and 500 Pa. If the pressure falls below 200 Pa, the alarm relay output is switched off.	

11 Alarm messages

These can appear as follows:

Alarm display	Cause	Remedy
5 flashing horizontal lines: 	**Measured value error** No valid value can be displayed	✱ Check error messages on the device ✱ Contact the JUMO Service department ⇨ Chapter 2.4 "Service addresses"
	**Measured value overrange** The measured value is too high, is outside the measuring range, or the probe is broken.	✱ Change the display to 2 measured values. This makes it possible to detect which channel is defective. ✱ Check the probe and connecting cable for damage or short circuit. ⇨ Chapter 4.3 "Connection diagram" ✱ Check that the correct probe is set and/or connected. ⇨ Chapter 8.2 "Analog inputs"
	**Measured value underrange** The measured value is too low, is outside the measuring range, or a short circuit occurred at the probe.	
5 flashing asterisks: 	**Display overflow** Value cannot be displayed	✱ Check error messages on the device ✱ Contact the JUMO Service department ⇨ Chapter 2.4 "Service addresses"

12 Error messages

These error messages are displayed one below the other.

Error display (Err)	Origin	Cause/remedy
	Internal	The set limit value for relay switching cycles has been reached ✱ Increase the limit value for the relay switching cycles ⇨ Chapter 8.7.1 "Limit switching cycle" Instead of the bell, a cross appears and the error message can be acknowledged.
Terminal temp.	Internal	The internal Pt100 is defective[1], or the terminal temperature is outside the admissible range (-10 to 80 °C). This error cannot be acknowledged until it is within the admissible range again.
Reference volt.[1]	Internal	The reference voltage is outside the valid range. Acknowledgement is not possible until it is within the valid range again.
Calibration const.[1]	Internal	A calibration constant is outside the valid range. Acknowledgement is not possible until it is within the valid range again.
Configuration	Internal	Configuration data outside the value range. Acknowledgement is not possible until it is within the valid range again.
Measured value	Internal	The measured value 1 or 2 is outside the valid range. Acknowledgement is not possible until it is within the valid range again.

Error display (Err)	Origin	Cause/remedy
Measured value missing	Internal	When the error status "Measured value" is signaled by the channel then the diagnosis function tries to show the precise error on the basis of the read measured value.
Probe short-circ.	External	
Meas.overr.		
Meas.underr.		
Probe break		
Operating access[1]	Internal	The diagnosis function communicates with the STB/STW. Acknowledgement is not possible until communication has finished.
Setup access	Internal	The setup program is communicating with the STB/STW. Acknowledgement is not possible until communication has finished.
CRC calibr.[1]	Internal	Checksum error of the EEPROM calibration data. Acknowledgement is not possible until it is within the valid range again.
CRC config.[1]	Internal	Checksum error of the EEPROM configuration data. Acknowledgement is not possible until it is within the valid range again.
Registry[1]	Internal	A registry error has occurred. Acknowledgement not possible until the error has been remedied.
RAM defective[1]	Internal	A RAM error has occurred. Acknowledgement not possible until the error has been remedied.
ROM defective[1]	Internal	A ROM error has occurred. Acknowledgement is not possible until it is within the valid range again.
Program sequence[1]	Internal	A program sequence error has occurred. Acknowledgement not possible until the error has been remedied.

Error display (Err)	Origin	Cause/remedy
Watchdog[1]	Internal	A watchdog reset has occurred. Acknowledgement is possible.
Overvoltage[1]	Internal	The uncontrolled secondary supply voltage is too high. Acknowledgement is possible.
Frequency[1]	Internal	Error of independent time base. Acknowledgement is possible
EEPROM defective[1]	Internal	Error during internal communication with the EEPROM. Acknowledgement is possible.
Stack[1]	Internal	Error in the memory area reserved for the stack. Acknowledgement is not possible until it is within the valid range again.
AD converter[1]	Internal	Error during internal communication with the A/D converter. Acknowledgement is possible
Simulation[1]	Internal	Error during measured value simulation. Acknowledgement is possible.
Zero point[1]	Internal	The zero point voltage of the A/D converter is too low. Acknowledgement is possible.
Limit value	Plant	The configured limit value has been exceeded or has not been met.

Error display (Err)	Origin	Cause/remedy
Diagnosis function		
FLASH defective[1]	Internal	An error was detected during the cyclic memory test of the ROM.
RAM defective[1]	Internal	An error was detected during the cyclic memory test of the RAM.
CRC config.[1]	Internal	An error was detected by the checksum test (CRC16) in the configuration of the diagnosis function.
CRC calib.[1]	Internal	An error was detected by the checksum test (CRC16) in the calibration data of the diagnosis function.
Configuration	Internal	The configuration contains invalid data.
SW version[1]	Internal	The software versions are not valid.
Editing	Internal	An error has occurred during editing.
V too low	Internal	The internal voltage supply value has fallen below the permitted range.
V too high	Internal	The permitted range of the internal voltage supply has been exceeded.
Int. communic.[1]	Internal	An error has occurred during internal communication.
Difference	Plant	The difference (channel 1 minus channel 2) of the measured values has exceeded the maximum permitted value.
Switching operations	Internal	The configured limit of switching cycles has been exceeded. (There is only one counter as all alarm relays always switch.) The error can be acknowledged once the current counter is reduced or the limit is increased. (So that the switching operations are not accidentally set to 0 in the event of further errors)
USB communic.	Internal	An error has occurred during USB communication.

Error display (Err)	Origin	Cause/remedy
Footnote 1		If the error cannot be acknowledged despite repeated switching off and on, the device must be repaired by JUMO. ✱ Return the device ⇨ Chapter 2.4 "Service addresses"

13 What to do, if ...

Description	Cause	Remedy
The following appears in the display: 	**Setup program transmitting data.** The monitoring function switches off briefly during data transmission and the device re-starts.	- Wait until data transmission has finished.
The measured value flashes in the top display. 	**The device is in the alarm range** LEDs K1 and K2 are lit red. The measured value flashes on the display and is higher or lower than the limit value depending on the switching behavior set. - Measured value too high or too low - Excessive deviation between the temperature values during difference monitoring	✱ Check the limit value in the configuration level. ✱ Find out the reason for the limit value overrange or underrange. ✱ If necessary, correct the limit value. ✱ Reduce excessive hysteresis if applicable as it may be too far into the valid range. ⇨ Chapter 8.3.3 "Limit value, hysteresis"
LED K1 is lit red although the measured value is in the valid range	**The device is set as a safety temperature limiter (STB).** Even if the measured value has already returned to the valid range after an overrange, the relay of a temperature limiter does not automatically reset. It must be unlocked manually.	✱ Press the ● key for longer than 3 seconds to manually unlock the relay. ⇨ Chapter 5.5 "Acknowledging alarms using the reset key (for temperature limiter STB only)"

Description	Cause	Remedy
... alarm relay output is not closed between terminals 14 and 15 although the OK LED is lit green (in valid range).	- The integrated fuse cut-out is defective, caused by an excessive relay current.	✱ Measure terminal 5 and 7 of the relay when the LED K1 is lit green using a continuity test device. ✱ The device must be returned to JUMO for repair. ⇨ Chapter 2.4 "Service addresses"
... the display is dark, only the LEDs are lit	- Display shut-down after time-out was activated.	✱ Press any key or switch off time-out. ⇨ Chapter 8.6.8 "Time-out operation"

14 Information for devices with extra code 062 GL

The following information supplements or replaces the existing specifications.

14.1 Technical data

Ambient conditions according to application category C for closed areas

Temperature	0 to 55°C
Relative air humidity	≤ 100 % rh
Vibration	≤ 0.7 g

Inspection basis: GL design specifications & directives:

EMC 1

Software requirement class: 4

14.2 Alarm messages

⇨ Chapter 11 "Alarm messages"

14.3 Locks

The configuration level can be locked with a code.

⇨ Chapter 8.6.9 "Code"

Intentional or unintentional adjustments are not possible without additional measures.

⇨ Chapter 5.8 "Seal device"

☞ For service, the device must be returned to the main factory.
According to the recommendation of Germanischer Lloyd, availability of a replacement device should be ensured for certain applications.

☞ It is recommended that a printout of the configuration parameters (setup program) and the technical documents for the JUMO safety**M** STB/STW Ex (connection diagram) are kept available on site (or requested if necessary).

15 Behavior of outputs

Operating status	Relay output alarm	Relay output pre-alarm KV	Analog output
Initialization			
Initialization phase after mains voltage – ON (for approx. 10 seconds)	Inactive	Inactive	0 mA 0 V
Setup communication			
During reading-writing of the configuration (for approx. 5 seconds)	Inactive	Pre-alarm monitoring active ⇨ Chapter 8.3.4	Scaled analog signal is being output ⇨ Chapter 8.5
Standard operation			
After initialization phase system is in error-free status (Initial STB commissioning)	Inactive Unlocking possible	Pre-alarm monitoring active ⇨ Chapter 8.3.4	Scaled analog signal is being output ⇨ Chapter 8.5
After initialization phase system is in error-free status (STB, STW)	Monitoring of the limit value active ⇨ Chapter 8.3.2		
External error			

15 Behavior of outputs

Operating status	Relay output alarm	Relay output pre-alarm KV	Analog output
Probe break, probe short circuit (e.g. input 1)	Inactive	Active	Error signal is being output ⇨ Chapter 8.5.5
After probe break, probe short circuit (STW)	Monitoring of the limit value active ⇨ Chapter 8.3.2	Pre-alarm monitoring active ⇨ Chapter 8.3.4	Scaled analog signal is being output ⇨ Chapter 8.5
After probe break, probe short circuit (e.g. input 1) (STB)	Inactive Unlocking possible		
After acknowledgement probe break, probe short circuit (STB)	Monitoring of the limit value active ⇨ Chapter 8.3.2		
Difference monitoring through diagnostics			
Difference – alarm (STW function)	Inactive	Active	Error signal is being output ⇨ Chapter 8.5.5
Difference – alarm inactive again (STW function)	Monitoring of the limit value active ⇨ Chapter 8.3.2	Pre-alarm monitoring active ⇨ Chapter 8.3.4	Scaled analog signal is being output ⇨ Chapter 8.5

15 Behavior of outputs

Operating status	Relay output alarm	Relay output pre-alarm KV	Analog output
Difference – alarm (STB function)	Inactive	Active	Error signal is being output ⇨ Chapter 8.5.5
Difference – alarm inactive again (STB function)	Inactive Unlocking possible	Pre-alarm monitoring active ⇨ Chapter 8.3.4	Scaled analog signal is being output ⇨ Chapter 8.5
After acknowledgement of difference – alarm (STB function)	Monitoring of the limit value active ⇨ Chapter 8.3.2		
Internal errors			
Internal errors diagnostic channel active	Inactive	Pre-alarm monitoring active ⇨ Chapter 8.3.4	Scaled analog signal is being output ⇨ Chapter 8.5
Internal errors diagnostic channel inactive again	Monitoring of the limit value active ⇨ Chapter 8.3.2		
Internal errors safety channel active (STB)	Inactive	Active	Error signal is being output ⇨ Chapter 8.5.5

15 Behavior of outputs

Operating status	Relay output alarm	Relay output pre-alarm KV	Analog output
Internal errors safety channel inactive again (STB)	Inactive Unlocking possible	Pre-alarm monitoring active ⇨ Chapter 8.3.4	Scaled analog signal is being output ⇨ Chapter 8.5
Internal errors safety channel after acknowledgement (STB)	Monitoring of the limit value active ⇨ Chapter 8.3.2		

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