JUMO Safety Performance
The compact solution for functional safety
Dear Reader,

In 1976 in Seveso, northern Italy, a dramatic accident involving toxic gas brought about a development, the results of which we know today as the terms “functional safety” or “SIL”. At the time, a serious overheating reaction took place in a plant which had neither automatic cooling systems nor warning systems, releasing large amounts of dioxin. As a result of this catastrophe, the laws and regulations regarding the protection of people, living things, and the environment were tightened.

The first result was the standard IEC 61508 “Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems” published in 1998, which has been applied as EN 61508 since 2002. For the first time, this standard comprehensively defined the safety requirements in automation technology. While IEC 61508 is primarily aimed at the manufacturers of components for safety equipment, IEC 61511 “Functional Safety - Safety Instrumented Systems for the Process Industry Sector” applies to the operators and planners of safety equipment. IEC 61511 provides recommendations and guidelines for assessing the risk of damage in plants, and can be used to help select safety-related components. The aim of these standards is to reduce the risk to an acceptable level.

But what do we actually mean when we talk about “functional safety” or “SIL” and “PL”? Functional safety refers to the part of system safety that depends on the correct functioning of safety-related subsystems and external devices to reduce risk.

The term “PL” stands for “Performance Level” and, according to EN ISO 13849, describes a discrete level that specifies the ability of safety-related parts of a control system to perform a safety function under foreseeable conditions. The performance level (PL) is therefore a measure of the reliability of a safety function.

The term “SIL” (“Safety Integrity Level”) functions as a measure of the safety-related performance or reliability of an electrical or electronic control system. The primary focus of SIL is on the evaluation of the safety chain, also known as SIF (Safety Instrumented Function). This safety chain typically consists of the safety controller, the actuator, and the sensor. The SIS (“Safety Instrumented System”) is made from one or more safety chains.

SIL and PL are gaining more and more importance in the process industry and in mechanical engineering. For this reason JUMO has developed a safety-oriented product portfolio for different measurands under the JUMO Safety Performance brand. This portfolio allows JUMO to now offer different compact solutions for different applications.

Additional information can be found at: http://jsp-en.jumo.info.
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JUMO Safety Performance – the compact solution for functional safety

JUMO Safety Performance is a new brand from JUMO. Products marked with this brand are suitable for safety-related plants. These include devices that are SIL and PL certified, but also passive elements that are suitable for use in SIL and PL measuring chains. These are labeled with “SIL qualified” and “PL qualified”.

The configuration of the components that has been especially adjusted to the process is important for a process-reliable application at the customer’s site. The JUMO Safety Performance team of experts was created to assist users with all questions about SIL and PL.

JUMO safetyM STB/STW – compact single-channel safety controller for Ex and non-Ex areas

Functional safety primarily focuses on the evaluation of a safety chain. Such a safety chain typically consists of a logic unit, an actuator, and a sensor. Safety-related solutions are normally made through a safety programmable logic controller. However, complex programming applications are required here and the inputs as well as outputs are coupled with card types and multichannel features. The disadvantage is that each application must be calculated and evaluated separately according to SIL.

The JUMO safetyM STB/STW is an attractive alternative to the safety programmable logic controller. This safety limiter and monitor is equipped with 3 different functional outputs and enables the simple implementation of a compact safety solution. Such a solution is especially well suited for smaller applications like special machines or individual applications with low signal density or low number of signals. Different temperature probes can be directly connected to the JUMO safetyM without transmitters. Other measurands such as pressure, level, or flow can be measured using a standard signal input. Another highlight of the JUMO Safety Performance applications is their possible use in explosion-protected areas. Configured compact solutions according to the ATEX directive are available for this purpose (see figure on page 7).
SIL classifications of the compact solution

Based on decades of experience in temperature measurement technology and safety controllers, JUMO has already developed a safety-related compact solution for the temperature measurand which does not require further verifications or calculations. Here, the safety controller JUMO safetyM is combined with JUMO RTD temperature probes or thermocouples. The manufacturer’s declaration issued by JUMO establishes a certified SIL 3 and PL e compact solution.

Compact solutions for the measurands pressure and level can be designed up to SIL 2 and PL d depending on the choice of sensor technology and actuators. The calculation is done by the user.

The JUMO Safety Performance team of experts supports the user with the calculations for compliance with the specified directives.

Your benefits in a nutshell:

- Certified measuring chain protection up to SIL 3 and PL e possible
- Highest degree of flexibility for the configuration of the SIL components through comprehensive delivery program
- Safe monitoring and shutoff of systems
- Selectable security features (e.g., limiter or monitor function according to DIN 14597)
- Suitable for different measurands such as temperature, pressure, and level
- Variable, manufacturer-independent selection of sensor technology and actuators

- Certified measuring chain individually adaptable to the process requirement
- A SIL calculation is no longer necessary by the user when the JUMO safetyM is used in combination with JUMO temperature probes
- Also available as explosion-protected compact solution according to ATEX directive in the different ignition protection types such as [Ex i] and [Ex e].
- Individual assessment of the safety chain by the experienced JUMO Safety Performance team of experts
Safety-related shutdown up to SIL 3

Certified compact system for temperature

![Diagram of certified compact system for temperature]

- JUMO thermocouples/RTD temperature probes
- JUMO dTRANS T07 B SIL Type 707081
- JUMO Ex-i repeater power supply and input isolating amplifier Type 707530
- JUMO safetyM STB/STW Type 701150

Compact system for temperature

![Diagram of compact system for temperature]

- JUMO thermocouples/RTD temperature probes
- JUMO dTRANS p20 Type 403025
- JUMO Ex-i repeater power supply and input isolating amplifier Type 707530
- JUMO safetyM STB/STW Type 701150

Compact system for pressure*

![Diagram of compact system for pressure]

- JUMO dTRANS p20 Type 403025
- JUMO Ex-i repeater power supply and input isolating amplifier Type 707530
- JUMO safetyM STB/STW Type 701150

Compact system for pressure

![Diagram of compact system for pressure]

- JUMO dTRANS p20 Type 403025
- JUMO Ex-i repeater power supply and input isolating amplifier Type 707530
- JUMO safetyM STB/STW Type 701150
Safety-related switch-off up to SIL 3 in ATEX version (ignition protection type [Ex ia] and [Ex e])

Certified compact system for temperature

JUMO thermocouples/RTD temperature probes

JUMO safetyM STB/STW Ex, [Ex ia]
Type 701155

Manufacturer’s declaration

JUMO thermocouples/RTD temperature probes

JUMO safetyM STB/STW Ex, [Ex e]
Type 701155

Manufacturer’s declaration

Compact system for temperature

JUMO dTRANS T07 B Ex SIL
Type 707086

JUMO Ex-i repeater power supply and input isolating amplifier
Type 707530

JUMO safetyM STB/STW
Type 701150

Compact system for pressure

JUMO dTRANS p20
Type 403025

JUMO safetyM STB/STW
Type 701150

General comment for the displayed safety-related compact solutions on page 6 and 7:

- The JUMO safetyM STB/STW has an output signal to control the downstreamed safety actuator systems.
- Additional output signal suitable for downstreamed visualization, controlling, and documentation.

* Auxiliary energy for power supply is required separately.
Always one step ahead:
The electronic JUMO Safety Performance products
JUMO safetyM STB/STW and STB/STW Ex
Safety temperature limiter and monitor

- Ignition source monitoring according to EN 50495 SIL 2 and EN 13463 IPL 2
- Ignition protection type [Ex ia] with intrinsically safe inputs or [Ex e] with increased safety
- 1oo2D structure for high degree of process reliability
- Approvals for DIN EN 14597, SIL 3, PL e, GL, PED
- LCD display with background lighting and plain text display
- Universal input for a large number of measuring signals and measurands

### Analog inputs
- RTD temperature probes: Pt100, Pt1000
- Direct current: 4 to 20 mA
- Analog inputs: configurable by user

### Analog output
- Current: 4 to 20 mA, 0 to 20 mA
- Voltage: 2 to 10 V, 0 to 10 V
- Analog output: can be used as actual value output for main measured value, measured value 1, measured value 2, difference between measured value 1 and measured value 2

### Digital input
- Connection: one potential-free contact – for unlocking, keyboard lock, level inhibit

### Relay outputs
- Relay output KV – can be used as a pre-alarm
- Relay output – limit value alarm evaluated for temperature limiter

### Voltage supply
- AC/DC 20 to 30 V, 48 to 63 Hz, AC 110 to 240 V +10 %/-15 %, 48 to 63 Hz

### Approvals
- ATEX, IECEx, SIL, PL

For further information: data sheet 701150, 701155
JUMO dTRANS T06
Multifunctional four-wire transmitter in mounting rail case

- Simple DIN-rail mounting with removable connection terminals
- Universal input for a large number of sensors
- Comprehensive self and sensor diagnostics
- Highest degree of accuracy and long-term stability
- Intelligent additional functions such as drag indicator and service counter
- SIL 2 or SIL 3 according to IEC 61508-1/2/3:2010
- Easy-to-use configuration via keys and display or USB interface
- Higher process quality and efficiency
- Increased plant safety and reliability

<table>
<thead>
<tr>
<th>Analog inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD temperature probes: Pt50, Pt100, Pt500, Pt1000, Ni100, Ni500, Ni1000, Cu50, Cu100, two/three/four-wire circuit</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current: 0(4) to 20 mA (invertible)</td>
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<tr>
<td>Voltage: 0(2) to 10 V (invertible)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting rail or DIN rail 35 × 7.5 mm</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Calibration accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>± 0.05 %</td>
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</table>

<table>
<thead>
<tr>
<th>Voltage supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 110 to 240 V, DC 24 V</td>
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<table>
<thead>
<tr>
<th>Special features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal input for a large number of sensors and standard signals</td>
</tr>
<tr>
<td>Intuitive operation and configuration on the device or through USB interface with setup program</td>
</tr>
<tr>
<td>RS485 interface (Modbus RTU) and relay output limit value (option)</td>
</tr>
<tr>
<td>Intelligent additional functions such as min./max. drag indicator and output simulation</td>
</tr>
<tr>
<td>SIL 2 or SIL 3 according to DIN EN 61508 and PL c or PL d according to ISO 13849 (option)</td>
</tr>
<tr>
<td>Sensor matching for RTD temperature probes</td>
</tr>
<tr>
<td>Customer-specific linearization</td>
</tr>
<tr>
<td>High galvanic signal separation</td>
</tr>
<tr>
<td>Service and operation hours counter</td>
</tr>
<tr>
<td>Connection diagram retrievable in the display</td>
</tr>
</tbody>
</table>

For further information: data sheet 707071
JUMO Safety Performance

Compact solution  Electronic products  Sensors  Training courses

JUMO dTRANS T07
Two-channel temperature transmitters

- High degree of accuracy as of 0.1 K with Pt100 sensor
- HART® 7 protocol
- SIL 2 hardware and SIL 3 for software according to IEC 61508:2010
- Reliable measurement operation through sensor monitoring and device hardware error detection

Analog inputs

2 sensor inputs for
RTD temperature probes:
Pt50, Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Cu50, Cu100, two-wire/three-wire/four-wire electrical circuit
or
Thermocouples:

Analog output

Current: 4 to 20 mA

Installation

In terminal head form B,
on mounting rail or DIN rail 35 × 7.5 mm

Calibration accuracy

± 0.05 %

Voltage supply

DC 12 to 32 V

Special features

- 2 universal measurement inputs (RTD, TC, Ω, mV)
- Output 4 to 20 mA (single channel, loop powered)
- 2 enclosure versions (B-head or DIN rail)
- Optional insert display BD7 for B-head device version

Approvals

- ATEX, IECEx, cULus, Hart®

For further information: data sheet 707080
JUMO Ex-i repeater power supply and input isolating amplifier

- For operation of intrinsically safe [Ex i] transmitters and [Ex i]-mA current sources installed in Ex areas
- HART® capability
- SIL 2 approval
- Universal power supply

| Input | 0(4) to 20 mA  
Supply isolation amplifier operation or input isolating amplifier operation |
|-------|--------------------------------------------------|
| Output| 0(4) to 20 mA  
0(1) to 5 V |
| Installation| On mounting rail or DIN rail 35 × 7.5 mm |
| Comparison accuracy| ± 0.05 % (typical) |
| Voltage supply| AC/DC 24 to 230 V |
| Special features| HART® capability  
Active or passive current output  
LED for power status  
Universal power supply |

For further information: data sheet 707530
JUMO exTHERM-AT
Explosion-protected surface-mounted thermostat

- Can be directly applied in Ex zones 1 and 2 or 21 and 22
- Switching capacity 16 A as standard, optionally 25 A
- Admissible ambient temperature: -60 to +70 °C
- Thermowell for Ex zone 0 available as an accessory
- Single thermostat and double thermostat
- Approvals according to ATEX, IECEx, and SIL 2

### Features
- Single thermostat and double thermostat

### Versions
- Temperature monitor (TW)
- Temperature limiter (TB)
- Safety temperature monitor (STW)
- Temperature limiter (STB)

### Switching element
- Flameproof enclosed panel-mounted thermostat

### Switching capacity
- 16 A, 230 V, optionally 25 A, 230 V

### Maximum control range/limit value
- 500 °C

### Approvals
- ATEX, RTN, EAC, DIN, IECEx

For further information: data sheet 605055
Measuring with safety
The JUMO Safety Performance sensors
Thermocouples and RTD temperature probes

- Over 40 different SIL and PL qualified temperature probes
- Head and cable probe as thermocouple or RTD temperature probe
- Approvals according to ATEX and IECEx

### Thermocouples
- For temperatures of up to 1500 °C
- As single or double thermocouple
- Thermocouples J, L, K, S, B*

### RTD temperature probes
- For temperatures of up to 700 °C
- Pt100, Pt500, Pt1000
- As single, double, or triple RTD temperature probe

### Process connection
- Thread, flange, compression fitting, hygienic process connections

For further information: see data sheet

**Thermocouples for types:**
901006, 901020, 901030, 901050, 901110, 901120, 901150, 901190, 901210, 901220, 901230, 901240, 901250, 901350, 901820, 901821

**RTD temperature probes for types:**
902006, 902020, 902023, 902030, 902040, 902044, 902050, 902120, 902123, 902130, 902150, 902153, 902190, 902210, 902220, 902230, 902240, 902250, 902350, 902520, 902524, 902550, 902554, 902810, 902815, 902820, 902821, 902830

*According to DIN 43710, DIN EN 60584, and ANSI MC96.1 or ASTM E230.*
JUMO dTRANS p20
Process pressure transmitter

- HART® interface
- Optional explosion protection [Ex ia] according to ATEX
- Linearity 0.05 %
- Turn down 1:50
- Simple operation with rotary knob
- Stainless steel case
- Optional high-temperature version up to 200 °C
- Display scaling with a choice of measuring units
- Display of sensor temperature
- For pressure, differential pressure, and level applications
- Display of minimum and maximum pressures

<table>
<thead>
<tr>
<th>Input</th>
<th>403025/26: 60 to 600 bar (relative; absolute)</th>
<th>403022/23: 1 mbar to 100 bar DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>4 to 20 mA two-wire, HART®</td>
<td></td>
</tr>
<tr>
<td>Accuracy (linearity)</td>
<td>403025/26: 0.05 %</td>
<td>403022/23: 0.07 %</td>
</tr>
<tr>
<td>Process connection</td>
<td>403025/26: thread, hygienic connections, JUMO PEKA, diaphragm seals</td>
<td>403022/23: 2x 1/4&quot;-18 NPT; diaphragm seals</td>
</tr>
<tr>
<td>Medium temperature</td>
<td>403025/26: -40 to +200 °C</td>
<td>403022/23: -40 to +110 °C</td>
</tr>
<tr>
<td>Special features</td>
<td>Programmable and highly precise</td>
<td>Stainless steel case</td>
</tr>
<tr>
<td></td>
<td>SIL 2, ATEX</td>
<td></td>
</tr>
</tbody>
</table>

For further information: data sheets 403025/26, 403022/23
SIL in practice

Continuous level measurement using differential pressure measurement on a tank system

Pressure monitoring in tank systems is a very relevant topic from a safety perspective—especially in the chemical industry. JUMO devices enable uncomplicated solutions for functional safety.

The core piece is the JUMO safetyM STB/STW. This safety limiter or safety monitor according to DIN EN 14597 has the primary task of reliably monitoring processes and bringing the systems into a safe operating state in the event of a malfunction. The built-in LEDs K1 and K2 (red) signal an exceeding of the limit value for each channel at which point the built-in relay output alarm switches the system into an operationally safe state (alarm range). The device concept meets the stringent requirements of DIN EN 61508 and DIN EN 13849. The 1oo2D structure ensures reliable detection of faults so that it 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 using various probes or standard signals which also makes the JUMO safetyM suitable for monitoring pressure. For this purpose, a differential pressure transmitter is connected to the JUMO safetyM via 2 JUMO Ex i repeater power supply and input isolating amplifiers. Even with this solution a limit value switch-off up to SIL 3 is possible for a set level height. The user therefore has a compact, single-channel safety control with selectable redundant input signals for standard signals. Configuration is simple and easy due to the device software.

But that is not all: the JUMO safetyM can also be connected to the JUMO mTRON T measuring, control, and automation system. Either the binary signal of the pre-alarm or the analog output signal is used for this purpose. This solution provides the user with a significantly increased functional range as well as comprehensive visualization options.

Further SIL solutions for which the JUMO safetyM can be used are temperature monitoring in heat treatment facilities as well as the monitoring of pumps, overfilling switch-offs, or extruders.
Training courses for JUMO Safety Performance products

JUMO offers several options for the perfect introduction to “functional safety”:
- Seminars
- Webinars
- Technical literature

Seminar:
Functional safety in Europe pertaining to “Safety Integrity Level” and the “Performance Level” – basic course

Contents
The seminar provides an introduction about the easy start into functional safety and gives application-oriented practical information when dealing with the standards.
- What does functional safety mean?
- Standards, definitions, values
- Differences between SIL and PL
- Manufacturer specifications
- System structures
- Risk assessment and the tools
- Security structures
- Case study of a safety chain
- SIL ratings according to standards
- Certificates and safety manual
- System applications and their different approaches with structures and calculations
- General information and examples for practical use
- Exchange of experience

Objectives
After the seminar the participants will have an overview of functional safety and can:
- Create risk assessments
- Retrace calculations
- Establish SIL structures
- Compile documentations

Target group
Technicians who wish to gain an initial requirements overview of the functional safety in plant and mechanical engineering.

Requirements
Basic technical knowledge

http://campus.jumo-en.info
Webinar:
Application of JUMO safetyM STB/STW
safety temperature limiters and monitors

The webinar introduces the JUMO safetyM STB/STW and conveys important information for the implementation of compact safety controllers:

- DIN EN 14597
- Definition of temperature monitor and limiter as well as of safety temperature monitor and limiter
- Overview of JUMO safetyM
- SIL and SIL-certified measuring chains from JUMO
- JUMO safetyM STB/STW hardware and configuration

Target group:
- All persons who implement safety controllers

Comparison between SIL-classified measuring chains with safety PLC and JUMO safetyM

Technical literature:
Functional Safety – Safety Integrity Level (SIL)

This specialist book aims to provide support for the introduction into functional safety. It describes the basic principles of functional safety based on legal principles in an easy to understand manner.

General Information

The current date of the seminar and the webinar can be found at http://campus.jumo-en.info.

We would be happy to shape the seminar to your requirements. We can hold the seminar on your company premises or at our training center in Fulda, Germany. Feel free to contact us.

JUMO has been providing seminars “by practitioners for practitioners” for over 20 years: all of our speakers are proven practitioners who have in-depth knowledge, both about their areas of specialization and the JUMO products.

We have set ourselves the goal of providing seminars of the highest quality.

We also offer exclusive webinars online. These generally last for 1 to 2 hours. They give you a compact overview of a topic that is especially tailored for you or that deals with a particular issue.

Your advantage: no travel expenses are necessary so that online training is highly efficient.