Read and understand this document

Please read and understand this document before using the products. Please consult your ABB Electrification Sweden representative if you have any questions or comments.

Suitability for use

ABB shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer’s application or use of the product. Third party certificates for the products are available at https://new.abb.com/low-voltage/products/safety-products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE ABB PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Descriptions and examples show how the product works and can be used. It does not mean that it fulfills the requirements for all types of machines and processes. The buyer/user is responsible for installing and using the product according to applicable standards and regulations. We reserve the right to make changes to the product and the documentation without prior notice.
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1 Introduction

1.1 Purpose of document
The purpose of this document is to describe the functions and to provide instructions for installation, operation, maintenance and troubleshooting of the product.

1.2 Intended audience
This document is intended for authorized personnel.

1.3 Reading prerequisites
It is assumed that the reader of this document has:
- Basic knowledge of ABB safety products.
- Knowledge of machine safety.
- Knowledge of safety devices.

1.4 Special notes
Pay attention to special notes in this document:

⚠️ Warning!  
Risk of severe personal injury!  
An instruction or procedure which, if not carried out correctly, may result in injury to the technician or other personnel.

⚠️ Caution!  
Risk of damage to the equipment!  
An instruction or procedure which, if not carried out correctly, may damage the equipment.

⚠️ Note!  
Important or explanatory information.
2 Safety

2.1 Intended use
The intended use of the Sentry safety relay is to monitor the state of a safety device and depending on the state, activate or inactivate the outputs within the system response time. The protective function of the safety device is only safe if the safety relay is correctly connected and configured. The safety relay is not by itself a complete protective device.

- Use the safety relay as a safety monitoring device.
- Use the safety relay as expansion device of safe outputs
- The safety relay is not intended for use in explosive or easily flammable adjacent air.
- Other use than defined as correct is considered as incorrect use.

2.2 Safety precautions

⚠️ Warning! The safety precautions must be followed during installation, operation, maintenance and troubleshooting.

⚠️ Warning! The safety functions must be tested at start up or at replacement before the system is put in operation.

Installation shall be conducted by authorized personnel following the Safety regulations, standards and local legal regulations. Carefully read through the entire original instruction before using the device.

Make sure that these instructions are included together with the documentation of the system. Make sure that these instructions always are available for users of the system.

The safety relay must be selected so its safety related capacity meets or exceed the performance level (PL) or safety integrity level (SIL) that has been estimated in the risk analysis. The safety relay must only be used after it has been selected according to related instructions, relevant standards, rules and regulations for protection and safety at work.

The entire dangerous zone must be visible from the position where the reset button is installed. The reset button must be positioned out of reach from the dangerous zone.

The safety functions must be tested after installation or replacement of components or cables. The safety relay must be exchanged within 20 years.

Failure to comply with instructions, operation that is not in accordance with the use prescribed in the instructions, improper installation or handling can affect the safety of people and the system. Failure to comply with the instructions or standards, excludes any liability.
3 Product description

3.1 Sentry safety relays

Sentry safety relays provide safe stop and start of monitored devices to prevent errors. The following safety device types are applicable for the Sentry safety relays:

- 1 channel safety device.
- 2 channel safety device with equivalent contacts.
- 2 channel safety device with antivalent contacts.
- Expansion of safety modules.
- Pressure sensitive safety device (short-circuit detection).
- Two-hand safety device.
- OSSD safety device.

Examples of devices for connection to the Sentry safety relays:

- Light beams.
- Light curtains.
- Three position safety device.
- Safety interlock switches.
- Emergency stop buttons.
- Bumpers, contact edges and safety mats.

3.2 Sentry product range

The Sentry product range has the following groups of safety relays:

**BSR (Basic function Safety Relay) group**

The BSR group include BSR10, BSR11 and BSR23. The safety relays have basic monitoring functions for 1- and 2-channel safety devices. The safety relay can be used as an expansion of other safety modules.

**SSR (Single function Safety Relay) group**

The SSR group includes SSR10, SSR10M, SSR20, SSR20M, SSR32 and SSR42. The safety relays have single safety device functions and limited configuration possibilities for automatic and manual reset. SSR32 and SSR42 have a timer function.

**TSR (Timer function Safety Relay) group**

The TSR group includes TSR10, TSR20 and TSR20M. The safety relays have timer functions and configuration possibilities. TSR10 is fully configurable with preset selection possibilities and password protection.

**USR (Universal function Safety Relay) group**

The USR group include USR10 and USR22. The safety relays have multiple functionalities for monitoring safety device including timer functions. The USR group is fully configurable with preset selection possibilities and password protection.
3.3 Safety relay overview

A. Connection block, top side back
B. Connection block, top side front
C. Product name.
D. Print for connection block, top side back
E. Print for connection block, top side front
F. Relay output configuration
G. Print for connection block, bottom side front
H. Print for connection block, bottom side back
J. LEDs for status indication
K. Switch for settings
L. Connection block, bottom side front.
M. Connection block, bottom side back
N. DIN rail latching device
4 Installation

4.1 Installing precautions

Follow the instructions carefully to avoid personal injury or damage to the device.

The safety relay shall be attached on a 35 mm DIN rail in a lockable enclosure that has at least protection class IP54. Sentry safety relays shall be installed in an upright position.

Make sure there is at least 10 mm distance between the safety relay and other non-Sentry units to prevent uncontrolled heating. Make sure there is at least 50 mm distance above and below the safety relay and other units for correct air flow in the venting holes of the safety relay.

Caution! Sentry safety relays can be installed without distance to other Sentry safety relays, with exception of BSR23. Make sure there is at least 5 mm distance between BSR23 and other Sentry safety relays.

4.2 Attaching the safety relay on the DIN rail

1. Make sure that the DIN rail latching is reset.
2. Hang the top rear side of the safety relay on the DIN rail.
3. Push the bottom rear side of the safety relay on the DIN rail until a click is heard.
4.3 Removing the safety relay from the DIN rail

1. Use a screwdriver to unlock the DIN relay latching device from the DIN rail.
2. Pull the bottom rear side of the safety relay away from the DIN rail until a click is heard.
3. Lift the top rear side of the safety relay away from the DIN rail.

4.4 Resetting the latching device

- Pull the bottom side of the DIN rail latching device from the safety relay and push it upwards to release it to its original position.
4.5 Connecting precautions

**Warning!** Disconnect the power supply before attaching or removing the connection blocks.

Make sure that connection blocks and wires are clearly marked for correct connections. Use applicable requirements in IEC 60204-1 for wire connections. Make sure that the wires are fitted with crimp terminals or ferrules before connection, unless solid copper conductors are used.

For connections of relay output contacts: Make sure that all power supplies or signal sources are connected to one side of the safety relay and that all power consumers or signal receivers are connected to the opposite side of the safety relay.

Make sure to use at least one of the following methods to ensure correct wire protection against short circuits for the safety relay outputs:

- The wires are permanently connected and protected against external damage, for example by wire ducts or other types of covers for protection.
- Use of separate multi-core wires.
- Use of cables with wires being individually shielded with earth connection.

The safety requirement is that fuses shall be used on the relay outputs.

4.6 Connection blocks

The connection blocks on the safety relay are detachable to simplify installation and replacement. The safety relay can be ordered with two different types of connection blocks, screw compression type or push-in type.

4.7 Coding the connection blocks

The coding kit is used to make each connection point individual to avoid faulty connection. Place the coding parts in an specific order on the connection block and match these with the pin header.

- The risk assessment must include the risk of mistakes when using the connection blocks without coding.
- If coding is used, a test of the outcome of the coding against the identified risks must be done.
4.8 Connecting to a screw compression type terminal
Use a screwdriver with slot size 3,5 mm.
1. Open the terminal before inserting a wire.
2. Insert the wire in the correct terminal.
3. Close the terminal and secure the wire with torque 0,7 Nm ±0,1.

4.9 Connecting to a push-in type terminal
1. Press the actuating lever.
2. Insert the wire in the correct terminal.
3. Release the actuating lever.

4.10 Wire properties

Wire area, screw compression type connection block
Wire with crimp sleeve, ferrule or single solid conductor. Two wires with the same area must be used. Wire strip length 6,5 mm ±0,5.
Minimum 1x24 AWG and Maximum 1x12 AWG
Minimum 1x0,2 mm² and Maximum 1x3,3 mm²
Minimum 2x24 AWG and Maximum 2x16 AWG
Minimum 2x0,2 mm² and Maximum 2x1,5 mm²

Wire area, push-in type connection block
Wire with crimp sleeve, ferrule or single solid conductor. Two wires with the same area must be used. Wire strip length 6,5 mm ±0,5.
Minimum 1x24 AWG and Maximum 1x14 AWG
Minimum 1x0,2 mm² and Maximum 1x2,5 mm²
Minimum 2x24 AWG and Maximum 2x16 AWG
Minimum 2x0,25 mm² and Maximum 2x1,5 mm²

4.11 Wire length
The maximum wire length depends on the total resistance and total capacitance in the transmitter loop for each channel. The model used to determine the maximum allowed wire resistance and wire capacitance between the transmitter port (T) and the receiver port (R) is shown in the figure.

Rext is the total wire resistance, and Cext is the total wire capacitance (to ground, or shield).
The switch symbolizes the sensor, placed halfway in the T-R loop (as indicated by having half of Rext/Cext on each side). Iext is the current drawn by the sensor for its operation and/or other external loads. The maximum allowed wire resistance, Rext, vs. the externally drawn current Iext is listed in the table.
The maximal wire length is limited by the resistive loading to the maximum wire resistance divided with the wire resistance per length of the unit.

The maximal wire length is limited by capacitive loading to \((100\text{nF} - \text{external capacitive loading})\) divided with the wire capacitance per length of unit.

\(R_{\text{ext}}\) is resistance for the complete wire.

<table>
<thead>
<tr>
<th>(I_{\text{ext}})</th>
<th>Maximum wire resistance (R_{\text{ext}}) (T–R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 mA</td>
<td>850 (\Omega)</td>
</tr>
<tr>
<td>5 mA</td>
<td>600 (\Omega)</td>
</tr>
<tr>
<td>10 mA</td>
<td>460 (\Omega)</td>
</tr>
<tr>
<td>15 mA</td>
<td>370 (\Omega)</td>
</tr>
<tr>
<td>20 mA</td>
<td>300 (\Omega)</td>
</tr>
<tr>
<td>25 mA</td>
<td>260 (\Omega)</td>
</tr>
<tr>
<td>30 mA</td>
<td>220 (\Omega)</td>
</tr>
</tbody>
</table>
5 Functions

5.1 Function overview
Power supply, mains.
Relay output
• 3 NO + 1 NC
Safety device interface
• Two channels with equivalent contacts
Test, start and reset interface
• Automatic reset
Timer function
• Off-delay 0.5 s
• Off-delay 1.5 s

5.2 Power supply
Mains power supply
The safety relay is designed for connection to 85 – 265 VAC (50/60 Hz) or 120 – 375 VDC.

5.3 Relay outputs
The safety relay output contacts are opened or closed based on the signals from the safety device. Each safety relay output has two contacts in series, one contact for each internal output relay.

A. Connectors: Terminals in connection blocks.
B. NO contact: The NO contact is open when the relay is inactivated and closed when the relay is activated.
C. NC contact: The NC contact is closed when the relay is inactivated and open when the relay is activated.

Caution! A relay output is in safe state when the contact is open.

Caution! The NC contact is intended to monitor the state of a safety device only. It is not a safe output.

Note! The NO contact is open at all types of internal failures and is a safe output.
Note! Arc suppression for inductive loads is recommended to get a longer lifetime for the relay contacts.

5.4 Safety device interface
Sentry safety relays have interfaces with inputs/outputs (I/O:s) for connections of safety devices.

Inputs/Outputs
T1/T2 detect short circuits to +24 VDC or other OSSD signals and are designed for supplying signals to different types of safety devices.

Note! It is not necessary to connect T1/T2 to the safety devices. The safety level may be reduced if T1/T2 are not used. Possible errors in the connected safety devices and wires may not be identified.

Warning! T1/T2 must be used on the mains powered relays.

R1/R2 receives the signals from the safety devices.

Warning! The safety relays and the safety devices supplied with 24 VDC must be connected to PELV/SELV power supply.

5.5 Test, start and reset interface
The safety relay has an interface for test, start and reset functions. The safety relay enters inactive mode when at least one input is not accepted. The safety relay enters active mode when the inputs are accepted, and a reset is performed.

5.6 Automatic reset
When at least one input signal is not accepted, the safety relay enters inactivated mode. The MODE LED light blue and at least one of CH1/CH2 LED will turn OFF. When the safety input signals are accepted and the test (X1/X4) circuit is closed, an automatic reset is made. The relay activates and the three LEDs will light green.
6 Connections

6.1 Connection groups

The connections are divided into groups.

A  Power supply
T  Signal to safety device
R  Signal from safety device
X  Test/reset/start/indication
13, 23, 33  Safety output, NO
14, 24, 34  Safety output, NO
41  Output, NC
42  Output, NC
7 Application connections

7.1 Connection examples

A. Two signals from T1/T2

Note! Always use transient suppressors when inductive loads are connected to the relay outputs.
7.2 Two channels connection with equivalent contacts

Two channels connection with equivalent contacts from T1/T2
Both contacts must be closed before the safety relay can be set in active mode. Opening one or both of the contacts inactivates the safe outputs. Both contacts must be opened and re-closed before the outputs can be reactivated. T1/T2 must be used.
8 Configuration

8.1 Setting switch
Use the switch (S) to change settings for Off-delay to 0.5 s (A) or 1.5 s (B).

8.2 Output groups
The delay time settings have effect on all the safety relay outputs.

8.3 Timer settings

Note! A setting can only be stored when the relay is in Setting mode.

To change the time delay setting
1. Set the switch to the new setting
2. Set the switch back
3. Set the switch to the new setting

The setting will be stored and the front LEDs will light up. At this state the storing of the setting needs to be completed with a power cycle.

<table>
<thead>
<tr>
<th>Setting mode indication</th>
<th>MODELED</th>
<th>CH2LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1LED</td>
<td>red</td>
<td>red</td>
</tr>
<tr>
<td>flashing blue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dependent on if input channels and test circuit is connected, the front LEDs will light up.

<table>
<thead>
<tr>
<th>Indication during operation</th>
<th>MODELED</th>
<th>CH2LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1LED</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td>green</td>
<td>green</td>
</tr>
<tr>
<td>blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td>green</td>
<td>green</td>
</tr>
<tr>
<td>green</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The relay is now operational with the new setting.
9 Maintenance

9.1 Maintaining precautions

⚠️ **Warning!**
Comply to maintenance precautions. Risk of severe personal injury.

A defective safety relay shall be replaced with a new. Never bypass the safety circuit. Repair and exchange of parts of the safety relay is forbidden. That may impair the safety of the system and could lead to serious personal injury. In case of breakdown or damage to the safety relay, contact nearest ABB Electrification service office or reseller.

ABB will not accept responsibility for failure of the functions if the installation and maintenance requirements shown in this document are not implemented. These requirements form part of the product warranty.

9.2 Scheduled test

**Scheduled test, high demand application**
All safety relays and connected safety devices used in high demand applications must be tested once a year.

**Scheduled test, low demand application**
All safety relays and connected safety devices used in low demand applications must be tested every third year.

**Test sequence**
Test should be conducted according to:
1. Set inputs to inactivate outputs.
2. Wait until all outputs are in off-state.
3. Set inputs to activate outputs.
4. Monitor that outputs are activated.
10 Troubleshooting

10.1 Front LEDs

A. CH1 Safety input channel 1 status
B. MODE Mode status
C. CH2 Safety input channel 2 status

10.2 LED operation indication and error status

<table>
<thead>
<tr>
<th>CH1</th>
<th>Mode</th>
<th>CH2</th>
<th>Status</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>off</td>
<td>off</td>
<td>The safety relay is not powered</td>
<td>Check A1–A2 voltage and connections</td>
</tr>
<tr>
<td>green</td>
<td>green</td>
<td>green</td>
<td>CH1 and CH2 accepted. Reset made and outputs activated.</td>
<td></td>
</tr>
<tr>
<td>off</td>
<td>flash green</td>
<td>off</td>
<td>CH1 and CH2 unaccepted. A timer function is counting down while the safety relay remains activated</td>
<td></td>
</tr>
<tr>
<td>CH1</td>
<td>Mode</td>
<td>CH2</td>
<td>Status</td>
<td>Action</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>------</td>
<td>---------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>off</td>
<td>flash green</td>
<td>green</td>
<td>CH1 unaccepted and CH2 accepted. A timer function is counting down while the safety relay remains activated.</td>
<td></td>
</tr>
<tr>
<td>green</td>
<td>flash green</td>
<td>off</td>
<td>CH1 accepted and CH2 unaccepted. A timer function is counting down while the safety relay remains activated.</td>
<td></td>
</tr>
<tr>
<td>off</td>
<td>blue</td>
<td>off</td>
<td>No channels accepted</td>
<td>Check CH1 and CH2</td>
</tr>
<tr>
<td>off</td>
<td>blue</td>
<td>green</td>
<td>CH1 unaccepted, CH2 accepted</td>
<td>Check CH1</td>
</tr>
<tr>
<td>green</td>
<td>blue</td>
<td>off</td>
<td>CH1 accepted, CH2 unaccepted</td>
<td>Check CH2</td>
</tr>
<tr>
<td>green</td>
<td>blue</td>
<td>green</td>
<td>CH1 and CH2 accepted, the safety relay wait for reset</td>
<td>Check reset settings, wiring and reset/test circuit</td>
</tr>
<tr>
<td>green</td>
<td>blue</td>
<td>fast flash green</td>
<td>Two-channels error: CH2 has been unaccepted and then accepted again while CH1 remained accepted.</td>
<td>Check installation. Restore by opening and closing both CH:s at the same time</td>
</tr>
<tr>
<td>fast flash green</td>
<td>blue</td>
<td>green</td>
<td>Two-channels error: CH1 has been unaccepted and then accepted again while CH2 remained accepted.</td>
<td>Check installation. Restore by opening and closing both CH:s at the same time</td>
</tr>
<tr>
<td>fast flash green</td>
<td>blue</td>
<td>fast flash green</td>
<td>Reading error on R1 and R2</td>
<td>Check installation. Restore by opening and closing both CH:s at the same time</td>
</tr>
<tr>
<td>red</td>
<td>fast flash blue</td>
<td>red</td>
<td>Fail-safe mode, a new setting has been stored</td>
<td>Power cycle the unit to use the new setting</td>
</tr>
<tr>
<td>red</td>
<td>flash red</td>
<td>red</td>
<td>Fail-safe mode, the system is waiting for a new setting</td>
<td>Change the timer setting switch</td>
</tr>
<tr>
<td>CH1</td>
<td>Mode</td>
<td>CH2</td>
<td>Status</td>
<td>Action</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>---------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>red</td>
<td>fast flash red</td>
<td>red</td>
<td>The safety relay is in failsafe mode</td>
<td>Check installation and power cycle</td>
</tr>
<tr>
<td>red</td>
<td>fast flash red</td>
<td>fast flash red</td>
<td>Failsafe mode due to short circuit between CH2 and 24 VDC or T1</td>
<td>Check and remove the short circuit</td>
</tr>
<tr>
<td>fast flash red</td>
<td>fast flash red</td>
<td>red</td>
<td>Failsafe mode due to short circuit between CH1 and 24 VDC or T2</td>
<td>Check and remove the short circuit</td>
</tr>
</tbody>
</table>
11 Model overview

11.1 Sentry models

The connection blocks are delivered without coding. The coding kit is an optional accessory and is ordered separately.

<table>
<thead>
<tr>
<th>Model</th>
<th>Order code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSR10</td>
<td>2TLA010040R0000</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>BSR10P</td>
<td>2TLA010040R0001</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>BSR11</td>
<td>2TLA010040R0200</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>BSR11P</td>
<td>2TLA010040R0201</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>BSR23</td>
<td>2TLA010041R0600</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>BSR23P</td>
<td>2TLA010041R0601</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR10</td>
<td>2TLA010050R0000</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR10P</td>
<td>2TLA010050R0001</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR10M</td>
<td>2TLA010050R0100</td>
<td>Screw compression connection blocks. 85-265VAC/120-375VDC</td>
</tr>
<tr>
<td>SSR10MP</td>
<td>2TLA010050R0101</td>
<td>Push-in connection blocks. 85-265VAC/120-375VDC</td>
</tr>
<tr>
<td>SSR20</td>
<td>2TLA010051R0000</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR20P</td>
<td>2TLA010051R0001</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR20M</td>
<td>2TLA010051R0100</td>
<td>Screw compression connection blocks. 85-265VAC/120-375VDC</td>
</tr>
<tr>
<td>SSR20MP</td>
<td>2TLA010051R0101</td>
<td>Push-in connection blocks. 85-265VAC/120-375VDC</td>
</tr>
<tr>
<td>SSR32</td>
<td>2TLA010052R0400</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR32P</td>
<td>2TLA010052R0401</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR42</td>
<td>2TLA010053R0400</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>SSR42P</td>
<td>2TLA010053R0401</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>TSR10</td>
<td>2TLA010060R0000</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>TSR10P</td>
<td>2TLA010060R0001</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>Model</td>
<td>Order code</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>TSR20</td>
<td>2TLA010061R0000</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>TSR20P</td>
<td>2TLA010061R0001</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>TSR20M</td>
<td>2TLA010061R0100</td>
<td>Screw compression connection blocks.</td>
</tr>
<tr>
<td>TSR20MP</td>
<td>2TLA010061R0101</td>
<td>Push-in connection blocks. 85-265VAC/120-375VDC</td>
</tr>
<tr>
<td>USR10</td>
<td>2TLA010070R0000</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>USR10P</td>
<td>2TLA010070R0001</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
<tr>
<td>USR22</td>
<td>2TLA010070R0400</td>
<td>Screw compression connection blocks. 24VDC</td>
</tr>
<tr>
<td>USR22P</td>
<td>2TLA010070R0401</td>
<td>Push-in connection blocks. 24VDC</td>
</tr>
</tbody>
</table>

11.2 **Accessories and spare parts**

<table>
<thead>
<tr>
<th>Type</th>
<th>Order code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection block</td>
<td>2TLA010099R0000</td>
<td>Screw compression type</td>
</tr>
<tr>
<td>Connection block</td>
<td>2TLA010099R0001</td>
<td>Push-in type</td>
</tr>
<tr>
<td>Coding kit</td>
<td>2TLA010099R0100</td>
<td>For coding connection block</td>
</tr>
</tbody>
</table>
12 Dimensions

All dimensions are in mm.

12.1 Sentry

<table>
<thead>
<tr>
<th>Measure</th>
<th>Connection block type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Screw connection type</td>
</tr>
<tr>
<td>A</td>
<td>120</td>
</tr>
<tr>
<td>B</td>
<td>22.5</td>
</tr>
<tr>
<td>C</td>
<td>120</td>
</tr>
</tbody>
</table>
13 Technical data

13.1 Technical data

Manufacturer
ABB Electrification Sweden AB
SE-721 61 Västerås
Sweden

Note! While every effort has been taken to ensure the accuracy of the information contained in this document, ABB cannot accept responsibility for errors or omissions and reserves the right to make changes and improvements without notice. Performance data given in this document is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of ABB's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the ABB Warranty and Limitations of Liability.

Note! There may be working points that will lead to higher performance for a specific application. An example would be the combination of installation distance between products, total load current and ambient temperature.

Caution! The difference between absolute maximum rating and max operating rating is the following: The product will have full performance as long as all parameters are within operating rating, in any combination. If any of the values in Absolute maximum rating are exceeded, the relay must be disposed.

### Absolute maximum rating

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum voltage rating for A1 and A2 Note 2</td>
<td>275 VAC or 385 VDC</td>
</tr>
<tr>
<td>Maximum voltage rating for R Note 2</td>
<td>30 VDC</td>
</tr>
<tr>
<td>Maximum voltage rating for X1 Note 2</td>
<td>30 VDC</td>
</tr>
<tr>
<td>Maximum voltage rating for X4 Note 2</td>
<td>30 VDC</td>
</tr>
<tr>
<td>Maximum operating breaking voltage for relay contacts</td>
<td>500 Vp</td>
</tr>
<tr>
<td>Maximum voltage rating for NO/NC contacts</td>
<td>265 VAC or 350 VDC</td>
</tr>
<tr>
<td>Maximum current rating for 1 NO relay contact</td>
<td>8 A</td>
</tr>
<tr>
<td>Maximum current rating for 1 NC relay contact</td>
<td>5 A</td>
</tr>
<tr>
<td>Maximum load capacity, $\Sigma l_{th}^2$ Note 1</td>
<td>$\leq 72^2$</td>
</tr>
</tbody>
</table>

**Note 1:** $\Sigma l_{th}^2$ is the sum of the square for each relay output contact. For example: $I_1 = 2$ AMPS; $I_2 = 4$ AMPS; $I_3 = 5$ AMPS; $I_4 = 1$ AMPS → $\Sigma l_{th}^2 = 4 + 16 + 25 + 1 = 46^2$

**Note 2:** Fault voltages up to 60 V is not dangerous but the safety relay might be broken or its performance might be degraded.

### Power supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply type</td>
<td>Mains</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>II</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>4 kV</td>
</tr>
</tbody>
</table>
### Power supply

- **Operating voltage**: 85 – 265 VAC (50/60 Hz) or 120 – 375 VDC
- **Terminal connection**: A1 = Line and A2 = Neutral
- **Consumption**: 12VA
- **Internal consumption**: 12VA
- **Required fuse**: 4 A gG external fuse is required (According to UL248: any (JDYX/7) Fast acting, Ratings 250V, 4A, IR200A)

### Relay output specification

- **Relay output configuration**: 3 NO + 1 NC
- **Maximum operating switching voltage**: 250 VAC
- **Overvoltage category**: II
- **Rated impulse withstand voltage**: 4 kV
- **Rated operational voltage**: 250 VAC
- **Minimum operating contact load**: 5 VDC / 10 mA (15 VDC / 3 mA)
- **Maximum operating switching frequency**: 0.5 Hz
- **Rated isolation voltage**: 400 V

**Note!** In a 400 V system a 3 phase load shall only be used in a star connection.

### NO contact

<table>
<thead>
<tr>
<th>AC load (AC15, AC1)</th>
<th>Rated operating voltage (Ue)</th>
<th>250 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating current (Ie)</td>
<td>1 contact</td>
<td>5A</td>
</tr>
<tr>
<td></td>
<td>2 contacts</td>
<td>5A</td>
</tr>
<tr>
<td></td>
<td>3 contacts</td>
<td>4.6A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC load (DC13, DC1)</th>
<th>Rated operating voltage (Ue)</th>
<th>+24 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating current (Ie)</td>
<td>1 contact</td>
<td>6A</td>
</tr>
<tr>
<td></td>
<td>2 contacts</td>
<td>5.6A</td>
</tr>
<tr>
<td></td>
<td>3 contacts</td>
<td>4.6A</td>
</tr>
</tbody>
</table>

**Required fuse**: 6.3 A gG, >=1 kA short circuit protection (6 A according to UL248)

### NC contact

<table>
<thead>
<tr>
<th>AC load (AC15, AC1)</th>
<th>Rated operational voltage (Ue)</th>
<th>250 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational current (Ie)</td>
<td>0.5A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC load (DC13, DC1)</th>
<th>Rated operational voltage (Ue)</th>
<th>+24 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational current (Ie)</td>
<td>2A</td>
<td></td>
</tr>
</tbody>
</table>

**Required fuse**: 4 A gG (4 A according to UL 248)

### T1/T2 safety device interface specification

#### Output (O) T1 and T2

<table>
<thead>
<tr>
<th>Output high voltage (VOH)</th>
<th>Minimum</th>
<th>15.8 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>25.6 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8 VDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum output low voltage (VOLmax)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output current Note 2</td>
<td>50 mA</td>
</tr>
<tr>
<td>Signal frequency</td>
<td>5 Hz ±1 Hz</td>
</tr>
<tr>
<td>Pulse length</td>
<td>500 μs ±100 μs</td>
</tr>
</tbody>
</table>
### T1/T2 safety device interface specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum capacitance to ground</td>
<td>100 nF</td>
</tr>
</tbody>
</table>

**Note 1:** VOH typical = power supply voltage -2.8 VDC  
**Note 2:** Current limited internally to typical 70 mA

### R1/R2 safety device interface specification

**Input (I) R1 and R2**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum operating input voltage</td>
<td>27.6 VDC</td>
</tr>
<tr>
<td>Minimum input high voltage (VIH)</td>
<td>9.8 VDC</td>
</tr>
<tr>
<td>Maximum input low voltage (VIL)</td>
<td>6 VDC</td>
</tr>
<tr>
<td>Typical input impedance</td>
<td>1.5 kΩ</td>
</tr>
<tr>
<td>Maximum current sink (Isink)</td>
<td>20 mA</td>
</tr>
</tbody>
</table>

**Note 1:** Voltage level above VIH is interpreted as logic “1”, in worst case operating conditions.  
**Note 2:** Voltage level below VIL is interpreted as logic “0”, in worst case operating conditions.  
**Note 3:** If VIH ≥15 VDC is applied to R1 and R2 (Isink is typical 2.8/VDCR).

### Test/start/reset interface specification

**Input (I) X1**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum input high voltage (VIH)</td>
<td>9.8 VDC</td>
</tr>
<tr>
<td>Maximum input low voltage (VIL)</td>
<td>6 VDC</td>
</tr>
<tr>
<td>Typical input impedance</td>
<td>800 Ω</td>
</tr>
</tbody>
</table>

**Input (I) X4**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum input high voltage (VIH)</td>
<td>13.2 VDC</td>
</tr>
<tr>
<td>Maximum input low voltage (VIL)</td>
<td>9.0 VDC</td>
</tr>
<tr>
<td>Typical input impedance</td>
<td>5 kΩ</td>
</tr>
<tr>
<td>Square wave signal frequency for automatic reset configuration/ manual reset configuration</td>
<td>Minimum 98 Hz, Maximum 102 Hz</td>
</tr>
<tr>
<td>Maximum current sink (Isink)</td>
<td>20 mA</td>
</tr>
</tbody>
</table>

**Note 1:** Voltage level above VIH is interpreted as logic “1”, in worst case operating conditions.  
**Note 2:** Voltage level below VIL is interpreted as logic “0”, in worst case operating conditions.

### Response time

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay at power on</td>
<td>≤ 1.5 s</td>
</tr>
<tr>
<td>Response time at activation</td>
<td></td>
</tr>
<tr>
<td>Automatic reset</td>
<td>≤ 50 ms</td>
</tr>
<tr>
<td>Manual reset</td>
<td>≤ 50 ms</td>
</tr>
<tr>
<td>Response time at inactivation</td>
<td>≤ 20 ms</td>
</tr>
</tbody>
</table>

**Note 1:** Additional 500 ms input acceptance delay for pressure sensitive device

### Electrical operations lifetime

| Load Σ lth ² | AC1, AC15 | 160 000 operations  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC1, DC13</td>
<td>100 000 operations</td>
</tr>
</tbody>
</table>
### Electrical operations lifetime

**Measurement conditions:**

- Maximum breaking voltage for relay contacts: 250 V
- Maximum switching voltage for relay contacts: 400 V
- Rated current
- Switching frequency ≤ 0.1 Hz (Switching frequency > 0.1 Hz will shorten life.)
- T ≤ 55 °C
- No arc suppression (Usage of arc suppression will prolong life but may increase response time at inactivation.)
- 3 phase load in a star connection.

### Mechanical data

<table>
<thead>
<tr>
<th>Material</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>190 – 230 g</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>PA66 with 25 % fiberglass (UL94 V0)</td>
</tr>
<tr>
<td>Connection block, screw compression type</td>
<td>PA66 (UL94 V0)</td>
</tr>
<tr>
<td>Connection block, push-in type</td>
<td>PA66 with 25 % fiberglass (UL94 V0)</td>
</tr>
<tr>
<td>Opener, push-in type</td>
<td>PBT/GF (UL94 V0)</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>Yellow</td>
</tr>
<tr>
<td>Connection block, screw compression type</td>
<td>Black</td>
</tr>
<tr>
<td>Connection block, push-in type</td>
<td>Black</td>
</tr>
<tr>
<td>Opener, push-in type</td>
<td>Orange</td>
</tr>
<tr>
<td><strong>Attachment requirements</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35 mm DIN rail (DIN 50022)</td>
</tr>
</tbody>
</table>

### Environmental data

| Pollution degree       | II             |
| Protection class       | Safety relay   |
| Enclosure for installation | At least IP54. Lockable. |
| **Ambient temperature range for operation within specified operation range** | -25°C – +55°C |
| **Ambient temperature range for storage** | -40°C ≤ Ta ≤ +70°C |
| **Humidity range for operation** | 10 % ≤ Rh ≤ 90 %, no icing, occasional condensation |
| **Humidity range for storage** | 10 % ≤ Rh ≤ 95 %, no icing, occasional condensation |
| **Maximum temperature gradient** | 2°C/min |
| **Altitude**           | Suitable for use at ≤ 2000 meters above sea level |
| **Vibration**          | 10-55 Hz sine, 0.35 mm (1 oct/min 20 sweep cycles, all directions) |
| **Shock**              | 5g, 11 ms Half sine +/- 100 Shocks |
## EU Directive Compliance

| Directives | European Machinery Directive 2006/42/EC  
EMC Directive 2014/30/EU  
RoHS Directive 2011/65/EU  
RoHS3 Directive 2015/863 |

## UK Regulations Compliance

| Regulations | 2008 No.1597 Supply of Machinery (Safety) Regulations (MD)  
2012 No.3032 Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations (RoHS)  
2016 No.1091 Electromagnetic Compatibility Regulations (EMC) |

## US/CA Compliance

| Application standard compliance | UL 60947-5-1:2014  
CSA C22.2 No. 60947-5-1:2014  
CSA B44.1 |

## Standard compliance and approvals

| Application standard compliance | EN ISO 13851:2019  
EN ISO 13856-1:2013  
EN ISO 13856-2:2013  
EN ISO 13856-3:2013 |
| Functional safety standard compliance | IEC 61508-1–4:2010, up to SIL3  
EN ISO 13849-1:2015, up to PLe/Cat.4  
EN 62061:2005, up to SILCL3  
EN 61511:1:2003  
UL 61508 |
| Electrical safety standard compliance | EN 50178-1:1997  
EN 60204-1:2018  
EN 60664-1:2007  
IEC 60947-5-1:2009 |
| Electromagnetic compatibility standard compliance | EN 61326-3-1:2008 |

## Approvals

| CE  
TÜV SÜD  
cULus  
CCC  
RCM  
S  
KC  
UKCA |
### Standard

<table>
<thead>
<tr>
<th>Standard</th>
<th>PFH&lt;sub&gt;D&lt;/sub&gt; 4.9E-9 and PFD 7.4E-5 (see chapter 8.2 Scheduled test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 61508</td>
<td></td>
</tr>
<tr>
<td>EN ISO 13849-1, EN 62061</td>
<td>PFH&lt;sub&gt;D&lt;/sub&gt; 4.9E-9</td>
</tr>
<tr>
<td>Mission time</td>
<td>20 years</td>
</tr>
</tbody>
</table>

### Information for use in USA/Canada

<table>
<thead>
<tr>
<th>Intended use</th>
<th>Applications according to NFPA 79</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power source</td>
<td>A suitable isolating source in conjunction with a fuse in accordance with UL248. The fuse shall be any (JDYX/7) fast acting, ratings 250V, 4 A, IR200A, and be installed in the +24 VDC and 230VAC power supply to the device in order to limit the available current.</td>
</tr>
</tbody>
</table>
Declaration of conformity
# EC Declaration of conformity

(according to 2006/42/EC, Annex 2A)

We ABB Electrification Sweden AB
SE-721 61 Västerås
Sweden

declare that the safety components of ABB AB manufacture
with type designations and safety functions as listed below, is
in conformity with the Directives
2006/42/EC - Machinery
2014/30/EU - EMC
2011/65/EU - RoHS
2015/863 - RoHS3

Authorised to compile the technical file
ABB Electrification Sweden AB
SE-721 61 Västerås
Sweden

**Product**
Safety relay
Sentry, all versions of
USR10, USR22, SSR10M, SSR10, SSR20M, SSR20, SSR32, SSR42,
TSR10, TSR20M, TSR20, BSR10, BSR11, BSR23

**EC type-examination certificate**
M6A 049833 0032 Rev.00

**Notified Body**
TÜV Süd Product Service GmbH
Ridlerstrasse 65
80339 München
Germany
Notified body No. 0123

**Used harmonized standards**
EN ISO 12100:2010, EN ISO 13849-1:2015,

**Other used standards**
EN 61508:2010

Magnus Backman
R&D Manager
Kungsbacka 2021-11-02

*abb.com/lowvoltage

Original
## Declaration of conformity

(according to 2008 No 1597)

We ABB Electrification
Sweden AB
SE-721 61 Västerås
Sweden declare that the safety components of ABB AB manufacture with type
designations and safety functions as listed below, is in conformity
with UK Statutory Instruments (and their amendments)
2008 No 1597 – Supply of Machinery (Safety) Regulations (MD)
2016 No. 1091 – Electromagnetic Compatibility Regulations (EMC)
2012 No 3032 – Restriction of the Use of Certain Hazardous
Substances in Electrical and Electronic Equipment Regulations
(RoHS)

### Authorised to compile the technical file

ABB Ltd. Tower Court
Coventry CV6 5NX
United Kingdom

### Product

Safety relay Sentry

- USR10, USR22,
- SSR10M, SSR10, SSR20M,
- SSR20, SSR32, SSR42,
- TSR10, TSR20M, TSR20,
- BSR10, BSR11, BSR23

### Used designated standards

- EN ISO 12100:2010, EN ISO 13849-1:2015,

### Other used standards

- EN 61508:2010

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Magnus Backman
R&D Manager
Västerås 2021-03-28

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Original