Read and understand this document

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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.

ℹ️ 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. Display.
E. Increment button.
F. Select button.
G. LEDs for status indication.
H. Print for connection block, top side back.
J. Print for connection block, top side front.
K. Print for connection block, bottom side front.
L. Print for connection block, bottom side back.
M. Connection block, bottom side front.
N. Connection block, bottom side back.
P. 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 (100nF - 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, 24 VDC

Relay output
- 3 NO + 1 NC

Safety device interface
- One channel connection
- Two channels with equivalent contacts
- Two channels with antivalent contacts
- Two channels OSSD
- Pressure sensitive device
- Two-hand device

Test, start and reset interface
- Automatic reset
- Manual reset
- Multi reset

Timer function
- Off-delay 0.5 s
- Off-delay 1.5 s
- Off-delay 0 – 999 s
- On-delay 0 – 999 s
- Time bypass 0 – 999 s
- Time reset 0 – 999 s

Features
- Display
- Error status code
- Password

5.2 Power supply

24 VDC

The safety relay and the safety devices are supplied with 24 VDC and common shared ground.

⚠️ Warning! The power supply must be of type PELV/SELV

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.

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.

5.7 **Manual reset**

⚠️ **Warning!** Always use the manual reset function when a reset button is installed.

When at least one input safety signal is not accepted, the safety relay enters to inactive mode. The MODE LED is blue and at least one of the CH1/CH2 LEDs will turn OFF and the reset button light is static on.

When the safety input safety signals are accepted, the CH1 LED and the CH2 LED are green and the MODE LED is blue. The reset button light is flashing to indicate that a reset is possible. To reset the safety circuit, press the reset button for 0.05 s to 2 s. The relay goes to active mode and the button light turns off when the button is released (falling edge).

A reset button light test can be executed by pressing the reset button in active mode.

5.8 **Multi-reset**

It is possible to use one reset button to reset up to ten safety relays while maintaining the reset button light function.
6 Connections

6.1 Connection groups

The connections are divided into groups.

A (+) Power supply
T (−) Signal to safety device
R CH1 Signal from safety device
X Test/reset/start/indication
X1 CH2
X2 MODE
X3 SENTRY
X4 USR10

13, 23, 33 Safety output, NO
14, 24, 34 Safety output, NO
41 Output, NC
42 Output, NC

+24 VDC
### 7 Application connections

#### 7.1 Connection examples

A. One signal from T1/T2  
B. One signal from T1  
C. Two OSSD signals  
D. Two signals from +24VDC  
E. One Signal from +24VDC  
F. Autoreset  
G. Antivalent signals from +24VDC  
H. Antivalent signals from T1/T2  
J. Mat/Bumper/Safety edge  
K. Two-hand device  

**Note!** Always use transient suppressors when inductive loads are connected to the relay outputs.
7.2 One channel connection

The safety device contact must be closed before the safety relay can be set in active mode. Opening of the safety device contact inactivates the safe outputs.

One channel connection, +24 VDC static signal

7.3 Two channels connection with equivalent contacts

Both contacts must be closed before the safety relay can be set in active mode. Opening one or both contacts inactivate the safe outputs. Both contacts must be opened and closed before the outputs can be activated. A short-circuit between the safety inputs is not monitored by the safety relay if T connections are not used. In this case category 4 can only be achieved if a safety device with short-circuit monitored outputs is connected.
7.4 Two channels connection with antivalent contacts

In the example the R1 contact must be closed and the R2 contact must be opened before the safety relay can be set in active mode. Switching one or both of the contacts inactivates the safety relay. If T1/T2 are used gives short circuit detection. Both contacts must switch from their initial position and back again before the outputs can be activated.

7.5 Two channels OSSD connection

Safety devices with dual OSSD outputs can be connected to R1 and R2. Short-circuit between the signals and to 24V DC are detected by the safety device from where the OSSD-signal originates.
### 7.6 Pressure sensitive device connection

Both T1/R1 and T2/R2 safety inputs must be used for this function. The total resistance of the circuit including inactivated pressure sensitive devices and cables is shown in chapter.

A force activated pressure sensitive device will result in a short-circuit over T1/R1 and T2/R2. A short-circuit will inactivate the safety relay output.

T1 and R1 shall be separated in different cables. T2 and R2 shall be separated in different cables.

### Pressure sensitive device connection with square wave signals

A short-circuit to +24 VDC or 0 V will give an unaccepted signal. All 4 contacts must leave and return to their unactuated positions before a new accepted signal can be given.

### 7.7 Two-hand device connection

A two-hand device has 2 NO and 2 NC contacts. These 4 contacts must be activated within 0.5 seconds in order for the signals to be accepted by the safety relay. If any of the 4 safety device contacts is inactivated during the process the signal will be unaccepted.

A short-circuit to +24 VDC or 0 V will give an unaccepted signal. All 4 contacts must leave and return to their unactuated positions before a new accepted signal can be given.
7.8 Reset button connection example

To use the multi-reset function the X1 inputs must be connected in parallel from the reset button. The X4 outputs must be parallel connected to the reset button indication light. All the safety relays involved in the multi-reset chain must be set to manual reset.

Connection example of reset button including indication light.

<table>
<thead>
<tr>
<th>Mixed state examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SR1</strong></td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>A</td>
</tr>
</tbody>
</table>

\text{A} = \text{Active}. The reset button light is turned off.
\text{I}_{\text{WFL}} = \text{Inactive}, waiting for reset. The input signals are accepted, the reset button light is flashing, waiting for a button press.
\text{I} = \text{Inactive}. The input signals are not accepted and the reset button light is constant on.
8 Configuration

The safety relay starts in configuration mode the first time it is used. Configuration mode is indicated with flashing segments on the display. The safety relay must be configured and power cycled (power off and on) before it is in operation. The safety relay can be configured into preset mode or custom mode.

The safety relay must be in configuration mode in order to change the settings. To enter configuration mode, enter correct password or perform a factory reset. The factory preset password is 000. Navigate through available presets by pressing the increment button. The custom mode is available after the last preset choice.

Note! A safety relay in preset mode does not have the password function.

Note! Before a new configuration of a preset configured safety relay is possible, a factory reset must be performed.

8.1 Buttons

Two buttons are used to navigate in the configuration menus for preset mode and custom mode.

Increment button (A)
The Increment button is used to increase the value that is shown on the display, for example the value for a timer setting or to step to the next option in a setting.

To increase the value for a setting:
- Push the Increment button 0.1-0.5 s.

Select button (B)
The Select button is used to step between settings and to confirm settings.

To step between settings:
- Push the Select button 0.1 – 0.5 s.

To confirm a setting:
- Push and hold the Select button more than 0.5 s.
8.2 Display
The display is placed in the upper part of the front panel. The display consists of three seven-segment digits. The display is used for navigation in the setting menus. Error codes are also shown on the display.

8.3 Password
A three-digit password will be set when using customized settings. The factory preset password is 000.

Note! The password is not for security, but to prevent unintentional changes of settings in the safety relay.

8.4 Timer settings
The delay function can be set to on-delay, off-delay, time reset or bypass. The delay time can be set to 0-999 seconds with 100 ms granularity.

8.5 Factory reset
Factory reset erases all settings included the password, except for the error codes. The safety relay will enter configuration mode after a factory reset. To do a factory reset:
- Push and hold the Increment button and the Select button for 5 seconds.

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

8.7 Preset
The preset function modes can be used to configure the safety relay for the most common types of applications. To set other functions, custom mode must be used. The safety relay has seven presets, to cover the most common usage. No timer settings are available in the presets.

8.8 Settings in preset mode
Preset mode has specified settings according to applicable type of safety device connection. A number of selectable pre-defined settings, where each type of setting has a combination of parameters for signal type, reset type, timer delay and time.

Note! The wiring for automatic/manual reset has to be fulfilled to complete the reset functionality.

<table>
<thead>
<tr>
<th>[P.0X]</th>
<th>Configuration</th>
<th>Signal type</th>
<th>Reset</th>
<th>Timer delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.01</td>
<td>Equivalent contacts</td>
<td>2 x NO, 24 VDC or signal from T1/T2</td>
<td>Manual reset</td>
<td>No-delay</td>
</tr>
<tr>
<td>P.02</td>
<td>Equivalent contacts</td>
<td></td>
<td>Automatic reset</td>
<td></td>
</tr>
<tr>
<td>P.03</td>
<td>Antivalent contacts</td>
<td>NO + NC, 24 VDC or signal from T1/T2</td>
<td>Manual reset</td>
<td></td>
</tr>
<tr>
<td>P.04</td>
<td>Antivalent contacts</td>
<td></td>
<td>Automatic reset</td>
<td></td>
</tr>
</tbody>
</table>
### 8.9 Configuration in preset mode

1. **Preset mode.**
   a. Push the Increment button to select type of preset configuration or to select custom mode [CUS].
   b. Push the Select button to step to the store mode [STO].

2. **Store mode.**
   a. Push and hold the Select button to store the configuration.
   b. Push the Select button to return to Preset mode.

3. **Failsafe mode waiting for power cycling.**
   a. Power cycle (power off and on) the safety relay.

4. **The safety relay is in operation mode with a preset configuration.**
   a. Power cycle (power off and on) the safety relay.

5. **The safety relay is in operation mode with a preset configuration.**

### 8.10 Settings in custom mode

The Custom mode must be used to get a function which is not available with the preset alternatives. The configuration parameters are set manually in custom mode.
8.11 Configuration in custom mode

After a factory reset, the custom configuration mode is reached from the preset menu. Push the increment button several times until you see the blinking “CUS” text on the display. This entry is shown to indicate Custom mode.

Custom configuration mode can also be reached directly, by entering the correct password in custom operation mode.

1. Custom entry.
   a. Push and hold the select button to step to the Configuration setting.

2. Configuration setting.
   a. Push the increment button to select configuration [C.01-C.04].
   b. Push the select button to step to the Reset setting.

3. Reset setting.
   a. Push the increment button to select Manual reset [r.01] or Automatic reset [r.02].
   b. Push the select button to step to the Timer delay type setting.

4. Timer delay type.
   a. Push the increment button to select Timer delay type [d.01-d.04].
b. Push and hold the select button to step to the Time setting.
c. Push the select button to step to the Password setting.

5. Time setting.
a. Push the increment button to select the Delay time.
b. Push and hold the select button to step to the Timer delay type setting.
c. Push the select button to step to the next segment.

6. Password setting is shown.
a. Push and hold the select button to step to Password entry.
b. Push the select button to step to the Store mode.

7. Password entry.
a. Push the increment button to increment the flashing segment.
b. Push the select button to step to the next segment.
c. Push and hold the select button to verify the password.

8. Store mode.
a. Push and hold the select button to store the settings.
b. Push the select button to return to Custom entry.

9. Fail safe mode waiting for power.
a. Power cycle the safety relay.

10. The safety relay is in operation mode with a custom configuration.

### 8.12 Operation mode with preset

1. Preset entry. This entry is shown to indicate the current preset mode.
   a. Push the select button to step to the timer setting.

2. Timer setting.
   a. Push the select button to step to the Log entry.

3. Log entry.
   a. Push and hold the select button to enter the logged error codes.
   b. Push the select button to step to the preset entry.

4. Logged error codes. The latest 10 errors can be displayed, where 0.XX is the latest error code and 9.XX is the oldest error code.
   a. Push the increment button to increment the error code number.
   b. Push and hold the select button to return to the Log entry.
8.13 Operation mode with custom configuration

1. Custom entry. This entry is shown to indicate Custom mode. During countdown, the remaining time is displayed.
   a. Push the select button to step to the Configuration setting.

2. Configuration setting.
   a. Push the select button to step to the Reset setting.

3. Reset setting.
   a. Push the select button to step to the Timer delay setting.

4. Timer delay setting.
   a. Push and hold the select button to enter the Timer delay timeout value.
   b. Push the select button to step to the Log entry.

5. Timer delay timeout value.
   a. Push and hold the select button to return to the Timer delay setting.

   a. Push and hold the select button to enter the Logged error codes.
   b. Push the select button to step to the Password setting.

7. Logged error codes. The latest 10 errors can be displayed, where 0.XX is the latest error code and 9.XX is the oldest error code.
   a. Push the increment button to increment the error code number.
   b. Push and hold the select button to return to the Log entry.

8. Password setting.
   a. Push and hold the Select button to enter the new password.
   b. Push the select button to step to the Custom entry.

   a. Push the increment button to increment the flashing segment.
   b. Push the select button to step to the next segment.
c. Push and hold the select button to verify the password. If the password is correct the safety relay will enter fail safe mode and the configuration can be updated. If the password is incorrect the display will show “Err” for a short while and return to the Password entry. See Configuration in custom mode for further action.

8.14 Delay functions

**On-delay.** When all safety input signals are accepted and a reset has been done, a countdown starts. After the set delay time the output activates.

\[
\begin{array}{c}
\text{In} \\
\text{u} \\
\text{A} \\
\text{SR} \\
\end{array}
\]

If at least one signal goes unaccepted within the set time, the output remains inactivated.

\[
\begin{array}{c}
\text{In} \\
\text{u} \\
\text{A} \\
\text{SR} \\
\end{array}
\]

**Off-delay.** When at least one input signal becomes unaccepted, a countdown starts. After the set time, the output is inactivated.

\[
\begin{array}{c}
\text{In} \\
\text{u} \\
\text{A} \\
\text{SR} \\
\end{array}
\]

If the input condition becomes unaccepted and accepted again within the delay time period, the output will remain activated. Safety input signals go high within the delay time period.

\[
\begin{array}{c}
\text{In} \\
\text{u} \\
\text{A} \\
\text{SR} \\
\end{array}
\]

**Timer reset.** The output activates during a set time when the input conditions become unaccepted. At the same time a countdown starts. After the set delay time the output inactivates.

\[
\begin{array}{c}
\text{In} \\
\text{u} \\
\text{A} \\
\text{SR} \\
\end{array}
\]
If the input conditions become accepted again within the set time, the output will be inactivated. Stopped timer reset function.

Timer bypass. When the safety input signals are accepted and a reset has been done, the output is activated, and a countdown starts. The output will be inactivated after the set time or if the input signals become unaccepted during the countdown.

If at least one input signal becomes unaccepted within the set time, the output will be inactivated. Timer bypass function when the input conditions become unaccepted during the countdown.

In: Input conditions
a: Accepted safety inputs and reset
u: Unaccepted safety inputs
SR: Safety relay output
A: Activated output
I: Inactivated output
T: Time
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 and display

A. Display
B. CH1 Safety input channel 1 status
C. MODE Mode status
D. 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 done 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>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>Check CH1 and CH2</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 and CH2</td>
</tr>
<tr>
<td>green</td>
<td>blue</td>
<td>off</td>
<td>CH1 accepted, CH2 unaccepted</td>
<td>Check CH2 and 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 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>off</td>
<td>flash blue</td>
<td>off</td>
<td>CH1 and CH2 unaccepted, a timer function is counting down while remaining inactivated</td>
<td>Check installation. Restore by opening and closing both CH:s at the same time</td>
</tr>
<tr>
<td>off</td>
<td>flash blue</td>
<td>green</td>
<td>CH1 unaccepted and CH2 accepted, a timer function is counting down while remaining inactivated</td>
<td>Check installation. Restore by opening and closing both CH:s at the same time</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>green</td>
<td>flash blue</td>
<td>off</td>
<td>CH1 accepted and CH2 unaccepted, a timer function is counting down while remaining inactivated</td>
<td></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 stored 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>Enter and store a new setting</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 error codes and installation</td>
</tr>
<tr>
<td>red</td>
<td>fast flash red</td>
<td>fast flash red</td>
<td>Fail-safe mode due to short-circuit between CH2 and 24 VDC or T1</td>
<td>Check error code. Check and remove the short-circuit</td>
</tr>
</tbody>
</table>

### Display codes

<table>
<thead>
<tr>
<th>Display indication</th>
<th>Status message</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.8.8.</td>
<td>The safety relay is powering up. The segments on the display are shortly lit up during the powering up process</td>
</tr>
<tr>
<td>E.xx</td>
<td>Error code. The error code E.xx is flashing if an error is present</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error code</th>
<th>Error type</th>
<th>Procedure for correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.10 – E.14</td>
<td>Internal error</td>
<td>1. Power cycle the safety relay 2. If the error code remains, contact your ABB representative.</td>
</tr>
<tr>
<td>E.15</td>
<td>Relay hardware error</td>
<td>1. Power cycle the safety relay 2. If the error code remains, contact your ABB representative.</td>
</tr>
<tr>
<td>E.16</td>
<td>+24 V power error</td>
<td>Check the supply voltage</td>
</tr>
<tr>
<td>E.20 – E.26</td>
<td>Input/Output (I/O) error</td>
<td>1. Power cycle the safety relay 2. If the error code remains, contact your ABB representative.</td>
</tr>
<tr>
<td>E.30 – E.34</td>
<td>System error</td>
<td>1. Power cycle the safety relay 2. If the error code remains, contact your ABB representative.</td>
</tr>
<tr>
<td>E.50</td>
<td>Internal error</td>
<td>1. Power cycle the safety relay 2. If the error code remains, contact your ABB representative.</td>
</tr>
<tr>
<td>Error code</td>
<td>Error type</td>
<td>Procedure for correction</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>E.51</td>
<td>External error. Signal short on T1</td>
<td>Examine T1 for short circuits</td>
</tr>
<tr>
<td>E.52</td>
<td>External error. Signal short on T2</td>
<td>Examine T2 for short circuits</td>
</tr>
<tr>
<td>E.53 – E.58</td>
<td>Internal error</td>
<td>1. Power cycle the safety relay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. If the error code remains, contact your ABB representative.</td>
</tr>
</tbody>
</table>
## Model overview

### 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>
</tbody>
</table>
### Model and Order code

<table>
<thead>
<tr>
<th>Model</th>
<th>Order code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<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. 85-265VAC/120-375VDC</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>

### 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>
<th>Screw connection type</th>
<th>Push-in type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>22,5</td>
<td>22.5</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>120</td>
<td>123</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.

<table>
<thead>
<tr>
<th>Absolute maximum rating</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum voltage rating for A1 and A2 Note 2</td>
<td>30 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, $\Sigma lth^2$ Note 1</td>
<td>$\leq 72^2$</td>
</tr>
</tbody>
</table>

Note 1: $\Sigma lth^2$ is the sum of the square for each relay output contact. For example: $l1^2 = 2_{\text{ABMS}}^2$, $l2^2 = 4_{\text{ABMS}}^2$, $l3^2 = 5_{\text{ABMS}}^2$, $l4^2 = 1_{\text{ABMS}}^2$ $\rightarrow$ $\Sigma lth^2 = 4 + 16 + 25 + 1 = 46^2$

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>Power supply type</th>
<th>PELV/SELV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>+24 VDC +15 %, -20 %</td>
</tr>
<tr>
<td>Terminal connection</td>
<td>A1 = +24 VDC and A2 = 0 VDC (GND)</td>
</tr>
</tbody>
</table>
Power supply

<table>
<thead>
<tr>
<th>Consumption</th>
<th>8 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal consumption</td>
<td>5W</td>
</tr>
<tr>
<td>Required fuse</td>
<td>4 A (gG external fuse is required (According to UL248: any (JDYX/7) Fast acting, Ratings 250V, 4A, IR200A))</td>
</tr>
</tbody>
</table>

Relay output specification

<table>
<thead>
<tr>
<th>Relay output configuration</th>
<th>3 NO + 1 NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum operating switching voltage</td>
<td>250 VAC</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>II</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>4 kV</td>
</tr>
<tr>
<td>Rated operational voltage</td>
<td>250 VAC</td>
</tr>
<tr>
<td>Minimum operating contact load</td>
<td>5 VDC / 10 mA (15 VDC / 3 mA)</td>
</tr>
<tr>
<td>Maximum operating switching frequency</td>
<td>0.5 Hz</td>
</tr>
<tr>
<td>Rated isolation voltage</td>
<td>400 V</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>NO contact</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AC load (AC15, AC1)</td>
<td>Rated operating voltage (Ue) 250 VAC</td>
</tr>
<tr>
<td>Rated operating current (Ie)</td>
<td>1 contact 5A</td>
</tr>
<tr>
<td></td>
<td>2 contacts 5A</td>
</tr>
<tr>
<td></td>
<td>3 contacts 4.6A</td>
</tr>
<tr>
<td>DC load (DC13, DC1)</td>
<td>Rated operating voltage (Ue) +24 VDC</td>
</tr>
<tr>
<td>Rated operating current (Ie)</td>
<td>1 contact 6A</td>
</tr>
<tr>
<td></td>
<td>2 contacts 5.6A</td>
</tr>
<tr>
<td></td>
<td>3 contacts 4.6A</td>
</tr>
<tr>
<td>Required fuse</td>
<td>6.3 A (gG, &gt;=1 kA short circuit protection (6 A according to UL248))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NC contact</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AC load (AC15, AC1)</td>
<td>Rated operational voltage (Ue) 250 VAC</td>
</tr>
<tr>
<td>Rated operational current (Ie)</td>
<td>0.5A</td>
</tr>
<tr>
<td>DC load (DC13, DC1)</td>
<td>Rated operational voltage (Ue) +24 VDC</td>
</tr>
<tr>
<td>Rated operational current (Ie)</td>
<td>2A</td>
</tr>
<tr>
<td>Required fuse</td>
<td>4 A (gG (4 A according to UL 248))</td>
</tr>
</tbody>
</table>

T1/T2 safety device interface specification

<table>
<thead>
<tr>
<th>Output (O) T1 and T2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output high voltage (VOH)</td>
<td>Minimum 15.8 VDC</td>
</tr>
<tr>
<td></td>
<td>Maximum 25.6 VDC</td>
</tr>
<tr>
<td>Maximum output low voltage (VOL_{max})</td>
<td>0.8 VDC</td>
</tr>
<tr>
<td>Maximum output current</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>
<tr>
<td>Square wave signal frequency</td>
<td>217 Hz ±3 Hz</td>
</tr>
<tr>
<td>Maximum capacitance to ground</td>
<td>100 nF</td>
</tr>
</tbody>
</table>
### T1/T2 safety device interface specification

**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>Characteristic</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\textsubscript{min})  \footnote{Note 1}</td>
<td>9.8 VDC</td>
</tr>
<tr>
<td>Maximum input low voltage (VIL\textsubscript{max})  \footnote{Note 2}</td>
<td>6 VDC</td>
</tr>
<tr>
<td>Typical input impedance</td>
<td>1.5 kΩ</td>
</tr>
<tr>
<td>Maximum current sink (I\textsubscript{sink})  \footnote{Note 3}</td>
<td>20 mA</td>
</tr>
<tr>
<td>Maximum OSSD pulse length</td>
<td>1.0 ms</td>
</tr>
</tbody>
</table>

**Note 1:** Voltage level above VIH\textsubscript{min} is interpreted as logic “1”, in worst case operating conditions.  
**Note 2:** Voltage level below VIL\textsubscript{max} is interpreted as logic “0”, in worst case operating conditions.  
**Note 3:** If VIH \geq 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>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum input high voltage (VIH\textsubscript{min})  \footnote{Note 1}</td>
<td>9.8 VDC</td>
</tr>
<tr>
<td>Maximum input low voltage (VIL\textsubscript{max})  \footnote{Note 2}</td>
<td>6 VDC</td>
</tr>
<tr>
<td>Typical input impedance</td>
<td>800 Ω</td>
</tr>
</tbody>
</table>

**Input/Output (I/O) X4**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output high voltage (VOH) Minimum</td>
<td>15.8 VDC</td>
</tr>
<tr>
<td>Output high voltage (VOH) Maximum</td>
<td>25.6 VDC</td>
</tr>
<tr>
<td>Output low voltage (VOL) Minimum</td>
<td>0 VDC</td>
</tr>
<tr>
<td>Output low voltage (VOL) Maximum</td>
<td>0.8 VDC</td>
</tr>
<tr>
<td>Minimum input high voltage (VIH\textsubscript{min})  \footnote{Note 1}</td>
<td>13.2 VDC</td>
</tr>
<tr>
<td>Maximum input low voltage (VIL\textsubscript{max})  \footnote{Note 2}</td>
<td>9.0 VDC</td>
</tr>
<tr>
<td>Typical input impedance</td>
<td>5 kΩ</td>
</tr>
<tr>
<td>Output current limit, short circuit protection Minimum</td>
<td>64 mA</td>
</tr>
<tr>
<td>Output current limit, short circuit protection Maximum</td>
<td>75 mA</td>
</tr>
<tr>
<td>Square wave signal frequency for automatic reset configuration/ manual reset configuration Minimum</td>
<td>98 Hz</td>
</tr>
<tr>
<td>Square wave signal frequency for automatic reset configuration Maximum</td>
<td>102 Hz</td>
</tr>
<tr>
<td>Maximum current sink (I\textsubscript{sink})</td>
<td>20 mA</td>
</tr>
</tbody>
</table>

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

### Response time

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay at power on</td>
<td>\leq 1.5 s</td>
</tr>
<tr>
<td>Response time at activation Automatic reset  \footnote{Note 1}</td>
<td>\leq 50 ms</td>
</tr>
<tr>
<td>Response time at activation Manual reset  \footnote{Note 1}</td>
<td>\leq 50 ms</td>
</tr>
<tr>
<td>Response time at inactivation</td>
<td>\leq 20 ms</td>
</tr>
</tbody>
</table>
### Response time

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

### Electrical operations lifetime

<table>
<thead>
<tr>
<th>Load $\Sigma$ Ith $^2 \leq 64$</th>
<th>AC1, AC15</th>
<th>160 000 operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC1, DC13</td>
<td>100 000 operations</td>
</tr>
</tbody>
</table>

**Measurement conditions:**
- Maximum breaking voltage for relay contacts: 250 V
- Maximum switching voltage for relay contacts: 400 V
- Rated current
- Switching frequency $\leq 0.1$ Hz (Switching frequency $> 0.1$ Hz will shorten life.)
- $T \leq 55$ °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>Weight</th>
<th>190 – 230 g</th>
</tr>
</thead>
</table>

**Material**
- **Housing:** PA66 with 25 % fiberglass (UL94 V0)
- **Connection block, screw compression type:** PA66 (UL94 V0)
- **Connection block, push-in type:** PA66 with 25 % fiberglass (UL94 V0)
- **Opener, push-in type:** PBT/GF (UL94 V0)

**Color**
- **Housing:** Yellow
- **Connection block, screw compression type:** Black
- **Connection block, push-in type:** Black
- **Opener, push-in type:** Orange

**Attachment requirements**
- 35 mm DIN rail (DIN 50022)

### Environmental data

<table>
<thead>
<tr>
<th>Pollution degree</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection class</td>
<td>Safety relay, IP20</td>
</tr>
<tr>
<td>Enclosure for installation</td>
<td>At least IP54. Lockable.</td>
</tr>
</tbody>
</table>

**Ambient temperature range for operation within specified operation range**
- $-25^\circ C - +65^\circ C$

**Ambient temperature range for storage**
- $-40^\circ C \leq T_a \leq +70^\circ C$

**Humidity range for operation**
- $10 \% \leq R_h \leq 90 \%$, no icing, occasional condensation

**Humidity range for storage**
- $10 \% \leq R_h \leq 95 \%$, no icing, occasional condensation

**Maximum temperature gradient**
- $2^\circ C/min$

**Altitude**
- Suitable for use at $\leq 2000$ meters above sea level

**Vibration**
- 10-55 Hz sine, 0.35 mm (1 oct/min 20 sweep cycles, all directions)
### Environmental data

| 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  |
## Approvals

**UKCA**

## Standard

<table>
<thead>
<tr>
<th>Standard</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 61508</td>
<td>$PFH_0 \cdot 4.9E-9$ and $PFD \cdot 7.4E-5$ (see chapter 8.2 Scheduled test)</td>
</tr>
<tr>
<td>EN ISO 13849-1, EN 62061</td>
<td>$PFH_0 \cdot 4.9E-9$</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>
14 Declaration of conformity
EC Declaration of conformity
(according to 2006/42/EC, Annex 2A)

We 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

ABB Electrification Sweden AB
SE-721 61 Västerås
Sweden

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
Riderstrasse 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

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


Original