440G-EZ Interlocking Safety Switch
Catalog Numbers 440G-EZS21STL05J, 440G-EZS21STL05H
Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

| WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss. |
| ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence. |
| IMPORTANT | Identifies information that is critical for successful application and understanding of the product. |

Labels may also be on or inside the equipment to provide specific precautions.

| SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present. |
| BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures. |
| ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE). |
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Preface

This user manual contains the information that is needed during the lifecycle of the 440G-EZ electromagnetic safety switch.

This user manual must be made available to all people who work with the safety switch. The structure of this user manual is based on the lifecycle phases of the safety switch: project planning, mounting, electrical installation, commissioning, operation, and maintenance.

Who Should Use This Publication?

These operating instructions are intended for use by the following:

- Project developers (planners, developers, designers)
- Installers
- Electricians
- Safety experts (such as CE authorized representatives, compliance officers, and people who test and approve the application)
- Operators
- Maintenance personnel

Terminology

The following terms and abbreviations are used throughout this manual. For definitions of terms not listed here, refer to the Allen-Bradley Industrial Automation Glossary, publication AG-7.1.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous state</td>
<td>A status of the machine or facility, where people can be injured. Protective devices help prevent this risk if the machine is operated within its intended use. The figures in this document always show the dangerous state of the machine as movement of a machine part. In practice, there are different dangerous states, such as: Machine movements, Electrical parts, Visible and invisible beam, A combination of multiple hazards</td>
</tr>
</tbody>
</table>

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>440G-EZ Interlocking Safety Switch Installation Instructions, publication 440G-IN019</td>
<td>Provides installation information for 440G-EZ switches.</td>
</tr>
<tr>
<td>Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1</td>
<td>Provides general guidelines for installing a Rockwell Automation® industrial system.</td>
</tr>
<tr>
<td>Product Certifications website: rok.auto/certifications</td>
<td>Provides declarations of conformity, certificates, and other certification details.</td>
</tr>
</tbody>
</table>

You can view or download publications at rok.auto/literature.
Notes:
Safety Information

Introduction

This chapter contains general safety information about the safety switch.

Further information about specific product use situations can be found in the relevant chapters.

ATTENTION: Hazard due to lack of effectiveness of the protective device

If non-compliant, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- Read this publication carefully and make sure that you understand the content fully before working with the device.
- Follow all safety notes in this publication.

Intended Use

The 440G electromagnetic safety switch is a transponder safety switch with a locking function, which is controlled without contact by actuators and is suitable for the following applications:

- Monitoring of movable physical guards
- Locking device for process protection

The safety switch must only be used within the limits of the prescribed and specified technical data and operating conditions.

Incorrect use, improper modification of, or tampering with the safety switch invalidates any warranty from Rockwell Automation; in addition, any responsibility and liability of Rockwell Automation for damage and secondary damage that this action causes is excluded.

The safety switch is not suitable for the ambient conditions such as, but not limited, to the following:

- Applications in which the dangerous state cannot be ended immediately (stopping time)
- Radioactivity (exception: natural radioactivity)
- Vacuum or high pressure
- High UV load
- In the vicinity of low-frequency RFID devices
- In the vicinity of magnetic fields
Requirements for Qualified Personnel

Only qualified safety personnel can configure, mount, connect, commission, and service the safety switch.

Project Planning

For project planning, a person is considered competent when they have expertise and experience in the selection and use of protective devices on machines and is familiar with the relevant technical rules and national work safety regulations.

Mechanical Mounting, Electrical Installation, and Commissioning

For the task, a person is considered qualified when they have the expertise and experience in the relevant field and is sufficiently familiar with the application of the protective device on the machine to be able to assess whether it is in an operationally safe state.

Operation and Maintenance

For operation and maintenance, a person is considered competent when they have the expertise and experience in the relevant field and is sufficiently familiar with the application of the protective device on the machine and the machine operator has instructed them in its operation.
Chapter 2

Product Overview

Structure and Function

The safety switch is an interlocking device with a locking device consisting of a non-contact sensor with locking solenoid and a coded actuator. The actuator has a low coding level.

If the protective device is closed, the actuator is led to the sensor. When the actuation field is reached, the actuator code is read out and evaluated by RFID. If the code is valid, the safe output signal switching device (OSSD) switches.

If the locking solenoid is supplied with power, the locking device is active.

Product Features

The following table describes the components of the sensor:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Locking solenoid</td>
</tr>
<tr>
<td>2</td>
<td>Sensor surface</td>
</tr>
<tr>
<td>3</td>
<td>Cover plate</td>
</tr>
<tr>
<td>4</td>
<td>Plug connector IN</td>
</tr>
<tr>
<td>5</td>
<td>LOCK light-emitting diode (LED)</td>
</tr>
<tr>
<td>6</td>
<td>OSSD LED</td>
</tr>
</tbody>
</table>

Figure 1 - Sensor Overview
Product Models

The safety switch is available in different models. The following is an overview of unique features of the models:

- One cable with M12 plug connector (5-pin)
- One cable with M12 plug connector (8-pin)

Locking Principle

**ATTENTION:** Hazard due to lack of effectiveness of the protective device.

If a voltage drop occurs, the locking device unlocks regardless of whether the dangerous state of the machine has ended.

- Do not use the safety switch in applications where the dangerous state cannot be ended immediately (stopping/run-down time).

**Power to Lock Principle**

- Lock locking device: voltage at locking device input
- Unlock locking function: no voltage at locking device input

If voltage is interrupted, the locking device is unlocked and the protective device can be opened immediately.

The locking device is not monitored, which means that the safety switch does not check whether the anchor plate is applied to the solenoid.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anchor plate</td>
</tr>
<tr>
<td>2</td>
<td>Protective cap</td>
</tr>
<tr>
<td>3</td>
<td>Actuator surface</td>
</tr>
</tbody>
</table>
Protective Functions

The safety switch has the following internal protective functions:
- Short-circuit protection at all outputs
- Cross-circuit monitoring at OSSDs
- Overload protection on OSSDs
- Supply voltage reverse polarity protection

Status Indicators

The safety switch displays important status information with the status indicators.

Figure 3 - Status Indicators

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OSSD</td>
<td>Green/Red</td>
<td>Green when the OSSD pair is in the ON state.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Red when the OSSD pair is in the OFF state. (1)</td>
</tr>
<tr>
<td>2</td>
<td>LOCK</td>
<td>Yellow</td>
<td>Turns ON when the magnet is supplied with voltage.</td>
</tr>
</tbody>
</table>

(1) When a load is applied to the application diagnostic output that is too high, the red OSSD status indicator remains continuously ON. The actual switching behavior of the safety switch is not affected.
Project Planning

Manufacturer of the Machine

ATTENTION: Failure to comply with obligations of manufacturer. Hazard due to lack of effectiveness of the protective device.
- Conduct a risk assessment before using the safety switch.
- Do not tamper with, open, or modify the components of the safety switch.
- Do not repair defective devices — they must be replaced instead.
- Make sure that switch-on commands, which bring about a dangerous state of the machine, are not enabled until the protective device is closed.
- Make sure that a stop command is triggered when the protective device is opened during the dangerous machine state.
- The safety switches must not be defeated (that is, contacts jumpered), rotated away, removed, or rendered ineffective in any other way. If necessary, put measures in place to reduce possibilities for defeat.

Operating Entity of the Machine

ATTENTION: Failure to comply with obligations of the operating entity. Hazard due to lack of effectiveness of the protective device.
- Modifications to the machine and modifications to the mechanical mounting of the safety switch necessitate a new risk assessment. The results of this risk assessment may require the operating entity of the machine to fulfill the obligations of the manufacturer.
- Apart from during the procedures described in this document, the components of the safety switch must not be opened or modified.
- Do not perform repair work on the components. Improper repair of the safety switch can lead to a loss of the protective function.
- Verify that there is no bypassing by replacement actuators. Restrict access to actuators.
Assembly

**ATTENTION:** Bypassing the protective device.
Hazard due to lack of effectiveness of the protective device.
Avoid incentives to manipulate the safety switch by taking at least one of the following measures:
- Cover the sensor and the actuator with additional equipment or protect them against access.
- If possible use permanent mounting methods for actuators (for example, glue, safety screws, or rivets).

**Mounting Location**
- Select the mounting location so that the sensor and actuator are accessible for maintenance work and are protected against damage.
- Select a mounting location for the sensor that is as far away from the door hinge as possible.
- If necessary, fit an additional stop for the moving protective device.

**Distance**

When several safety switches are mounted to the machine, they must be mounted at a minimum distance to one another see Mount Multiple Safety Switches on page 19

**Alignment**

The safety switch can be mounted in any alignment. When mounted horizontally, the anchor plate with rotating bearings increases the manipulation protection. When mounted horizontally, if the movable physical guard triggers the actuator, the magnet holds the actuator. As the anchor plate has rotating bearings, the gravitational force rotates the actuator surface away from the sensor surface and the OSSDs go into the OFF state.

**Mounting Methods**

The sensor can be mounted in the following ways:
- Surface mount: The sensor is mounted on the fixed part of the protective device (for example, door frame).
- Flush mount (1): The sensor is mounted in the fixed part of the protective device (for example, door frame). There must be a suitable recess in the mounting surface. The thickness of the mounting surface must be 1.5...3 mm (0.06...0.12 in.).

(1) For the recess dimensions for flush mounting, see figure 12 on page 34
Switch-on commands that put the machine in a dangerous state can only be activated when the protective device is closed. When the machine goes into a dangerous state, a stop command must be triggered if the protective device is opened. Depending on the safety concept, a safety relay or a safety controller analyzes the signal.

The control that is connected and all devices responsible for safety must comply with the required Performance Level and the required category (for example, according to ISO 13849-1).

**OSSDs**

Safety switches with local inputs and outputs can be directly integrated into the machine controller.

**ATTENTION:** Hazard due to lack of effectiveness of the protective device.

If non-compliant, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- Make sure that the following control and electrical requirements are met so the protective function can be fulfilled.

- The output signals from an OSSD pair must not be connected to each other.
- In the machine controller, both signals from an OSSD pair must be processed separately.

*Figure 4 - Dual-channel and isolated connection of OSSD 1 and OSSD 2*

- The machine must switch to the safe state at any time if at least one OSSD in an OSSD pair switches to the OFF state.
- Prevent the formation of a potential difference between the load and the protective device. If you connect loads to the OSSDs (safety outputs) that then also switch if controlled with negative voltage (for example, electromechanical contactor without reverse polarity protection diode), you must connect the 0V connections of these loads and the connections of the corresponding protective device individually and directly to the same 0V terminal strip. If there is a fault, this way verifies that there can be no potential difference between the 0V connections of the loads and the connections of the corresponding protective device.
Figure 5 - No Potential Difference Between Load and Protective Device

ATTENTION: Hazard due to lack of effectiveness of the protective device.
If non-compliant, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.
Downstream contactors must be positively guided and monitored depending on applicable national regulations or required reliability of the safety function.
- Make sure that downstream contactors are monitored (external device monitoring, EDM).

Requirements for the Electrical Control of the Machine
- Use the control without test pulses. The safety switch is self-testing.
- The safety switch tests the OSSDs at regular intervals. To conduct this test, it switches each OSSD briefly (for max. 1 ms) to the OFF state and checks whether this channel is voltage-free during this time.
  Make sure that the control of the machine does not react to these test pulses and the machine does not switch off.
- The inputs of a connected evaluation unit must be positive-switching (PNP), as the two outputs of the safety switch send a level of the supply voltage in the switched on state.

The OSSDs are short-circuit protected to 24V DC and 0V. When the actuator is in the response range of the sensor, the OSSDs signal the ON state with the HIGH signal level (nonisolated). If the actuator is removed from the response range of the sensor or there is a device fault, the OSSDs signal the OFF state with the LOW signal level.

The safety switch complies with the regulations for electromagnetic compatibility (EMC) for the industrial sector (Radio Safety Class A). Radio interference cannot be ruled out when used in residential areas.

ATTENTION: Hazard due to lack of effectiveness of the protective device.
If non-compliant, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.
- Make sure that the following control and electrical requirements are met so the safety switch can fulfill its protective function.
- The external voltage supply of the safety switch must be able to withstand brief power failures of 20 ms as specified in IEC 60204-1.
- The power supply unit must provide safe isolation according to IEC 61140 (SELV/PELV). We have suitable power supplies available as accessories, contact your local Allen-Bradley distributor or Rockwell Automation sales office.

**Course of the OSSD Test Over Time**

![Figure 6 - Course of the OSSD test over time](image)

(1) Usually every 40 ms. The interval is dynamic and can be smaller than 40 ms.

**Locking Solenoid Control**

The locking solenoid is activated through the upstream control. There is no internal activation or deactivation of the locking solenoid through the safety switch. The locking device and locking force are not monitored. When the machine starts, the following sequence must be followed:

1. Check whether safety switch OSSDs are in the ON state.
2. Supply the locking solenoid with power.
3. Start the machine.

**Application Diagnostic Output**

The application diagnostic output signal changes as soon as the actuator is moved into or out of the response range of the safety switch. That is, when the movable protective device is opened or closed. This output is not a safety output.

**Table 1 - Switching Behavior of the Application Diagnostic Output**

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Application Diagnostic Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator not in the response area, or safety switch in an error state</td>
<td>OFF</td>
</tr>
<tr>
<td>Actuator in the response area</td>
<td>ON</td>
</tr>
</tbody>
</table>

For more information, see Specifications on page 31.
Chapter 3  Project Planning

Thorough-check Concept

Appropriately qualified safety personnel must test the safety switch during commissioning, after modifications, and at regular intervals; see Thorough-check Requirements on page 27.

Regular thorough checks serve to investigate the effectiveness of the safety switch and discover anomalies that result from modifications or external influences (such as damage or manipulation).

The manufacturer and operating entity must define the type and frequency of the thorough checks on the machine based on the application conditions and the risk assessment. The process of defining the thorough checks must be documented in a traceable manner.

Regular Thorough Check Minimum Requirements

The following thorough checks must be conducted at least once a year:

- Thorough check of the protective function of the safety switch
- Thorough check of the switch housing for damage
- Thorough check of the switch cables for damage
- Thorough check of the safety switch for signs of misuse or manipulation
- Thorough check of the locking solenoid for correct function
Installation

Mount Multiple Safety Switches

**IMPORTANT** When several safety switches are mounted, the minimum distance between the individual systems must be followed to avoid mutual interference.

**Figure 7 - Spacing Requirement**

The sensor can be mounted in the following ways:

- **Surface mount** — The sensor is mounted on the fixed part of the protective device (for example, door frame).
- **Flush mount** — The sensor is mounted in the fixed part of the protective device (for example, door frame). There must be a suitable recess in the mounting surface. The thickness of the mounting surface must be between 1.5...3 mm (0.06...0.12 in.)

For recess dimensions for flush mounting, see **Figure 12 on page 34**

**IMPORTANT** Install the safety switch horizontally to help increase protection against manipulation.
Mount the Sensor

1. Unscrew the fixing screw (hexagon socket, 2 mm [0.08 in.]) and remove the cover plate.

2. Mount the sensor on the fixed part of the protective device with 4 x M4 screws and secure it with four nuts.
   - For surface mount: mount the sensor on the fixed part of the protective device. The screws can be set in the front or the back.

   Tightening torque: 1 N•m
- For flush mount: mount the sensor in the fixed part of the protective device.

3. Set cover plate on the sensor.
4. Tighten the fixing screws to 1 N•m.

**Mount the Actuator**

1. Align the actuator to the mounted sensor.
2. Mount the actuator on the moving part of the protective device (for example, door) with 4 x M4 screws. Tightening torque: 1 N•m. Use disposable screws if possible.
   - Maximum angle between sensor and actuator when protective device is closed is 3°
3. Cover drill holes of the actuator with protective caps.
Notes:
Wiring

Notes on c-UL-us

For use according to the requirements of UL 508, the following conditions must also be met:

- Voltage supply Uv sensor secured with 2 A fuse
- Voltage supply Uv magnet secured with 2 A fuse

Device Connection (M12, 5-pin)

Figure 8 - Device Connection Pin Assignment (Male Connector, M12, 5-pin, A-coded)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Wire Color (1)</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>+24V DC</td>
<td>Safety switch voltage supply</td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td>OSSD 1</td>
<td>OSSD 1 output</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>0V</td>
<td>0V DC voltage supply</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>OSSD 2</td>
<td>OSSD 2 output</td>
</tr>
<tr>
<td>5</td>
<td>Gray</td>
<td>Magnet</td>
<td>Magnet activation 24V DC</td>
</tr>
</tbody>
</table>

(1) Applies to the extension cables recommended as accessories.

**IMPORTANT** Pay attention to tightness of the plug connector.
### Device Connection (M12, 8-pin)

**Figure 9 - Device Connection Pin Assignment (Male Connector, M12, 8-pin, A-coded)**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Wire Color (1)</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>White</td>
<td>Aux</td>
<td>Application diagnostic output (not safe)</td>
</tr>
<tr>
<td>2</td>
<td>Brown</td>
<td>+24V DC</td>
<td>Safety switch voltage supply</td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
<td>Magnet</td>
<td>Magnet activation 24V DC</td>
</tr>
<tr>
<td>4</td>
<td>Yellow</td>
<td>In 2</td>
<td>OSSD 2 input (2)</td>
</tr>
<tr>
<td>5</td>
<td>Gray</td>
<td>OSSD 1</td>
<td>OSSD 1 output</td>
</tr>
<tr>
<td>6</td>
<td>Pink</td>
<td>OSSD 2</td>
<td>OSSD 2 output</td>
</tr>
<tr>
<td>7</td>
<td>Blue</td>
<td>0V</td>
<td>0V DC voltage supply</td>
</tr>
<tr>
<td>8</td>
<td>Red</td>
<td>In 1</td>
<td>OSSD 1 input (2)</td>
</tr>
</tbody>
</table>

1. Applies to the extension cables recommended as accessories.
2. When used as an individual safety switch or as the first safety switch in a cascade apply 24V DC.

**IMPORTANT** Pay attention to tightness of the plug connector.
Connect Safety Switches with T-connectors

The following connection system components facilitate connection.

<table>
<thead>
<tr>
<th>Item</th>
<th>Connection</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety-wired Splitter/T-Port</td>
<td>898D-438Y-D8</td>
</tr>
<tr>
<td>2</td>
<td>Safety-wired Shorting Plug</td>
<td>898D-418U-DM</td>
</tr>
<tr>
<td>3</td>
<td>8-pin Device Patchcords</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 m (3.3 ft)</td>
<td>889D-F8ABDM-1</td>
</tr>
<tr>
<td></td>
<td>2 m (6.6 ft)</td>
<td>889D-F8ABDM-2</td>
</tr>
<tr>
<td></td>
<td>5 m (16.4 ft)</td>
<td>889D-F8ABDM-5</td>
</tr>
<tr>
<td></td>
<td>10 m (32.8 ft)</td>
<td>889D-F8ABDM-10</td>
</tr>
<tr>
<td>4</td>
<td>5-pin Patchcords</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 m (3.3 ft)</td>
<td>889D-F5ACDM-1</td>
</tr>
<tr>
<td></td>
<td>2 m (6.6 ft)</td>
<td>889D-F5ACDM-2</td>
</tr>
<tr>
<td></td>
<td>5 m (16.4 ft)</td>
<td>889D-F5ACDM-5</td>
</tr>
<tr>
<td></td>
<td>10 m (32.8 ft)</td>
<td>889D-F5ACDM-10</td>
</tr>
<tr>
<td>5</td>
<td>5-pin Cordsets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 m (6.6 ft)</td>
<td>889D-F5AC-2</td>
</tr>
<tr>
<td></td>
<td>5 m (16.4 ft)</td>
<td>889D-F5AC-5</td>
</tr>
<tr>
<td></td>
<td>10 m (32.8 ft)</td>
<td>889D-F5AC-10</td>
</tr>
</tbody>
</table>

(1) Add the letter S to above catalog numbers for stainless steel connectors (example: 889DS-F5AC-1).
Chapter 6

Commissioning

Switch On

The device initializes after it is switched on. OSSDs are switched off in the meantime. The OSSD light-emitting diode lights up after initialization.

Thorough-check Requirements

The protective device and its application must be thoroughly checked in the following situations:

- Before commissioning
- After changes to the configuration or the safety function
- After changes to the mounting, the alignment, or the electrical connection
- After exceptional events, such as after a manipulation has been detected, after modification of the machine, or after replacing components

The thorough check verifies the following:

- All relevant regulations are complied with and the protective device is active for all operating modes of the machine.
- The documentation corresponds to the state of the machine, including the protective device.

Qualified safety personnel or specially qualified and authorized personnel must conduct the thorough checks and must be document results in a traceable manner.

IMPORTANT

- Check whether the protective device of the machine is effective in all operating modes in which the machine can be set.
- Verify that operating personnel have been instructed in the function of the protective device before starting work on the machine. The machine operator has overall responsibility for the instruction, which qualified personnel must conduct.

ATTENTION: Hazard due to lack of effectiveness of the protective device.

If non-compliant, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- Before commissioning the machine, have qualified safety personnel check and release it.
- Make sure that the time for the safety requirement (closing the protective device again) is longer than the response time.
Chapter 7

Maintenance and Troubleshooting

Maintenance

Clean the Switch

**IMPORTANT**
- Do not use aggressive cleaning agents (such as isopropanol or spirit).
- Do not use any substances that hinder the wetting properties of lacquers.
- We recommend anti-static cleaning agents.

Regular Thorough Check

The safety switch must be checked regularly. The type and frequency of thorough checks is defined by the manufacturer and the operating entity of the machine, see **Thorough-check Concept on page 18**.

The regular thorough checks serve to investigate the effectiveness of the safety switch and detect any ineffectiveness due to modifications or external influences (for example, damage or manipulation).

**IMPORTANT** Conduct the thorough checks according to the instructions from the manufacturer and the machine user.

Troubleshooting

**ATTENTION:** Hazard due to lack of effectiveness of the protective device.
If non-compliant, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.
- Immediately shut down the machine if the behavior of the machine cannot be clearly identified.
- If a machine fault cannot be determined or safely rectified, immediately shut down the machine.
- Secure the machine so that it cannot switch on unintentionally.

**ATTENTION:** Hazard due to unexpected starting of the machine.
When any work is taking place, use the protective device to secure the machine or to verify that the machine is not switched on unintentionally.
Perform one of the following steps when an error occurs:

- Check voltage supply.
- Check cables.
- Check alignment of safety switch and actuator.
- Check ambient conditions (for example, interfering RFID frequencies or magnetic fields, distances to other safety switches).

**ATTENTION:** Hazard due to lack of effectiveness of the protective device.
If non-compliant, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- Do not repair device components.
- Do not modify or manipulate device components.
- Apart from during the procedures described in this document, the device components must not be opened.

**IMPORTANT** If you cannot remedy the fault with the help of the information that is provided in this chapter, contact your local Allen-Bradley distributor or Rockwell Automation sales office.

**IMPORTANT** If a safety switch has a fault in a cascade with an end connector, the OSSDs of all safety switches between the safe evaluation unit and the safety switch concerned switch into the OFF state.
## Specifications

### Technical Data

#### Table 2 - Features

<table>
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<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe switch on distance $S_{ao}$</td>
<td>4 mm (0.16 in.)</td>
</tr>
<tr>
<td>Typical switch on distance $S_o$</td>
<td>15 mm (0.59 in.)</td>
</tr>
<tr>
<td>Safe switch off distance $S_{af}$</td>
<td>45 mm (1.77 in.)</td>
</tr>
<tr>
<td>Max. actuation frequency</td>
<td>0.5 Hz</td>
</tr>
<tr>
<td>Locking force</td>
<td>500 N (112.4 lbf)</td>
</tr>
<tr>
<td>Magnetic retaining force when not supplied with power</td>
<td>25 N (5.6 lbf)</td>
</tr>
<tr>
<td>Alignment tolerance for locking device</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>5 mm (0.2 in.)</td>
</tr>
<tr>
<td>Horizontal</td>
<td>5 mm (0.2 in.)</td>
</tr>
<tr>
<td>Aperture angle</td>
<td>3°</td>
</tr>
</tbody>
</table>

#### Table 3 - Safety

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards</td>
<td>IEC 60947-5-3, IEC 60947-5-1, IEC 61508, EN ISO 13849-1, IEC 62061, ISO 14119, UL 508</td>
</tr>
<tr>
<td>Safety Classification (Guard door sensing and lock monitoring)</td>
<td>PLe Category 4 per ISO 13949-1, SIL 3 per IEC 61508 and IEC 62061</td>
</tr>
<tr>
<td>Certifications</td>
<td>CE Marked for all applicable EU directives, c-UL-us (UL 508), TÜV, C-tick</td>
</tr>
<tr>
<td>Performance level</td>
<td>PL e (ISO 13849-1) (1)</td>
</tr>
<tr>
<td>Category</td>
<td>4 (ISO 13849)</td>
</tr>
<tr>
<td>Safety integrity level</td>
<td>SIL 3 (EN 61508)</td>
</tr>
<tr>
<td>SIL claim limit</td>
<td>SILCL 3 (EN 62061)</td>
</tr>
<tr>
<td>PFHd (mean probability of a dangerous failure per hour)</td>
<td>1.5 x 10^{-8} at 40 °C (104 °F) and 1000 m (3280.8 ft) above sea level</td>
</tr>
<tr>
<td>$T_M$ (mission time)</td>
<td>20 years (ISO 13849-1)</td>
</tr>
<tr>
<td>Type</td>
<td>Type 4 (ISO 14119)</td>
</tr>
<tr>
<td>Coding level</td>
<td>Low coding level (ISO 14119)</td>
</tr>
<tr>
<td>Safe state when a fault occurs</td>
<td>At least one OSSD is in the OFF state</td>
</tr>
</tbody>
</table>

(1) In a cascade, the performance level for the cascade as a whole depends on the number and type of devices in the cascade. PL e is only possible in cascades with a maximum of 6 devices.
### Table 4 - System Connection of Variant with 1 x M12 Plug Connector, 5-pin

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>Male connector, M12, 5-pin, A-coded (common plug connector for voltage supply and outputs)</td>
</tr>
<tr>
<td>Local inputs and outputs</td>
<td>Male connector, M12, 5-pin, A-coded (common plug connector for voltage supply and outputs)</td>
</tr>
<tr>
<td>Length of connecting cable</td>
<td>150 mm (5.91 in.)</td>
</tr>
</tbody>
</table>

### Table 5 - System Connection of Variant with 1 x M12 Plug Connector, 8-pin

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>Male connector, M12, 8-pin, A-coded (common plug connector for voltage supply as well as inputs and outputs)</td>
</tr>
<tr>
<td>Local inputs and outputs</td>
<td>Male connector, M12, 8-pin, A-coded (common plug connector for voltage supply as well as inputs and outputs)</td>
</tr>
<tr>
<td>Length of connecting cable</td>
<td>150 mm (5.91 in.)</td>
</tr>
</tbody>
</table>

### Table 6 - Electrical

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD pairs</td>
<td>1</td>
</tr>
<tr>
<td>Rated impulse withstand voltage $U_{imp}$</td>
<td>1500V</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3 (external, according to EN 60947-1)</td>
</tr>
<tr>
<td>Power-up delay (after supply voltage applied)</td>
<td>2.5 s</td>
</tr>
<tr>
<td>Supply voltage when an individual safety switch is connected</td>
<td>24 V DC (19.2…28.8V) Class 2 supply</td>
</tr>
<tr>
<td>Supply voltage $V_v$, sensor</td>
<td>24 V DC (19.2…28.8V) Class 2 supply</td>
</tr>
<tr>
<td>Supply voltage $V_v$, magnet</td>
<td>24 V DC (19.2…28.8V) Class 2 supply</td>
</tr>
<tr>
<td>Supply voltage when an cascade is connected</td>
<td>24 V DC (22.8…28.8V) Class 2 supply</td>
</tr>
<tr>
<td>Supply voltage $V_v$, sensor</td>
<td>24 V DC (22.8…28.8V) Class 2 supply</td>
</tr>
<tr>
<td>Supply voltage $V_v$, magnet</td>
<td>24 V DC (21.6…28.8V) Class 2 supply</td>
</tr>
<tr>
<td>Muting time when supply voltage is interrupted</td>
<td>4 ms</td>
</tr>
<tr>
<td>Rated insulation voltage $U_i$</td>
<td>32V DC</td>
</tr>
<tr>
<td>Cable capacitance</td>
<td>400 nF (for Out A and Out B)</td>
</tr>
<tr>
<td>Device fuse</td>
<td>0.6…1 A</td>
</tr>
<tr>
<td>Current consumption at 24 V</td>
<td>50 mA</td>
</tr>
<tr>
<td>Locking device deactivated</td>
<td>350 mA</td>
</tr>
<tr>
<td>Protection class</td>
<td>III (EN 61140/IEC 61140)</td>
</tr>
<tr>
<td>Response time (2)</td>
<td>$\leq 50$ ms (5)</td>
</tr>
<tr>
<td>Release time (3)</td>
<td>$\leq 100$ ms (5)</td>
</tr>
<tr>
<td>Risk time (4)</td>
<td>$\leq 100$ ms (5)</td>
</tr>
</tbody>
</table>

1. Once the supply voltage has been switched on, the OSSDs are in the OFF state during the time delay before availability. The time specified applies to one sensor; in a cascade, 0.1 s must be added per sensor.
2. Response time for moving the OSSDs into the OFF state when the actuator is removed from the response area or when the OSSD input signals go into the OFF state.
3. Response time for moving the OSSDs into the ON state when the actuator is detected by the sensor and the OSSD input signals are in the ON state.
4. The risk time is the time needed to detect internal and external faults. External errors affect the OSSDs (short-circuit to an OSSD and cross-circuit between the two OSSDs). At least one of the two OSSDs is safely switched off during the risk time.
5. In a cascade, the value is multiplied by the number of safety switches in the cascade.
### Table 7 - Mechanical Data

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W x H x D)</td>
<td>120 x 60 x 38.5 mm (4.72 x 2.36 x 1.52 in.)</td>
</tr>
<tr>
<td>Safety switch</td>
<td>120 x 60 x 20.5 mm (4.72 x 2.36 x 0.81 in.)</td>
</tr>
<tr>
<td>Material</td>
<td></td>
</tr>
<tr>
<td>Sensor housing</td>
<td>Anodized aluminum</td>
</tr>
<tr>
<td>Actuator housing</td>
<td>Fiber-glass-reinforced PVC</td>
</tr>
<tr>
<td>Anchor plate</td>
<td>Nickel-plated steel</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
</tr>
<tr>
<td>Safety switch</td>
<td>510 g (18 oz)</td>
</tr>
<tr>
<td>Actuator</td>
<td>210 g (7.41 oz)</td>
</tr>
</tbody>
</table>

### Table 8 - Inputs

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>ON state</td>
<td>≤5 mA</td>
</tr>
<tr>
<td>OFF state</td>
<td>0 mA</td>
</tr>
<tr>
<td>ON state</td>
<td>19.2…28.8V DC</td>
</tr>
<tr>
<td>OFF state</td>
<td>0…2V DC</td>
</tr>
</tbody>
</table>

### Table 9 - Outputs

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 OSSDs (Out 1 and Out 2)</td>
<td>2 x PNP, max. 100 mA, short-circuit protected and overload-proof</td>
</tr>
<tr>
<td>1 Application diagnostic output (Aux)</td>
<td>25 mA max (1), short-circuit protected (resistive load)</td>
</tr>
<tr>
<td>Switching voltage (all outputs)</td>
<td></td>
</tr>
<tr>
<td>ON state</td>
<td>19.2…28.8V DC</td>
</tr>
<tr>
<td>OFF state</td>
<td>0…2V DC</td>
</tr>
<tr>
<td>Switching current (OSSDs)</td>
<td></td>
</tr>
<tr>
<td>ON state</td>
<td>≤100 mA</td>
</tr>
<tr>
<td>OFF state</td>
<td>≤500 μA</td>
</tr>
<tr>
<td>Test pulse duration (OSSDs)</td>
<td>300 μs</td>
</tr>
</tbody>
</table>

(1) A higher load affects the behavior of the status indicators, see Status Indicators on page 11.

### Table 10 - Environment

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure rating</td>
<td>IP 67 (IEC 60529)</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-20…+55 °C (-4…+131 °F)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-25…+70 °C (-13…+158 °F)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>50% at 70 °C (158 °F) (IEC 60947-5-2)</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>1 mm/10…55 Hz (IEC 60068-2-6)</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>30 g, 11 ms (IEC 60068-2-27)</td>
</tr>
<tr>
<td>EMC</td>
<td>In accordance with IEC 61326-3-1, IEC 60947-5-2, IEC 60947-5-3, and EN 300330 V2.1.1</td>
</tr>
<tr>
<td>Minimum distance between two safety switches</td>
<td>Depending on alignment, see Mount Multiple Safety Switches on page 19</td>
</tr>
</tbody>
</table>
Appendix A  Specifications

Approximate Dimensions

Figure 10 - 440G-EZ Sensor with 1 x M12 Male Connector [mm (in.)]

Figure 11 - 440G-EZ Sensor Actuator [mm (in.)]

Figure 12 - Flush Mounting [mm (in.)]

(1) L = 150±2 mm (5.91±0.79 in.)
Appendix B

Ordering Information

Package Contents

- Safety switch
- Actuator
- Four protective caps
- Safety note
- Mounting instructions

Ordering Information

<table>
<thead>
<tr>
<th>Sensor Connection Type</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic switch</td>
<td></td>
</tr>
<tr>
<td>Cable with 5-pin M12 connector</td>
<td>440G-EZS21STL05J</td>
</tr>
<tr>
<td>Electromagnetic Switch</td>
<td></td>
</tr>
<tr>
<td>Cable with 8-pin M12 connector</td>
<td>440G-EZS21STL05H</td>
</tr>
</tbody>
</table>
Notes:
Appendix C

Replacement Parts/Accessories

Replacement Parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator</td>
<td>440G-EMAS</td>
</tr>
</tbody>
</table>

Accessories

Table 12 - DC Micro (M12) Cables

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-pin cordset — female, straight</td>
<td>889D-F8AB-x (1)</td>
</tr>
<tr>
<td>8-pin patchcord — female, straight</td>
<td>889D-F8ABDM-x (2)</td>
</tr>
<tr>
<td>5-pin cordset — female, straight</td>
<td>889D-FSAC-x (1)</td>
</tr>
<tr>
<td>5-pin patchcord — female, straight</td>
<td>889D-FSACDM-x (2)</td>
</tr>
</tbody>
</table>

(1) Replace the x with a 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
(2) Replace the x with a 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths
Notes:
## Declaration of Conformity (DoC)

### EU DoC (excerpt)

The undersigned, who represents the manufacturer below, hereby declares that the product complies with the regulations of the EU directive(s) below (including all relevant changes), and that it is based on the relevant standards and/or technical specifications.

### Complete EU DoC for Download

You can find the EU declaration of conformity for the protective device at [rok.auto/certifications](rok.auto/certifications).
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**Rockwell Automation Support**

Use the following resources to access support information.

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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Dial Codes</td>
<td>Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.</td>
<td><a href="http://www.rockwellautomation.com/global/support/direct-dial.page">http://www.rockwellautomation.com/global/support/direct-dial.page</a></td>
</tr>
</tbody>
</table>

**Documentation Feedback**

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_en-e.pdf.

**Waste Electrical and Electronic Equipment (WEEE)**

At the End of Life, this equipment should be collected separately from any unsorted municipal waste.


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