

Installation Instructions

Original Instructions



Allen-Bradley
by ROCKWELL AUTOMATION



TLSZR/L-GD2 Guard Locking Switch (Series E)

Catalog Numbers 440G-TZS21UPRH, 440G-TZS21UPLH, 440G-TZS21UTRH, 440G-TZS21UTLH

IMPORTANT Do not attempt to install this device unless the installation instructions have been studied and understood.

IMPORTANT Save these instructions for further use.

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Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

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Specifications

Table 1 - Applicable Standards and Certifications

Attribute	Value
Standards	EN IEC 60947-5-3, IEC 61508, EN ISO 13849-1, EN ISO 14119, EN IEC 60947-5-2, IEC 60947-5-1, IEC 62061 ⁽¹⁾
Certifications	cULus Listed (UL 508), TÜV Certified, CE Marked for all applicable EU directives, UKCA Marked for all applicable regulations

(1) Suitable for use in 62061 SIL 3 applications.

Table 2 - Safety Ratings per EN ISO 13849-1 and EN IEC 62061

Attribute	PL	Maximum SIL	PFD _d	Category	Proof Test Interval
Interlocking function ⁽¹⁾	PLe	3	1.70x10 ⁻⁹	4	20 years
Locking function ⁽²⁾					

(1) The safety rated OSSD outputs of the device monitoring both the guard that is closed and locked

(2) The lock/unlock command includes monitoring the locking status.

Table 3 - Operating Characteristics

Attribute	Value
TLSZR-GD2	Power to Release
TLSZL-GD2	Power to Lock
Assured Locking Distance [mm (in.)]	Maximum target distance: 13 (0.51) Maximum clearance between actuator base and switch in the door-closed position: 5 mm (0.2 in.) (see Figure 5 on page 3)
Locking Force Fmax	Plastic pins: 1950 N (488 lb); Steel bolts: 2600 N (585 lb)
Locking Force Fzh (with EN/ISO 14119)	Plastic pins: 1500 N (337 lb); Steel bolts: 2000 N (450 lb)
Maximum Output Current (all outputs)	200 mA
Current Consumption - solenoid not energized (no load supply current)	50 mA
Current Consumption - solenoid energized (no load supply current)	120 mA (260 mA inrush)
Solenoid Duty Cycle	100%
Off-State Current	< 0.5 mA DC
Maximum Number of Switches (connected in series)	Unlimited. See Figure 9 on page 6
Operating Voltage Ue	24V DC +10% / -15%
Frequency of Operating Cycle	1 Hz maximum
Actuation Speed, max	160 mm (6.29 in.) per second
Actuation Speed, min	100 mm (3.94 in.) per minute
Response Time (Off)	75 ms first switch, 25 ms additional for each switch
Utilization Category (IEC 60947-5-2)	DC-13 24V 200 mA
Impulse Withstand Voltage Uimp	250V
Pollution Degree	3
Protection Class	2
Mechanical Life	1 x 10 ⁶ cycles

Table 4 - Environmental

Attribute	Value
Operating Temperature	-10...+60 °C (14...140 °F)
Operating Humidity	5...95% relative
Risk Time	If the RFID door target moves outside of the operating distance, the safety outputs are deactivated after a maximum of 60 ms
Rated Insulation Voltage Ui	500V
Enclosure Ingress Rating	NEMA 3, 4X, 12, 13, IP66, IP67, IP69K
Shock and Vibration	IEC 68-2-27 30 g (1.06 oz), 11 ms/IEC 68-2-6 10...55Hz
Radio frequency	IEC 61000-4-3 IEC 61000-4-6

The device can be used under normal service conditions. Maximum altitude up to 2000 m (6561.66 ft).

Table 5 - Physical Characteristics

Attribute	Value
Incorporated protections ⁽¹⁾	<ul style="list-style-type: none"> • Short Circuit Protection • Current Limitation • Overload Protection • False Pulse Protection • Transient Noise Protection • Reverse Polarity Protection • Overvoltage Protection • Thermal Shutdown/Restart
Material	<ul style="list-style-type: none"> • Housing: UL Approved glass-filled PBT • Actuator: Stainless steel • Target: UL Approved glass-filled PBT
Connection	M12 8-pin connector
Torque [N·m (lb·in)]	<ul style="list-style-type: none"> • M5 mounting bolts: 1.4 (12.39) • Lid screws: 1.2 (10.62)

(1) Outputs are short circuit protected.

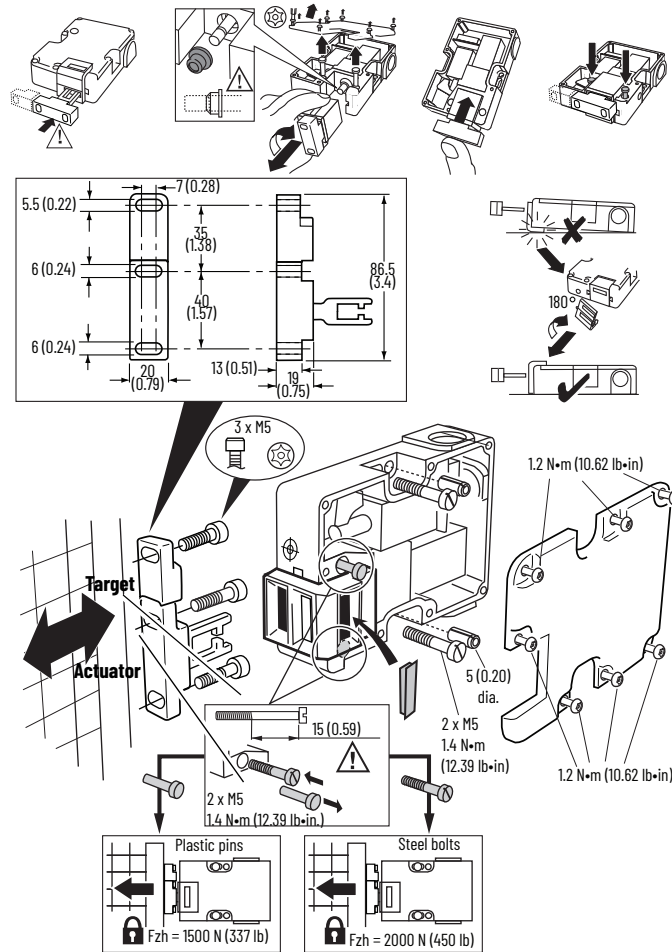
Table 6 - Outputs

Outputs	Description	Status
Safety	2 x PNP, 0.2 A max	ON (+24V DC)

Voltage drop 2V maximum

Installation

Figure 1 - Typical Mounting [mm (in.)]



Installation must be in accordance with the following steps and stated specifications and conducted by competent personnel. The unit is not to be used as a mechanical stop. Guard stops and guides must be fitted. Adherence to the recommended maintenance instructions forms part of the warranty.

This device is intended to be part of the safety-related control system of a machine. Perform a risk assessment before installation to determine whether the specifications of this device are suitable for all operational and environmental characteristics of the machine. See [Specifications on page 1](#) for certification information and ratings.

Use nonremovable screws, bolts, or nuts to mount the switch and actuators. Do not over torque the mounting hardware.

For use with flexible actuator only, catalog number 440G-A27143.

TLS-Z guard locking switches are classified according to ISO 14119 as Type 4 switching devices. The RFID targets are classified as having a high level of coding.

Measures are to be taken to minimize the need to defeat and to manage the use and availability of spare RFID targets.

Figure 2 - Actuator Placement

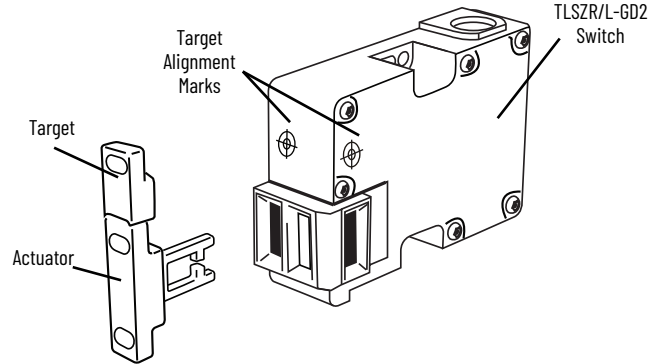
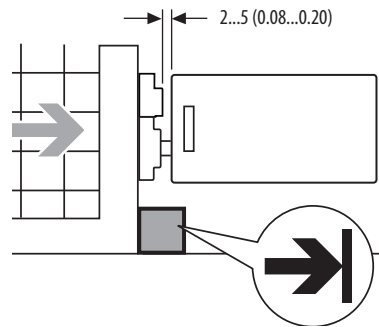


Figure 3 - Clearance in Closed Position [mm (in)] (max actuator insertion distance for locking)



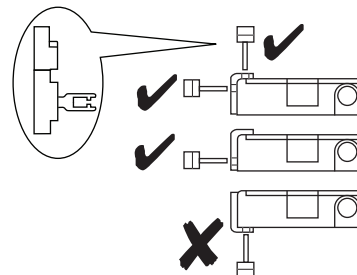
Provide a separate mechanical stop to protect the switch.

- Minimum clearance: 2 (0.08)
- Maximum assured locking distance: 5 (0.20)



ATTENTION: Guard locking switches that are activated by the Power to Lock principle, 440G-TZS2IUPLH, must only be used after a risk assessment has shown that the use of a Power to Release principle, 440G-TZS2IUPRH, is inappropriate, since the guard can be immediately opened after a loss of the power supply or upon activation of the unlocking signal.

Figure 4 - Allowable Approach Directions

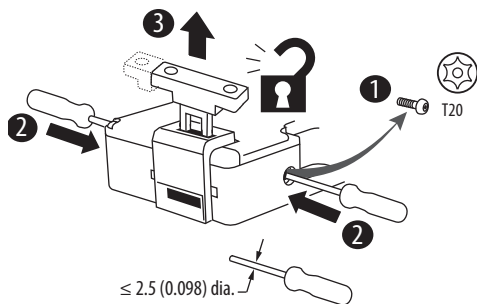


The actuator and target must mount as close coupled and so you can approach the switch in any of the three entry slot positions shown.

Approach from the underside is not allowed.

IMPORTANT Do not use the switch as a guard stop.

Figure 5 - Auxiliary/Manual Release [mm (in.)]

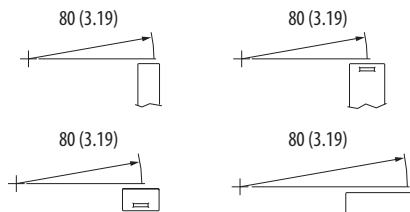


If power is supplied to the switch and the switch is in the locked state, operation of the auxiliary release causes the switch to enter a fault condition (flashing red light-emitting diode).

To reset the switch, cycle the power.

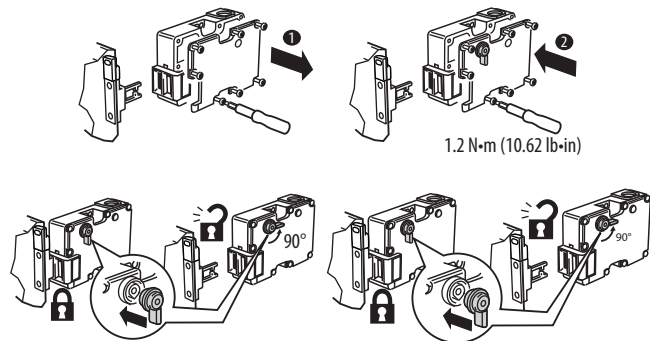
A manual release is possible by removing the secure Torx screws and pressing the internal mechanism.

Figure 6 - Minimum Operating Radius [mm (in.)]



Minimum operating radius is for all planes of approach of the actuator key, both along the length and perpendicular to the key. Use the two setscrews on the actuator to optimize the key angle.

Figure 7 - Manual Override Key for Power to Release Version



The cover with manual override key is intended for use with a Power to Release version TLSZR-GD2. It provides an auxiliary release function for use when power is not available to achieve automatic/electrical interlocking.

Mounting Restrictions

If a pair of TLS-Z switches is mounted close to each other, the two inductive fields interact causing crosstalk, which results in nuisance faults and false operation.

An absolute minimum of 200 mm (8 in.) must be used to help achieve correct operation.

The restriction applies if a TLS-Z switch is mounted close to the 440G-LZ guard locking and the 440N-Z SensaGuard™ switches.

Commissioning

Before use, the switch must first learn a new RFID door target. This step is not done at the factory, as there are two options:

- Multi-time learn: the switch can learn up to eight targets consecutively
- One-time learn: the switch can learn just one target, for life, non-reversible.

One-Time learn can be invoked at any time, not just at commissioning. For example, the switch could Multi-Time learn consecutively four different targets, and then complete a One-Time learn that can help prevent it from learning any more targets.

IMPORTANT During the learning process, the target and actuator must always be inserted or withdrawn from the switch together in their normal mounting configuration. If the target is introduced or withdrawn without the actuator, or the actuator is inserted without the target present, then it's possible a nonrecoverable fault condition occurs (requiring you to power off-on cycle).

Multi-time Learn Process

Learning the First Multi-time Target

- Connect the switch to 24V DC (see [Wiring Diagrams on page 5](#)). The Status/Diagnostic light-emitting diode blinks the number of times a new target can be learned (eight times when new). Then repeats, which indicates that the switch has not yet learned a target.
- The switch automatically starts the learning process as soon as a target and actuator are placed into the door-closed, locked position of the switch

IMPORTANT Leave the target/actuator in the door-closed position during the learning process. If they are removed during the learning process, the ability to learn an additional target is disabled.

Table 7 - Learning Sequence

Sequence Step	Status/Diagnostic Indicator Action
Target present:	Flashing green, 1 Hz rate
Verifying target:	Blinking Green/Red, 1 Hz rate (15 s)
Programming switch:	Blinking Green/Red, 4 Hz rate (15 s)
Programming finalizing:	Flashing green (number of learns left, 15 sec)
Verifying target:	Blinking Green/Red, 1 Hz rate (15 s)
Ready state (learn is completed):	Steady green (TLSZR), steady red (TLSZL)

Learning Additional New Multi-time Targets

Mount the new target to the door and repeat the previous process, introduce the target and actuator to the switch as described. While finalizing the program, the light-emitting diode blinks Green indicating the number of learns remaining.

One-time Learn Process

- Proceed as the Multi-time learn process indicates, except that at the programs completion stage, withdraw the target and actuator from the switch until the status indicator turns to steady red. Then replace the target and actuator back to the switch. This action must be completed within 15 s.
- The light-emitting diode blinks and then turns solid to indicate that learn is complete:
 - TLSZR: Steady green
 - TLSZL: Steady red

IMPORTANT For power-to-unlock switches, to be able to withdraw the target and actuator away from the switch as described it is necessary to execute a manual release.

Table 8 - Unique Coded Diagnostics

Status/Diagnostic LED - Flashes (4 Hz)	Error Code
Red-Red-Red-Green-Green	Target already learned
Red-Red-Red-Green-Green-Green	Bad RFID; target that is moved out of range
Red-Red-Red-Green-Green-Green-Green	Exceeded learning eight targets
Red-Red-Red-Green-Green-Green-Green-Green	Unit is locked to One-time learn; cannot learn another target

These code sequences persist until the power off-on cycle is undertaken.

For operating Status/Diagnostic light-emitting diode codes, see [Diagnostic](#).

Functional Testing

A manual functional electric test must be made:

- After installation
- After any maintenance or change of component
- If the guard is used infrequently
 - Less than once per month for SIL 3/PLe
 - Less than once per year for SIL 2/PLd



ATTENTION: During the functional test, confirm that there are no persons in the danger area and that the machine startup causes no hazard.

1. Confirm that guard door is open.
2. Connect the 24V DC power to pin 2. The switch conducts a self-testing regime at the end of which the diagnostic light-emitting diode shows steady red.
3. Test to confirm the machine cannot start.
4. Confirm the lock control at pin 3 is set to 0V for PTR and 24V for PTL types.
5. Test again to confirm the machine cannot start.
6. Close the guard door and then confirm that the guard is mechanically locked and the diagnostic light-emitting diode shows steady green.
7. Test to confirm the machine can now start.
8. Change the lock control at pin 3...24V for PTR and 0V for PTL types.

Confirm the machine stops, the guard door is mechanically unlocked, and the machine cannot restart.

Maintenance

Every week check for signs of abuse or interference. Check for missing screws, particularly for the manual release, which can indicate abuse or interference. Check for damage, which can cause loss of sealing at the lid or conduit entry.

Repair

If there is any malfunction or damage, no attempts at repair can be made. The unit must be replaced before machine operation is allowed.



ATTENTION: Do not dismantle the unit.

Diagnostic

Table 9 - Status Indicator

State	Status	Operating	Troubleshooting
Off	Not powered	–	–
Steady green	OSSD on	Door/guard closed and locked, safety outputs active.	–
Steady red	OSSD not active	Door/guard not locked, safety outputs off.	–
Flashing Green	Power up test or Safety inputs not present	Door/guard closed and locked, no input signal.	Check 24V DC or OSSD inputs (yellow and red wire)
Flashing Red	1 Hz Flash: Recoverable fault 4 Hz Flash: Nonrecoverable fault	Unit failure. See Troubleshooting.	Recoverable fault: Check OSSD. Outputs are not shorted to GND, 24V DC, or each other. Cycle power. Nonrecoverable fault: Cycle power.

For Learn Process light-emitting diode error codes, see [Table 8](#).

If there's an internal fault, the switch disables the OSSD outputs. Safety A and Safety B to the safe state 0V and the diagnostic output light-emitting diode flashes red at 1 Hz or 4 Hz, depending on the fault.

Wiring

Auxiliary Out Function

Lock and door position status are available for auxiliary output.

Lock Status (440G-TZS21UPRH and 440G-TZS21UPLH): Auxiliary output changes state when the lock is either unlocked or locked independent of the OSSD status.

Lock Status	AUX (0D Pin 1)
Unlocked	High, 24V (0.2 A max)
Locked	Low, 0V

Door Position Status (440G-TZS21UTRH and 440G-TZS21UTLH): Auxiliary output changes state when the actuator key is either inserted or withdrawn. If the AUX is high (24V) the switch can lock, position sensing of the actuator is accomplished by an internal microswitch.

Door Position Status	AUX (0D Pin 1)
Actuator key that is withdrawn	Low, 0V
Actuator key that is inserted	High, 24V (0.2 A max)

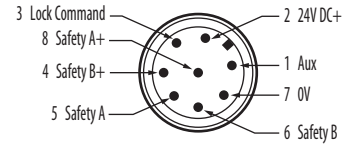
OSSD Outputs and Pulse Testing

The safety inputs are Safety A+ and Safety B+.

The OSSD outputs are Safety A and Safety B with the safe state defined as 0V (guard door open or not locked).

The safety outputs use test pulses to detect short circuit and cross-wire short detection. The cross-short pulses are asynchronous of duration 0.1 ms repeats every 11 s and the short circuit pulses are synchronous of duration of 0.5 ms repeats every 11 s. The connected control system must be tolerant of these pulses.

Table 10 - 8-Pin Micro (M12) Connections

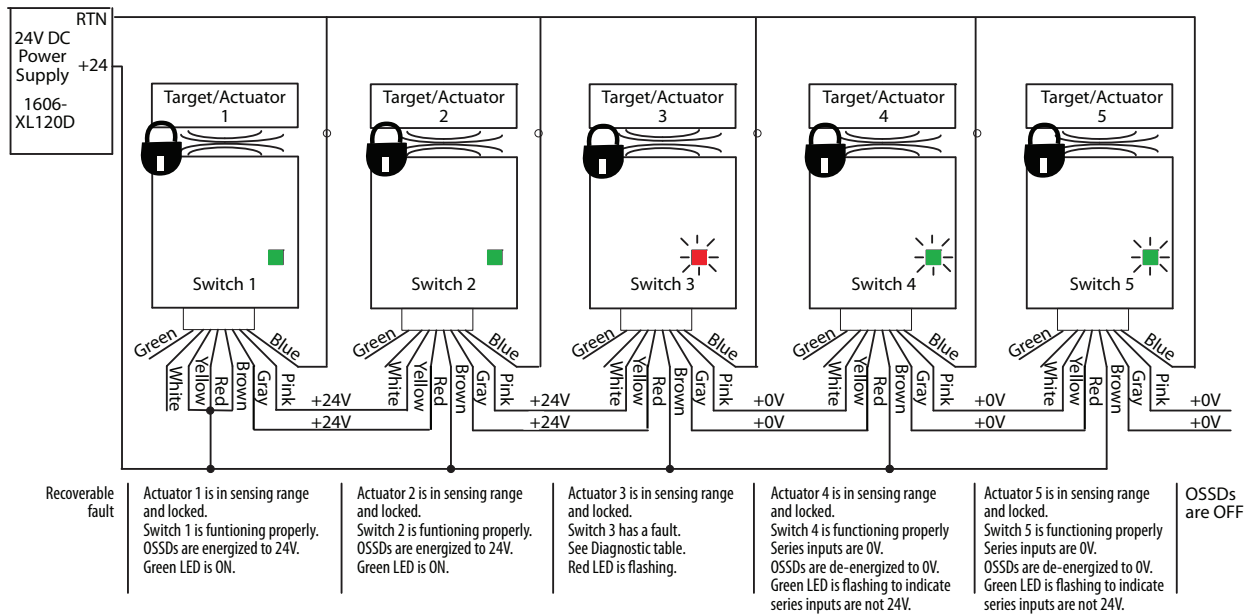


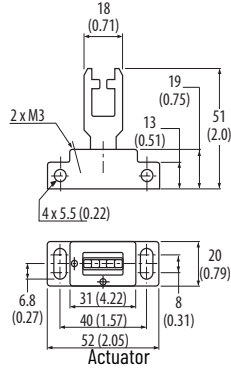
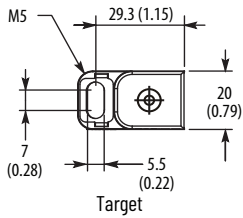
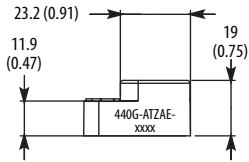
Pin	Color	Function
1	White	Aux
2	Brown	24V DC+
3	Green	Lock
4	Yellow	Safety B+ OSSD Input
5	Gray	Safety A OSSD Output
6	Pink	Safety B OSSD Output
7	Blue	Gnd / 0V
8	Red	Safety A+ OSSD Input

8-pin cordset 889D-F8AB-x or cable version
 x = 2 [2 m (6.6 ft)], 5 [5 m (16.4 ft)], or 10 [10 m (32.8 ft)] for standard cable lengths.

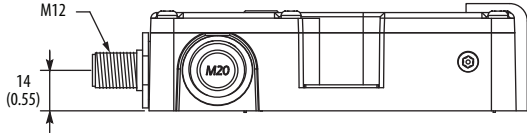
Wiring Diagrams

Figure 8 - Troubleshooting Series Circuit

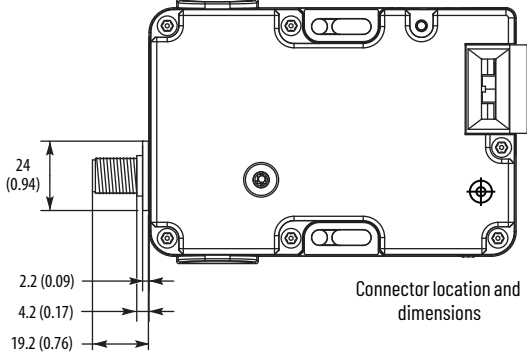




Actuator
Use with flexible actuator only:
440G-A27143



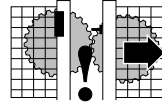
Do not use cable gland knockouts, two places



Connector location and dimensions

Recommended Relays

Guardmaster® safety relay family (440R-D22R2, 440R-D22S2, 440R-S12R2, 440R-S13R2, 440R-GL4S2P, 440R-GL4S2T), MSR57, MSR126, MSR127, MSR131, MSR138, MSR211, MSR320, SmartGuard™, Safety PLC I/O.



Verify that the machine is isolated and stopped whenever the interlocked guard door is open.

IMPORTANT

After installation and commissioning, the actuator, switch, and switch lid mounting screws are coated with tamper evident varnish or similar compound.

Declaration of Conformity

CE Conformity

Rockwell Automation declares that the products that are shown in this document conform with the 2014/30/EU Electromagnetic Compatibility Directive (EMC) and 2006/42/EC Machinery Directive (MD) and that the respective standards and/or technical specifications have been applied.

For a comprehensive CE certificate visit: rok.auto/certifications

UKCA Conformity

Rockwell Automation declares that the products that are shown in this document are in compliance with 2016 No. 1091 Electromagnetic Compatibility Regulations and 2008 No. 1597 Supply of Machinery (Safety) Regulations and that the respective standards and/or technical specifications have been applied.

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Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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Waste Electrical and Electronic Equipment (WEEE)



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

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

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