# SI-RFA-DM Diagnostic Module

## Instruction Manual

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209882

# Contents

# 1 Product Description

The SI-RFA Diagnostic Module acts as an interface to provide the user with serial data from Banner In-Series Diagnostic (ISD) enabled devices across various interfaces (IO-Link, USB, and PNP output).

⚠️ **CAUTION:** The SI-RFA Diagnostic Module is not a safety device. This device supplies status information that is not relevant to safety.



*Figure 1. SI-RFA-DM1*



*Figure 2. SI-RFA-DM2*

- Comprehensive diagnostic information for each device and for the entire system (chain of devices)
- Easily retrievable diagnostic data
- Time and cost savings during commissioning, maintenance and fault investigation
- Protection against unexpected machine stops through pre-fault detection
- Diagnostic module can provide the diagnostic information as follows:
  - Directly via IO-Link or an IO-Link Master with gateway
  - Via a laptop with USB interface (model SI-RFA-DM1 only)
- Basic information, such as safety input and safety output status, can be quickly obtained
- Extended diagnostic information and fault information can also be obtained as needed

## 1.1 Models

| Model | Output | Interface |
|---|---|---|
| **SI-RFA-DM1** | 8 digital outputs; 1 diagnostic circuit | IO-Link and USB 2.0 |
| **SI-RFA-DM2** | 1 diagnostic circuit | IO-Link |

Use the SI-RFA Diagnostic Module in conjunction with a chain of Banner ISD-enabled products and a Safety Monitoring device. To obtain the diagnostic information via USB from the SI-RFA-DM1, download the USB In-Series Diagnostic software from www.bannerengineering.com/si-rf.

⚠️ **WARNING:**
- **The SI-RFA Diagnostic Module only provides status information**, such as which gate is open.
- **Failing to include a Safety Monitoring device in the circuit may create a dangerous condition that may lead to serious injury or death.**
- A Safety Monitoring device is required to provide the safety function.

## 1.2 Important... Read this before proceeding!

**The user is responsible for satisfying all local, state, and national laws,** rules, codes, and regulations relating to the use of this product and its application. Banner Engineering Corp. has made every effort to provide complete application, installation, operation, and maintenance instructions. Please contact a Banner Applications Engineer with any questions regarding this product.

**The user is responsible** for making sure that all machine operators, maintenance personnel, electricians, and supervisors are thoroughly familiar with and understand all instructions regarding the installation, maintenance, and use of this product, and with the machinery it controls. The user and any personnel involved with the installation and use of this product must be thoroughly familiar with all applicable standards, some of which are listed within the specifications. Banner Engineering Corp. makes no claim regarding a specific recommendation of any organization, the accuracy or effectiveness of any information provided, or the appropriateness of the provided information for a specific application.

## 1.3 Overview

The SI-RFA Diagnostic Module is used in conjunction with the SI-RF In-Series Diagnostic (ISD) Safety Switches (SI-RFD models) and/or the Lighted Emergency Stops Buttons with ISD (**SSA-EB1PLx-0Dx** models). The module interprets the ISD signal and converts it to IO-Link and USB (model **SI-RFA-DM1** only) readable information.

The information transmitted from the SI-RFA Diagnostic Module is for status and not a safety function. The output signals from the SI-RFA Diagnostic Module must be wired into a safety evaluation module (for example, a safety controller).

The SI-RFA Diagnostic Module can interpret one chain of ISD enabled devices of up to 32 units. It can quickly provide the status of all 32 devices (on or off) via IO-Link or IO-Link master to any PLC/HMI platform.

| SI-RFA-DM1 Status Indicators | | |
| --- | --- | --- |
| LED | Color | Status |
| Power | Green | Power is applied |
| Fault | Red | Fault is detected |
| Diagnostic | Green | Receiving information at the Diagnostic IN terminals |
| IO-Link | Green | Communicating via the IO-Link terminals |

| SI-RFA-DM2 Status Indicators | | |
| --- | --- | --- |
| LED | Color | Status |
| Power | Green | Power is applied |
| Fault | Red | Fault is detected |
| IO-Link | Green | OSSD OK, no IO-link communications |
| | Green flashing at 1 Hz | OSSD OK, IO-link OK |
| | Green flashing at 2 Hz | OSSD Error, IO-link OK |

# 2 Installation Instructions

## 2.1 Requirements

To be able to receive data from all the ISD-enabled devices in the chain with the SI-RFA Diagnostic Module, wire the SI-RFA Diagnostic Module between the last switch in the chain and the safety evaluation module.



*Figure 3. Connecting the SI-RF in series with a DM1 and monitoring device*

Every SI-RFA Diagnostic Module has a USB Mini B port and IO-Link connections.



*Figure 4. The SI-RFA-DM2 can be connected using a t-adapter (SI-RFA-TS) connected to a reset t-adapter (SI-RFA-TK)*

## 2.2 Mechanical Installation

Install the Diagnostic Module inside an enclosure; it is not designed for exposed wiring. It is the user's responsibility to house the module in an enclosure with NEMA 3 (IEC IP54) rating, or better. The module mounts directly to standard 35 mm DIN rail.

**Heat Dissipation Considerations**—For reliable operation, ensure that the operating specifications are not exceeded. The enclosure must provide adequate heat dissipation, so that the air closely surrounding the module does not exceed the maximum operating temperature stated in the specifications. Methods to reduce heat build-up include venting, forced airflow (e.g. exhaust fans), adequate enclosure exterior surface area, and spacing between modules and other sources of heat.

The **SI-RFA-DM2** can be mounted in any position as long as it is protected from damage. The cabling must also be protected from damage. The unit does not need to be mounted inside of an enclosure (it is rated to IP69).

## 2.3 Electrical Installation

⚠️ **CAUTION:** The diagnostic data is not relevant to safety.

⚠️ **WARNING:**
- **Risk of electric shock**
- Use extreme caution to avoid electrical shock. Serious injury or death could result.
- Always disconnect power from the safety system (for example, device, module, interfacing, etc.), guarded machine, and/or the machine being controlled before making any connections or replacing any component. Lockout/tagout procedures might be required. Refer to OSHA 29CFR1910.147, ANSI Z244-1, or the applicable standard for controlling hazardous energy.
- Make no more connections to the device or system than are described in this manual. Electrical installation and wiring must be made by a Qualified Person[1] and must comply with the applicable electrical standards and wiring codes, such as the NEC (National Electrical Code), ANSI NFPA79, or IEC 60204-1, and all applicable local standards and codes.

The Diagnostic Module requires 24 V dc power. Wire the +24 V dc to pin 01 and wire common (0 V dc) to pin 04.

Wire the output signals from the last SI-RFD Safety Switch in the series to the Diagnostic Module Input 1 and 2 (pins 05 and 06). Wire the Diagnostic Module Output 1 and 2 (pins 07 and 08) to the safety evaluation module for the safety actions of the circuit.

The unit has 8 PNP outputs (pins 9 through 16) that can provide actuator presence or absence status (non-safety). The output is high (+24 V dc) when an actuator is not detected (door open) and low when an actuator is detected (door closed).

💡 **Tip:** For high and uniquely coded units, the PNP output still changes states when any actuator is presented. To distinguish between any actuator and the correct actuator, use a PLC to compare the PNP output with the status of the safety outputs (this helps determine attempts at tampering with the system).

| Wiring Terminal | Function | Wiring Terminal | Function |
| --- | --- | --- | --- |
| 01 | +24 V DC | 09 | PNP Status Output 01 |
| 02 | IO-Link 24 V | 10 | PNP Status Output 02 |
| 03 | IO-Link COM | 11 | PNP Status Output 03 |
| 04 | 0 V DC | 12 | PNP Status Output 04 |
| 05 | Safety Diagnostic 1 IN | 13 | PNP Status Output 05 |
| 06 | Safety Diagnostic 2 IN | 14 | PNP Status Output 06 |
| 07 | Safety Diagnostic 1 OUT | 15 | PNP Status Output 07 |
| 08 | Safety Diagnostic 2 OUT | 16 | PNP Status Output 08 |

The simplest wiring of the **SI-RFA-DM2** uses the t-adapter **SI-RFA-TK** and a **MQDC-4xx** cordset. Connect the blue wire (pin 3) to DC COM and the brown (pin 1) to +24 VDC. The white wire (pin 2) is not connected, and the black wire (pin 4) is the IO-Link Communication line.

If the simplified wiring for the ISD chain is not used, the 8-pin connections must be wired as shown below.

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[1] A person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

| 8-pin Male Connection | Pin | Function |
|---|---|---|
|  | 1 | + 24 V DC |
| | 2 | Output 1 (Q1) |
| | 3 | DC COM |
| | 4 | Output 2 (Q2) |
| | 5 | Input 1 (I1) |
| | 6 | Input 2 (I2) |
| | 7 | IO-Link communication |
| | 8 | No connection |
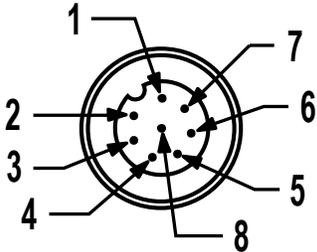
# 3 Operating Instructions

## 3.1 Output Status Information

The eight PNP outputs (pins 09 to 16 of the **SI-RFA-DM1**) can provide the status of eight consecutive doors.
- High (+24 V DC) - Door open (actuator not detected)
- Low (0 V DC) - Door closed (actuator detected)
- Cycling - Sensor at its maximum range (minimum signal)

**Tip:** For high and uniquely coded sensors, the PNP outputs change state when any actuator is detected.

These eight PNP outputs can be used to indicate which door is open. They can also provide information that a door's alignment is poor (at maximum range). Each module can provide status of eight doors. If more door monitoring is needed, the modules can be cascaded (Safety Diagnostic Outputs of one module go into the Safety Diagnostic Inputs of the next module). Each module can be set to provide the status of a different series of 8 sensors based on the position of switch 1 and 2 of the Offset switch on the top of the module.

| Switch 1 | Switch 2 | PNP Output Status |
|----------|----------|-------------------|
| Off | Off | Displays status of switches 1 to 8 (default setting) |
| On | Off | Displays status of switches 9 to 16 |
| Off | On | Displays status of switches 17 to 24 |
| On | On | Displays status of switches 25 to 32 |

Switch 1 is the furthest from the Diagnostic Module (closest to the terminating plug, **SI-RFA-P**). To engage the maximum range signal, turn on switch 3 of the Offset switches.

## 3.2 USB Status Information

The SI-RFA Diagnostic Module provides an interface for displaying switch information on a computer. The computer must be connected to the device with a standard USB A (computer side) to Mini B (module site) USB cable (see Accessories on p. 14).

Download the SI-RF diagnostic software from www.bannerengineering.com, under Software in the download section of the SI-RF Safety Switch or SI-RFA Diagnostic Module page.

The SI-RF diagnostic software can be used to configure the information received from the series of ISD units (set the number of units in the string).

## 3.3 IO-Link Status Information

The Diagnostic Module offers an IO-Link interface for bus-independent transmission of diagnostic data into an industrial network.

The module has an IO-Link 24 V connection (pin 02) and IO-Link common/GND connection (pin 03). If you are using an IO-Link master, connect the IO-Link master's L+ to pin 02 and the COM to pin 03.

Download the IODD needed for configuration from www.bannerengineering.com in the Product Data Files section of the SI-RF Safety Switch or Diagnostic Module page.

The SI-RFA-DM1 IO-Link Data Reference Guide (p/n 212340) provides an overview of the IO-Link data structure. This document can be found in the Technical Literature section on the module page.
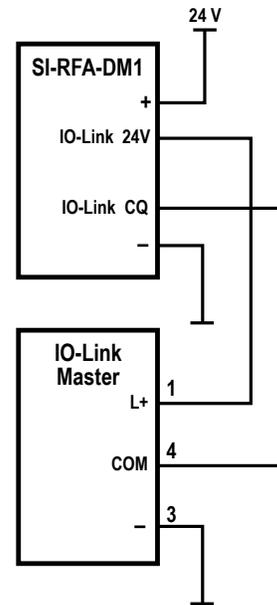
| Information | Meaning |
|---|---|
| Actuator Detected | Actuator detected or not detected |
| Wrong Actuator | Correct actuator code or not (high & unique units) |
| Actuator code not taught-in | Actuator code saved or not saved |
| Safety Input 1 | On/Off |
| Safety Input 2 | On/Off |
| Safety Output 1 | On/Off |
| Safety Output 2 | On/Off |
| Local Reset | Local reset required |
| Operating Voltage Warning | Operating voltage is OK or ±5% to end of the voltage range |
| Operating Voltage 24V | Operating voltage is OK or outside of specification |
| Additional Sensor Functions | Display of the additional function of the sensor, e.g. local reset coding level, etc. |
| Number of Remaining Teach-In Operations | Shows remaining number of teach in cycles available |
| Received Actuator Code | Indication of the actuator code |
| Time actuator in detection limit | Time in hours since actuator is detected in detection area |
| Output error switch-off time | The remaining time, in minutes, until the sensor switches off the safety outputs after an error has been detected on one output channel |
| Operating Voltage Warning | Information on the frequency of operating voltage warnings |
| Sensor Temperature | Indicates the sensor temperature in °C |
| Supplied Voltage Applied | Indicates the applied voltage in volts |

| Information | Meaning |
|---|---|
| Actuator Distance | Indicates the actuator distance in % to the maximum sensing distance |

See the manual of the ISD enabled devices for the complete list of ISD information available from that device.

Each ISD-enabled safety device has an internal error memory that keeps records of the current status of the sensor. The logged events are:
- Operating voltage errors
- Incorrect actuator detected (only for high and unique coded sensors)
- Actuator at limit of detection range
- Status of safety outputs 1 and 2

Up to 512 of these error events are stored permanently with date and time. If further events occur, the oldest entry is overwritten. To facilitate output of error data with the correct time and date, synchronize with the SI-RF Diagnostic Software.

# 4 Specifications

## SI-RFA-DM1 Diagnostic Module

**Rated Supply Voltage ($U_e$)**
24 V DC +25%, –20%
Reverse polarity protection
Voltage level according to Type 3 EN 61131-2

**Rated operating current ($I_e$)**
50 mA each signal output

**No-load current**
≤ 15 mA

**Voltage drop ($U_d$)**
< 3.5 V each signal output

**Signal Outputs**
PNP, N.O. (closed by opened protective device)

**Interfaces**
USB 2.0

**Short Circuit Protection**
Yes

**EMC**
According to EN 61326-1 and EN 61131-9

**IO-Link Specifications**
Compliant with IO-Link Spec V 1.1
COM 2 Speed: 38400 baud

**Construction**
Housing: Black PA-GF
Front plate: Light gray PBT

**Indicators**
4 LEDs

**Connections**
Screw terminals

**Operating Conditions**
Ambient and Storage Temperature: 0 °C to 60 °C (32 °F to 140 °F)
Altitude: ≤ 2000 m NHN

**Environmental Rating**
IEC IP20
Protection Class according to EN IEC 61558: III

## SI-RFA-DM2 Diagnostic Module

**Rated Supply Voltage ($U_e$)**
24 V DC +25%, –20%
Reverse polarity protection
Voltage level according to Type 3 EN 61131-2

**No-load current ($I_o$)**
≤ 15 mA

**Short Circuit Protection**
Yes

**EMC**
According to EN 61326-1 and EN 61131-9

**Operating Conditions**
Ambient and Storage Temperature: –25 °C to +70 °C (–13 °F to +158 °F)
Altitude: ≤ 2000 m NHN
Maximum relative humidity: 93% at 40 °C non-condensing

**IO-Link Specifications**
Compliant with IO-Link Spec V 1.1
COM 2 Speed: 38400 baud

**Construction**
Housing: Black PBT
Tension Relief: Black TPE

**Indicators**
3 LEDs

**Connections**
0.25 m cable with an 8-pin M12/Euro-style quick disconnect connector

**Environmental Rating**
IEC IP69
Protection Class according to EN IEC 61558: III

## 4.1 Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise.



Figure 5. SI-RF-DM1 Module

30.0
[1.18]

15.0
[0.59]

68.0
[2.68]

4 x R2.3  THRU
[0.09]

4.0
[0.16]

4 x R3.8  ⌴▽  4
[0.15]

27.0
[1.06]
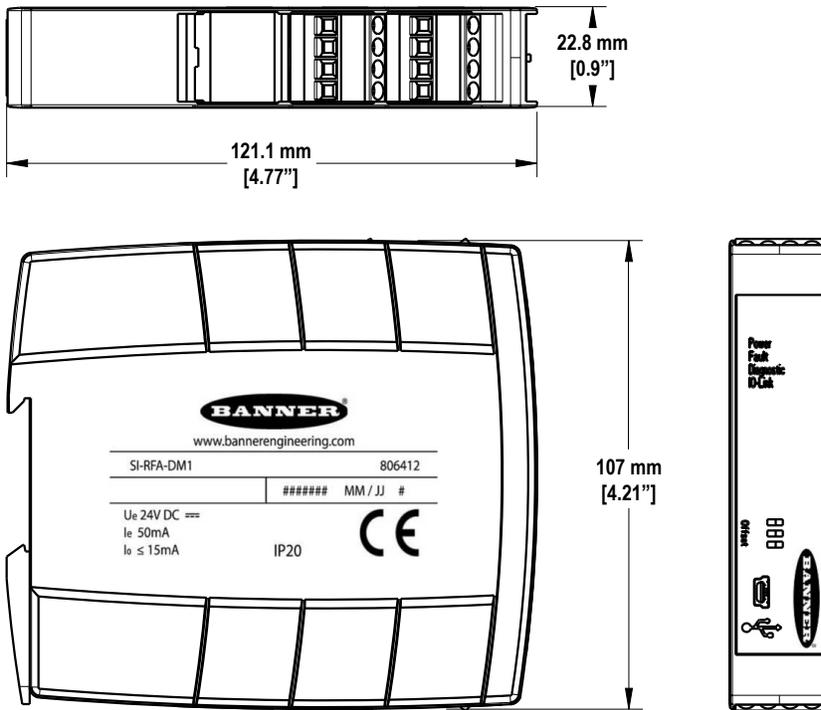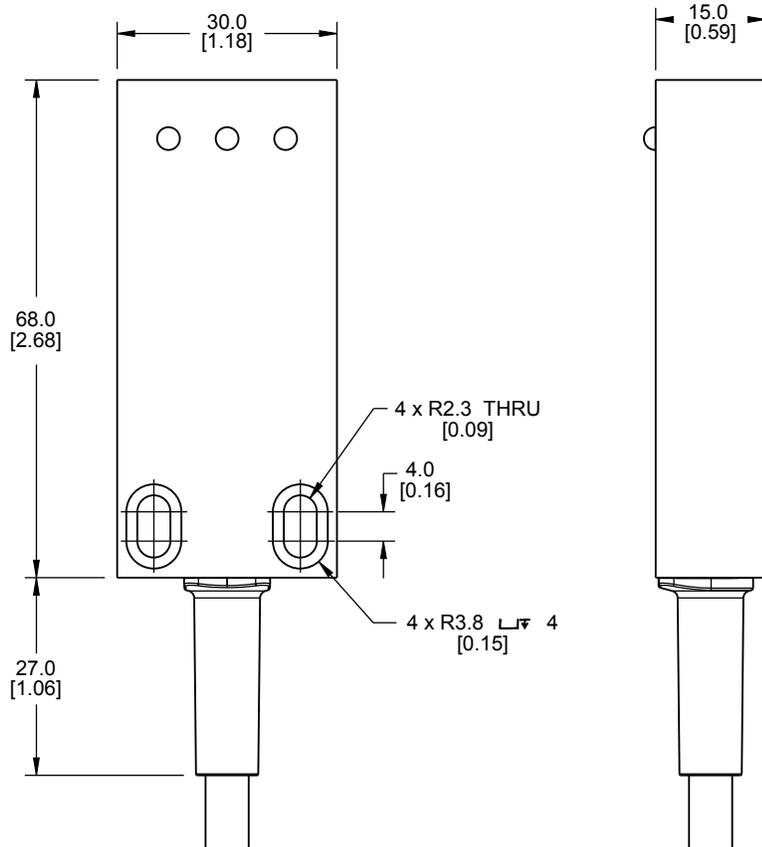
*Figure 6. SI-RF-DM2 Module*

# 5 Accessories

## 5.1 Cordsets for the DM1 Module

The following cordsets may be used with the DM1 module.

**USB-USBM-1**
- USB-A to USB-Mini B
- 1 meter

| 4-Pin Threaded M12/Euro-Style Cordsets—Single Ended | | | | |
|---|---|---|---|---|
| Model | Length | Style | Dimensions | Pinout (Female) |
| MQDC-406 | 2 m (6.56 ft) | Straight |  |  |
| MQDC-415 | 5 m (16.4 ft) | | | |
| MQDC-430 | 9 m (29.5 ft) | | | |
| MQDC-450 | 15 m (49.2 ft) | | | 1 = Brown |
| MQDC-406RA | 2 m (6.56 ft) | Right-Angle |  | 2 = White |
| MQDC-415RA | 5 m (16.4 ft) | | | 3 = Blue |
| MQDC-430RA | 9 m (29.5 ft) | | | 4 = Black |
| MQDC-450RA | 15 m (49.2 ft) | | | |

## 5.2 Cordsets for the DM2 Module

The following cordsets may be used with the DM2 module.

| 4-Pin Threaded M12/Euro-Style Cordsets—Single Ended | | | | |
|---|---|---|---|---|
| Model | Length | Style | Dimensions | Pinout (Female) |
| MQDC-406 | 2 m (6.56 ft) | Straight |  |  |
| MQDC-415 | 5 m (16.4 ft) | | | |
| MQDC-430 | 9 m (29.5 ft) | | | |
| MQDC-450 | 15 m (49.2 ft) | | | 1 = Brown |
| MQDC-406RA | 2 m (6.56 ft) | Right-Angle |  | 2 = White |
| MQDC-415RA | 5 m (16.4 ft) | | | 3 = Blue |
| MQDC-430RA | 9 m (29.5 ft) | | | 4 = Black |
| MQDC-450RA | 15 m (49.2 ft) | | | |

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| 8-Pin Threaded M12/Euro-Style Cordsets—Flying Leads | | | | |
|---|---|---|---|---|
| Model | Length | Style | Dimensions | Pinout (Female) |
| SXA-815D | 4.57 m (15 ft) | Straight | 44 Typ. / M12 x 1 / ø 14.5 | 1 = White   5 = Gray<br>2 = Brown   6 = Pink<br>3 = Green   7 = Blue<br>4 = Yellow   8 = Red |
| SXA-825D | 7.62 m (25 ft) | | | |
| SXA-850D | 15.24 m (50 ft) | | | |
| SXA-8100D | 30.48 m (100 ft) | | | |
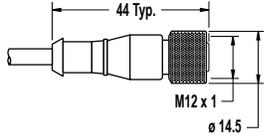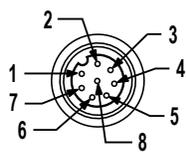
## 5.3 Adapters

| Model | Description |
|---|---|
| SI-RFA-TS | SI-RF T-adapter for series connection, 4-pin to 8-pin to 4-pin |
| SI-RFA-TK | SI-RF T-adapter for connection of the reset button, 8-pin to 4-pin to 8-pin |
| SI-RFA-P | SI-RF Termination plug M12 |

# 6 Product Support and Maintenance

## 6.1 Repairs

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

> **Important:** If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

## 6.2 Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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