

MCR-403 *InStar* Proximity Reader

The MCR-403 *InStar*™ Proximity Reader is designed to provide compatibility with Motorola™ ASP™ 26-bit Wiegand™ formatted cards and tags, as well as with Keri's KC-26X, MT-26X, and PKT-26X cards and tags. It will **not** read Motorola ASP⁺, ESP, or ECR formatted cards and tags.

The *InStar* Reader can be mounted directly to any solid surface including metal door frames (mullions). The unique size and shape of the MCR-403 reader allows it to be fitted with any of the Motorola Linear, Arch, Curve, and Wave doorframe and wall switch covers (bezels), allowing it to blend seamlessly into existing installations.

When a card or tag is read, the MCR-403 reader immediately responds with a beep and an LED flash. The access panel then handles subsequent LED and beeper responses. Both the beep and the flash in this "Beep-n-Flash™" feature can be disabled. The MCR-403 reader also features built-in diagnostics: a start-up self test to ensure reader functionality and a data line test to ensure reader/access panel communication.

The MCR-403 reader is compliant with the following organizations: FCC, , and .

1.0 Reader Specifications

- Dimensions – 4 inches High x 1.5 inches Wide x 0.63 inches Deep (101.6 mm H x 38 mm W x 16 mm D)
- Weight – 4 ounces (113 g)
- Operating Voltage¹ – +5 to 14 VDC @ 95 mA typical
- Operating Temperature – -40° C to +65° C
- Frequency – 125 KHz excitation
- Format – 26-bit Wiegand industry standard
- Card Compatibility² –
 - Motorola: ASP formatted ASC-121T, ISO-30, and ASK-116
 - Keri: KC-26X, MT-26X, and PKT-26X
- Audio Tone – standard
- LED Indicator – four-state standard (red, green, amber, off)
- Color – black, but can be fitted with any of the Motorola Linear, Arch, Curve, and Wave doorframe and wall switch covers

1. +12 VDC recommended for optimum operation.

2. The MCR-403 is intended primarily for use with Motorola's 26-bit Wiegand ASP formatted credentials, as well as Keri's -26X formatted credentials.

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MCR-403 *InStar* Proximity Reader

1.1 Motorola Compatibility

The MCR-403 *InStar* Proximity Reader is designed to read Motorola's 26-bit Wiegand ASP formatted cards and tags (card format number 40134), including the ASC-121T card, ISO-30 card, and ASK-116 key tag. The MCR-403 is also designed to read Keri's 26-bit Wiegand formatted KC-26X card, MT-26X card, and PKT-26X key tag. Refer to Table 1 for a compatibility summary.

Like Motorola proximity readers, the MCR-403 uses "format matching" technology. This means for correct card data output the format of the card must be matched to that of the reader. The MCR-403 is currently matched to Motorola's 26-bit Wiegand ASP formatted cards. However the MCR-403 can read Motorola credentials programmed with ASP formats other than 26-bit Wiegand, as well as Keri's credentials programmed with the -10X format, though it will only transmit 26-bits of credential data. A key consideration here is card code duplication. This is because the format may include more data bits than can be output by the reader.

Motorola's proximity card and reader communications are based on phase shift keying (PSK) modulation. This type of modulation varies the phase of the card's return signal. As the MCR-403 uses PSK modulation, it will **not** read Keri's Pyramid Series Proximity line of OEM proximity cards and tags, or HID's proximity cards and tags. Also, due to data structure and/or frequency incompatibilities, the MCR-403 will **not** read Motorola cards programmed with the ASP+, ECR, or ESP format structures.

Table 1: Motorola Compatibility Summary

	Motorola Format Structures					Keri Format Structures			HID
	ASP Standard	ASP Custom	ASP+	ECR	ESP	-26X Format	-10X Format	Pyramid Series Proximity	HID
MCR-403 <i>InStar</i> Proximity Reader	Yes 26-bit Wiegand	Yes non 26-bit Wiegand formats	NO	NO	NO	Yes	Yes	NO	NO ^a
Credentials	ASC-121T ISO-30 ASK-116	ASC-121T ISO-30 ASK-116 ^b	N/A	N/A	N/A	KC-26X MT-26X PKT-26X	KC-10X MT-10X PKT-10X ^b	N/A	N/A

- a. For HID compatibility, use the Pyramid Series Reader with optional HID compatibility (e.g. P-300H).
b. The MCR-403 will only output 26-bits of Wiegand data regardless of format bit length.



MCR-403 *InStar* Proximity Reader

1.2 Read Range

Read range is measured in a clean RF and electrical environment using Motorola's ASC-121T Proximity Card presented parallel to the reader surface with the reader operating at 12 VDC. The read range is less for ISO-30 and ASK-116 cards and for readers operating at +5 VDC.

- Read Range – up to 4 inches (10 cm)

Like all manufacturers of Proximity Readers, Keri recommends a good quality, regulated, linear power supply (such as Keri Systems' KPS-5) be used with all proximity readers. Read range will be reduced if a reader is located in electrical or RF noisy environments such as mounted near a computer monitor, powered by a switching power supply, or a lack of a good earth ground.

1.3 Cable Requirements

The MCR-403 reader operates with up to 500 feet (152 m) of cable, using seven-conductor, shielded, stranded cable. Per Wiegand specification, AWG 24 (such as Belden 9537) is the minimum gauge required for data transfer in a 500-foot run length. However, the proper wire gauge to use must be determined by the current draw requirements of the reader, the length of the cable run, and the voltage being applied to the reader.

If the reader is to be operated at 5 VDC, 5 VDC must be available at the reader (long cable runs have a voltage drop due to the resistance in the cable). A larger gauge of wire (having less resistance) or a separate power supply near the reader may be required to ensure 5 VDC is available at the reader.



MCR-403 *InStar* Proximity Reader

1.4 Reader Mounting Instructions

Three holes need to be drilled to mount the MCR-403 reader (refer to Figure 1). One large hole (1 inch - 25.4 mm) accommodates the beeper and the reader cable. Two small pilot holes for a #6 screw (1/8 inch - 3 mm) are for mounting the reader on the mullion or doorframe.

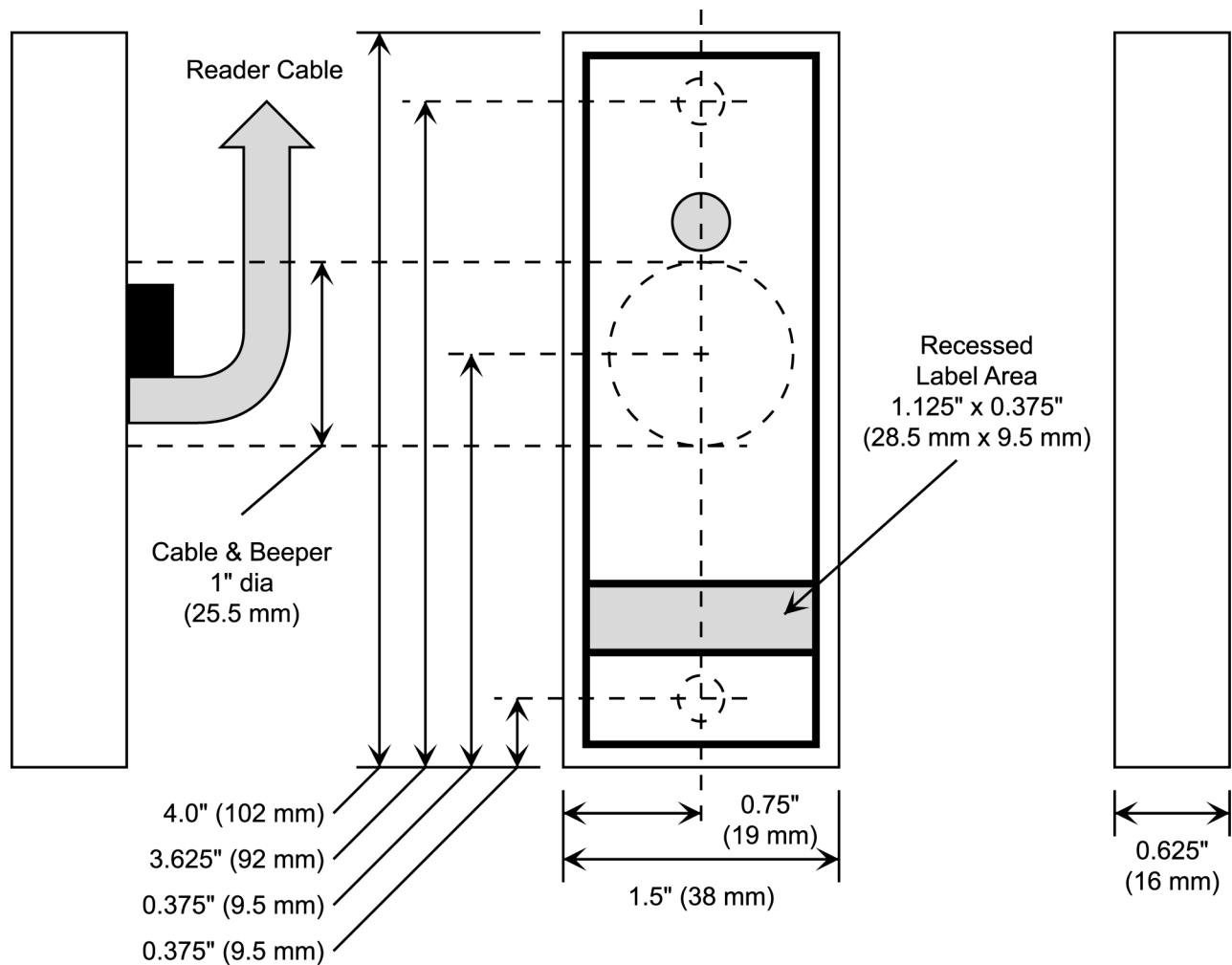


Figure 1: MCR-403 Mounting Diagram

MCR-403 *InStar* Proximity Reader

1.5 Reader Covers

The MCR-403 reader is similar in size to the Motorola Reader Core Electronics Module – model CEM-603. This allows the MCR-403 to be fitted with Motorola’s range of FlexPass covers (bezels). Specifically, these include the Slim and Wallswitch covers in their Linear, Arch, Curve, and Wave lines. Using the Motorola FlexPass covers allows the MCR-403 to blend seamlessly into an existing installation. Unlike Motorola’s CEM-603, the MCR-403 does not require a tamper screw. Instead, the covers are held in place by friction. A short strip of double-stick tape may also be used to secure the cover in place.

The MCR-403 can be mounted to a standard U.S. single-gang wall switch box. However, as the MCR-403 itself will not completely cover the switch box, it is strongly recommended a Motorola Wallswitch cover be used.

If a FlexPass cover is not used, users will find the small and compact reader attractive on its own. The front of the reader carries no company name or logo, though it does have a recessed label area for private labeling. This label area is the same as that found on Motorola’s FlexPass Arch cover series, as well as HID’s proximity readers.

1.6 Wiring Connections

Refer to Figure 2 for instructions for wiring an InStar Proximity Reader to a Wiegand compatible access panel.

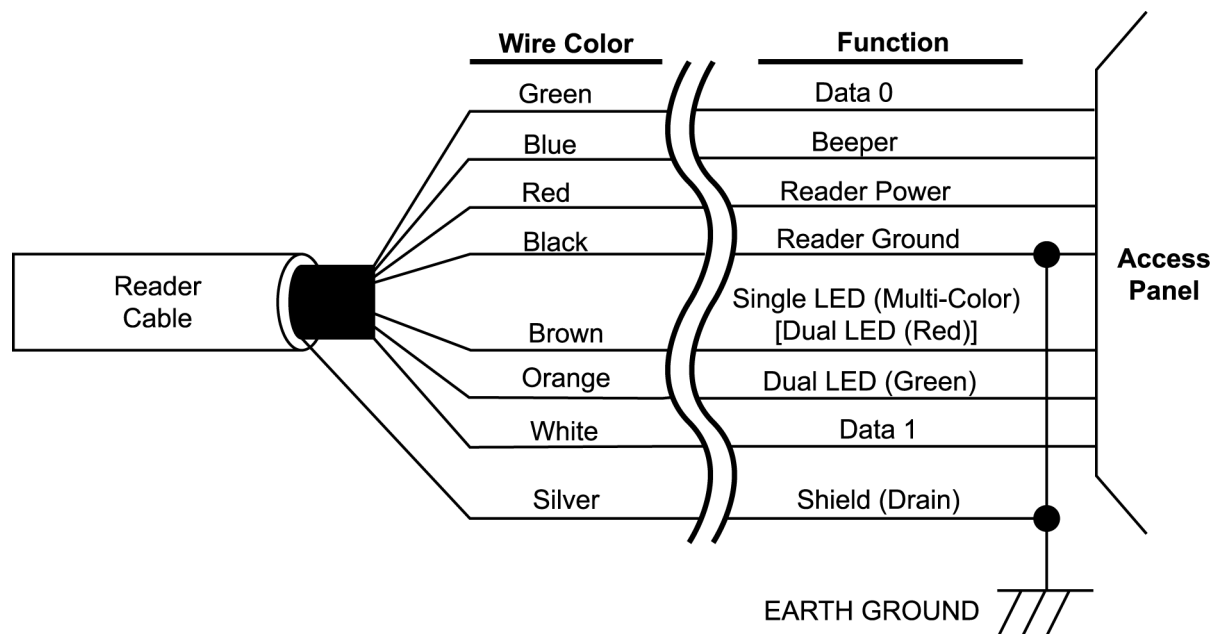


Figure 2: InStar Proximity Reader Wiring Connections

MCR-403 *InStar* Proximity Reader

2.0 Installation Verification

The following information applies to an installation with an access panel. Refer to the Troubleshooting the Reader Installation section beginning on page 9 if the reader is not functioning properly.

2.1 Grounding

Shield (Drain) continuity must run from the reader to the access panel. Shield (Drain) and reader ground should tie together at the access panel and connect to an earth ground in one place.

2.2 Power

A reader may be powered by the access panel, so the reader is powered on when the access panel is powered on. When powered, verify the voltage at the reader meets the reader's requirements (refer to "Reader Specifications" on page 1). When the reader is powered on, its beeper sounds 2 long beeps.

NOTE: Switching power supplies are known sources of electromagnetic interference and cannot be used with the MCR-403 reader. Only commercially built, linear, regulated power supplies should be used with any access control system using proximity readers.

2.3 Beeper and LED Control

- Beeper (the blue wire): Pull the beeper line low to activate the beeper.
- Single LED Control Line Mode (the brown wire)
 - The normal state is for this line to be high activating the Red LED.
 - Pull the Single LED line low to activate the Green LED.
 - Toggle the Single LED line to activate the Amber LED.
- Dual LED Control Line Mode (the brown and orange wires)
 - The normal state is for both LED lines to be high (brown and orange) turning the LED Off.
 - Pull both lines low (brown and orange) to activate the Amber LED.
 - Pull the Brown wire high and pull the Orange wire low to activate the Green LED.
 - Pull the Brown wire low and the Orange wire high to activate the Red LED.

MCR-403 *InStar* Proximity Reader

2.4 Verifying Read Range

Perform the following steps to verify the read range¹ of the MCR-403 reader (see “Read Range” on page 3 for read range specifications).

1. Hold a Motorola ASC-121T card parallel to the reader, 6 inches (17 cm) away from the reader.
2. Slowly bring the card in toward the reader and note the distance when the reader recognizes the card (the reader beeps and the LED flashes).

3.0 Control Cards

Control cards are specially coded proximity cards that toggle readers between specified modes of operation. To toggle between modes, simply present the control card to the reader. The reader beeps and the LED flashes indicating the control card was recognized and the mode has been changed, but no data is sent to the access panel. Control cards must be ordered from the supplier.

3.1 MCR LED Mode Control Card

Motorola Compatible Readers can work with access panels configured to drive either Wiegand single or dual LED control line devices. This refers to the access panel's ability to drive a reader's LED with either one control line wire or two control line wires. The reader uses the MCR LED Mode Control Card to change between single and dual line LED control modes. The default setting for the readers is for single LED control line operation.

In Single Line LED Control the LED is red when the control line is high, indicating the door is locked. The LED turns green when the line is low; indicating the door is unlocked. The LED turns amber when the line is toggled at a 1 KHz rate. There is no LED off state. Single line LED control is the default configuration for Motorola Compatible Readers.

In Dual Line LED Control, the red and green LEDs each have separate control lines. If both lines are pulled low at the same time, the LED turns amber. If both lines are high the LED turns off.

The reader uses an LED Mode control card to toggle the reader between single and dual line LED control modes. To change between modes, simply present the LED Mode control card to the reader. The reader will beep and the LED will flash indicating the control card was recognized and the mode has been changed, but no data is sent to the access panel.

1. The Reader's read range can be affected by the installation conditions, the material on which the reader is mounted, and whether it is a card or a tag being read. Due to the physical size difference between the coils of various credentials, Keri MT-26X cards and PKT-26X key tags and Motorola ISO-30 and ASK-116 cards provide less read range than Keri KC-26 cards and Motorola ASC-121T cards.

MCR-403 *InStar* Proximity Reader

If the access panel is designed for single LED control line operation:

1. The LED Mode control card is not needed, as this is the default configuration for the reader.
2. Of the reader's two LED control line wires, only the reader's brown wire needs to be connected to the access panel's LED control line.

To toggle from single LED mode to dual LED mode – If the access panel is designed for dual LED control line operation:

1. Verify the reader is correctly wired to the access panel: the reader's brown wire to the access panel's red LED control line, the reader's orange wire to the access panel's green LED control line.
2. Verify the reader is powered on.
3. Present the LED Mode control card to the reader.
4. From the card's special code the reader recognizes that the card is the LED Mode control card. The reader does not send any card data to the access panel.
5. The reader beeps twice and the red LED blinks off indicating the card is recognized.
6. The reader toggles from single LED mode operation to dual LED mode operation.
7. There are NO other signs or notifications that this change has been made.

To toggle from dual LED mode to single LED mode:

1. Verify the reader is correctly wired to the access panel: the reader's brown wire to the access panel's LED control line, the reader's orange wire is disconnected.
2. Verify the reader is powered on.
3. Present the LED Mode control card to the reader.
4. From the card's special code the reader recognizes that the card is the LED Mode control card. The reader does not send any card data to the access panel.
5. The reader beeps once and the red LED flashes on to indicate the card is recognized.
6. The reader toggles from dual LED mode operation to single LED mode operation.
7. There are NO other signs or notifications that this change has been made.

MCR-403 *InStar* Proximity Reader

4.0 Troubleshooting the Reader Installation

Table 2: Reader Installation

Problem	Possible Cause	Corrective Action
The reader does not recognize a card/tag (no beep, no LED flash).	1. One or more of the reader's wiring connections are incorrect.	<ul style="list-style-type: none"> Power down the access panel and verify the wiring connections are correct for the reader/access panel combination per the instructions in the <u>Wiring Connections</u> section on page 5.
	2. The reader is not receiving proper power from the access panel.	<ul style="list-style-type: none"> Verify the voltage supplied to the reader is between 5 and 14 VDC.^a
	3. The reader is mounted too close to a device that radiates electromagnetic interference.	<ul style="list-style-type: none"> Devices such as computer monitors radiate electromagnetic interference that affects read range. When possible, relocate either the reader or the device to provide a greater distance between the two.
	4. The reader is not compatible with the presented card/tag.	<ul style="list-style-type: none"> Refer to Table 1 on page 2 and verify the card/tag is compatible with the reader. Verify the card is functioning and not damaged.
The reader has a short read range.	1. The access panel is not properly grounded.	<ul style="list-style-type: none"> Ensure there is a quality earth ground connection made to the access panel. Refer to the access panel's documentation for information regarding the earth ground connection.
	2. The shield wire for the reader's cable has opened somewhere between the reader and the access panel.	<ul style="list-style-type: none"> Verify the shield line from the access panel to the reader is one continuous, connected line. Refer to the access panel's documentation and verify the shield line is correctly connected to the access panel.
	3. The reader is mounted too close to a device that radiates electromagnetic interference.	<ul style="list-style-type: none"> Devices such as computer monitors radiate electromagnetic interference that affects read range. When possible, relocate either the reader or the device to provide a greater distance between the two.
	4. The power supply is generating electromagnetic interference.	<ul style="list-style-type: none"> The power supply on the access panel must be a regulated linear supply – do not use switching supplies as they are often sources of electromagnetic interference.

a. A supply voltage of 12 VDC at the reader is recommended for best operation.



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