RM-4/RM-4E

TECHNICAL MANUAL

REVISION C0

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Firmware versions: RM-4 Version 3.0, RM-4E Version 1.04
Document Number: UM-064
Revision Number: C0
Release Date: March 2005

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Preface

The *RM-4 /RM-4E Technical Manual* is for experienced security system installers responsible for wiring and configuring an RM-4 or RM-4E board on a C•CURE 800/8000 system.

This manual describes how to install an RM-4 or RM-4E board on either apC or iSTAR hardware. For additional information on how install an RM-4 on apC/8X or apC/L hardware, refer to the *apC/8X Technical Manual* or the *apC/L Technical Manual*.

In This Preface

How to Use this Manual

This manual contains the following information.

Chapter 1: RM-4 Technical Overview

This chapter introduces RM-4 technology and hardware, and includes information about basic features, reader technology, card technology, and the RM-4 boards and products available from Software House.

Chapter 2: Planning the Installation

This chapter provides the information you need to set up an iSTAR or apC installation that includes RM-4 hardware.

Chapter 3: Installing the RM-4

This chapter provides detailed RM-4 component diagrams, overviews the installation procedure, and provides detailed installation instructions.

Chapter 4: Installing the RM-4E

This chapter provides detailed RM-4E component diagrams, overviews the installation procedure, and provides detailed installation instructions.

Chapter 5: Testing the Installation

This chapter describes the test procedures and responses for RM-4 modules and read heads.

Appendix A: Equipment Specifications

This appendix includes information about equipment dimensions and operating requirements.

Finding More Information

In addition to this manual, you may find the following manuals useful:

- **C•CURE System Installation Guide** (UM-029) – online and print
- **apC/8X Technical Manual** (UM-010) – online and print
- **apC/L Technical Manual** (UM-025) – online and print
- **iSTAR Installation and Configuration Guide** (UM-060) – online and print

Conventions

This manual uses the following text formats and symbols.

Convention	Meaning
Bold	This font indicates screen elements, and also indicates when you should take a direct action in a procedure. Bold font describes one of the following items: ■ A command or character to type, or ■ A button or option on the screen to press, or ■ A key on your keyboard to press ■ A screen element or name
Regular italic font	Indicates a new term.
	Indicates an alternate method of performing a task.
Note	Indicates a note. Notes call attention to any item of information that may be of special importance.
	Indicates a caution. A caution contains information essential to avoid damage to the system. A caution can pertain to hardware or software.
	Indicates a warning. A warning contains information that advises users that failure to avoid a specific action could result in physical harm to the user or to the hardware.
	Indicates a danger. A danger contains information that users must know to avoid death or serious injury.

1

RM-4 Technical Overview

This chapter provides a conceptual overview of RM-4 technology, and also includes information about Software House products that provide RM-4 features. If you are new to Software House security products, read this chapter to learn about RM-4 technology and devices.

In This Chapter

RM-4 and RM-4E Boards

The *RM-4* and *RM-4E* are printed circuit boards that provide the hardware interface between a magnetic or Wiegand read head and apC or iSTAR hardware. The RM-4 and RM-4E also provide the inputs and outputs that communicate between door components and apC or iSTAR hardware.

The RM-4 Board

Figure 1.1 shows an RM-4 board. The firmware for this board has been upgraded, and now supports keypad data from third-party Wiegand keypad readers.
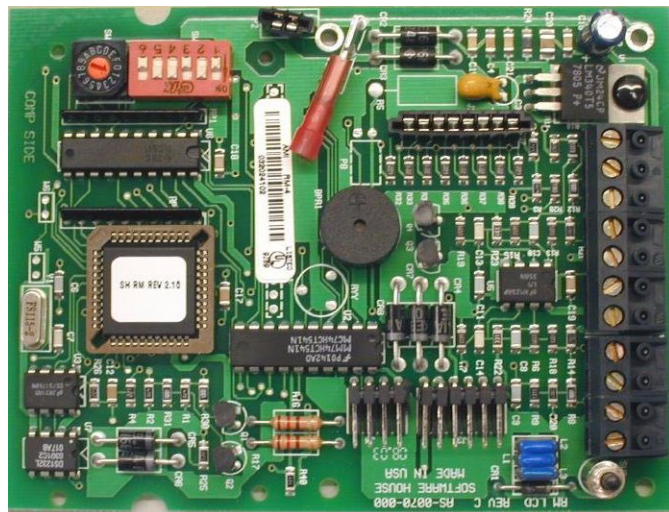
Figure 1.1: The RM-4 Board

The RM-4E Board

Figure 1.2 shows the RM-4E board. The RM-4E board is larger than the RM-4 board, and provides additional features. The optional LCD is used during board installation and for troubleshooting.
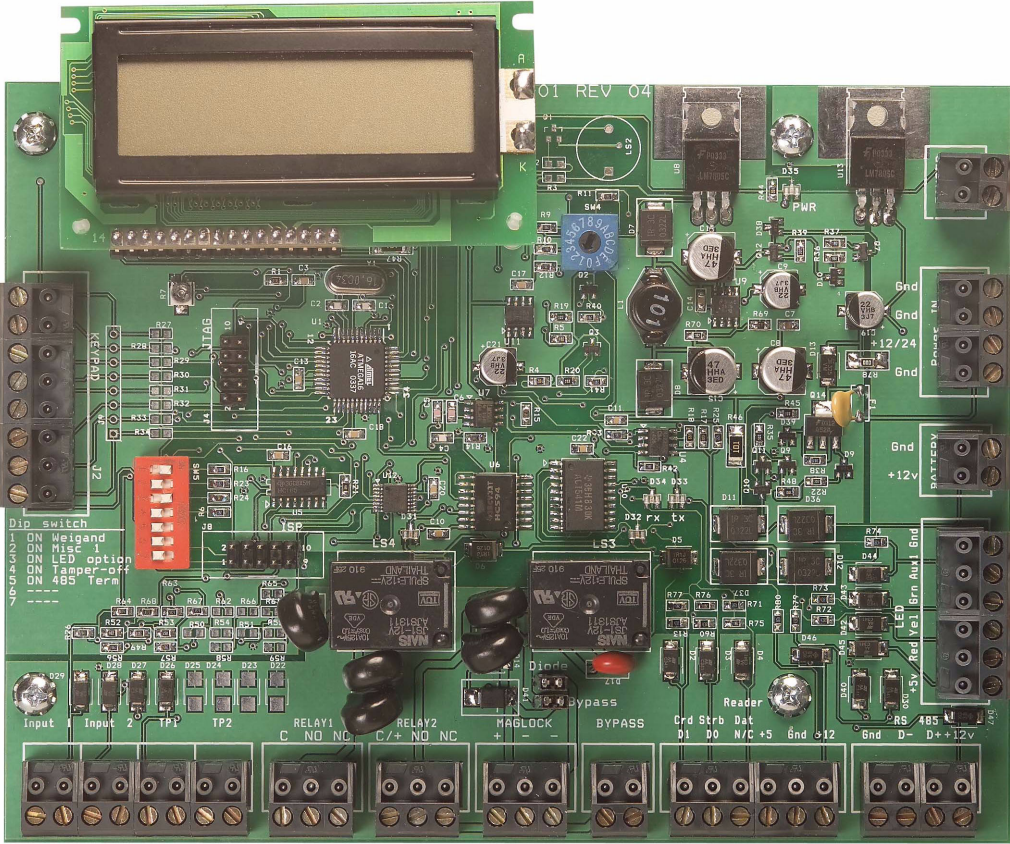
Figure 1.2: The RM-4E Board

RM-DCM-2

The RM-DCM-2 provides the RM-4E module within an enclosure. The RM-4E is installed and mounted at the top of the door. Additional hardware, including I/8 and R/8 boards, can be mounted on the door and within the enclosure.

Figure 1.3 shows the RM-DCM-2 with optional battery and LCD.
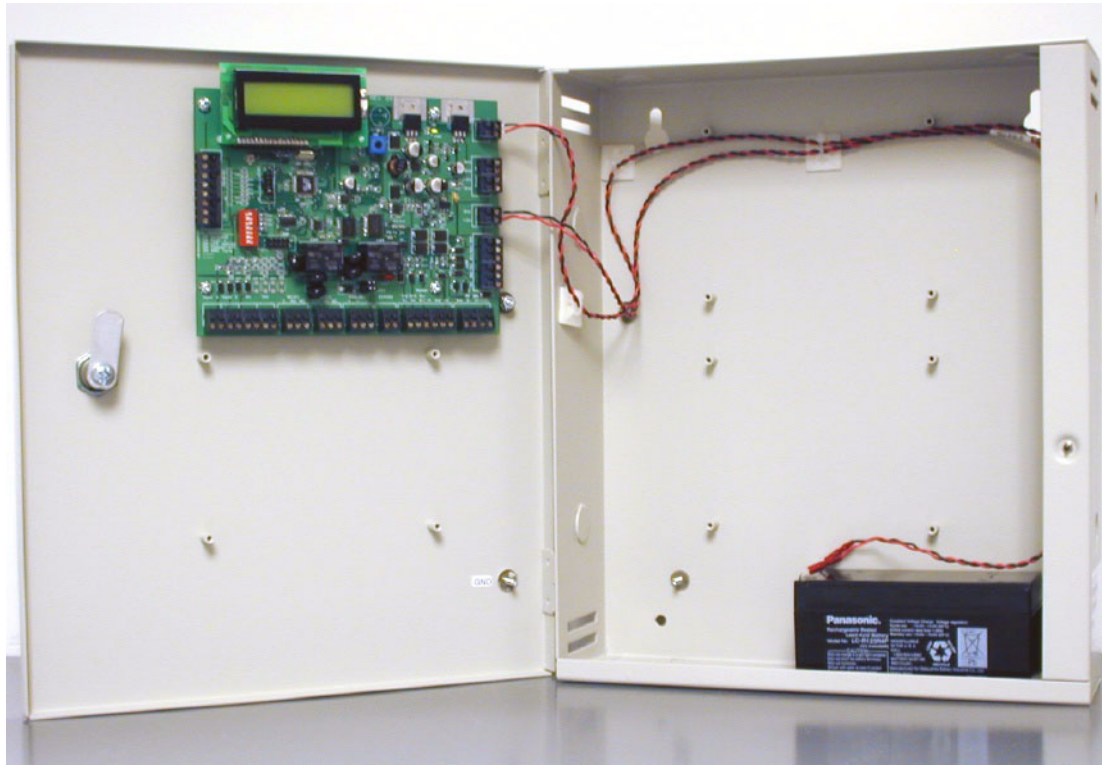
Figure 1.3: RM-DC-2 With Options

RM-DCM-2 Features

RM-DCM-2 features include:

- New LED status indicators – displays RS-485, relay, power, and battery charging status.
- An on-board battery charger – supplies power to an optional battery for memory retention in the event of a power failure.

Note: The onboard battery is for memory retention only. UL has not evaluated the battery to the Standby Power requirements of the Standard(s).

- Two relay components – eliminates the need for external relays required with the RM-4 board.

- A maglock component – connects to a maglock power supply, and also provides an onboard power protection diode.

- A bypass component – connects to a release switch door secured by a magnetic lock.

Optional Items

Optional equipment for the RM-4E/RM-DCM-2 includes:

- Backup battery kit – provides the RM-4E with backup power for memory retention in the event of a power failure. The kit includes a cable assesmbly that connects the battery to the RM-4E battery component.

- LCD component – displays status messages for readers attached to the RM-4E. The optional LCD is connected to the J1 (LCD) component on the RM-4E board.

Read Head Interfaces

To provide access, RM-4 and RM-4E boards connect to a *read head*. The read head is a hardware device that accepts access requests from card or key holders. To gain access on a door protected by a C•CURE 800/8000 system:

1. A person presents a card or key at the read head.

2. The read head scans the information encoded on the card or key, and sends it to the RM-4 or RM-4E.

3. The RM-4 or RM-4E translates the read head signal, and forwards it to the apC or iSTAR, which grants or denies access.

Read Head Interfaces

The RM-4 and RM-4E support magnetic stripe or Wiegand read head interfaces. You select the interface you want by setting:

-   SW3 position 1 on an RM-4 board
-   SW5 position 1 on an RM-4E board

Set the switches to the On position for Wiegand read heads and Off for magnetic stripe.

Note: Only the RM-DCM-2 has been evaluated by Underwriters Laboratories Inc (UL) for compatibility with the HID Model 30387 (swipe) reader and the HID Model 5355 (prox) reader.

Magnetic Stripe Read Heads

Magnetic stripe read heads accept a magnetically encoded card that is passed (swiped) through a slot on the read head. Data is transmitted to the RM-4/RM-4E in ABA track 2 format.

Wiegand Read Heads

Wiegand read heads accept many types of cards, and transmit data to the RM-4/RM-4E interface that conforms to Wiegand signalling technology.

There are three types of Wiegand read heads:

- **Wiegand swipe read heads** – accept cards or keys that are presented to the read head by swiping or inserting through a slot. A magnetic field in the read head interacts with wires embedded in a card or key, and transmits binary impulses.

- **Wiegand proximity read heads** – accept cards that are presented in the proximity of the read head. The cards contain an antenna coil and an integrated circuit chip encoded with a unique identification number. When the card is passed near the read head, the read head transmits a signal that energizes the card's antenna, causing the card to send its identification number to the reader.

  Wiegand proximity read heads accept a variety of cards including:
    - HID Proximity (125 KHz)
    - Motorola Proximity (62.5 KHz)

- **Wiegand "Smart Card" read heads** – accept smart cards that make contact with the reader. Contact can be an insertion or a swipe.

  Wiegand "Smart Card" read heads accept a variety of cards, including CAC cards, which are commonly used in government installations. Cards may be in either ISO 14443 or ISO 15693 formats.

Note: "Smart Card" read heads have not been evaluated by UL for compatability with the RM-DCM-2.

RM-4 Connections

Figure 1.4 shows how RM-4 and RM-4E products and read heads connect to apC and iSTAR hardware.
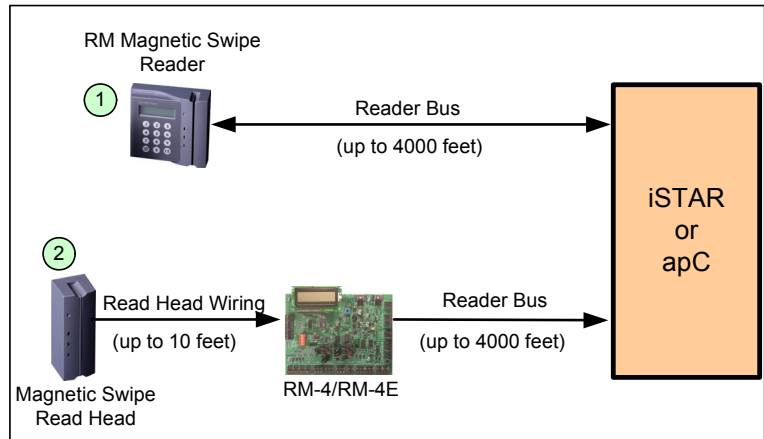
Figure 1.4: RM-4 and RM-4E Connections

Note: The voltage received at an RM-4E must be 11V or more. Busses that include drops that do not meet this requirement will require additional power. Refer to "Wire Length and Voltage Drops," on page 2-7 for information about calculating voltage drops.

RM-4 and RM-DCM-2 Offerings

Table 1.1 shows the standalone RM-4 and RM-DCM-2 board and enclosure offered by Software House. You can install a standalone RM-4, RM-4E, or RM-DCM-2 assembly up to 4000 feet (1219 meters) from the apC or iSTAR hardware.

Table 1.1: RM-4 and RM-DCM-2 Offerings

Product	Description	Enclosure
RM-4	Standard RM-4 module.	Customer supplied grounded metal junction box.
RM-4E	Enhanced, easy to install RM-4 module, with improved connectors, additional LEDs, on board relays, and battery charger.	
RM-DCM-2	Enhanced, easy to install RM-4 module, with improved connectors, additional LEDs, on board relays, and battery charger.	Factory mounted in metal junction box with mountings for additional hardware, including I/8 and R/8 boards, also available from Software House.

Figure 1.5 shows the RM-4E board with optional battery and LCD.
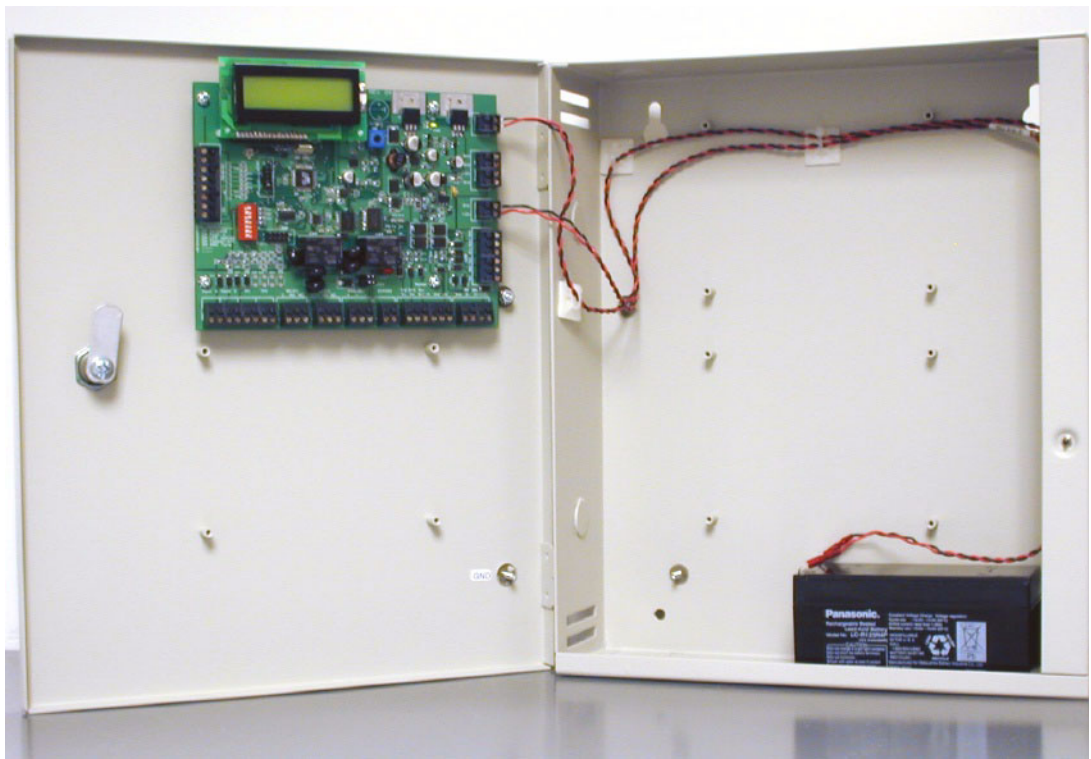
Figure 1.5: RM-4E Board with Options

RM Series Readers

Software House provides RM-4 boards and read heads in the following styles:

- *Standard style reader* – an RM-4 board and housing with a built in read head
- *Mullion style read head* – a read head that connects to a standalone RM-4 module

Figure 1.6 shows RM Series Readers in both standard and mullion styles.

Figure 1.6: RM Series Readers

Standard Style Products

Software House offers these standard style products:

Table 1.2: Standard Style RM-4

Model	Description
RM1	RM Series Reader with read head and RM-4
RM2	RM Series Reader with read head, keypad, and RM-4
RM2L	RM Series Reader with read head, keypad, LCD display, and RM-4

Note: RM readers have not been evaluated by UL for outdoor use.

Mullion Style Products

Software House offers read heads in the following mullion style:

Table 1.3: Mullion Style RM-4

Model	Description
RM3	Wiegand Proximity read head enclosed in RM Series housing. The RM-4 is external.

Third Party Readers

Although RM-4 and RM-4E hardware works with almost all third-party
Wiegand readers, Software House has qualified and tested the following
devices:

- HID
- Indala
- Keri
- Biocentric Solutions
- Bioscrypt
- Barantec
- RSI

Refer to third party reader documentation for detailed information about
individual readers.

Note: These readers have not been evaluated by UL. Contact Software
House customer support to obtain the most recent list of UL
approved readers.

Third Party Readers

2

Planning the Installation

This chapter describes RM-4 and RM-4E connection, topology, power, and wiring requirements.

RM-4 and RM-4E configurations vary based on customer and site requirements. Read this chapter to review RM-4 and RM-4E configuration requirements, so you can properly plan your installation.

In This Chapter

RM-4 and RM-4E Wiring Configuration

RM-4 and RM-4E devices can be wired to an apC or iSTAR in either of the following configurations:

- *Bus* – connects multiple RM-4 devices in a daisy chain to an RS-485 port on an apC or iSTAR
- *Star* – connects each RM-4 to its own RS-485 port on an apC or iSTAR

Configurations on an iSTAR or apC can be of one type (all bus or star) or mixed types (both bus and star).

Caution: The system must be installed within the protected premise in accordance with the National Electrical Code (ANSI/NFPA 70), local codes, and the authorities having jurisdiction.

Bus Configuration

Figure 2.1 shows RM-4 or RM-4E bus topology on an iSTAR configuration.

I/8 and R/8 modules may also be attached to the RS-485 bus.
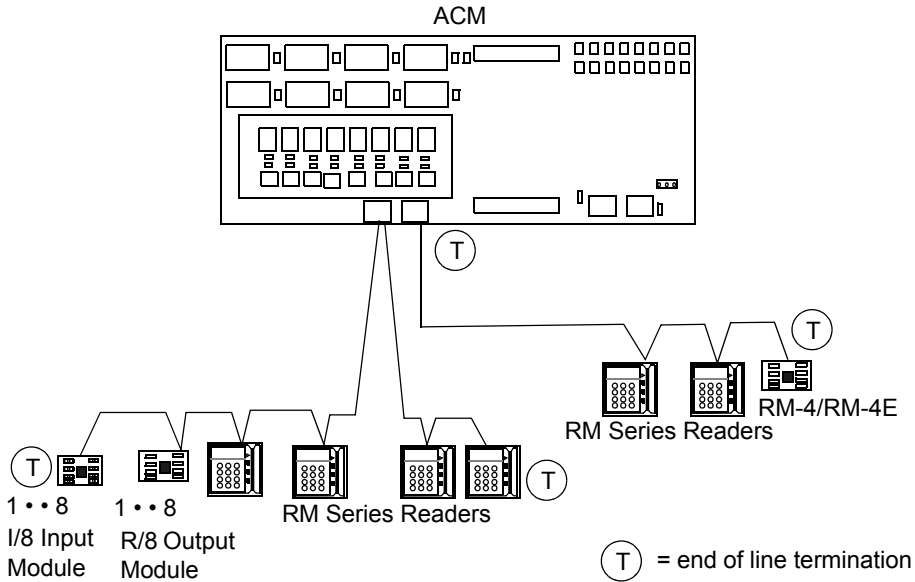
Figure 2.1: RM-4 or RM-4E Bus Configuration

Star Configuration

Figure 2.2 shows RM-4 or RM-4E star topology on an iSTAR configuration.
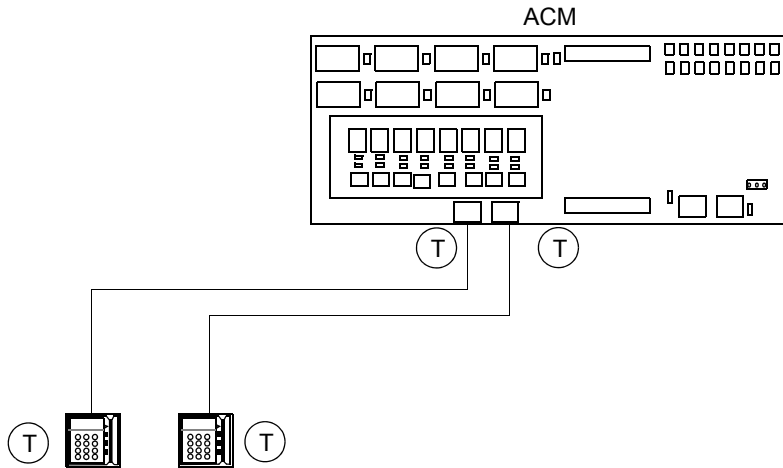
Figure 2.2: RM-4 or RM-4E Star Configuration

EOL Termination

RM-4 and RM-4E devices must be terminated at each end of the line.

ACM Termination

ACM termination is accomplished using a jumper (iSTAR) or switch settings (iSTAR Pro).

- To terminate an RM-4 or RM-4E device at the iSTAR end of the line, use Jumpers JP-20 to JP-23, adjacent to each RS-485 port (Figure 2.3). Reader ports are factory set as Terminated (EOL) devices.
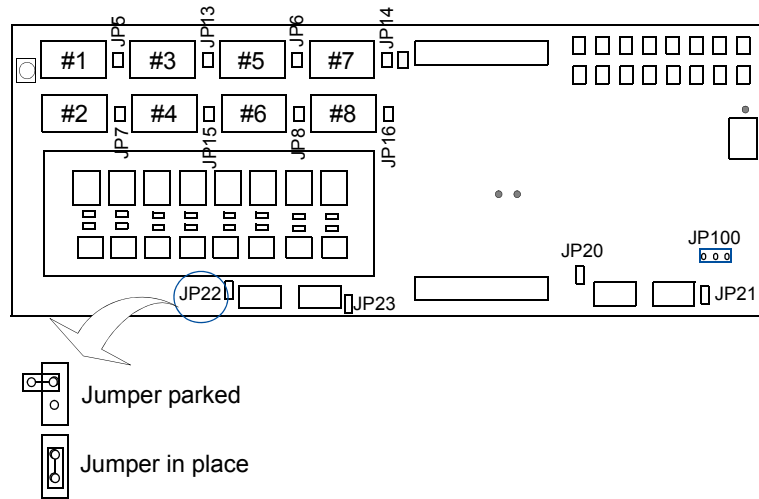
Figure 2.3: EOL Jumpers on iSTAR ACM

- To terminate an RM-4 or RM-4E device that is attached to an iSTAR Pro ACM, refer to the *iSTAR Pro Installation and Configuration Guide* for the appropriate switch and setting

RM-4 Termination

Use the SW3 switch, position 5 to terminate an RM-4 if it is the last device on the line. Set the SW3-5 switch to the On position.

RM-4E Termination

Use the SW5 position 5 switch to terminate an RM-4E if it is the last device on the line. Set the SW5-5 switch to the On position.

RS-485 Ports and Capacities

Table 2.1 describes the location of RS-485 ports for iSTAR, apC/8X and apC/L hardware, as well as the bus and board capacity.

Table 2.1: RS-485 Connections and Capacity

Hardware	Connected To	Capacity
iSTAR	RS-485 ports on ACM module ■ ACM ports STAR1 to STAR4	8 RM-4 or RM-4E per ACM, in either star or bus configuration 16 RM-4 or RM-4E fully loaded (2 ACMs)
apC/8X	apC/8X ■ Port 3 on the apC/8X ■ Ports RD1 to RD8 on the star coupler	8 RM-4 or RM-4E per apC/8X - in either star or bus configuration
apC/L	RS-485 port on the apC/L ■ apC/L port P6, P7	2 RM-4 or RM-4E per apC/L, in star or bus configuration

Wire Length and Voltage Drops

This section provides information for calculating voltage drop between iSTAR or apC hardware and RM-4 or RM-4E devices. If the voltage drops below the minimum required for a device, an external power supply is necessary.

Voltage Requirements

A standard RM series reader and/or RM-4/RM-4E board requires at least 11 Volts to operate properly.

While the iSTAR or apC hardware supplies 12 Volts at its connectors, the amount of voltage that actually reaches each reader in a bus may be less than 12 Volts. The voltage is lowered by each reader and by the resistance of the wire. The total voltage drop cannot exceed 1 Volt for the bus.

Whether a reader bus needs a local power supply depends on all of the following factors:

- Current draw of each device
- Number of devices in the bus
- Distance between the devices on the bus
- Distance between the devices and the iSTAR or apC hardware
- Wire gauge used to connect the devices and the iSTAR or apC hardware

Determining Total Voltage Drop

The formula is:

(the current draw of the device in amps) × (the resistance per foot of the wire) × (the length of wire) = voltage drop of the device.

Add up the voltage drop of all the devices to determine the total voltage drop.

If the total is greater than 1 Volt, take one of the following actions to ensure proper operation of the RM module:

- Shorten the wire lengths
- Use a heavier wire gauge
- Use a local power supply

Determining Wire Resistance

Use the following chart to select the proper value for wire resistance. The values given are guidelines. A specific manufacturer's cable may exhibit a slightly different value for a given wire gauge.

Table 2.2: Wire Resistance

Wire Gauge	Resistance (ohms per foot (30.38 Cm))
18 AWG	0.01277
22 AWG	0.03227

Determining Power Consumption

This section lists typical currents for the RM series readers and standalone board. Use this section to calculate power consumption and determine power supply requirements.

RM Series Readers

Table 2.3 shows the power requirements for RM series readers.

Table 2.3: RM Series Reader Power Supply Limitations

RM Series Reader Type	Model #s	Power Requirements: 12 VDC
Magnetic stripe	RM1-MP, RM2-MP	80 mA
Mag. stripe with LCD display	RM2L-MP	180 mA
Magnetic stripe mullion	RM3-MP	80 mA
Motorola Indala Proximity	RM1-PI, RM1-PI/C, RM2-PI, RM2-PI/C	80 mA
Motorola Indala Proximity with LCD display	RM2L-P1	180 mA
HID proximity	RM1-PH, RM2-PH	135 mA ave., 250 mA peak

Table 2.3: RM Series Reader Power Supply Limitations (Continued)

RM Series Reader Type	Model #s	Power Requirements: 12 VDC
HID proximity with LCD display	RM2L-PH	235 mA ave., 250 mA peak
HID proximity mullion	RM3-PH	135 mA ave., 250 mA peak
Wiegand	RM1-W, RM2-W[a]	80 mA
Wiegand with LCD display	RM2L-W[a]	180 mA
Wiegand mullion	RM3-W[a]	80 mA

a.   These readers have not been evaualted by UL.

Standalone RM-4 /RM-4E Boards

Power consumption requirements for standalone boards are:

- 550 mA max @12VDC or 24VDC, for RM-4E boards
- 175 mA @12VDC, for RM-4 boards

Power requirements for attached read heads are in addition to these requirements.

Sample Voltage Drop Calculation

The following example shows how to make sure that each device has adequate voltage.

Example

An installation uses 18 AWG wire to connect three readers to the iSTAR controller. Each reader draws 0.08 amps. The readers are laid out with distances as shown in Figure 2.4.

Calculate voltage drop for each unit, then sum up the unit voltage drops to determine the total voltage drop.

Using the steps in the example, the voltage drop is .86836 V.

To perform the sample calculation

1. Determine the wiring lengths.

   • The wire resistance per foot for 18 AWG wire is 0.01277 ohms per foot. Table 2.4 shows a typical worksheet.

Table 2.4: Voltage Drop Calculation Worksheet

Device	Current draw of device	Distance from source	Wire Resistance per foot	Voltage drop for the unit
1	0.08	x 50	x 0.01277	= 0.05108
2	0.08	x 200	x 0.01277	= 0.20432
3	0.08	x 600	x 0.01277	= 0.61296
Total voltage drop for reader bus				= 0.86836

   • The total voltage drop for this chain is 0.86836 volts. Since this is less than the 1 volt maximum, the wiring is adequate for this installation.

2. See Figure 2.4 for an illustration of the calculations.
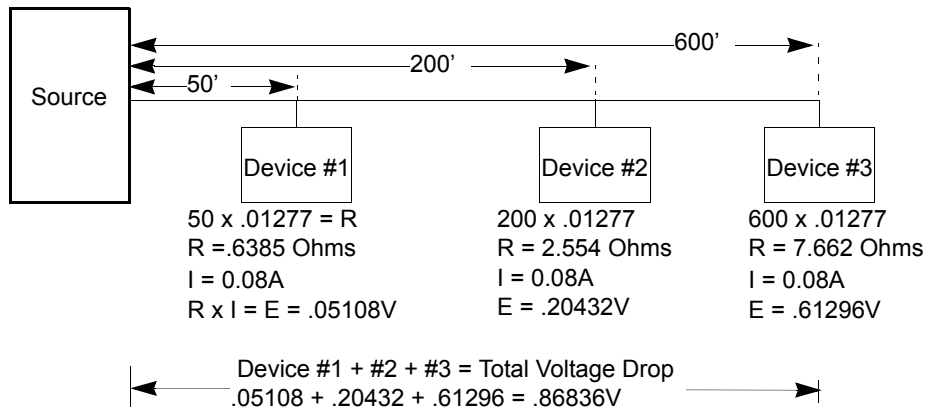
Figure 2.4: Calculation of Voltage Drop

Wiring Requirements

Table 2.5 shows the wiring requirements for RM-4 and RM-4E modules.

Table 2.5: RM-4 Wiring Requirements

Signal	From	To	Belden #	Gauge	# Prs	Shielded	Max Length
Comm	apC iSTAR	RM-4	9841[a]	24	1	Yes	4000 ft. (1219 m.)
Power	apC iSTAR	RM-4	8442 8461	22/18	1	No	See "Wire Length and Voltage Drops," on page 2-7
RTE	RM-4 RM-4E	Switch	8442 8461	22/18	1	No	2000 ft. (610 m.)
DSM	RM-4 RM-4E	Contact	8442 8461	22/18	1	No	2000 ft. (610 m.)
Relay	RM-4	ARM-1 (used on RM-4 models only)	9462	22	1	Yes	25 ft. (7.6 m.)
Reader data	RM-4 RM-4E	Wiegand Read Head	9942 9260 Alpha wire 5386C	22 20 18	3	Yes	200 ft. (61 m.) 300 ft. (91 m.) 500 ft. (152 m.)
Reader data	RM-4 RM-4E	Magnetic Read Head		22		No	10 ft. (3.05 m.)

a. For plenum or underground applications, use Manhattan M63995 or 2 pair only, 150 ohm, 8.8 pf/ft or Belden 89182 for 1 pair 22 AWG, 100 ohm 12.95 pf/ft. Control and supervised input cables must be shielded for FCC Class B operation.

Power Consumption

You must calculate total power consumption for the iSTAR or apC components to ensure your configuration has adequate power.

To determine total power consumption, add up the total current for all components in the system. This includes RM-4/RM-4E components, read heads, and RM series readers described in "Determining Power Consumption," on page 2-8.

■ The iSTAR can supply up to 2.3 A at 12 VDC for powering readers, option boards and door controls.

The iSTAR includes a power supply that is rated for 3.5 A. A configuration with two ACM boards will draw 1.0 A when all relays are energized, and provide an additional 2.5 A to power other components. Configurations that draw more than 2.5A must use an external power supply to ensure adequate power.

Refer to the *iSTAR Installation and Configuration Manual* for information about power requirements for connected components.

■ The apC/8X is rated for a maximum continuous load of 12 VDC at 3.3 A. However, Software House recommends that you do not exceed a total current load of 2.5 A. The apC/8X voltage tolerance is +5V ±5%, +12V ±5%.

Refer to the *apC/8X Technical Manual* for information about power requirements for connected components.

■ The apC/L internal power supply provides power to readers with specific limitations.

Refer to the *apC/L Technical Manual* for information about internal and local power requirements.

Note: A UL-listed power-limited access control or burglar alarm power supply, capable of four hours standby, must be used when the unit is powered from a source other than the apC or iSTAR.

3

Installing the RM-4

This chapter provides information about RM-4 components and enclosures, and also provides detailed procedures for mounting, wiring, and configuring RM-4 boards. Read this chapter when you have completed your site planning and you are ready to install.

In This Chapter

Installation Overview

This section overviews the steps you need to take to configure an RM-4 board.

Sample Configuration

Figure 3.1 shows a typical RM-4 door configuration.
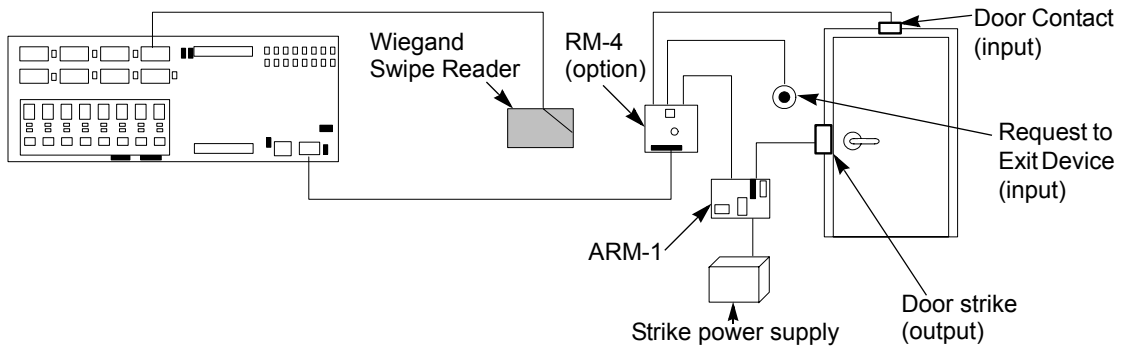
Typical setup - Wiegand with two
inputs, ARM-1, and output

Figure 3.1: RM-4 Door Configuration

Configuration Overview

Table 3.1 describes the tasks you must complete to install an RM-4 board.

Table 3.1: Installation Overview

Task	Description	Additional Information
Mount the enclosure	Mounts a standard, mullion, or standalone RM-4 component.	See "Mounting Standalone Boards," on page 3-7 or "Mounting Standard or Mullion Style Devices," on page 3-8
Connect to the host	Wire the P1 connector to the STAR1-STAR4 ports on the ACM.	See "Connecting to an apC Panel or iSTAR Controller," on page 3-11
Ground and shield the reader bus	Ground and shield wiring for RM-4 components in bus configurations.	See "Grounding and Shielding the Reader Bus," on page 3-12
Set up RM-4	Set RM-4 address, reader type, LED, tamper, and termination options.	See "RM-4 Setup," on page 3-14
Connect door components	Set up wiring for supervised inputs in NO or NC positions.	See "Supervised Input Wiring," on page 3-17
Install the ARM-1	Mount and install ARM-1 component(s)	See "Installing the ARM-1," on page 3-19

Additional Information

For additional information about RM-4 installation with apC hardware, refer to the *apC/L Technical Manual* or the *apC/8X Technical Manual*.

RM-4 Components

This section describes the location and function of RM-4 components.

RM-4 Components

Figure 3.2 shows the RM-4 components used during installation.
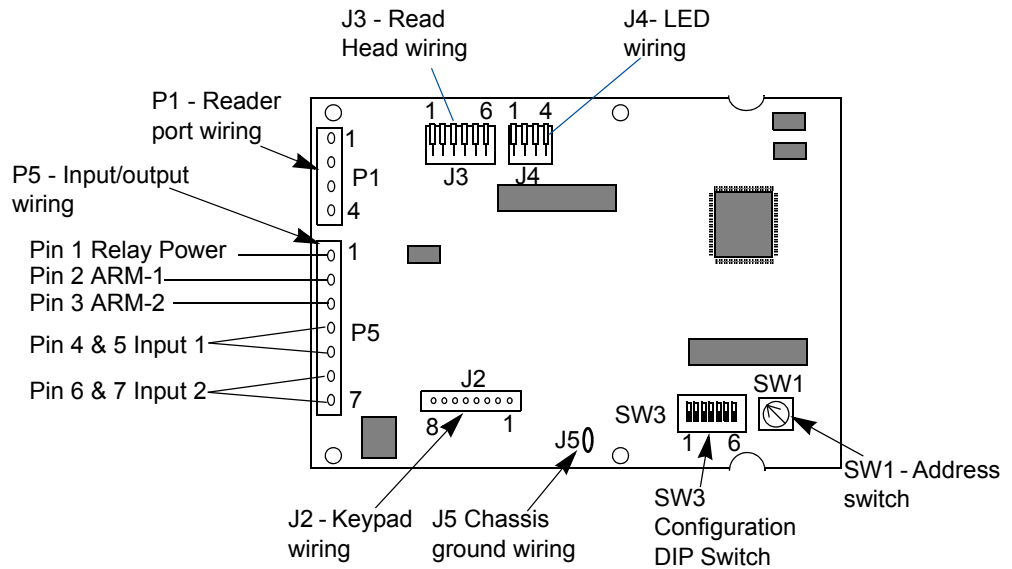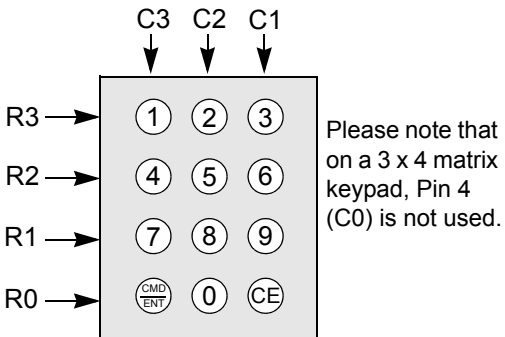
Figure 3.2: RM-4 Components

RM-4 Component Wiring

Table 3.2 provides details about RM-4 component wiring.

Table 3.2: RM-4 Component Wiring

Component	Description	Pin	Wire	
J2	Keypad wiring Please note that on a 3 x 4 matrix keypad, Pin 4 (C0) is not used.	1 2 3 4 5 6 7 8	C3 C2 C1 C0 R3 R2 R1 R0	
J3	Read head wiring		**Magnetic Stripe**	**Wiegand**
		1	Card Load	Data 1 (white)
		2	Clock	Data 0 (green)
		3	Data	Not Used
		4	+5	+5V
		5	GND	GND
		6	Not Used	+12V
J4	Read head LEDs	1 2 3 4	+5V Red LED Yellow LED Green LED	
P1	Reader port wiring	1 2 3 4	+12V TXD/RXD + TXD/RXD - GND	
P5	Input/output wiring to door	1 2 3 4,5 6,7	+12V Relay Power Relay 1 Drive Relay 2 Drive Supervised Input 1 Supervised Input 2	
J5	Chassis ground wiring	N/A	N/A	

RM-4 Switch Settings

Table 3.3 provides details about RM-4 switch settings.

Table 3.3: RM-4 Switch Settings

Component	Description	Pin Position	Wire		Setting
SW1 (rotary)	Address switch	1-8 9	Reader address Reader test		
SW3 (DIP)	Configuration settings	1	Reader type	Open (Magnetic) Closed (Wiegand)	Off On
		2	LCD	Open (Present) Closed (N/A)	Off On
		3	LED	Open (Normal) Closed (External Bi-color)	Off On
		4	tamper	Open (Normal) Closed (Bypass)	Off On
		5	EOL term	Open (last unit in line) Closed (not last unit in line)	Off On
		6	LED option	Open (Normal) (Closed) J4-3 wire-or red and green	Off On

Mounting the RM-4

The RM-4 enclosure or mounting plate available depends on the style of the RM-4 component. Table 3.4 describes the RM-4 styles and the mounting plate or enclosure available from Software House for each style.

Table 3.4: RM-4 Enclosures and Mounting Plates

Component	Style	Type of Enclosure
RM-4	Standalone	Customer supplied grounded metal junction box (4" x 6" minimum) with customer supplied Belden 9841 wire.
RM-4	Standard	Mounting plate attached to the components housing by two screws.
Read Head	Mullion	Mounting plate attached to the components housing by two screws.

Mounting Standalone Boards

You can mount a standalone RM-4 board in an enclosure that you supply. When doing so, you must consider the following issues:

- The location and type of enclosure must be determined and approved by an appropriate engineer or authorized personnel.

- The RM-4 requires Belden #9841 wiring or equivalent, as required to comply with all codes.

- When using 18 AWG wire for a Wiegand read head, the maximum distance is 500 feet (152 m) between the read head and the RM-4. For a magnetic read head, the maximum distance is 10 feet (3.08 m).

- The RM-4 is designed to be installed inside a metal, grounded, minimum 4" x 6" (10.16 cm by 15.24 cm) junction box.

- The RM-4 also includes two supervised inputs and two outputs, and permits use of two optional ARM-1 modules.

To install an RM-4 and read head

1. Mount the optional RM-4 in an approved enclosure and location, which is at least two feet (61 cm) away from high voltage sources (such as computer monitors or power lines) or motorized equipment (such as elevators or compressors).

2. Ground the module to earth via ground lug J5.

3. Mount the read head and route the wiring to the RM-4 module. Ensure the wiring avoids high voltage lines or motorized equipment, such as elevators.

Mounting Standard or Mullion Style Devices

Standard RM-4 readers and mullion style read heads use mounting plates (see Figure 3.3). A mounting plate is attached to the housing by two screws on the bottom of the housing.

You should verify that the wiring is the approved type:

- The recommended data wiring is Belden #9841or equivalent. The maximum wiring length is 4000 feet (1219 meters) between the two EOL devices.

- The recommended power supply wiring is Belden #8461/8442 twisted pair. The maximum length is up to 4000 feet (1219 meters).

To mount a standard or mullion style device

1. Follow the precautions for static electricity.

2. If the mounting plate is attached, use a security screwdriver to remove the housing screws, and carefully detach the mount plate from the housing (see Figure 3.3).

3. Attach the mounting plate to the mounting location with the hardware specified by the site engineer (or equivalent authorized individual). The standard style has eight mounting holes, the mullion style has two mounting holes.

Caution: An outdoor reader must be installed in a vertical position to allow for proper drainage. Position the precut, fitted foam gasket between the mounting plate of the reader and the wall, then attach the plate. Ensure that the "weep" holes in the bottom of the housing are unobstructed. For cold climates, an optional heater kit is available.

Note: UL has not evaluated these readers for outdoor use.

Mounting the RM-4
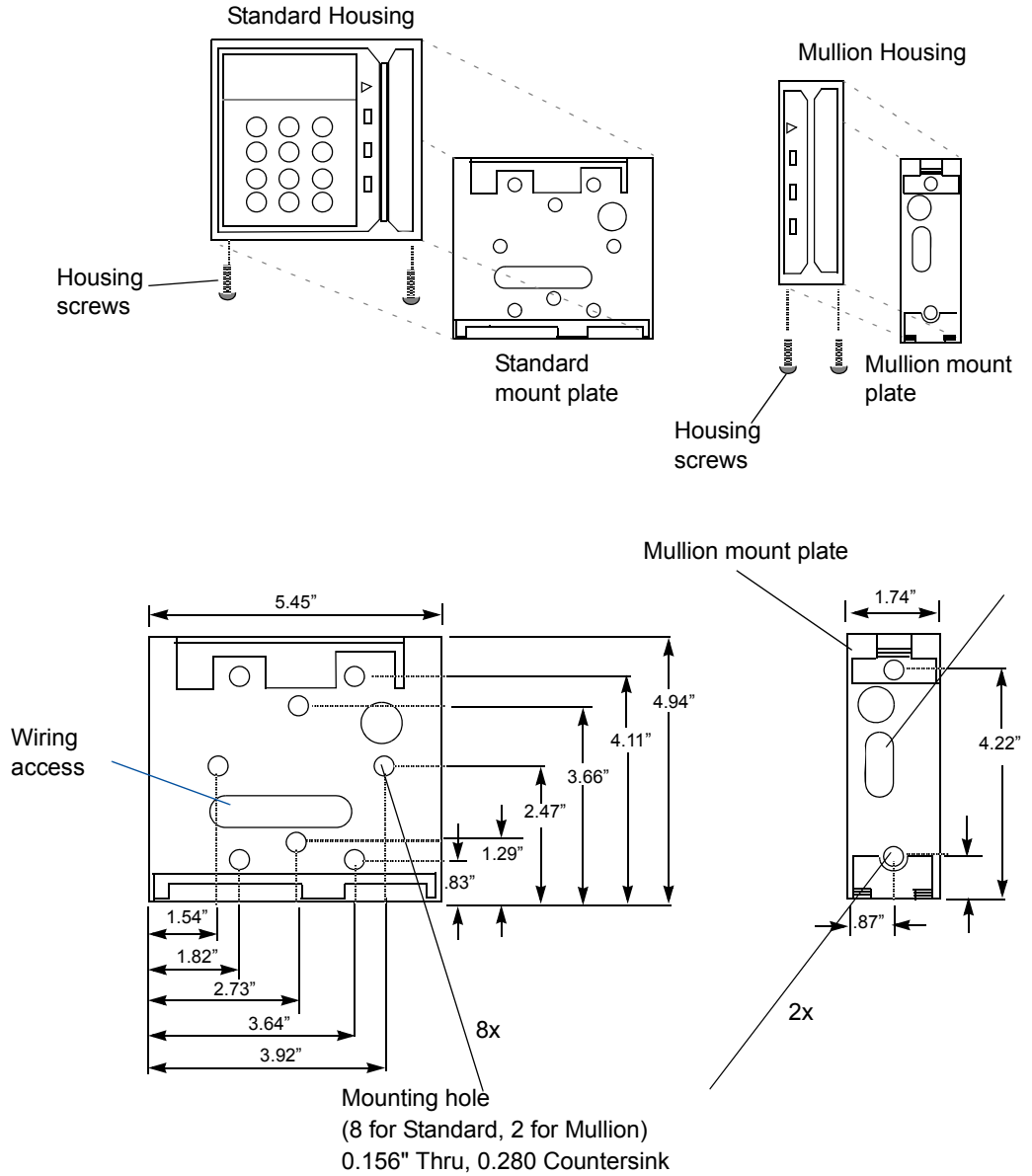
Figure 3.3: Mounting Plates for Standard and Mullion Styles

Connecting to an apC Panel or iSTAR Controller

Use the P1 connection to wire the RM-4 board to an apC panel or iSTAR controller.

Figure 3.4 shows the P1 connection on the RM-4 board.
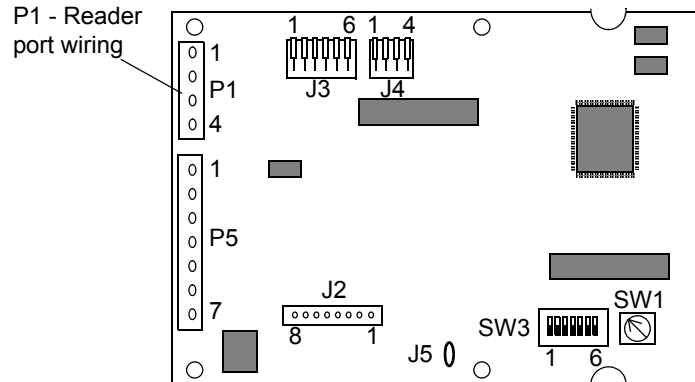
Figure 3.4: Reader Port Connection

Table 3.5 describes P1 wiring.

Table 3.5: Reader Port Wiring

Component	Description	Pin	Wire
P1	Reader Port Wiring	1	+12V
		2	+TXD/RXD
		3	-TXD/RXD
		4	GND

Grounding and Shielding the Reader Bus

When bus wiring more than one reader:

- Attach the shields along the bus together (insulate each connection). Snip off the shield wire at the end of the bus.

- Attach the shield to the ground at only one point, the ground stud inside the controller cabinet adjacent to the knockout.

- Attach a local earth ground (18 or 22 gauge) wire to the J5 component.

Figure 3.5 shows reader shield wiring.
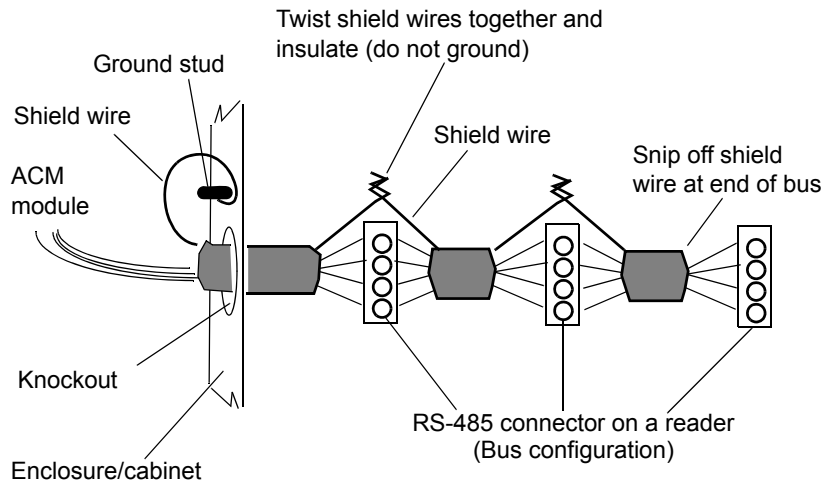
Figure 3.5: Reader Shield Wiring

Figure 3.6 shows the J5 component.
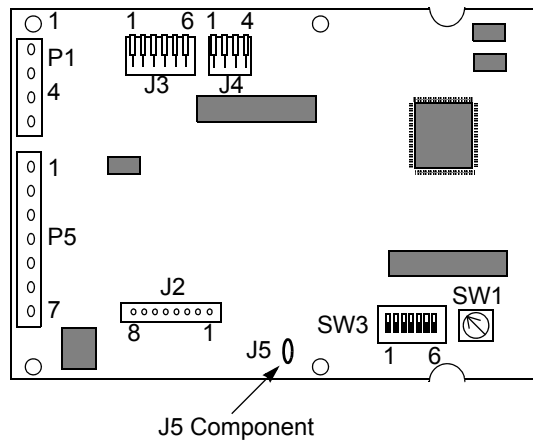
Figure 3.6: The J5 Component

RM-4 Setup

This section describes how to set up the RM-4.

To set up a reader

1. Set reader address switch SW1 (a 16-position rotary switch, see "RM-4 Switch Settings" on page 3-6) to a number from one to eight. Each RM-4 along the bus must have a unique address.

2. Ensure that Configuration Switch SW3 (DIP switch) is set to the values required for your site (see Table 3.6).

Table 3.6: SW3 Switch Settings

SW #	Function	Off (Open)	On (Closed)
1	Reader type	Magnetic	Wiegand
2	LCD	LCD present	No LCD
3[a]	LED	Normal	External bi-color
4	Tamper	Normal	Bypass
5 (see caution)	EOL-termination	Not last	Last unit in bus
6[a]	LED Option	Normal	J4-3 wire or red/green

a.   Used only with 3rd party readers connected to an RM-4 module.

Caution: To properly terminate an RS-485 line, the last unit must be terminated. The unit can be an RM-4, RM-4E, I/8, or R/8 device. If the unit is an RM-4, use the SW3-5 switch, in the On (closed) position, to terminate the line.

3. Connect P5 input and output wiring (see Table 3.7).

Table 3.7: P5 Input and Output Wiring

P5	Function
1	+12 V relay power
2	Relay 1 drive for first ARM-1 module
3	Relay 2 drive for second ARM-1 module
4	Supervised input1
5	Supervised input1
6	Supervised input2
7	Supervised input2

4. Connect read head wiring, if required (see Table 3.8). The read heads are prewired in the RM Series readers.

Table 3.8: Read Head Wiring

J3	Magnetic stripe	Wiegand (Swipe or Proximity)
1	Card load	Data 1 (white)
2	Clock	Data 0 (green)
3	Data	No connection
4	+5V	+5 V (red)
5	Ground	Ground (black)
6	No connection	+12 V
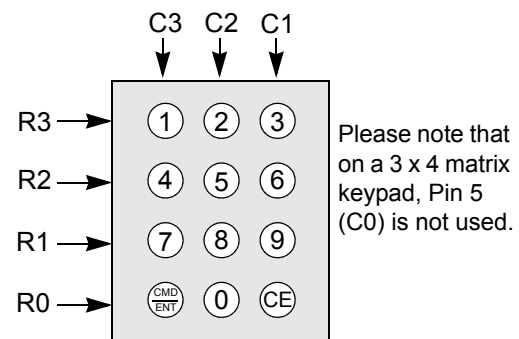
5. Connect the LED wiring, if required (see Table 3.9). RM series readers are prewired.

Table 3.9: LED Wiring

J4	Function
1	+5V
2	Red LED
3	Yellow LED
4	Green LED

6. For units with installed keypads (or to wire a 3x4 matrix keypad), Table 3.10 indicates the wiring.

Table 3.10: Wiring for Units with Keypads

J2	Function	Keypad Diagram
1	C3	
2	C2	
3	C1	
4	C0	
5	R3	
6	R2	
7	R1	
8	R0	

Please note that on a 3 x 4 matrix keypad, Pin 5 (C0) is not used.

Supervised Input Wiring

Figure 3.7 shows typical supervised input wiring, and provides an example of wiring for Normally Closed (NC) and Normally Open (NO) wiring using 1K Ohm resistors (install the resistors near the switch).

Use the recommended wiring (Belden 8442/8461 or equivalent) to connect the input devices. The maximum length of wiring is 2000 feet (609 meters).

Table 3.11 and Table 3.12 indicate the possible NO and NC states.

Table 3.11: NO States

Condition	Resistance (ohms) +/- 20%	Status
Contact open	1K	Secure
Contact closed	500	Alarm
Short circuit	<360	Trouble
Open circuit	>12K	Trouble
Line fault	any reading outside the ranges given	

Table 3.12: NC States

Condition	Resistance (ohms) +/- 20%	Status
Contact closed	1K	Secure
Contact open	2K	Alarm
Short circuit	<360	Trouble
Open circuit	>12K	Trouble
Line fault	any reading outside the ranges given	

Supervised Input Wiring
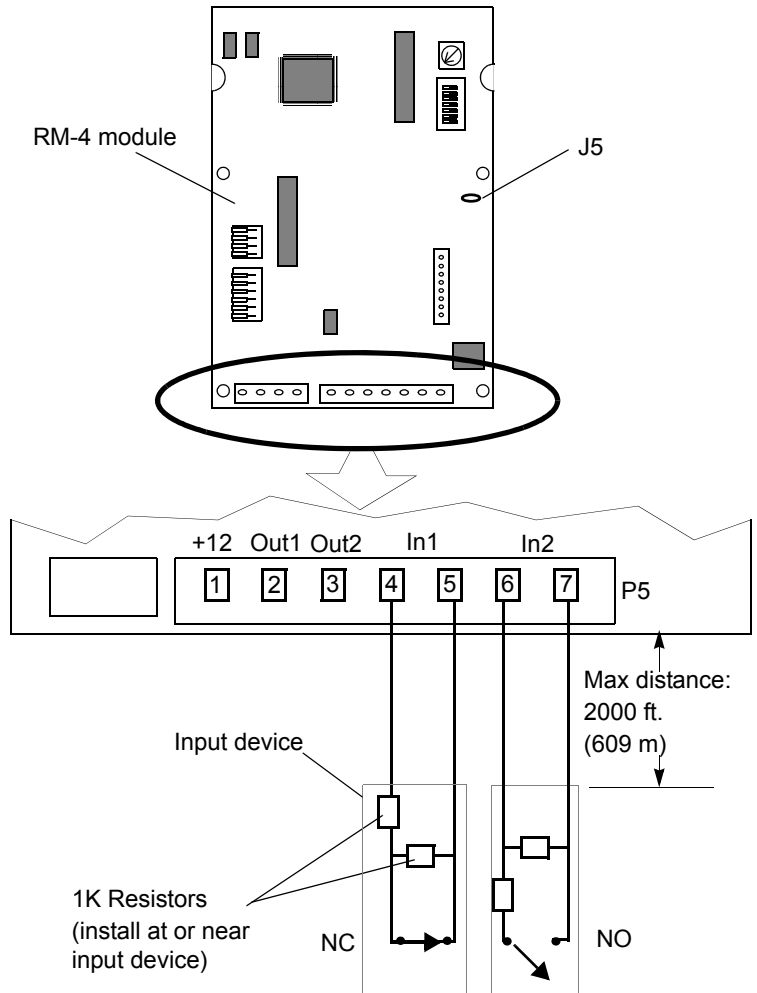
Figure 3.7: Wiring Setup for Supervised Inputs

Installing the ARM-1

The ARM-1 is a small circuit board designed to be connected to an RM-4 board and a local power supply and output device (typically a door strike). The ARM-1 provides a relay for a local door strike or for other equipment located near an RM-4. The installation of the ARM-1 also reduces wire runs back to the iSTAR or apC.

Requirements

Installation involves the consideration of the following items:

- The wiring must meet all appropriate codes.
- The maximum distance is 25 feet (7.6 meters) between an ARM-1 and a connected device (RM-4).
- Two ARM-1 boards can be connected to an RM Series Reader or to an RM-4 Module.

Note: The ARM-1 has not been evaluated by UL.

Cautions: To suppress noise:
– For a DC power supply, use diode 1N4933 or equivalent.
– For an AC power supply, use a Metal Oxide Varistor (MOV) that is 5NR-56K2 or equivalent.

The diode or MOV must be installed as close as possible to the device that the ARM-1 controls (strike).

To install an ARM-1

1. Mount the ARM-1.

2. Use twisted, shielded Belden #9462 wiring (or equivalent) to attach the ARM-1 to the RM Series Reader or to an RM-4 (see Figure 3.8).

   a. Connect P2-1 to P5-1 (+12v) in the RM Series Reader (or RM-4).

   b. Connect P2-2 to P5-2 (Out1) in the RM Series Reader (or RM-4).

   Note: When connecting a second ARM-1, attach the ARM-1 P2-1 to P5-1 (+12v) and P2-2 to P5-3 (out2) on the RM Series Reader or RM-4 Module (see Figure 3.8).

3. Attach the ARM-1 to the Power Supply and the Door Strike using Belden 8442/8461 wiring:

   a. Connect the diode (DC power supply) or MOV (AC power supply) as close to the door strike as possible.

   b. Connect P1-3 (COM) to the Positive (+) terminal of the Power Supply.

4. Connect the Negative (-) terminal of the Power Supply to the negative side of the door strike.
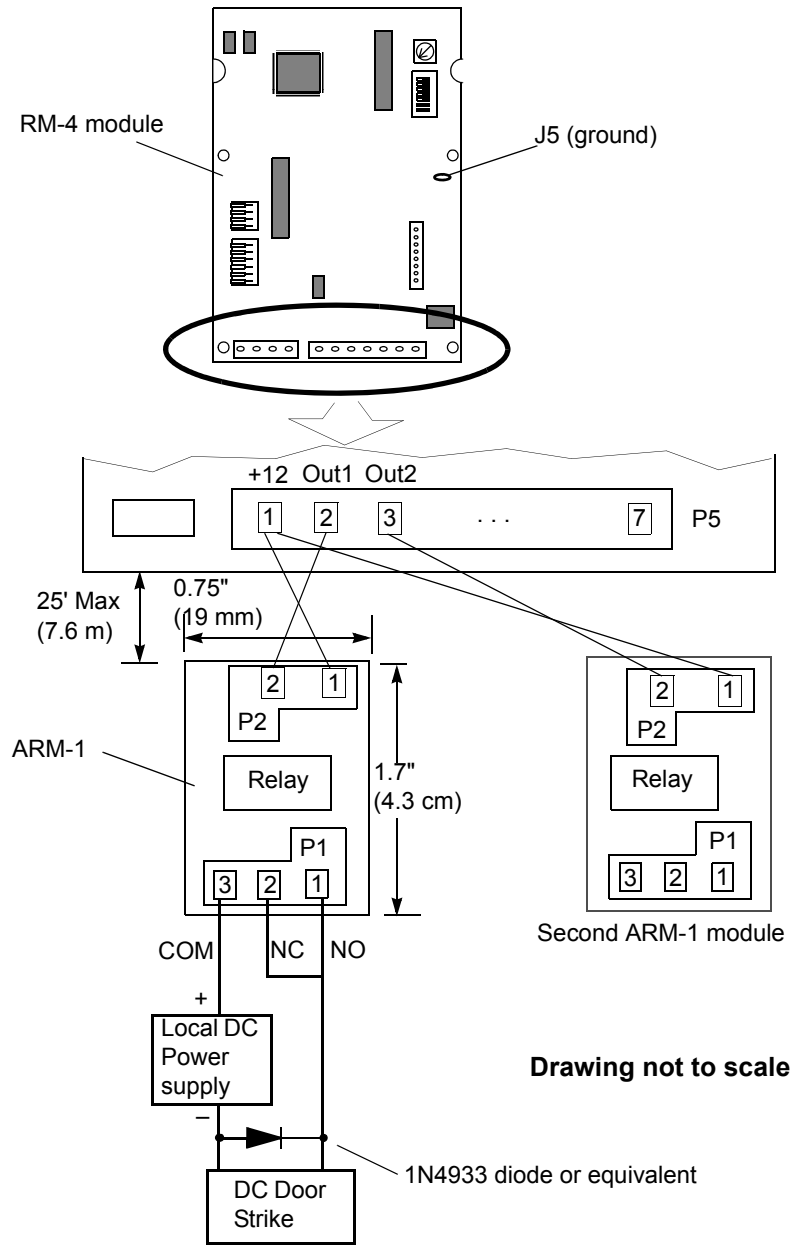
Figure 3.8: Typical ARM-1 Wiring, DC Power Source

Optional Heater Kit for RM Series Readers

A thermostatically-controlled heater is available for readers installed outdoors or in other locations where the temperature falls below the normal environmental specifications. The heater kit requires a separate power supply and is supplied with a 12 VAC, 40VA transformer for operation on 117 VAC. The current draw for a heater strip is 1.25A at 12 VAC. Do not use the reader or iSTAR power supply for a heater kit.

The heater switches on at 40° F (4° C). The thermostat is designed to turn off the heater at approximately 60° F (15° C).

Note: The optional heater kit for the RM Series Readers has not been evaluated for UL compliance.

To install the heater unit

1. Remove the backing from the double-sided adhesive tape on the heater strips. Firmly press the strips onto the inside of the mount plate (see Figure 3.9).

2. Route the heater wires through the access hole in the mount plate.

3. Connect the wires from the 12V transformer and the thermostat using the provided wire nuts. Use Belden 8442/8462 wire to connect the transformer to the thermostat/heater strip.

4. Locate the thermostat close to the heater strip(s) so that the reader does not overheat. Failure to do so can result in damage to the reader.

2.75" (7 cm) maximum   1.25" (3.2 cm)

Heater placement
Magnetic strip reader

1.25" (3.2 cm)

Heater placement
Mullion reader
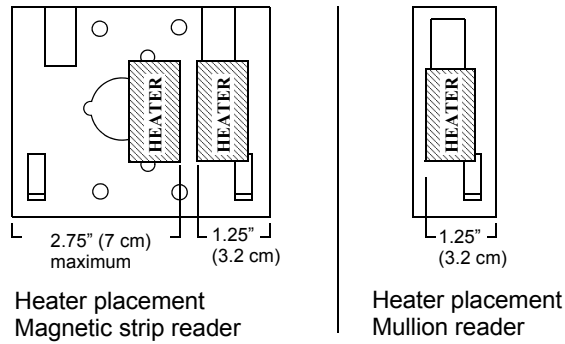
Heater strips: Use 1 strip for Mullion reader.
Use 2 strips for magnetic stripe reader

Transformer

Wire Nut

Wire Nut   Thermostat   Wire Nut

Locate the thermostat and all wire nut connections inside the junction box while the reader is mounted

Wiring: Magnetic stripe and Mullion readers
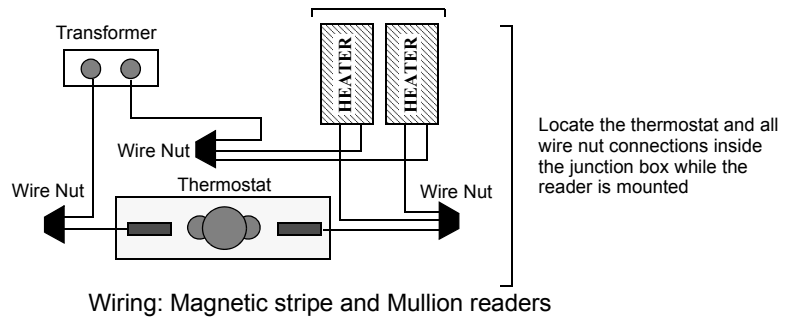
Figure 3.9: Heater installation on Standard and Mullion Mounting Plates

Optional Heater Kit for RM Series Readers

4

Installing the RM-4E

This chapter provides information about RM-4E components and enclosures, and also provides detailed procedures for mounting, wiring, and configuring RM-4E boards. Read this chapter when you have completed your site planning and you are ready to install.

In This Chapter

Installation Overview

This section provides an overview of how to configure an RM-4E board.

Sample Configurations

The RM-4E allows you to configure door strike configurations in the same way that you configured them with the RM-4 board. The RM-4E also provides new components that configure doors with magnetic locks.

Standard Door Configuration

Figure 4.1 shows a typical door strike configuration.
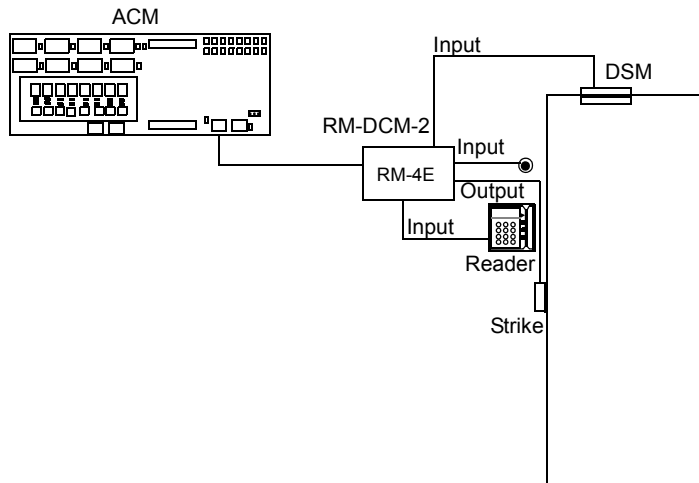
Figure 4.1: RM-4E Door Configuration

Magnetic and Electric Strike Relay Configurations

RM-4E provides new components that are used to connect doors with magnetic and electric strikes.

- Refer to "Magnetic Locks," on page 4-20 for information about magnetic lock information and schematics.
- Refer to "Electric Strikes," on page 4-23 for electric strike information information and schematics.

Configuration Overview

Table 4.1 describes the tasks you must complete to install an RM-4E board.

Table 4.1: Installation Overview

Task	Description	Additional Information
Mount the enclosure	Install the enclosure with one or more Software House boards.	See "Installing the Enclosure," on page 4-8
Connect to the host	Wire RS-485 connector to: ■ STAR1 to STAR4 ports on the ACM ■ apC/8X port P3 ■ star coupler ports PD0 to PD7 ■ apC/L ports P6, P7	See "Connecting to the Host," on page 4-9
Ground and shield the reader bus	Ground and shield wiring for RM-4E components in bus configurations.	See "Grounding and Shielding the Reader Bus," on page 4-10
Set up RM-4E	Set RM-4E address, reader type, supervised inputs, LED, tamper, magnetic lock, relay outputs, keypad, LCD, and termination options.	See "RM-4E Setup," on page 4-12
Connect door inputs	Set up wiring for supervised inputs in NO or NC positions.	See "Supervised Input Wiring," on page 4-16
Connect door outputs	Set up wiring for door outputs.	See "Output Wiring," on page 4-18

RM-4E Components

This section describes the function and location of RM-4E components.

Note: RM-4E boards contain new components that are not provided on RM-4 boards. These components are Maglock and Bypass. Refer to Table 4.2 on page 4-5 for information about these components.

RM-4E Components

Figure 4.2 shows the RM-4E components you need for installation.
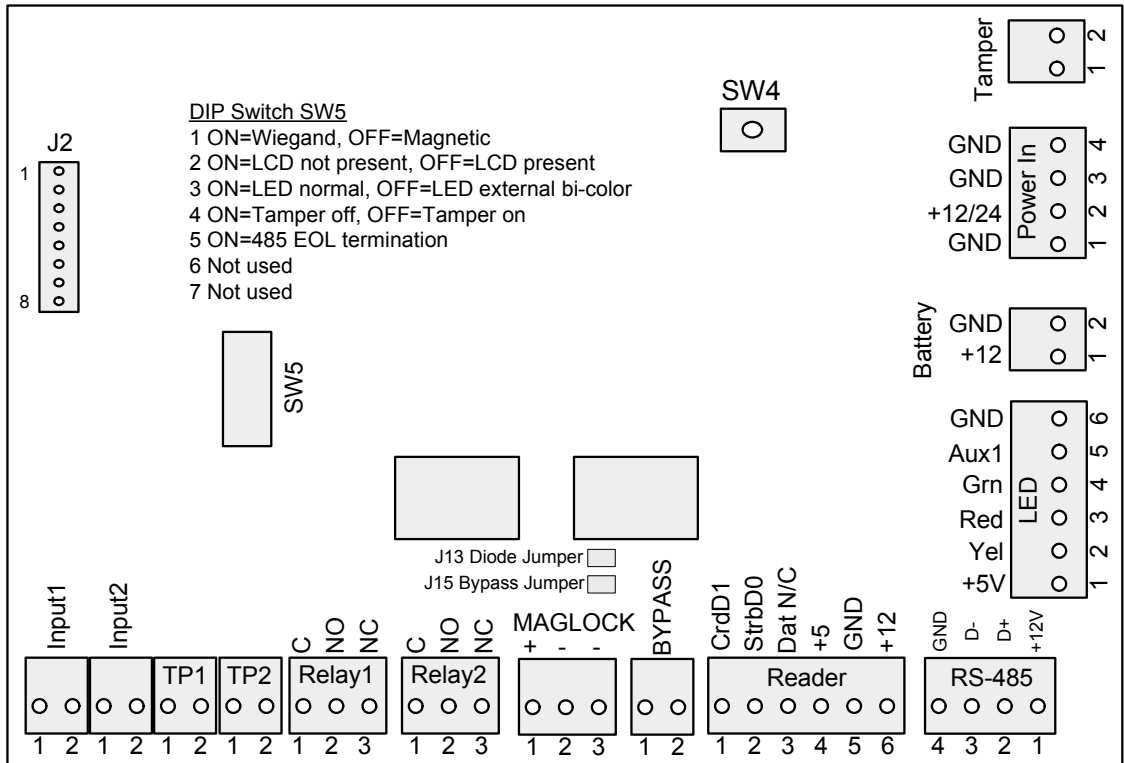
Figure 4.2: RM-4E Components

RM-4E Component Wiring

Table 4.2 provides details about RM-4E component wiring.

Table 4.2: RM-4E Component Wiring

Component	Description	Pin	Pin/Wire
J2[a]	Keypad wiring C3 C2 C1 R3 → ① ② ③ Please note that R2 → ④ ⑤ ⑥ on a 3 x 4 matrix R1 → ⑦ ⑧ ⑨ keypad, Pin 5 R0 → (CMD ENT) ⓪ (CE) (C0) is not used.	1 2 3 4 5 6 7 8	R0 R1 R2 R3 C0 C1 C2 C3
Inputs (2)	Supervised input to door	1 2	
Tie Points (2)	Tie point (no etch) connection for locks that use Relay 1.[b]	1 2	Tie point Tie point
Relays (2)	Relay output (replaces external relays)	1 2 3	Common Normally Open Normally Closed
RS-485	Reader port wiring	1 2 3 4	+12V D+ D– Gnd
LED	Read head LEDs	1 2 3 4 5 6	+5V Red Yellow Green Aux1 (reserved for future use) Gnd

Table 4.2: RM-4E Component Wiring (Continued)

Component	Description	Pin	Pin/Wire	
Reader	Read head wiring		**Magnetic Stripe[a]**	**Wiegand**
		1	Card Load	Data 1 (white)
		2	Strobe	Data 0 (green)
		3	Data	Not Used
		4	+5	+5V
		5	GND	GND
		6	Not Used	+12V
Battery[a]	Battery source for backup battery power	1	+12V	
		2	Gnd	
Auxiliary Power	Alternate power source	1	Gnd	
		2	+12/24V	
		3	Gnd	
		4	Gnd	
Maglock	Connects to an electric strike or magnetic lock. Also provides a connection to a protection diode that is enabled by closing J13.[c]	+	+ Side of lock	
		–	– Gnd side of lock	
		–	– Gnd side of power supply	
Bypass	Connects to an emergency release switch for a magnetic lock.	1	One side of switch	
		2	The other side of switch	
J13	Inductive kickback suppression diode, optionally used for an electric or magnetic lock.		On (closed) if using the diode for an electric or magnetic lock. Off (open) if the magnetic lock has the suppression circuitry built in.	
J15	Energency door switch.		On (closed) if emergency door switch is not used (that is, an electric strike is installed on Relay 2). Off (open) if emergency door switch is configured.	

a.   Magnetic stripe wiring , backup battery, and J2 components have not been evaluated by UL.
b.   Tie points eliminate the need for a field splice. Refer to "Using Relay 1 for a Fail-Secure Electric Strike," on page 4-25 for wiring details.
c.   Refer to "Lock Components," on page 4-19 for conceptual information and "Magnetic Locks," on page 4-20 and "Electric Strikes," on page 4-23 for wiring details.

RM-4E Switch Settings

The RM-4E includes:

- SW4 rotary address switch
- SW5 DIP switch

These are described in the following sections.

SW4 Rotary Switch

Table 4.3 provides details about SW4 rotary switch settings.

Table 4.3: SW4 Rotary Switch Settings

Setting	Setting
Position 0	Used for diagnostics. Refer to Chapter 5, "Testing the Installation", for more information on testing the RM-4E.
Positions 1-8	Sets the address of the reader
Positions 9-F	Not used.

SW5 DIP Switch

Table 4.4 describes SW5 switch settings.

Table 4.4: SW5 DIP Switch Settings

SW #	Function	Off (Open)	On (Closed)
1	Reader type	Magnetic	Wiegand
2	LCD	LCD is present	LCD is not present
3[a]	LED	Normal	External bi-color
4	Tamper	Normal	Bypass
5	EOL-termination	Not last unit in bus	Last unit in bus
6	Not used	—	—
7	Not used	—	—

a. Used only with 3rd party readers connected to an RM-4E module.

RM4-E Enclosures

The Software House RM-DCM-2 enclosure accommodates an RM-4E board as well as three additional Software House boards. The enclosure door is hinged, for ease of installation, and includes a tamper switch and key lock.

Installing the Enclosure

Make sure the installation location provides enough space for the RM-4E enclosure, and the necessary electrical conduit.

Figure 4.3 gives the dimensions for mounting the RM-4E enclosure.
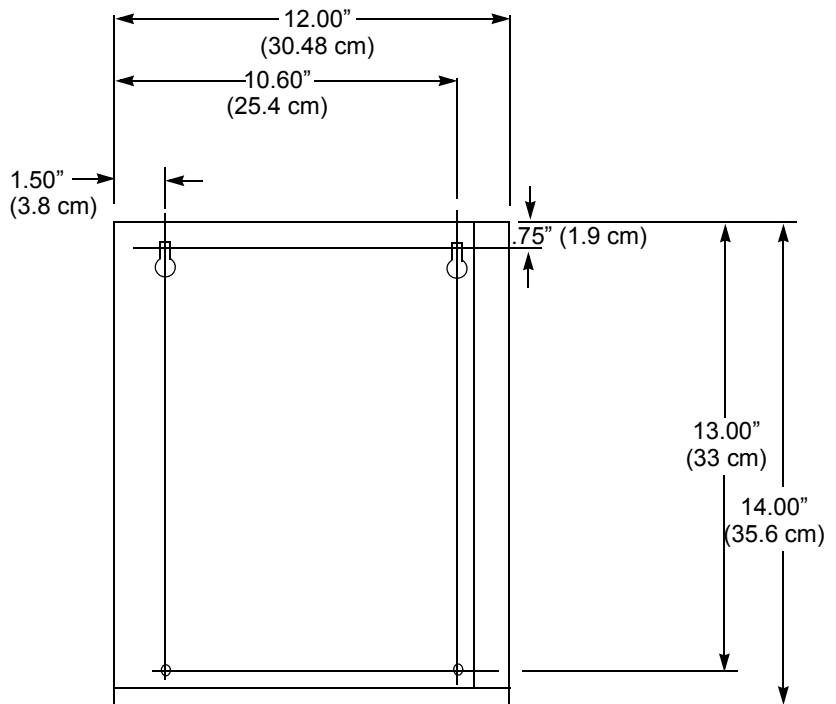
Figure 4.3: RM-4E Enclosure Mounting Specifications

Connecting to the Host

Use the RS-485 connection to wire the RM-4E board to the ACM or apC port. Figure 4.4 shows the RS-485 connection. Table 4.5 describes RS-485 port wiring.
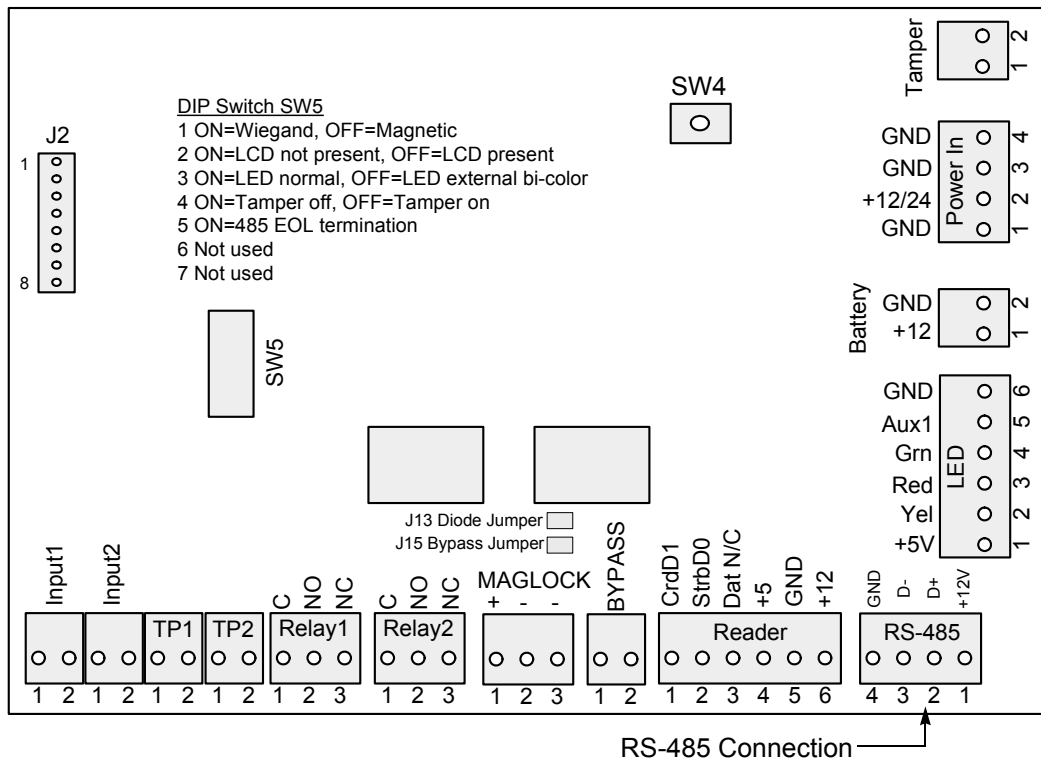
Figure 4.4: Reader Port Connection

Table 4.5: RS-485 Port Wiring

Component	Description	Pin	Wire
RS-485	Reader port wiring	1	+12V
		2	D+
		3	D–
		4	Gnd

Grounding and Shielding the Reader Bus

When bus-wiring more than one reader:

- Attach the shields along the bus together (insulate each connection). Snip off the shield wire at the end of the bus.

- Attach the shield to a ground at only one point, the ground stud inside the controller cabinet adjacent to the knockout.

- Attach a local earth ground (14 gauge) wire to the ground stud inside the cabinet.

Figure 4.5 shows grounding and shield wiring.

Figure 4.5: Reader Shield Wiring

Figure 4.6 shows the shield wire attached to the ground stud.

Figure 4.6: Shield Wiring Example

RM-4E Setup

This section describes how to set up the RM-4E.

To set up a reader

1. Set Reader Address Switch SW4 (a 16-position rotary switch, see "RM-4E Switch Settings," on page 4-7) to a number from one to eight.
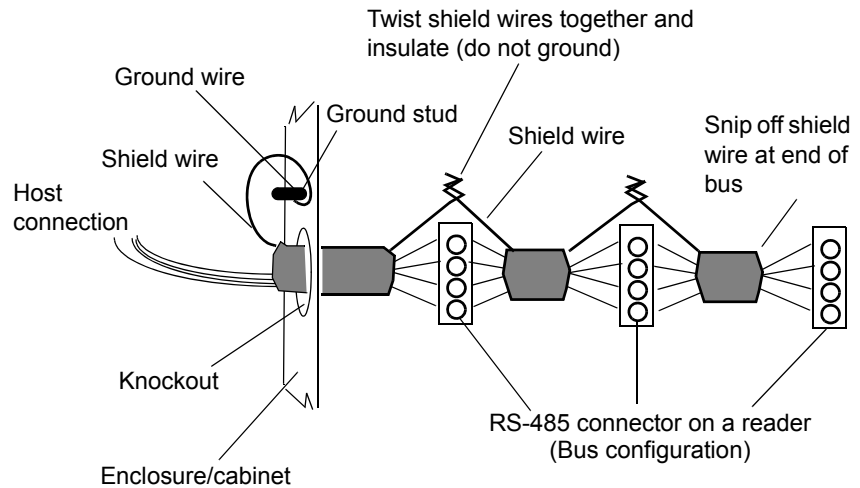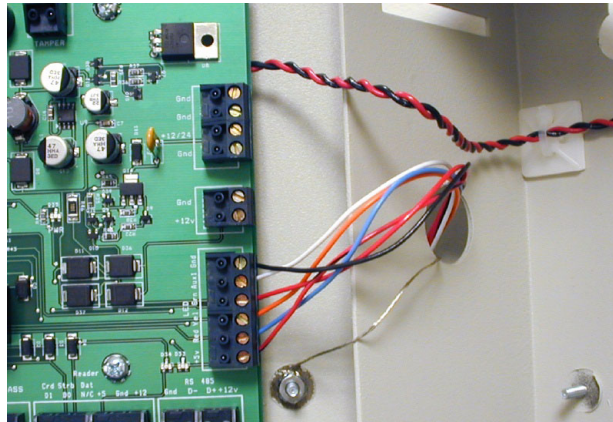
   • Each device along a bus must have a unique number. Configurations that include mixed RM4 and RM-4E hardware must use a unique address for every RM device along the bus. I/8 and R/8 devices along the bus are also assigned a unique number. Device numbers can overlap, but must be unique for each component type.

   • iSTAR configurations that include two ACM boards use the same numbering scheme (1-8) for the second ACM.

2. Ensure that the SW5 Configuration Switch (DIP) is set to the values required for your site (see Table 4.6).

Table 4.6: SW5 Switch Settings

SW #	Function	Off (Open)	On (Closed)
1	Reader type	Magnetic	Wiegand
2	LED	LED is present	LED is not present
3[a]	LED	Normal	External bi-color
4	Tamper	Normal	Bypass
5	EOL termination	Not last unit in bus	Last unit in bus
6	Not used	—	—
7	Not used	—	—

a. Used only with 3rd party readers connected to an RM-4E module.

Caution: To properly terminate an RS-485 line, only one unit, the last unit in a bus, should have SW5-5 in the On (closed) position.

3. Connect wiring for supervised inputs (Input 1 and Input 2 in Table 4.7). Refer to "Supervised Input Wiring," on page 4-16 for wiring information.

Table 4.7: Supervised Input Wiring

Input	Function
1	Supervised input
2	Supervised return

4. Connect wiring for relay outputs, if required (see Table 4.8). Refer to "Output Wiring," on page 4-18 for wiring details.

Table 4.8: Relay Output Wiring

Relay 1/2	Function
1	Common
2	Normally open
3	Normally closed

5. Connect the lock component, if required (see Table 4.9).
    • Refer to "Magnetic Locks," on page 4-20 to configure a magnetic lock.
    • Refer to "Electric Strikes," on page 4-23 to configure an electric strike.

Table 4.9: Magnetic Lock Wiring

Pin	Function
+	+ Side of lock
-	- Gnd side of lock
-	- Gnd side of power supply

6. Connect the read head wiring (see Table 4.10).

Table 4.10: Read Head Wiring

Reader	Magnetic Stripe[a]	Wiegand (Swipe or Proximity)
1	Card load	Data 1 (white)
2	Strobe	Data 0 (green)
3	Data	No connection
4	+5V	+5 V (red)
5	Ground	Ground
6	No connection	+12 V

a. Magnetic stripe wiring has not been evaluated by UL.
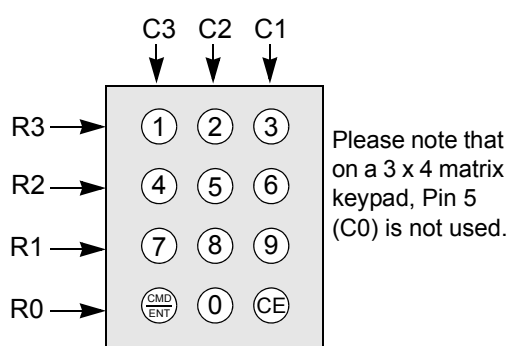
7. Connect the LED wiring, if required (see Table 4.11).

Table 4.11: LED Wiring

Pin	Function
1	+5V
2	Red LED
3	Yellow LED
4	Green LED
5	Aux 1 - (reserved for future use)
6	GND

8. Connect the keypad (or wire a 3x4 matrix keypad) if required (see Table 4.12).

Table 4.12: Wiring for Units with Keypads

J2[a]	Function	Keypad Diagram
1	R0	
2	R1	
3	R2	
4	R3	
5	C0	
6	C1	
7	C2	
8	C3	

a.   The J2 component has not been evaluated by UL.

9. Install the backup battery, if required. Table 4.13 shows the wiring for the backup battery connector:

Table 4.13: Wiring for Backup Battery

Pin	Function
1	+12 V (to red wire on cable assembly)
2	Gnd (to black wire on cable assembly)

10. Install the LCD, if required.

    a.   Power off the RM-4E.

    b.   Disconnect the backup battery, if one is installed.

    c.   Plug the LCD into the J1 (LCD) connector.

       Be sure to plug in pin 1 of the LCD into pin 1 of the connector. Pin 1 is located at the right, near R47.

    d.   Turn on RM-4E power, and reconnect the backup battery.

Supervised Input Wiring

Figure 4.7 shows typical supervised input wiring, and provides an example of wiring for Normally Closed (NC) and Normally Open (NO) wiring using 1K Ohm resistors (install the resistors near the switch).

Use the recommended wiring (Belden 8442/8461 or equivalent) to connect the input devices. The maximum length of wiring is 2000 feet (606 meters).

The following tables indicate the possible NO and NC positions.

Table 4.14: NO Positions

Condition	Resistance (ohms) +/- 20%	Status
Contact open	1K	Secure
Contact closed	500	Alarm
Short circuit	<100	Trouble
Open circuit	>32 K	Trouble
Line fault	any reading outside the ranges given	

Table 4.15: NC Positions

Condition	Resistance (ohms)	Status
Contact closed	1K	Secure
Contact open	2K	Alarm
Short circuit	<100	Trouble
Open circuit	>32K	Trouble
Line fault	any reading outside the ranges given	

RM-4E module

1   2   3   4
In 1   In 2

Max distance:
2000 ft.
(609 m)

Input device

1K resistors
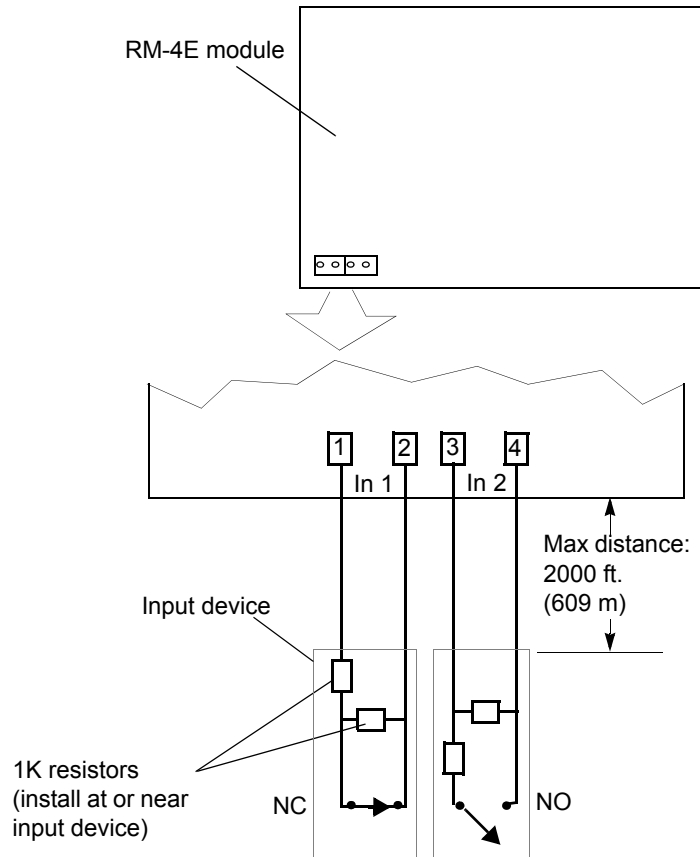(install at or near
input device)

NC   NO

Figure 4.7: Wiring Setup for Supervised Inputs

Output Wiring

Use recommended wiring (Belden 8442/8461) to connect relay, maglock, and bypass wiring to door components. You can wire outputs to an RM-4E board using:

- Relay 1 or Relay 2 for standard door strike configurations.
- Maglock and Bypass for configurations that use magnetic locks.

Note: If you plan to use Relay 2 for the Maglock, you cannot use it for any other purpose.

Relay Wiring

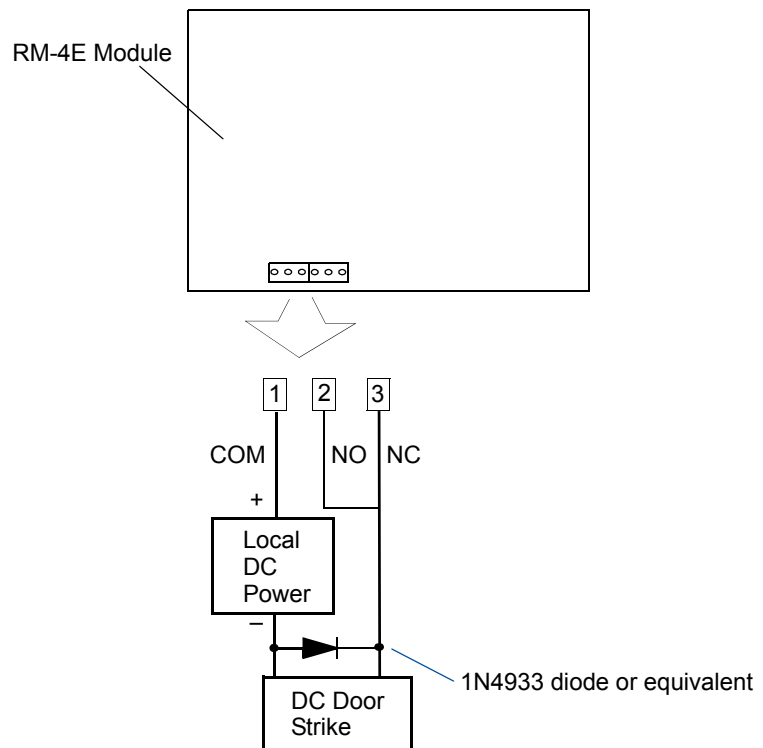Figure 4.8 shows relay wiring using Relay 1 or Relay 2.

Figure 4.8: Output Wiring using Relay1 or Relay 2

Lock Components

The RM-4E provides lock components for connecting magnetic and electric strike locks.

- Relay 1 is a standard Form C dry contact relay, similar to the relays found on the iSTAR ACM.

- Relay 2, along with the Maglock and Bypass connectors, has internal etch connections for wiring magnetic and electric strike locks.

- The Tie Point (TP1/TP2) connector pins have no etch, and are used as connection points to avoid field splices when connecting locks to Relay 1.

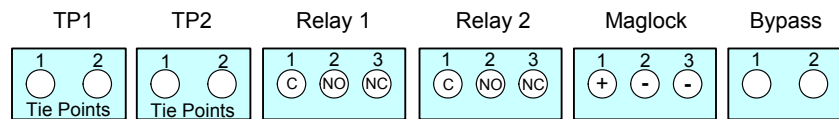Figure 4.9 shows the Maglock, Bypass, Relay and Tie Point Components.

Figure 4.9: RM-4E Lock connectors

Types of Connections

RM-4E lock components support the following wiring configurations:

- Magnetic Lock using Relay 2
- Electric Strike using Relay 2 (Fail - Secure)
- Electric Strike using Relay 1 (Fail - Secure)

Refer to "Magnetic Locks," on page 4-20 for information about wiring a magnetic lock, and "Electric Strikes," on page 4-23 for information about electric strikes.

Magnetic Locks

Figure 4.10 shows magnetic lock wiring. The normal state of a magnetic lock is to have current flowing through an electromagnet on the lock that pulls a strike plate with a force 500-2000 lbs. (227-907 kg.). Safety codes usually require a bypass switch for emergency egress. This is not the Request to Exit (REX) switch. The REX function is usually accomplished with a PIR.

Note the internal etch connections between Relay 2, Maglock, and the Bypass connector.

Connecting a Magnetic Lock

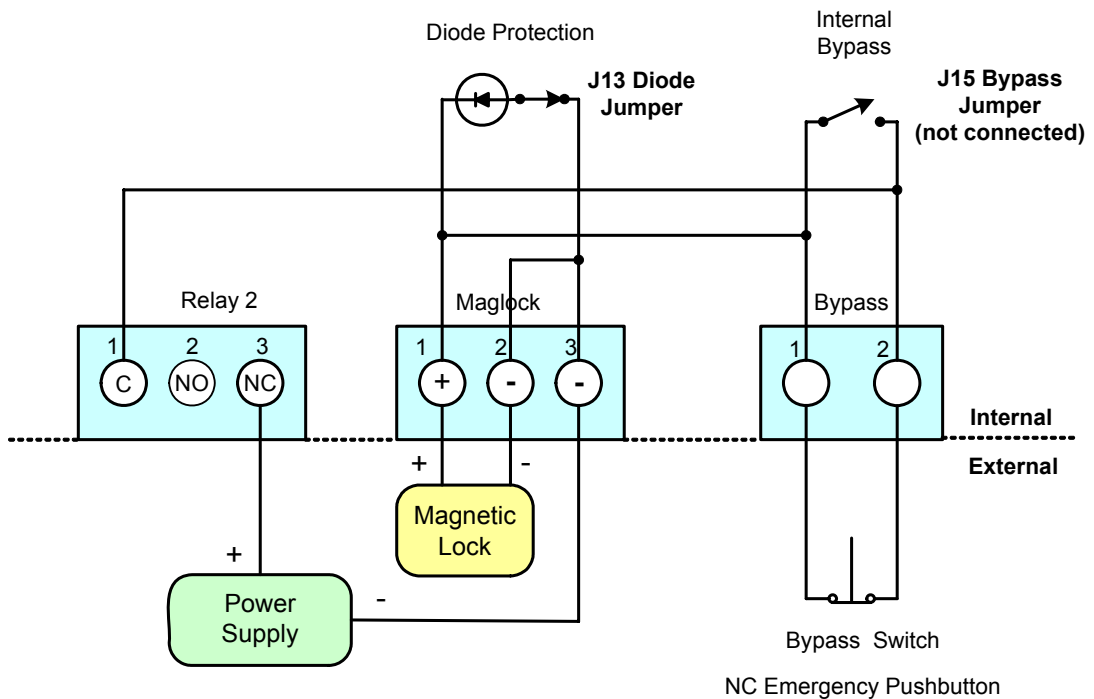Connect the power supply, magnetic lock, and bypass switch as shown in Figure 4.10.

Figure 4.10: RM-4E Magnetic Lock Wiring – Relay 2

Component Description

This section describes the components and connections for magnetic lock wiring.

Power Supply

The power for a magnetic lock must be filtered, regulated direct current (DC) voltage. Alternating current (AC) does not work and half-wave rectified DC does not work reliably.

Most magnetic locks consume about 3 watts, which is about 125 mA@24 VDC or 250 mA@12 VDC.

18 AWG wire is generally recommended. If the wire runs are in excess of 100 feet, use 16 AWG wire instead.

Warning: The power supply to a magnetic lock must be isolated. Do not connect the output of the supply or the negative side of the lock to earth ground. The connection from the minus side of the power supply *must* go to Maglock pin 3.

Bypass Switch

Connect a normally closed (NC) emergency Bypass switch as shown in Figure 4.10 on page 4-20. Remove (open) the J15 Bypass jumper for normal operation.

If you install an electric strike on Relay 2, install (close) the J15 Bypass jumper.

Diode Protection

An optional inductive kickback suppression diode is available installing (closing) the J13 Diode jumper.

If the magnetic lock you are using has the suppression circuitry built-in, remove (open) the J13 Diode jumper.

RM-4E Failure

When using the configuration shown in Figure 4.10, the magnetic lock stays locked if the RM-4E loses its' connection to the apC or iSTAR because the normally closed (NC) connection of Relay 2 is used. The magnetic lock also remains locked if the RM-4E loses power.

You have the option of wiring to the normally open (NO) connector of Relay 2 if you want to have the Magnetic lock unlock under those conditions. If you use the normally open (NO) connector, then Relay 2 will have to be normally energized using the C•CURE 800/8000 Administration application.

If the power supply shown in Figure 4.10 fails, the magnetic lock unlocks, regardless of whether normally closed (NC) or normally open (NO) is used.

Electric Strikes

Unlike magnetic locks, electric strike locks typically lock when not powered and unlock when powered.

You must decide if you want to wire for fail-secure or fail-safe. Fail-secure means that if there is a power failure, the door goes to a secure or locked state. Fail-safe (fail-open**)** means that the door is open if there is a failure. It is important that local codes be followed to avoid people getting trapped in an emergency situation. Normally, fail-secure doors have crash bars to allow emergency egress.

Using Relay 2 for a Fail-Secure Electric Strike

The same internal connections that are used for a magnetic lock can be used to wire an electric strike (Figure 4.11). Connect the plus side of the power supply to the normally open (NO) connection of Relay 2 and connect the remaining external connections the same as the magnetic lock.
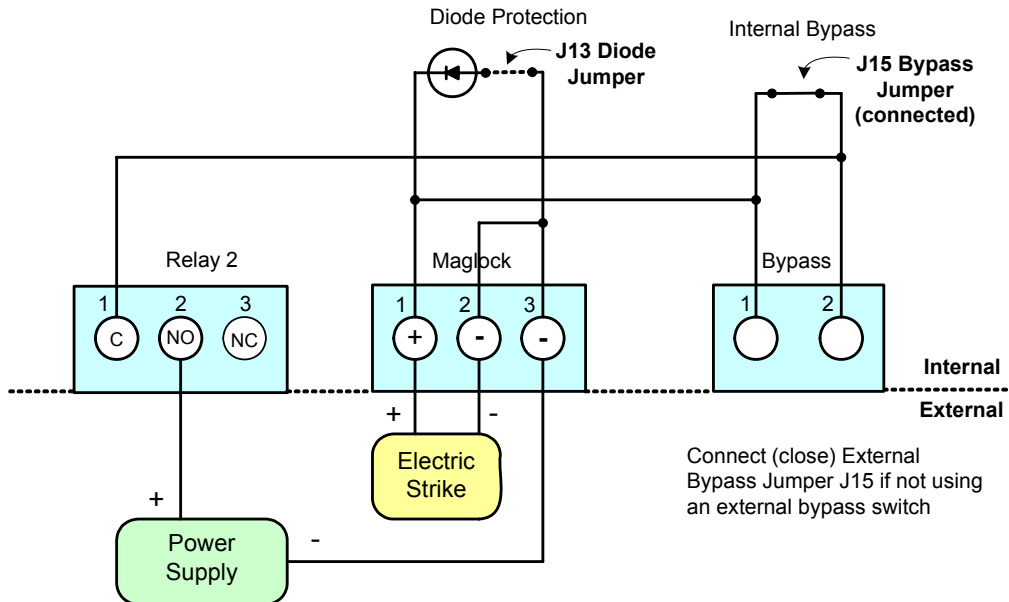

Figure 4.11: RM-4E Electric Strike Wiring – Relay 2 (Fail-Secure Wiring)

Component Description

This section describes the components and connections for electric strike wiring.

Bypass Switch

Connect (close) J15 to provide the internal connection from Maglock Pin 1 to the C contact of Relay 2. Do not connect an external bypass switch.

Diode Protection

An optional surge suppression diode is available by connecting (closing) the J13 Diode jumper. If the electric strikes has a built-in suppression diode, remove (open) the J15 Bypass jumper.

Using Relay 1 for a Fail-Secure Electric Strike

Relay 1 is a standard Form-C dry contact relay. Wiring door strikes using this relay on the RM-4E is the same as wiring them to apCs, iSTARs, R-8s, and other devices.

Two isolated tie points have been added to minimize splices.

Connect the strike and the power supply as shown. There is no internal etch to consider when using Relay 1.

In the example in Figure 4.12, a fail-secure door is shown with the normally open (NO) contact. You can add an optional external suppression diode, if desired.
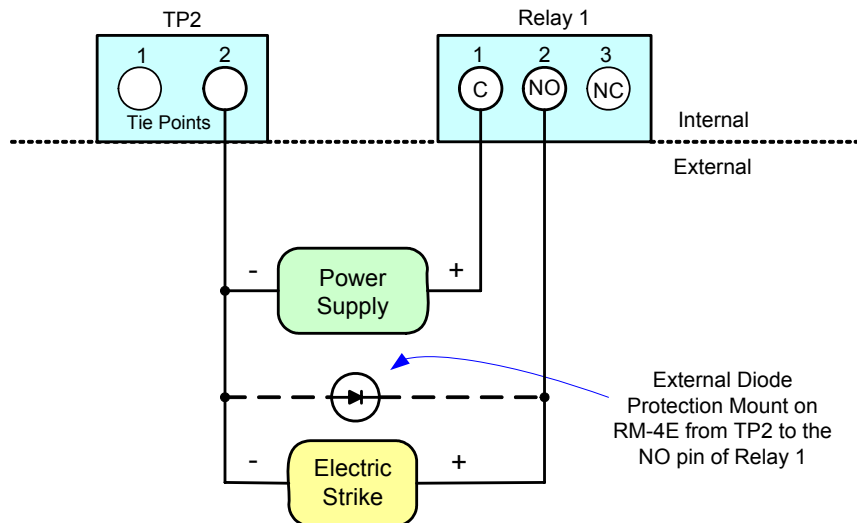

Figure 4.12: RM-4E Electric Strike Wiring – Relay 1 (Fail-Secure Wiring)

Electric Strikes

5

Testing the Installation

This chapter provides information about testing RM-4 boards and RM-4E boards. Read this chapter when you have completed the installation, to ensure that your system is running properly.

In This Chapter

Testing the RM-4

This section describes the test procedures for the RM-4.

To initiate a test on an RM-4 board, set the RM-4 reader address switch to 9, power up the RM-4, and follow the steps in the following "Test Procedure" section. When you complete the test, reset the RM-4 reader address switch to its original setting.

Note: The following procedure is not supported on RM-4E boards.

Test Procedure

The LEDs on the reader indicate whether each step in the test procedure is successful. This section describes each step along with the LED response. If the reader has no keypad, the test procedure consists of steps 15 through 17.

To test the reader

1. Press the **1** key. The red LED lights up.

2. Press the **1** key again. The red LED flashes slowly.

3. Press the **1** key again. The red LED flashes rapidly.

4. Press the **1** key again. The red LED goes out.

5. Press the **2** key. The amber LED lights up.

6. Press the **2** key again. The amber LED flashes slowly.

7. Press the **2** key again. The amber LED flashes rapidly.

8. Press the **2** key again. The amber LED goes out.

9. Press the **3** key. The green LED lights up.

10. Press the **3** key again. The green LED flashes slowly.

11. Press the **3** key again. The green LED flashes rapidly.

12. Press the **3** key again. The green LED goes out.

13. Press the **4** key. If an ARM-1 is connected, the relay(s) should activate. Press the **4** key again to deactivate the relay(s).

Note: Pressing the **4** key activates both relay outputs on an RM reader.

14. Press the **5** key to activate the card swipe test. The LEDs make no response when the key is pressed.

15. Swipe a card in the forward direction.

16. The green LED lights up for two seconds. If the red LED lights up, there is an error in the card read.

17. Swipe the card in the reverse direction. The amber LED lights up. If an error is read, the red LED lights up. This only applies to magnetic stripe readers.

18. Press the **6** key to test supervised input number 1. The LEDs indicate the following conditions:

Table 5.1: LED Indications

LED Response	Condition
Green LED lights	Input is in secure condition (1K)
Amber LED lights	Input is in alarm condition (500Ω)
Red LED lights	Input is in alarm condition (2K)
Amber LED flashes slowly	Input is open (open)
Red LED flashes rapidly	Input is shorted (shorted)

Note: Use resistors across the inputs to simulate the conditions listed in the previous table.

19. Press the **7** key to test supervised input number 2. The LED response indicates the conditions listed in the previous table.

20. Press the **8** key to test the tamper switch. If the tamper switch is depressed, the red LED is off. When the switch is released, the red LED lights up.

Testing the RM-4E

This section describes the procedures that verify RM-4E/RM-DCM-2 installation and operation.

Required Equipment

The following equipment is required.

- Two 1K-ohm resistors
- An LCD display module (2 line x 16 character), Software House part number RM-LCD
- Three LEDs
- Heat shrink
- A multimeter to measure voltage and resistance

Configuration Requirements

You must complete the following configuration requirements before you test the RM-DCM-2:

1. Install the RM-DCM-2 as described in this manual.

2. Install the LCD display module into the LCD connector on the RM-DCM-2 circuit board.

Self-Test Mode

The RM-4E has a built-in self-test mode. Perform the steps in this section to run the self-test.

Note: To use the built-in self-test mode, the RM-4E must be using firmware version 1.01 or later.

1. Remove power to the RM-4E.

2. Set Rotary Switch SW4 to position 0.

3. To test the reader LEDs, connect three LEDs to the Reader LED port as shown in Figure 5.1. Connect the anode (long lead) of each LED to Pin 1 (+5v). Cover the LED wires with heat shrink to prevent short circuits.

Note: If you are using an older LED that does not have a built-in current-limiting resistor, add a 1K-ohm resistor in series.
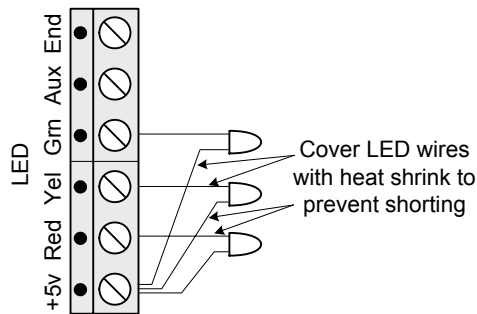

Figure 5.1: Connecting LEDs for Self-Test Mode

4. Power up the RM-4E. When you power up the RM-4E:
    *   Relays 1 and 2 toggle every second.
    *   Reader LED lines Red, Green, and Yellow flash on and off .

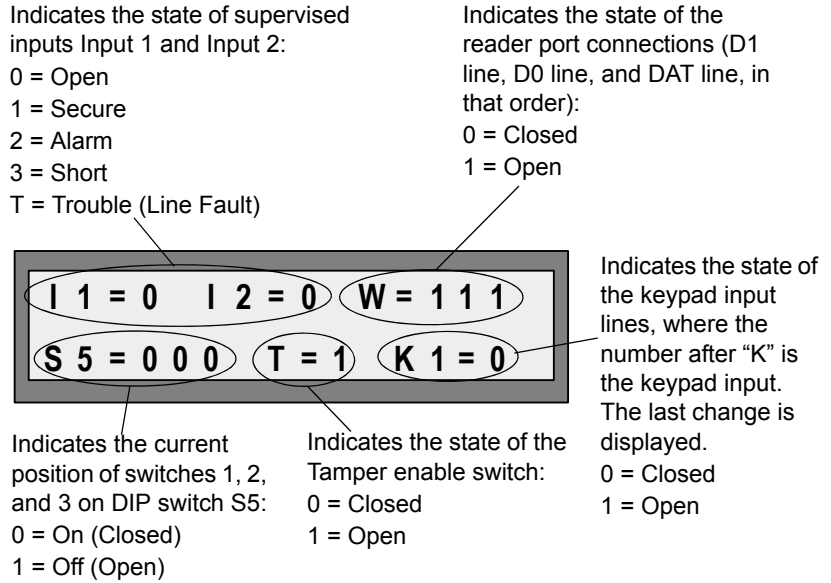   The LCD displays the information shown in Figure 5.2.

Indicates the state of supervised
inputs Input 1 and Input 2:
0 = Open
1 = Secure
2 = Alarm
3 = Short
T = Trouble (Line Fault)

Indicates the state of the
reader port connections (D1
line, D0 line, and DAT line, in
that order):
0 = Closed
1 = Open

Indicates the state of
the keypad input
lines, where the
number after "K" is
the keypad input.
The last change is
displayed.
0 = Closed
1 = Open

```
I 1 = 0    I 2 = 0  W = 1 1 1
S 5 = 0 0 0  T = 1   K 1 = 0
```

Indicates the current
position of switches 1, 2,
and 3 on DIP switch S5:
0 = On (Closed)
1 = Off (Open)

Indicates the state of the
Tamper enable switch:
0 = Closed
1 = Open

Figure 5.2: Self-Test LCD Display

5. To test the supervised inputs, attach a 1K-ohm resistor to each input
(Input 1 and Input 2) as shown in Figure 5.3. Prior to installing the
resistors, the input state should be open (0). After installing the
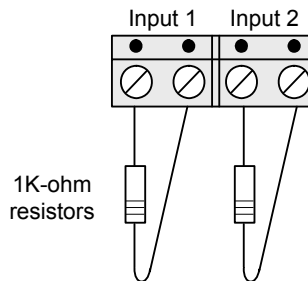resistors, the input state should be secure (I1=1 and I2=1).

Input 1   Input 2

1K-ohm
resistors

Figure 5.3: Attaching Resistors to the Supervised Inputs

6. To test each reader line, short to ground, one at a time, each of the three
reader data lines (D0, D1, and DAT) on the Reader port. After shorting
a data line, the display should show a "1" in the appropriate reader line

position to indicate that the data line is low (for example, W=010 when you short the D1 line). After removing the short from the data line, the display should revert to 0 for that reader line.

7. To test the tamper switch, short tamper connector SW2-2 to ground. The display should change to T=0. Remove the short. The display should revert to T=1.

8. To test SW5 positions 1, 2, and 3, set each of these DIP switches to the Off (open) position. The display should show S5=111. Set each of these DIP switches to the On (closed) position. The display should show S5=000.

9. To test the keypad, short to ground each of the eight keypad connectors on port J2 one at a time. The display should indicate that a voltage level change was detected. For example, if you short keypad connector 3, the display should show K3=0, where K3 is the keypad connector number and 0 is the new state.

Manual Test Procedure

To further test the RM-4/RM-DCM-2:

1. Measure the supply voltage to the RM-DCM-2.

    The voltage can be measured between pin 1 (ground) and pin 2 (supply) on the Power-In connector. The voltage must be +12 Volts (+/-5%) or +24 Volts (+/- 10%).

2. Check the RM-DCM-2 address setting.

    The RM-DCM-2 must be set to an unused address when connected to the apC or ISTAR. The LCD will display the switch setting upon power-up. Verify that the displayed reader address is correct for your installation.

3. Check the board for communications to the apC or iSTAR.

    Observe LEDs D33 and D34 on the lower right corner of the RM-4E board. The LEDs should blink rapidly to indicate communication to and from the RM-DCM-2. If the LEDs are not blinking, the RM-DCM-2 may not be properly configured in the C•CURE 800/8000.

4. Check the supervised inputs.

    With no switches or resistors connected to the "Input 1" and "Input 2" lines, the C•CURE 800/8000 Monitoring Program should report inputs as "Open Loop". When you connect the 1,000-ohm resistor to the input terminals, the C•CURE 800/8000 Monitoring Program should report the input as "Open loop cleared".

5. Check the outputs.

    The outputs can be functionally tested by using the "momentary activate" feature in the C•CURE 800/8000 Monitoring Program. When the outputs are momentarily activated, the relays energize for a few seconds. The corresponding LED (D31 for output #1 and D32 for output #2) will light. The multimeter can be used to check for continuity between the C and NO pins on connectors Relay1 and Relay2.

6. Check the reader interface.

    The reader interface can only be tested with the reader chosen for the installation. Reading a card will cause the display to show "Access Granted" or "Access Denied", depending upon the clearance of the card.

RM LEDs

Each RM-4 or RM-4E board can control 3 external LEDs: red, green, and amber. The various conditions indicated by these LEDs are described in Table 5.2.

Table 5.2: RM Reader LED Indications

Red LED	Amber	Green	Indication
Brief flash	Brief flash	Brief flash	Power up
Off	Off	Off	Online (software flag enabled)
Off	On	Off	Online
On	Off	Off	Offline or reader tamper
Solid for 1 sec.	Off	Off	Access denied
Fast flash for 2 sec.	Off	Off	Access denied (Software Flag Enabled)
Off	Off	On	Access granted or door unlocked (Software Flag Enabled)
Off	Off	Fast flash	Access granted
Off	Off	Slow flash	Door unlocked
Off	Slow flash	Off	Enter second card (escorted access only)
Off	Fast flash	Off	Enter PIN
Off	Fast flash	Off	Enter floor # (systems configured for elevator control only)
Flash w/ each key press	Off	Flash w/ each key press	Keypad input
Slow flash	Off	Off	Reader not configured
Fast flash	Fast flash	Fast flash	Alarm: door forced/held open
On	On	On	Error condition: Remove power to prevent damage to RM

RM LEDs

A

Equipment Specifications

This appendix provides the specifications and environmental requirements for RM-4 and RM-4E boards.

In This Appendix

RM-4/RM-4E Specifications

This section provides product specifications, including:

- Dimensions and weight
- Optimal operating conditions

Dimensions and Weight

Table A.1 provides dimension and weight information.

Table A.1: Dimensions and Weight of RM-4 Products

Unit	Height	Depth	Width	Weight
RM-4 (standalone)	4.65 in 11.81 cm	0.6 in 1.5 cm	3.55 in 9.02 cm	9 oz. 255 g
RM-4E	5.4 in 13.71 cm	.875 in 2.22 cm	7.1 in 18 cm	15 oz. 425 g
Magnetic stripe reader (RM-1, RM-2)	5.10 in. 12.95 cm	1.95 in. 4.95 cm	5.6 in. 14.22 cm	21 oz. 595 g
Mullion reader (RM-3)	5.10 in. 12.95 cm	1.81 in. 4.6 cm	1.91 in. 4.85 cm	10 oz. 283 g
Wiegand swipe reader	2.3 in. 5.84 cm	1.7 in. 4.3 cm	5.3 in. 13.46 cm	12.5 oz. 354 g
Wiegand insertion reader	1.8 in. 4.57 cm	3.5 in. 8.9 cm	4.5 in. 11.4 cm	15 oz. 425 g
Wiegand key reader	1.1 in. 2.79 cm	2.0 in. 5.1 cm	1.4 in. 3.56 cm	5.8 oz 164 g

Optimal Operating Conditions

Table A.2 provides optimal operating information for RM-4 series readers.

Note: UL has evaluated the following readers for indoor use between 0° C to 49°C (32°F to 120°F).

Table A.2: RM Series Readers Environmental Specifications

Model	Operating Temperature (Environmental)	Operating Temperature with Heater Kit	Power Requirements	Dimensions
Magnetic Stripe: RM1-MP RM2-MP	32° F to 140°F 0°C to 60°C	-22°F to 140°F -30°C to 60°C	+12V DC 80 mA	5.10 x 5.60 x 1.95 in. 12.95 x 14.22 x 4.95 cm 21 oz. (595 g)
Magnetic Stripe with LCD Display: RM2L-MP	32°F to 140°F 0°C to 60°C 95% humidity Non-condensing	Not applicable	+12V DC 180 mA	5.10 x 5.60 x 1.95 in. 12.95 x 14.22 x 4.95 cm 23 oz. (652 g)
Magnetic Stripe Mullion: RM3-MP	32° F to 140° F 0° C to 60°C	-22°F to 140°F -30°C to 60°C	+12V DC 80 mA	5.10 x 1.91 x 1.81 in. 12.95 x 4.85 x 4.60 cm 10 oz. (283 g)
Indala Proximity: RM1-PI RM2-PI	32°F to 140°F 0°C to 60°C	-22°F to 140°F -30°C to 60°C	+12V DC 80 mA	5.10 x 5.60 x 1.95 in. 12.95 x 14.22 x 4.95 cm 25 oz. (709 g)
Indala Proximity with LCD Display: RM2L-PI	32°F to 140°F 0°C to 60°C 95% humidity Non-condensing	Not applicable	+12V DC 180 mA	5.10 x 5.60 x 1.95 in. 12.95 x 14.22 x 4.95 cm 27 oz. (765 g)
HID Proximity: RM1-PH RM2-PH	32°F to 140°F 0°C to 60°C	-22°F to 140°F -30°C to 60°C	+12V DC 135 mA average 250 mA peak	5.10 x 5.60 x 1.95 in 12.95 x 14.22 x 4.95 cm 21 oz. (595 g)
HID Proximity with LCD Display: RM2L-PH	32°F to 140°F 0°C to 60°C 95% humidity Non-condensing	Not applicable	+12V DC 135 mA average 250 mA peak	5.10 x 5.60 x 1.95 in 12.95 x 14.22 x 4.95 cm 23 oz. (652 g)

Table A.2: RM Series Readers Environmental Specifications, continued

Model	Operating Temperature (Environmental)	Operating Temperature with Heater Kit	Power Requirements	Dimensions
HID Proximity Mullion: RM3-PH	-22°F to 149°F -30°C to 65°C	Not applicable	+12V DC 135 mA average 250 mA peak	5.10 x 1.91 x 1.81.in. 12.95 x 4.85 x 4.60 cm 10 oz. (283 g)
Wiegand: RM1-W RM2-W[a]	32°F to 140°F 0°C to 60°C	-32°F to 140°F -0°C to 60°C	+12V DC 180 mA	5.10 x 5.60 x 1.95 in. 12.95 x 14.22 x 4.95 cm 25 oz. (708 b)
Wiegand with LCD Display: RM2L-W[a]	32°F to 140°F 0°C to 60°C 95% humidity Non-condensing	Not applicable	+12V DC 180 mA	5.10 x 5.60 x 1.95 in 12.95 x 14.22 x 4.95 cm 25 oz. (708 g)
Wiegand with Mullion: RM3-W[a]	-40°F to 158°F -40°C to 70°C	Not applicable	+12V DC 80 mA	5.10 x 1.91 x 1.81 in. 12.95 x 14.22 x 4.95 cm 13 oz. (369 g)

a.   These readers have not been evaluated by Underwriters Laboratories.

Table A.3 provides optimal operating information for RM-4 standalone modules.

Table A.3: RM-4 Standalone Environmental Specifications

Operating Temperature (Environmental)	Operating Temperature with Heater Kit	Power Requirements	Dimensions
32° F to 140° F 0° C to 60° C	32° F to 140° F 0° C to 60° C	+12V DC 75 mA	4.65 x 3.55 x 0.60 in. 11.81 x 9.02 x 1.52 cm 9 oz. (255 g)

RM-DCM-2 Specifications

This section includes physical specifications and optimal operating specifications for the RM-DCM-2.

Note: UL has evaluated the RM-DCM-2 for indoor use between 0° C to 49°C (32°F to 120°F).

Optimal Operating Conditions

Requirement	Specification
Power requirement (without reader or lock)	+12 VDC or +24 VDC 550 mA maximum
Maximum input (with full load)	12/24Vdc, 550 mA max
Relay power control	Up to 30 VAC/DC, 8A maximum
Reader LED output control	4.0 V to 5.25V, 20mA maximum
Reader output voltage	5 VDC or 12VDC
Reader output maximum current	300 mA (at 5V or 12V)

Physical Specifications

Requirement	Specification
Enclosure dimensions	14 x 12 x 3.5 in. 35.6 x 30.5 x 8.9 cm.
Weight (without battery)	10 lbs. (4.53 kg.)

RM-DCM-2 Specifications

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