Sensormatic
securing today's business™

C•CURE® Watch

Installation and Service Guide

8000-2803-01 A

Sensormatic
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Access Systems

C•CURE Watch

Installation and Service Guide

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8000-2803-01, Rev. 0/A

SHF 5/01

WARNING

Do not install this product in hazardous areas where highly combustible or explosive products are stored or used.

WARNING

The C•CURE Watch installation must be performed by qualified service personnel and should conform to all local codes. The reader/controller enclosure does not contain user serviceable parts. Contact Technical Support at 1-800-392-2873 for help in resolving system performance issues.

FCC COMPLIANCE

FCC COMPLIANCE: This equipment complies with Part 15 of the FCC rules for Class A digital devices when installed and used in accordance with the instruction manual. Following these rules provides reasonable protection against harmful interference from equipment operated in a commercial area. This equipment should not be installed in a residential area as it can radiate radio frequency energy that could interfere with radio communications, a situation the user would have to fix at their own expense.

DISCONNECT DEVICE

A 20A max., disconnect device, which also provides short circuit and overload protection, and has a minimum 3mm open circuit clearance, in accordance with the National Electric Code and applicable local codes must be installed at a location readily accessible to the equipment.

EQUIPMENT MODIFICATION CAUTION

Equipment changes or modifications not expressly approved by Sensormatic Electronics Corporation, the party responsible for FCC compliance, could void the user's authority to operate the equipment and could create a hazardous condition.

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Chapter 1

Introduction

In This Chapter

Product Overview

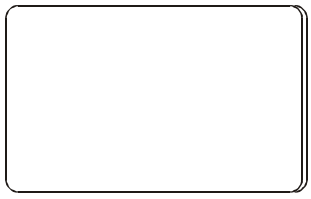
C•CURE Watch products use RFID (radio frequency identification) technology to gather unique identification data from access control badges and asset tags. This information is sent to the C•CURE 800/8000 Access Control System (host) for customized event handling and database storage.

The components of a C•CURE Watch solution include:

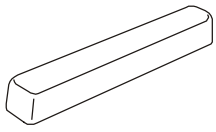
- Access badges and asset tags
- Handheld reader
- RF Readers

Access Badges and Asset Tags

C•CURE Watch badges and tags are small, passive devices that contain a transponder encoded with unique data. This data is detected and decoded by RF readers and sent to the host for processing.



Access badges identify individuals. When a C•CURE Watch RF reader detects an access badge, identification data is sent to the host system which decides whether to open the door or initiate other actions based on the privileges assigned to that individual.



Asset tags are permanently affixed to assets that the user wants to manage. When a C•CURE Watch RF reader detects an asset tag, identification data is sent to the host system which responds based on the privileges assigned to that asset.

Handheld Reader

A handheld reader is available for initializing assets. Asset tags must be initialized before they can be assigned to specific assets in the host system.

RF Readers

A C•CURE Watch RF reader is different from a typical access control reader. It is a “virtual” component that is comprised of two different C•CURE Watch components: one or more antennas and an RF controller. RF antennas can be connected to an RF controller in a variety of configurations that represent from one to four RF readers.

An RF reader protects a door or portal up to six feet wide by establishing an interrogation zone. When an access badge or asset tag enters this zone, its identification data is captured and sent to the host for processing.

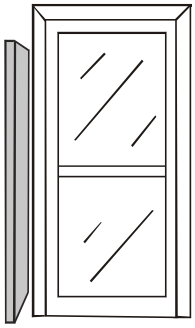
Each RF reader is recognized as a separate door or portal by the host system.

Antennas

C•CURE Watch products include two types of antenna which can be configured as part of an RF reader: RF passage antenna and RF proximity antenna (not yet available).

Under the direction of an RF controller, RF antennas transmit and receive radio signals that enable them to gather data from badges and tags. This data is sent to the RF controller for decoding and transmission to the host.

RF Passage Antenna



The RF passage antenna is designed to detect both access badges and asset tags by establishing

an extended interrogation zone that makes badge and tag detection practically transparent to users. It does not require line of sight and operates without any special presentation effort.

RF passage antennas can be installed at doors or portals to monitor badges and/or assets. A portal is any location where access is not restricted such as: halls, passageways, and doors that are not controlled by the host.

RF passage antennas are available in two models: A and B. Model A RF passage antennas are designed for hands-free access control applications. Model B RF passage antennas work in conjunction with model A RF passage antennas for applications that monitor assets.

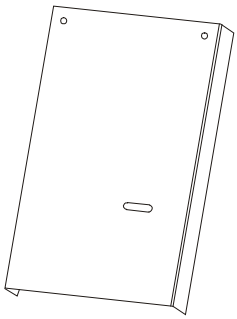
There are many ways to configure an RF reader using RF passage antennas. The number and type of antennas and their placement at the door or portal depends on the size of the opening and the security goals of the customer. For more information about configuring RF readers with RF passage antennas, see **RF Reader Configuration** on page 1-3.

RF Proximity Antenna

The RF proximity antenna is not yet available.

The RF proximity antenna is designed to detect only access badges. It establishes a limited interrogation zone.

RF Controller



Every RF reader configuration includes an RF controller. The RF controller directs the RF antenna's transmission and reception of radio signals, conditions and decodes signals from the antennas, and communicates with the host.

Each RF controller provides connections for up to four antennas. These connections can represent from one to four RF readers depending on antenna type and board settings.

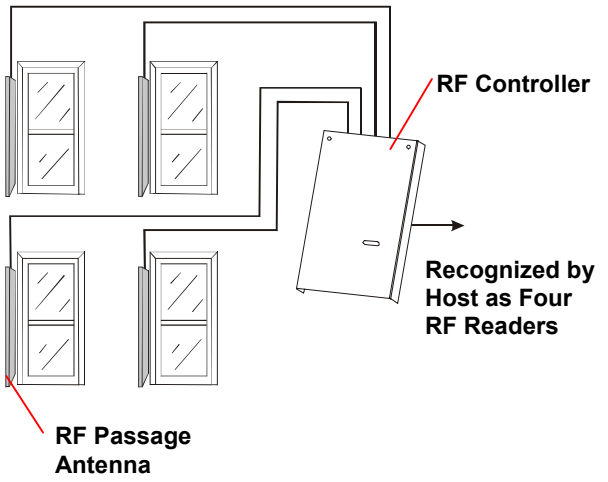
RF Reader Configuration

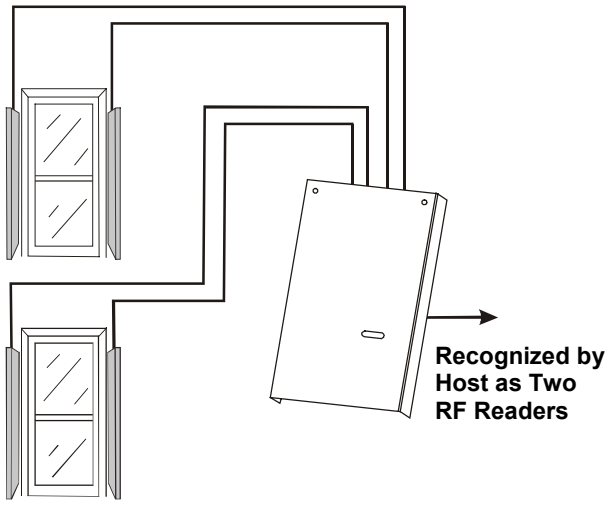
The RF controller provides a flexible foundation for configuring RF readers. Each RF reader must include at least one antenna connected to an RF controller. However, the RF controller provides connections for up to four antennas enabling a single RF controller to represent multiple RF readers to the host.

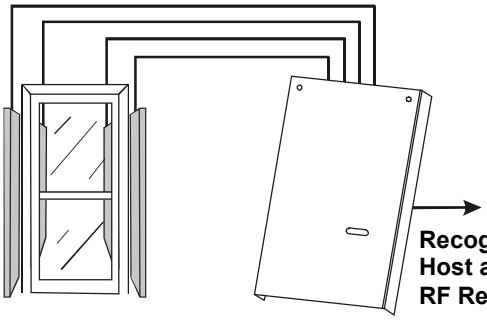
RF Passage Antenna Configurations

RF passage antennas can be configured in a variety of ways depending on application requirements and the size of the door/portal.

When four RF antennas are connected to an RF controller, they may represent one, two, three, or four RF readers depending on the address settings selected.







The number of RF passage antennas required for a particular door/portal depend on the size of the opening being protected and whether the RF reader is to recognize assets. The following configurations are recommended:

Door/Portal Width	Tags Only	Badges Only	Optimum Performance
Up to .9m (3ft)	1 Model A *and* 1 Model B	1 Model A	2 Model A *and* 2 Model B
.9m (3ft) – 1.8m (6ft)	2 Model A *and* 2 Model B	2 Model A	2 Model A *and* 2 Model B

RF Proximity Antenna Configurations

RF proximity antennas are not available at this time.

Specifications

Electrical

Transponder

Type: .....Passive, TIRIS® , read/write

.....(64-bit usable data max.)

Style: .....Asset tag or access control badge

Antennas

Input Requirements:.....16V nominal @ 4A peak

Type: .....Tunable passage antenna

RF Controller

Input Requirements:.....15V nominal @ 8A peak

Power Fuse: .....5A, 250V manufactured by Semko or equivalent

Outputs:.....10V @ 10 mA, 12V open circuit

Transmitter/Receiver

Operating Frequency: 134.2kHz

Transmit/Receive Cycle: 70ms

Transmit Time: 50ms

Receive Time: 20ms

Receiver Data Format: 52-bit

External Power Supply for RF Controller

North America: ..... Requires a nominal 15Vdc @ 8A peak Class 2 linear power supply. (Not investigated by UL).

EU: This product runs on 15Vdc linear power supply. In the EU, it is intended to be powered from a Limited Power Source. A limited power source is a certified source of SELV, and if inherently limited, with 8A maximum output current, and a maximum of 100VA available; or if not inherently limited, fused with a maximum value of 3.3 Amps, meeting section 2.11 of IEC950, and a maximum of 250VA available. The power supply can be obtained through Sensormatic or through another source where the provider can furnish the verification. This is required to assure electrical safety in the product. (Not investigated by UL).

Inputs and Outputs

System Inputs: ..... 2 auxiliary inputs

System Outputs: ..... 2 auxiliary outputs: 10V @ 10mA / 12V open circuit

1 RS-422 sync output

1 RS-485 communications interface

Environmental

Ambient Temperature: ..... 0°C to 50°C (32°F to 122°F)

Storage Temperature: ..... –30°C to 70°C (–22°F to 158°F)

Relative Humidity: ..... 0 to 90% non-condensing

Regulatory

Emissions: ..... FCC Part 15
ETS 300330
ETS 300683

Safety: ..... UL 294

External Power Supply: ..... Listed Class 2
EN60950 (CE) LPS
UL 294

Chapter 2

Basic Functionality

In This Chapter

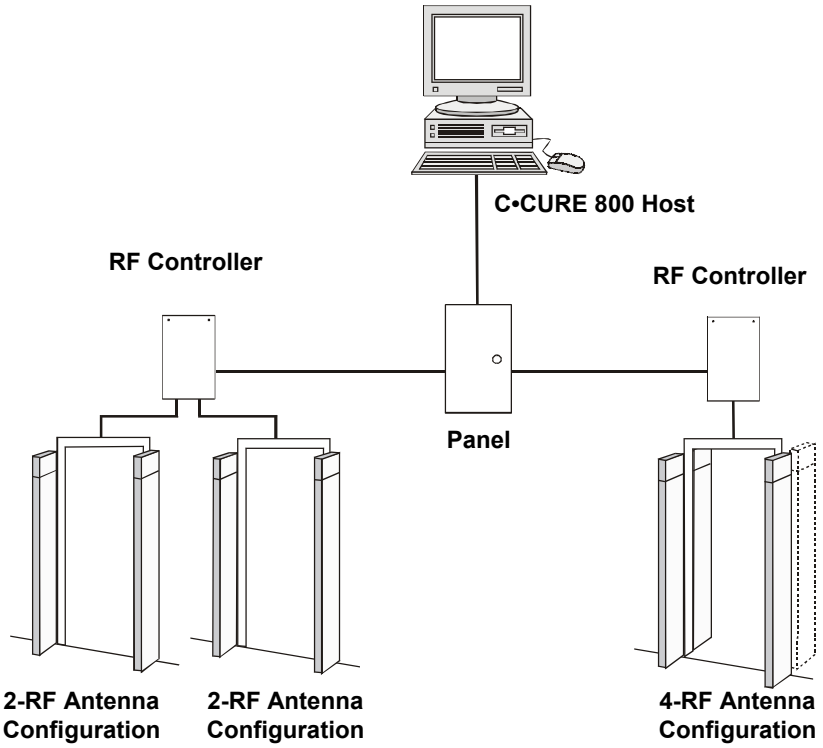
Basic System Operation

The C•CURE Watch system consists of three major parts: transponder (embedded in tag or card), antenna, and RF controller.

To read data from a tag/card, the RF controller transmits a 134.2kHz charging field for approximately 50ms to an antenna connected to the RF controller. The electromagnetic field generated by the antenna charges the tag/card. The tag/card stores this charge in a capacitor.

After the 50ms charging period ends, the tag/card immediately transmits its pre-programmed data for 20ms, using the energy stored in the capacitor as its power source. Once all the data is transmitted, the storage capacitor is discharged, and the transponder is reset, readying it for the next power pulse.

Figure 1. C•CURE Watch System Configuration



RF Controller Block

Synchronization Circuitry

The synchronization circuitry (7) consists of one input and one output channel using the RS-422 differential communications protocol. This circuitry prevents interference from other RFID components in the area by synchronizing transmit/receive signals.

Synchronization establishes a daisy-chain connection between RF controllers operating in close physical proximity to each other. Every RF controller operating within 152m (500ft) of another RF controller must be included in the wiring configuration (even if they are part of a separate C•CURE 800 system).

The wiring configuration establishes the first RF controller in the daisy chain as the primary controller. The first RF controller in the chain is identified based on the lack of an input synchronization signal at the synchronization port (7). All other RF controllers in the synchronization daisy chain operate as secondary controllers.

Synchronization circuitry operates automatically based on installation configuration and system status:

- RF controller offline

  When the RF controller is not powered on or is being reset, the synchronization signal is passed straight through to other RF controllers in the system.

- RF controller initialization

  When an offline or reset RF controller begins operating, the synchronization signal continues to be passed through to other RF controllers while the system monitors the input signal.

  The monitoring process enables the hardware to determine whether this RF controller is a primary or secondary controller.

  The RF controller checks for proper synchronization polarity. If synchronization wiring is incorrect, the RF controller locks up and the on-board status LEDs flash an error code.

- Primary controller operation

  If initialization establishes the RF controller as the primary controller, it generates a synchronization signal and sends it to the next RF controller (if any).

- Secondary controller operation

  If initialization establishes the RF controller as a secondary controller, it synchronizes operation of this RF controller and sends the synchronization signal to the next RF controller (if any).

Communications Interfaces

The communications interfaces include the following:

- RS-485

  The RS-485 communications interface controls the flow of information between the apC and the CID controller. The half-duplex interface limits communication to one direction at a time.

  The RS-485 interface currently is set by the system software to operate at 9600 baud, eight data bits, no parity, no flow control, and one stop bit.

- On-board Digital Signal Processor (DSP) LEDs

  DS1—Flickers when a valid detection occurs.

  DS4–Flickers when a partial detection occurs. A partial detection may be caused by interference.

Chapter 3

Planning

In This Chapter

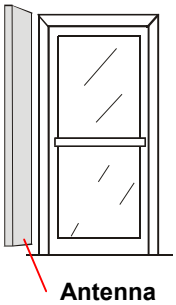
RF Passage Reader Configurations

An RF passage reader protects a door or portal by detecting badges and/or tags. An RF reader is represented by a combination of hardware components: an RF controller and one or more RF passage antennas.

Since an RF controller accepts input from up to four antennas, one RF controller can represent up to four RF readers. Some RF readers use a single RF antenna while others consist of one or two antenna pairs.

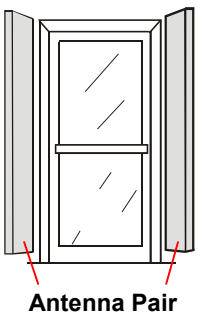
Single-Antenna Configurations

In some circumstances, a single RF antenna can be used to protect a door. In this configuration, one RF controller can represent one, two, three, or four RF readers.

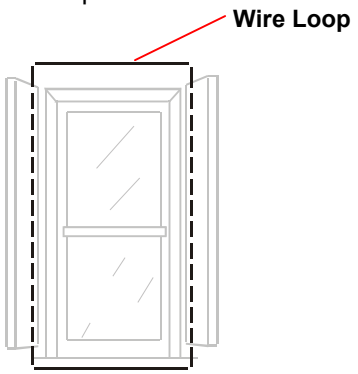


Multiple-Antenna Configurations

In many cases, more than one RF passage antenna is required to protect a door/portal. Multiple antennas are always installed in pairs—one on the left side of the door/portal and one on the right side. Users pass between the antennas in a pair when they walk through the door/portal. In multiple-antenna configurations, one RF controller can represent one or two RF readers.



In many configurations, antennas in an antenna pair are connected above and below the door to form a wire loop.



Two RF passage antenna models are available to maximize performance for multiple-antenna configurations: Model A antennas and Model B antennas. Model A antennas are optimized to detect badges and Model B antennas are optimized to detect tags. Antenna pairs are always configured with two antennas of the same model. A pair cannot be configured using one Model A and one Model B antenna.

Application-Specific Configuration Requirements

The number, model, and placement of RF passage antennas varies based on whether or not the system is to be used for asset management.

Hands-Free Access Control Requirements

Hands-free access control systems do not detect assets. The following requirements apply:

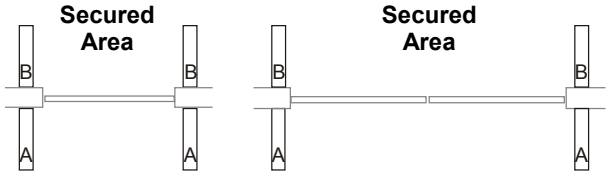
- A single Model A RF passage antenna may be used to protect doors up to .9m (3ft).

- A pair of Model A RF passage antennas may be used to protect doors up to .9m (3ft). The wire loop is optional for this configuration.

- A pair of Model A RF passage antennas is required to protect doors between .9m (3ft) and 1.8m (6ft). The wire loop is required for this configuration.

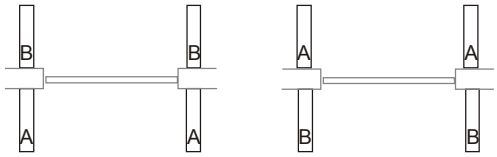
Asset Management Requirements

RF passage readers that detect assets (whether they detect assets and badges or assets only) are always configured in multiple-antenna configurations that include one pair of Model A antennas and one pair of Model B antennas to protect doors/portals up to 1.8m (6ft).



Model A Antennas Outside Secured Area at Doors Controlled by Badges

When a door that detects assets also secures an area through the use of access control badges, the Model A antenna pair is installed outside the secured area. For doors/portals that detect assets only (badges are not detected), it does not matter which side has Model A and which side has Model B antennas.



Placement of Model A and Model B Antennas Not Critical if Opening Not Controlled by Badges

A wire loop is required for doors/portals greater than .9m (3ft) wide. At doors/openings that are .9m (3ft) or less, a wire loop is optional.

Coordinating with Software Features

The C•CURE 800/8000 application provides several features that require specific hardware components or configurations including:

- Asset/badge linking requires that systems be configured with four RF passage antennas at secured doors/portals.
- Check out feature requires that RF readers be configured with PIR or other exit detection devices.

Configuration Requirements

Configuration requirements provide information needed when selecting hardware components and planning the installation. Requirements are provided for the following:

- RF passage antennas
- RF controllers
- Host panel (apC or iStar)
- RF controller power supply
- External power
- Cabling
- Asset tag
- Access control badge

RF Passage Antennas

- See **Cabling** on page 3-5 for maximum cable distance between RF passage antennas and RF controller.
- A wire loop is recommended for antenna pairs when they are installed at doors/portals greater than .9m (3ft) wide. A wire loop is optional for antenna pairs installed at doors/portals that are .9m (3ft) or less.

  Note: The wire loop generally enhances RF antenna performance. Occasionally, environmental noise conditions can cause the wire loop to degrade performance.

- Check installation sites for potential noise sources:
  - Whenever possible, remove noise sources such as computer monitors, TVs, switching power supplies, and neon displays from within 1.8m–2.4m (6ft–8ft) of antennas.
  - Whenever possible, remove large metal office furniture such as desks, filing cabinets, book shelves, and waste baskets from within .6m–.9m (2ft–3ft) of antennas.
  - Avoid installing passage antennas where metal construction materials (recessed door frames, corner beading) are adjacent and parallel to flat side of antenna.

RF Controllers

- The enclosure must be mounted in a protected location such as: above ceiling tiles, in a utility room, or in a basement. The RF controller must be installed within the following cable distances from other system components:
  - 61m (200ft) of RF passage antennas
  - 30m (100ft) of power supply
  - 305m (1000ft) of host panel

  Note: Cable specifications vary based on the distance between components. Select the correct cable for each installation.
- Select a mounting location that provides adequate space for installation and service.

  The enclosure is approximately 28cm (11in) high, 22.5cm (8.9in) wide, and 5.4cm (2.2in) deep.
  - When possible, select an installation site that DOES NOT impede traffic during installation and servicing.
  - Select an installation site that enables direct conduit runs and cable runs, without causing cable routing problems. All cables except power enter the enclosure from the top.
  - Power cables must enter enclosure from the bottom knockout.

Inputs

Two supervised inputs are provided. These inputs are automatically associated with antenna 1.

Outputs

The outputs provide 12V open circuit or 10V at 10mA. These outputs are automatically associated with antenna 1.

Host Panel

- Connect to a dedicated line controlled by an easily accessible power switch.
- Maximum cable distance from the panel to an RF controller is 305m (1000ft).

RF Controller Power Supply

Note: External power supply not evaluated by UL (see electrical specifications in **Chapter 1: Introduction**.

- For external power sources, 15Vdc linear power supply is recommended.
- Maximum distance from power supply to RF controller is approximately 30m (100ft) (see **Cabling** on page 3-5).
- **North America:** requires a nominal 15V Class 2 linear power supply.
- **EU**: This product runs on 15Vdc linear power supply. In the EU, it is intended to be powered from a Limited Power Source. A limited power source is a certified source of SELV, and if inherently limited, with 8 amps maximum output current, and a maximum of 100VA available; or if not inherently limited, fused with a maximum value of 3.3 Amps, meeting section 2.11 of IEC950, and a maximum of 250VA available. The power supply can be obtained through Sensormatic or through another source where the provider can furnish the verification. This is required to assure electrical safety in the product.

External Power (to Power Supply)

The ac source to the RF controller power supply must be unswitched with less than 0.5Vac between neutral and ground. DO NOT share the ac source with neon signs, motors, computers, cash registers, terminals, or data communications equipment.

DO NOT use orange-colored outlets dedicated for computer equipment.

Cabling

General cabling guidelines:

- A single common ground is required for all system components.
- All wiring that runs through a plenum area must be plenum rated.
- RF controller cabling should not share conduit with mains line power cabling.
- All exposed wiring must be concealed with raceway or similar cabling protection.
- apC/iStar RS-485 cable runs of exceptional distance may require Belden 9842, which IS NOT plenum rated.
- Synchronization cabling is required for RF controllers located within 152m (500ft) of each other, even when they are not connected to the same system.
- Passage antenna wire loop may be exposed to corrosive cleaning fluids; cable jacket MUST be composed of a fluoropolymer such as FEP Teflon or Kynar with a thickness of .3mm (.015in.).

Wire Use	Wire Type	Specification	Star Con.	Daisy Chain	Maximum Distance
RF Controller Sync to common terminal block (add'l wire may be needed between terminal blocks)	2 or 4 conductor / 22 AWG, shielded	Belden 82723 or equiv.	No	Yes	305m (1000ft)
RS-485 between panel and RF controller (are there differences between apC and istar?)	2 conductor / 22 AWG, shielded	Belden 82761 or equiv.	Yes	Multi Drop	305m (1000ft)
RF Controller to RF Passage Antenna (Signal/Control)	8 conductor / 22AWG, shielded				
	8 conductor / 18AWG, shielded				23m (75ft)
	8 conductor / 16AWG, shielded				38m (125ft)
	8 conductor / 14AWG, shielded				61m (200ft)
RF Controller to RF Passage Antenna (Power)	2 conductor / 20AWG, shielded				15m (50ft)
	2 conductor / 18AWG, shielded				23m (75ft)
	2 conductor / 16AWG, shielded				38m (125ft)
	2 conductor / 14AWG, shielded				61m (200ft)
Wire Loop for RF Passage Antenna Pairs	1 conductor / 18 AWG, DO NOT use shielded wire, cable jacket must be composed of a fluoropolymer with a thickness of .3mm (.015in.)		N/A	N/A	3m (10ft)
RF Controller to Inputs	2 conductor / 22 AWG, shielded	Belden 82761 or equiv.	N/A	N/A	305m (1000ft)
RF Controller to Outputs	2 conductor / 18 AWG, shielded	Belden 82760 or equiv.	N/A	N/A	305m (1000ft)
RF Controller to External Power Supply	2 conductor / 20AWG, shielded				6m (20ft)
	2 conductor / 18AWG, shielded				11m (35ft)
	2 conductor / 16AWG, shielded				18m (60ft)
	2 conductor / 14AWG, shielded				30m (100ft)
RF Controller ac Power Cord	Type SJ or SJT / 18AWG 250V rated (power cord connection not evaluated by UL)				1.8m (6ft) minimum
Chassis Ground Wire	multi-stranded / 16AWG 250V				1.8m (6ft)

Note: To maintain UL Listing, field wiring shall not be less than 22AWG.

Asset Tag

Note: Asset tags have not been evaluated by UL.

Allow two hours for the adhesive to set, ensuring a bond to the asset's surface that will not be easily compromised. Complete application instructions are provided in **Appendix A: Asset Tag Installation**.

Access Control Badge

Access control badges and badge format (RFID 56) must be defined in the host system before use.

Tools and Equipment

The installation process may vary based on construction materials and hardware components. The following tools and equipment may be required to install this system:

- Digital voltmeter (DVM)
- Drill with 6.4mm (1/4in.) and 9.5mm (3/8in.) bits
- Fish tape (snake)
- Hammer
- Hammer drill and masonry drill bits
- Hand vacuum and broom
- Hacksaw
- Jig saw (hand-held)
- Laptop computer running Microsoft® Windows®
- Level
- Permanent ink marker
- Plastic sheeting (to protect environment from dust)
- Pliers, small needlenose
- PVC pipe-cutting tool
- Ratchet and socket set
- RJ-6/telephone crimping tool
- Saw (with diamond blade) for cutting floor trench
- Screwdrivers (including Phillips screwdrivers)
- Wire crimper
- Wire cutters
- Wire stripper

Chapter 4

Installation

In This Chapter

Installation Checklist

This check list provides an overview of the steps required to install C•CURE Watch components. Since order of installation can vary somewhat based on site requirements, the check list establishes guidelines concerning the relative order in which they may be completed.

Site planning should be completed before beginning the installation.

WARNING: Do not install this product in hazardous areas where highly combustible or explosive products are stored or used.

Phase 1: Hardware Installation

- ❑ Install cable runs.
  - – Cable requirements overview, page x
  - – RF passage antenna cabling, page x
  - – RF controller cabling, page x
- ❑ Install RF antennas, RF controllers, door hardware (door latch relay, door sense monitor, request to exit, passive infrared detector).
- ❑ Install RF controller, page x.
  - – Mount RF controller enclosure, page x
  - – Connect power supply cables, page x
  - – Connect RF antenna cables, page x
  - – Connect inputs and outputs, page x
  - – Connect communications cables, page x
  - – Connect synchronization cables, page x
- ❑ Connect to host panel (apC or I-Star), refer to installation instructions supplied with panel.
- ❑ Connect power to RF controller, page x.

Phase 2: System Activation and Test

All steps in Phase 1 must be completed before beginning Phase 2. Complete these steps in the order presented.

- ❑ Inspect the installation, page x.
- ❑ Activate the system, page x.
  - – Tune RF passage antennas, page x
  - – Configure C•CURE 800 software, page x
- ❑ Verify system operation, page x.

Install Cable Runs

Tag all wire bundles and run cables.

Pull a little extra wire to place less strain at the connection points (excess wire can be coiled into the wall space).

Required cable runs include:

- RF controller to door/portal being protected.
- Host panel to RF controller.
- RF controller to RF controller (for synchronization).
- Power to RF controller.

Refer to Chapter 3: **Planning** for more specific cable specifications.

Install RF Passage Antennas

Installing RF passage antennas includes the following:

- Prepare for installation
- Install brackets and mount antennas
- Install wire loop (for antenna pairs)
- Connect RF controller cables
- Install finishing hardware

Prepare for Installation

The following items are required before installation begins:

- Site plan indicating model of each RF passage antenna and its mounting location.
- Two cables run between RF antenna mounting location and RF controller mounting location: control cable and power cable.

RF Passage Antenna Kit (0351-2180-01)

Description	Qty.	Part No.
Top Bracket, Passage Antenna	1	0500-5026-01
Butt Splice, FULLINS, 22-16	2	2141-0003
Screws, SDRL 8 x 1/2, PHP, S304	16	2816-7669-01
Anchors, MLY, 8-10, W/PH SCR, 7/8"L	16	2880-0097-01
Wire, HK, 18G, 19x30, TFE, Black	8	6018-0012-01

Install brackets and Mount Antennas

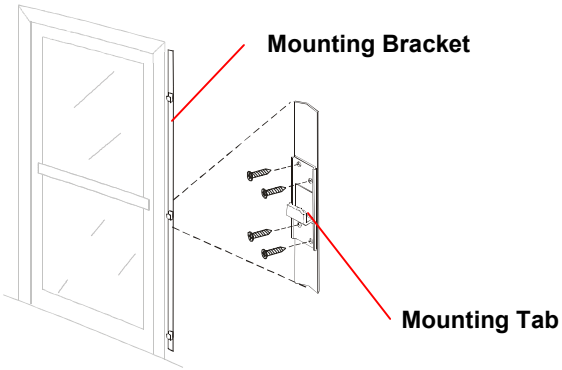
1. With bracket tabs facing up, press bracket against door frame or wall with bottom of bracket 17cm (6.75in.) above floor.

   Position bracket perpendicular to floor. Antennas that comprise a pair must be mounted parallel to each other on opposite sides of door/opening.

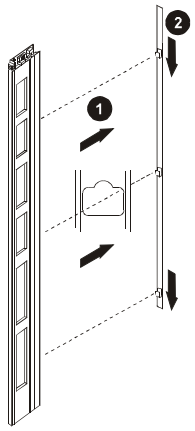
2. Mark and drill mounting screw holes.

   Note: Mount bracket using holes adjacent to mounting tabs. Holes at top and bottom of mounting bracket are not used at this time (you may want to pre-drill for later use).

3. Mount antenna bracket using appropriate mounting hardware from install kit.



4. With antenna's mounting surface facing bracket, align three openings over bracket tabs, press antenna against bracket (1), then slide antenna down (2) until it is secure.

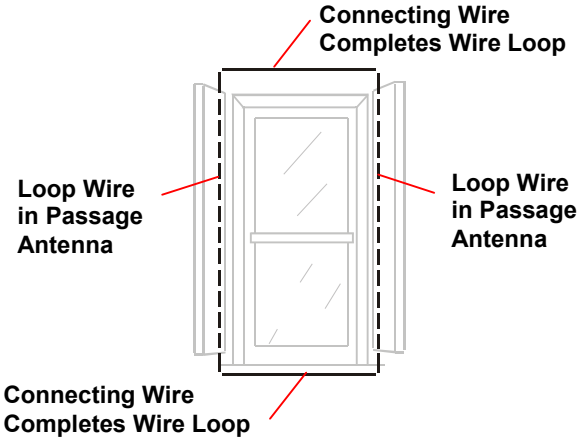


5. Determine where cables will exit wall/ceiling and drill holes. Fish required cables through appropriate holes.

Install Wire Loop for Antenna Pairs

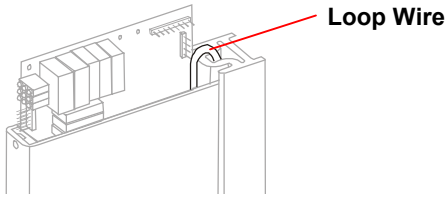
Installation of a wire loop is optional. Check with project manager to determine if wire loop is required.

Each RF passage antenna includes a loop wire that runs the length of the antenna, exiting at the top and bottom (near the mounting bracket). A wire loop is created when the loop wires of an antenna pair are connected to each other above and below the door/portal.



Exposed wire loop wiring may be concealed with raceway and/or placed under the doorway threshold. In some cases it may be necessary to conceal the lower connecting wire within a floor trench.

1. Remove door threshold, and determine if there is adequate clearance to place connecting wire under it without cutting a floor trench.
2. If necessary, cut floor trench (0.3cm [1/8in.] wide by 1.2cm [1/2in.] deep).
3. Locate ends of loop wire tucked into frame at top and bottom of each antenna.



Note: Remove bottom cap to retrieve wire loop, feed through opening in cap, and re-install cap.

4. Cut two pieces of wire to complete wire loop above and below door/portal (connecting wires).
5. Run top connecting wire above door/portal and connect to antenna wire at top of each antenna.
6. Run bottom connecting wire under doorway. Conceal by replacing threshold or sealing trench being careful not to pinch wire.
7. Connect to antenna loop wire at bottom of each antenna.

   The wire loop is installed and ready to operate.

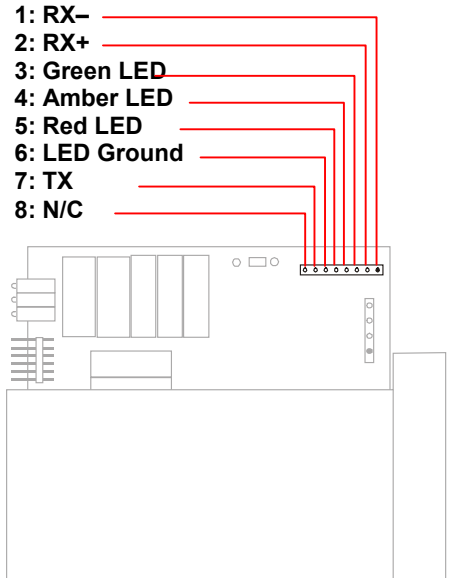
Connect RF Controller Cables

WARNING: RISK OF ELECTRIC SHOCK! Read manual before servicing.

1. Connect 8-conductor control cable from RF controller to terminal block on the RF antenna board as follows:

Pin	Function
Pin 1	RX–
Pin 2	RX+
Pin 3	Red LED
Pin 4	Amber LED
Pin 5	Green LED
Pin 6	LED Ground
Pin 7	TX
Pin 8	N/C

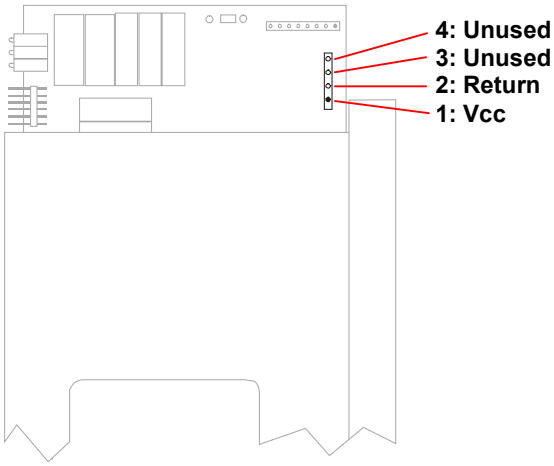
2. Connect terminal block to control connector **P2** (pin 1 is at outside edge of board).



3. Connect 2-conductor power cable to terminal block as follows:

Pin	Function
Pin 1	+16Vdc
Pin 2	Return
Pin 3	Unused
Pin 4	Unused

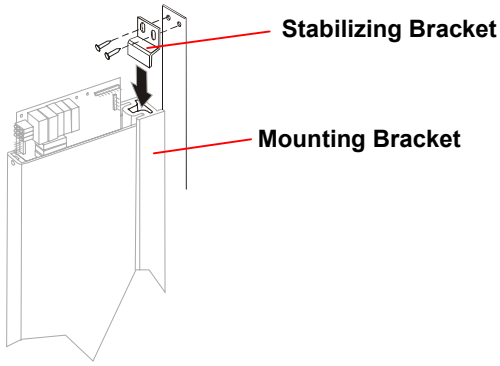
4. Connect terminal block to power connector **P1** (pin 1 is at bottom).



Note: See **Chapter 5: Service** for information about verifying and optimizing antenna performance.

Install Finishing Hardware

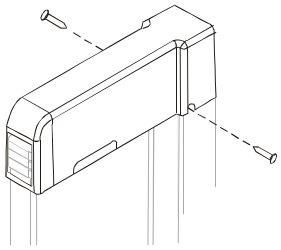
1. Insert stabilizing brackets as shown below, one at top and one at bottom of antenna. Attach to mounting bracket with two screws.



2. Install antenna top cap.

   Place top cap over antenna interface board starting at front. Position LED window over LEDs. A pin inside cap front seats in antenna cover beneath LEDs. Secure at sides with two screws.

   DO NOT leave antenna components exposed for extended periods.



3. Install raceway to conceal exposed wiring.

Install RF Controller

Installing RF controller includes the following:

- Prepare for installation
- Mount the RF controller enclosure
- Connect RF antenna cables
- Connect inputs and outputs
- Connect power supply cable
- Connect communications cable
- Connect sync cable

Prepare for Installation

The following items are required before installation begins:

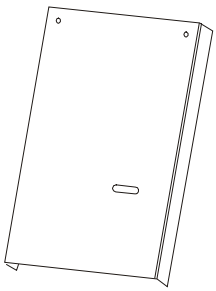
- Site plan indicating:
  - Installation site of RF controller
  - Installation sites of RF antennas and associated reader addresses
  - Inputs and outputs associated with antenna 1 (optional)
  - Installation site of host panel
  - Installation site of power supply enclosure
  - Optional inputs and outputs are to be connected to antenna 1.
  - Installation site of common terminal block for RF controller synchronization.
- Two cables (one control and one power) run between RF antennas and RF controller.
- Optional — cable run between each required input and output and RF controller.

RF Controller Install Kit (0351-2160-01)

Verify contents of kit before beginning installation.

Description	Qty.	Part No.
Plastic Anchors, 10-12, 1”L, w/scr	4	2880-0098-01
Template, C•CURE Watch RFID Contrlr	1	8000-2820-01
Install and Service Guide	1	8000-2803-01

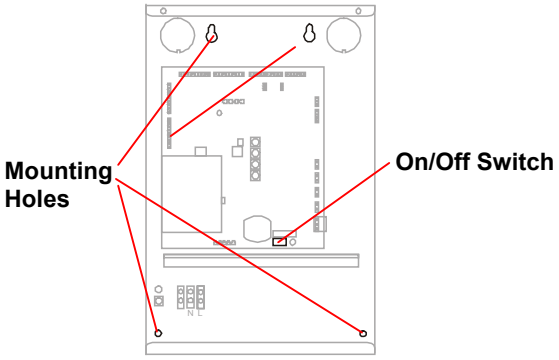
Mount the RF Controller Enclosure



1. Remove screws that secure enclosure cover.

   Remove cover by pulling forward slightly at top and slip cover straight up until cover is free of the retaining tab at bottom of enclosure.

2. Verify that **On/Off** switch is in off position.



3. Hold enclosure in its mounting location and mark position of mounting screws (4) at openings in back of enclosure.
4. Drill holes for screws and install wall anchors if required. Insert top screws and tighten until almost flush with wall.
5. Slip enclosure over screws and slide down to lock screws in keyhole openings.
6. Tighten top screws. Insert bottom screws and tighten.

Connect RF Antenna Cables

RF antenna cable connections differ depending on whether RF proximity or RF passage antennas are used.

Connecting RF Proximity Antenna Cables

RF proximity antennas are not available at this time.

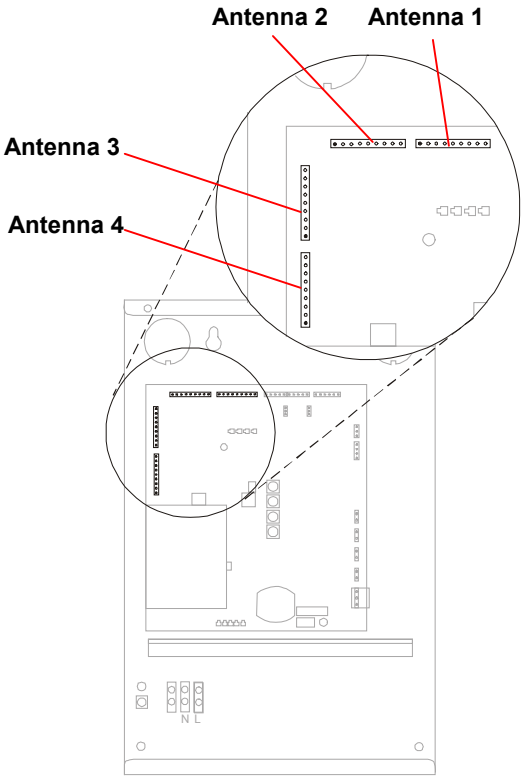
Connecting RF Passage Antenna Cables

The following steps must be completed for each RF antenna connected to this RF controller.

1. Connect 8-conductor control cable from RF antenna to 9-pin terminal block on RF controller as follows:

Pin	Function
Pin 1	Shield
Pin 2	RX–
Pin 3	RX+
Pin 4	Red LED
Pin 5	Amber LED
Pin 6	Green LED
Pin 7	LED Ground
Pin 8	TX
Pin 9	N/C

2. Connect terminal block to appropriate antenna control connector (pin one is solid).



Note: The RF controller provides two channels. One channel is associated with antenna connectors 1 and 2 and the other channel is associated with antenna connectors 3 and 4.

Always connect the two antennas that comprise a pair to the same channel.

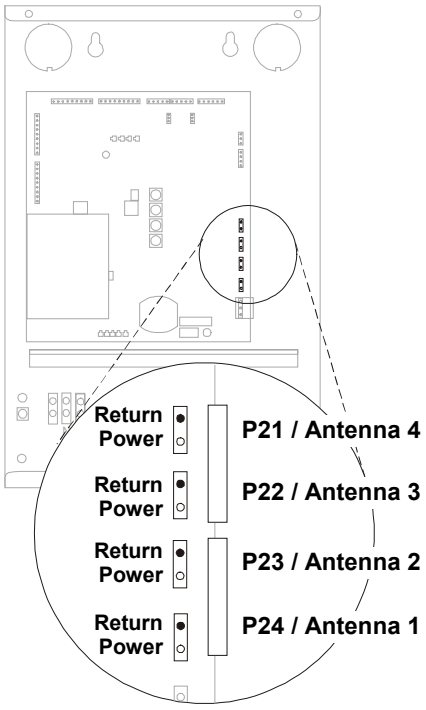
Antenna Connector	Channel
Antenna 1	First Channel
Antenna 2	First Channel
Antenna 3	Second Channel
Antenna 4	Second Channel

3. Connect 2-conductor power cables from RF antennas to 4-pin terminal blocks as follows. Always combine antennas 1 and 2 on one connector and antennas 3 and 4 on the other.

Pin	Function	Connector	Antenna
Pin 1	Return	P24	Antenna 1 or 2
Pin 2	+16Vdc	P23	
Pin 1	Return	P22	Antenna 3 or 4
Pin 2	+16Vdc	P21	

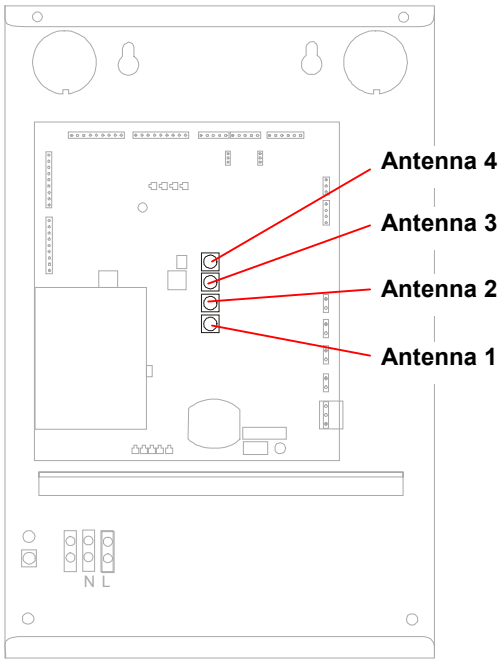
4. Connect Connect terminal block to appropriate antenna power connector.

CAUTION: System failure may result if antennas are not connected as specified below.



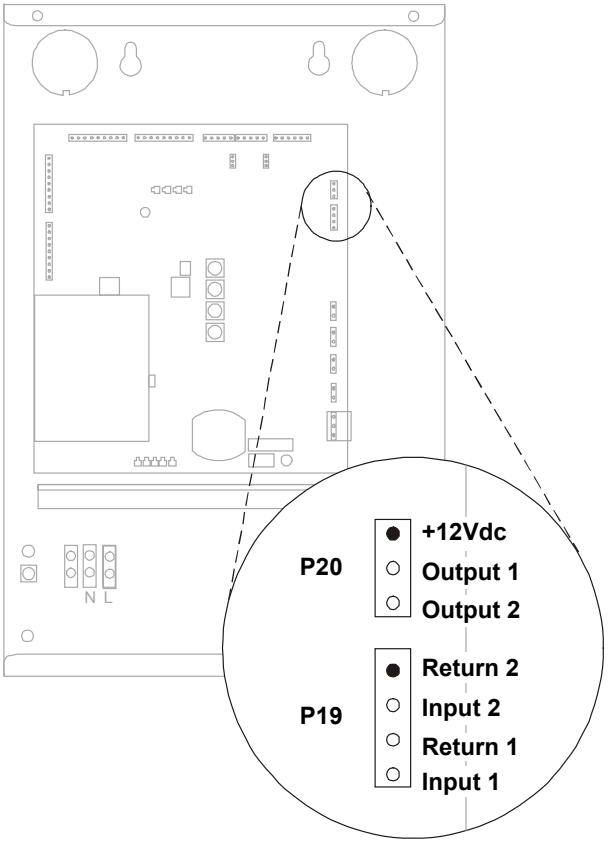
5. Set antenna address switches. Multiple RF passage antennas configured as part of the same RF reader must have corresponding address switches set to same address.

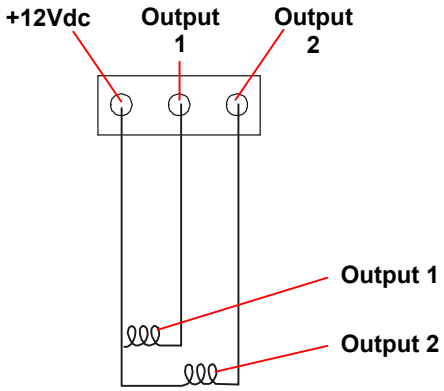
Important: Set address switches for unconnected antennas to **0**.



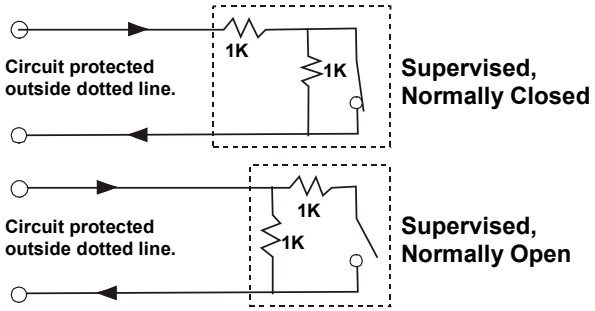
Connect Inputs and Outputs

The RF controller provides connections for two inputs and two outputs. These inputs and outputs must be associated with the opening/portal connected to the **Antenna 1** connector.





Inputs must be supervised. All inputs and outputs are configured from the host system. Inputs must be wired as shown below.



The output connector provides internal power for both outputs. These must be wired in series. Outputs provide 10 milliamps at 10V and 12V open circuit.

Connect Communications Cable

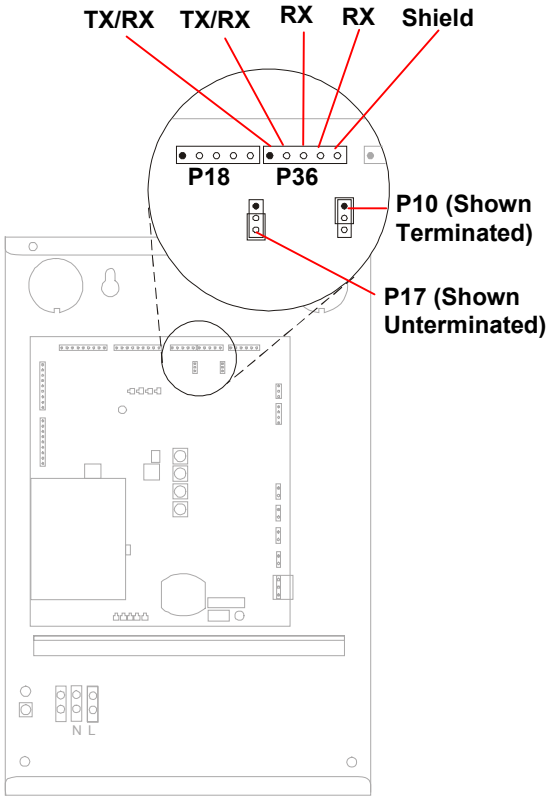
The RF controller provides two RS-485 connectors for configuration flexibility. RF controllers may be daisy-chained to the host panel. In addition to RF controllers, input/output boards may also be included in the daisy chain.

1. Connect 2-conductor or 4-conductor, shielded cable to 5-pin terminal block.

Pin	Function
Pin 1	TX/RX
Pin 2	TX/RX
Pin 3	RX
Pin 4	RX
Pin 5	Shield

Note: Connection depends on RS-485 implementation. For 2-conductor, half-duplex mode connect to TX/RX pins. This mode operates at 9600 baud. For 4-conductor, full-duplex mode use the TX/RX pins for transmit and the RX pins for receive.

2. Connect communications cable from panel, another RF controller, or input/output board to connector **P18** or **P36**.



3. Do one of the following:

   – If another device, is to be connected to this RF controller, connect additional communication cable to 5-pin terminal block and connect to the available RS-485 connector (**P18** or **P36**).

   – If a connection terminates at this RF controller, the shield must be connected to a chassis ground instead of the RS-485 connector (**P18** or **P36**).

   In addition, pins one and two must be jumpered on the associated termination jumper.

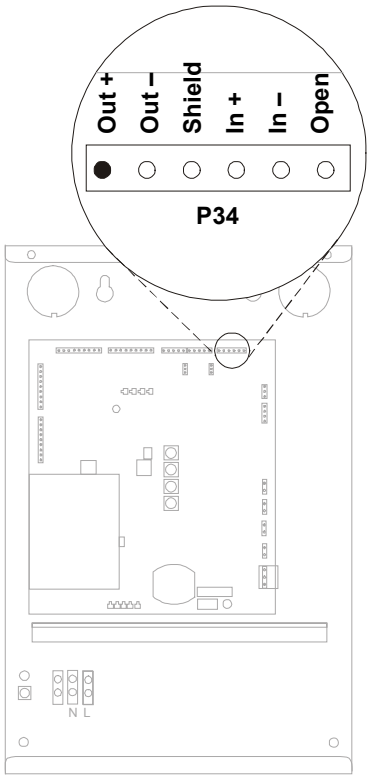
Connector	Jumper	Terminated	Unterminated
P18	P10	Pins 1 / 2	Pins 3 / 4
P36	P17	Pins 1 / 2	Pins 3 / 4

Connect Sync Cable

RS-422 synchronization (sync) cabling coordinates transmit and receive signals on a system-wide basis to eliminate system-generated interference. ALL RF controllers must be installed with sync cabling, even if they are associated with different host systems. Call Technical Support for synchronization guidelines regarding RF controllers installed in separate buildings.

Sync cabling establishes a single daisy-chain connection for all RF controllers. The daisy chain is installed through one or more common terminal blocks.

Sync cabling establishes one RF controller as primary and all others as secondary. The first RF controller in the sync cabling daisy chain becomes the primary RF controller.



The following guidelines must be observed:

- Sync cabling connects to **P34**.
- Input terminals are not connected on primary RF controller. Output terminals are not connected on last secondary RF controller in daisy chain.
- Polarity MUST BE strictly observed (output– to input– and output+ to input+).

To connect sync cable to RF controller:

1. Remove jacket and metal shielding from end of sync cable, leaving enough to connect to **P34**.
2. Connect wires to 6-pin terminal block that mates to **P34** on RF controller.

Pin	Signal
Pin 1	Open
Pin 2	Input, –
Pin 3	Input, +
Pin 4	Shield
Pin 5	Output, –
Pin 6	Output, +

3. Connect terminal block to **P34**.

Connect RF Reader at Panel

Connect the RF Reader to the host panel using instructions provided by the manufacturer.

Note: Shield in RS-485 cable must be connected to chassis ground at panel.

Connect Power to RF Controller

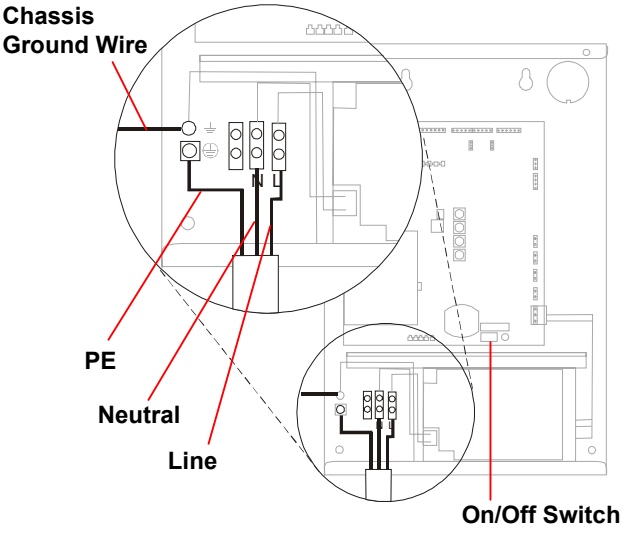
The RF Controller is available in two models:

- Model CW-RID-1 is hard-wired to ac power. It includes a universal power supply (Eos model VLT 130-1002).
- Model CW-RID-XPS requires an external power supply.

WARNING: RISK OF ELECTRIC SHOCK! Be sure power is off before connecting components.

Connect Model CW-RID-1 to AC Power

This model may be hard wired or connected using a line cord.



Hard Wired Connection

This step must be performed by a licensed electrician in accordance with National Electric Code and applicable local codes.

CAUTION: A 10A, 2 pole, ganged disconnect device, which also provides short circuit and overload protection, and has a minimum 3mm open circuit clearance, in accordance with the National Electric Code and applicable local codes must be installed by a licensed electrician at a location readily accessible to the equipment.

Ein 10A, 2-poliges, gekoppeltes Ausschalt-gerät, welches auch über einen Kurzschluß- sowie Überbelastungsschutz verfügt, und einen minimum 3mm offenen Schaltabstand aufweist, nach Übereinstimmung mit den Nationalen Elektrischen Regelungen sowie lokalen Regeln, muß an einem Standort installiert werden, welcher einfachen Zugang zum Gerät erlaubt.

1. Verify that RF controller is turned off.
2. Use knockout at bottom left corner of enclosure to access the power connector.
3. Connect incoming ac wires to the connector for 115Vac or 230Vac operation based on the following:

NAa	Europe	Pin	Function
Green/Yellow	Green/Yellow	PE	Ground
White	Blue	N	Neutral
Black	Brown	L	Line

4. For FCC compliance, a chassis ground wire is required. Connect chassis ground wire from a building ground (such as pipes or conduit) to the chassis ground terminal in the RF controller enclosure. Use 16AWG 250V multi-stranded wire with maximum length 1.8m (6ft).

Cord Connection

Use one of the following installation kits.

Power Cord (NA)

Description	Qty.	Part No.
Txxx	1	0xxx-xxxx-01
Txxx	1	0xxx-xxxx-01

Power Cord (EU)

Description	Qty.	Part No.
Txxx	1	0xxx-xxxx-01
Txxx	1	0xxx-xxxx-01

CAUTION: For installation using a line cord, the socket-outlet must be installed near the equipment and at a location which is easily accessible.

Für Installationen mit einem Stromkabel muß die Steckdose an einem Standort installiert werden, welcher einfachen Zugang erlaubt.

1. Verify that RF controller is turned off.
2. Tighten strain relief into conduit knockout at bottom of enclosure.
3. Thread power cord through strain relief and secure.
4. Connect incoming ac wires to the connector for 115Vac or 230Vac operation based on the following:

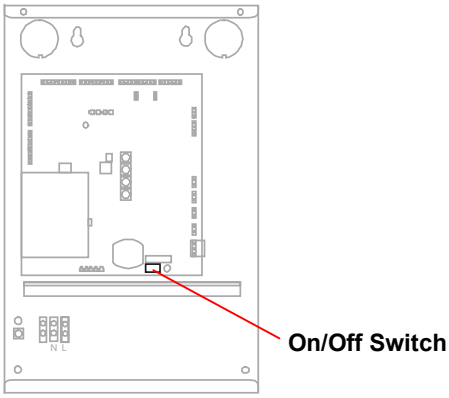
NA	Europe	Pin	Function
Green/Yellow	Green/Yellow	PE	Ground
White	Blue	N	Neutral
Black	Brown	L	Line

5. For FCC compliance, a chassis ground wire is required. Connect chassis ground wire from a building ground (such as pipes or conduit) to the chassis ground terminal in the RF controller enclosure. Use 16AWG 250V multi-stranded wire with maximum length 1.8m (6ft).

Inspect Installation

A final inspection of the installation should be conducted before applying power to the system.

1. Verify that the RF controller power switch is turned **Off**.



2. Inspect RF controller, host panel, power supply enclosures, and wiring connections:
   - Remove metal shavings and other installation debris from enclosures.
   - Verify that all connections are secure.

Apply Power

1. Provide power to the RF controller.
2. Turn the RF controller power switch **On**.

Verify System Operation

There are two levels of system verification:

- Functional test of RF controller and RF antenna does not require connection to panel.
- Full system test requires connection to panel and configuration of host system.

Functional Test

The functional test consists of an RF antenna LED test and a signal detection test.

RF Antenna LED Test

1. Verify that rotary switches have been set for this antenna configuration.
2. Record rotary switch settings.
3. Change rotary switches to 9-1-1-9.
4. Turn RF controller **Off**, then **On** to activate test mode. It may take a short time for the test to begin.

   Green, amber, and red LEDs on all antennas connected to this controller should light in sequence.
5. Set rotary switches back to original configuration or to setting for signal detection test.
6. Turn RF controller **Off**, then **On** for settings to take effect.

RF Antenna Signal Detection Test

1. Verify that rotary switches have been set for this antenna configuration.
2. Record rotary switch settings.
3. Change rotary switches to 9-1-0-9.
4. Turn RF controller **Off**, then **On** to activate test mode. It may take a short time for the test to begin.

   The RF antenna LEDs should remain off until a badge or tag is detected. Detection of a badge or tag should activate the amber LED. Blinking of the LED indicates a weak detection.
5. Set rotary switches back to original configuration.
6. Turn RF controller **Off**, then **On** for settings to take effect.

Full System Test

The full system test requires configuration of the C•CURE 800/8000. To add an RF reader to the host system, refer to the *C•CURE 800/8000 Administrator's Guide (UM-028)* and the *C•CURE 800/8000 Asset Manager User's Guide* (UM-033).

To verify system operation you must configure the following software parameters:

- Configure C•CURE Watch readers.
- Define tag and card formats.
- Define tags and cards to be tested.

Based on system configuration, test each opening with tags and/or badges. Verify that system identifies and responds as expected based on system configuration. Be sure to test the following:

- Detection of tags and/or badges.
- Read range of reader extends at least .9m (3ft) in front of antennas.
- C•CURE 800 recognizes and reports detected tags and badges.
- Inputs and outputs operate correctly.

Chapter 5: Service provides information on troubleshooting system and antenna read range problems.

Chapter 5

Service

In This Chapter

Parts List

Description	Product Code
C•CURE Watch RF Controller with universal power supply	CW-RID-1
RF Passage Antenna, Model A	CW-ANT-PA
RF Passage Antenna, Model B	CW-ANT-PB
C•CURE Watch Programmed Badge	CW-FBRW-1

RFID 56 Format

The RFID 56 card format must be selected in the Card Format window of C•CURE 800/8000. If it is not an available choice, the following information should be entered:

Identification

Name: RFID 56

Card Characteristics

Format Usage: Select Access control if this is an access only installation.

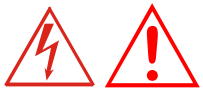
Select Asset tracking if this is an asset and access or an asset only installation.

Type: Proximity

Field List

Field Type	Start	Length	Compl.	P. Start	P. Length	Shift
Facility Code	17	16	No	0	0	0
Card Number	33	24	No	0	0	0

Tune RF Passage Antennas



WARNING: RISK OF ELECTRIC SHOCK! When powered, high voltage exists on the antenna board and at tuning jumpers.

To optimize system performance, each RF passage antenna must be tuned. The tuning process uses six tuning jumpers to peak antenna voltage.

Tuning Guidelines

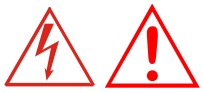
RF passage antennas located within 4.6m (15ft) of an antenna being tuned may interfere with the tuning process (other passage antennas connected to the same RF controller as antenna being tuned DO NOT interfere with tuning). Interference is possible even if antenna is connected to another system or not connected to any system. Follow these guidelines to eliminate the possibility of interference:

- If interfering passage antenna can be moved, place it further than 4.6m (15ft) from antenna being tuned.

Tuning Procedure

Passage antennas are tuned while they operate. If you have a partner, multiple antennas can be tuned at the same time.

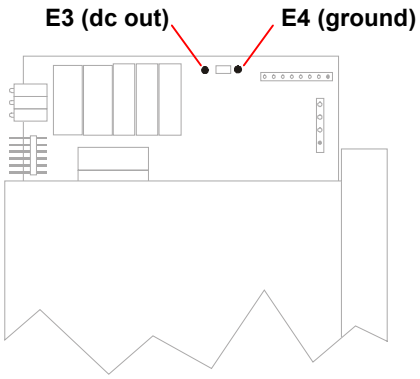
1. Turn Off RF controller power switch **Off**.



WARNING: RISK OF ELECTRIC SHOCK! When powered, high voltage exists on the antenna board and at tuning jumpers.

2. Verify the following before beginning:
   - Antennas are completely installed and connected to RF controller. This includes wire loop if it is to be used.
   - Power is available to RF controller.
3. Remove RF passage antenna top cap.

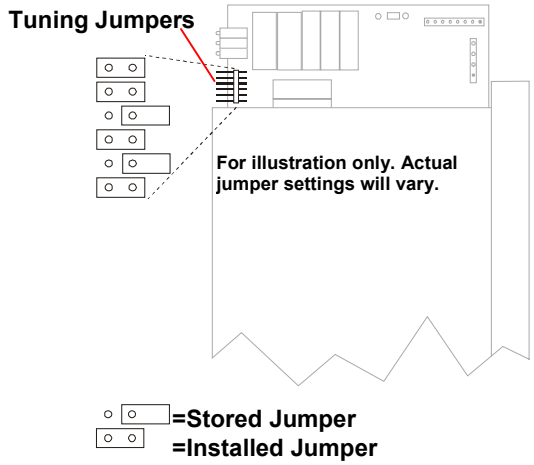
4. Place a digital dc voltmeter between test points **E3** (dc out) and **E4** (ground).



5. Turn RF controller power switch **On**.

   Add or remove jumpers to achieve maximum voltage. See **Set Tuning Jumpers** on page 5-3 for recommended tuning procedure.

   Jumpers removed during tuning process remain on tuning board in storage position.



   Note: Tune to maximum voltage.

6. Test antenna performance by trying to read a tag or badge in optimum orientation from at least .9m (3ft) away. Red (badge) or amber (tag) LED flashes when transponder is read.

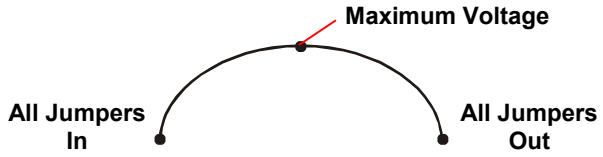
   If read range is less than .9m (3ft), refer to **Chapter 5: Service** for troubleshooting information.

7. Install antenna top cap after antenna is tuned.

   Antenna is ready for operation.

Set Tuning Jumpers

The tuning process maximizes system performance by ensuring that antennas receive the maximum possible voltage. The various combinations of tuning jumper positions represent an impedance curve.



The procedure used to identify the optimum jumper combination must take into account that any particular combination of jumpers may be above or below maximum.

The following recommended procedure uses the least significant jumper to indicate whether antenna is over or under tuned at each stage of the tuning process. The procedure requires you to check the position of each jumper, beginning with the bottom jumper which represents the most significant bit (MSB).

1. Attach voltmeter to test points. Voltage measurements are taken throughout tuning process.
2. Remove jumpers from all pin positions and examine voltage at test points. Be certain to wait a few seconds for voltage level to stabilize.
3. Place jumper in pin position to be checked (begin with position 1 at top). You are ready to determine if this jumper remains **In** or **Out**:

   If reading increases with jumper in, proceed to step 4.

   Or…

   If reading decreases with jumper in, change jumper being checked to **Out** position (storage) and go to step 5.

4. Place another jumper on bottom pin position (position 6–LSB). If reading increases with jumper in, remove bottom jumper and go to step 5. Jumper being checked remains **In**.

   Or…

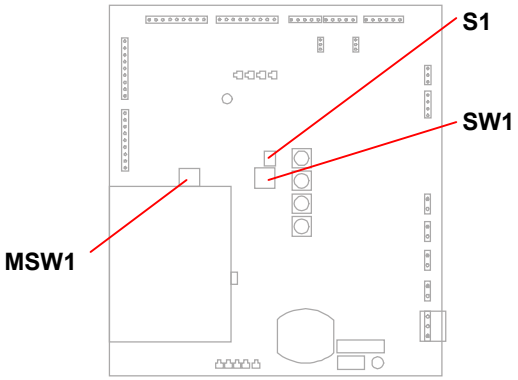
   If reading decreases with jumper in, change jumper being checked to **Out** position (storage). Then, remove bottom jumper and go to step 5.

5. Complete steps 3–5 for each pin position, working from top to bottom. The next pin position to check is pin position 2.

   Note: Voltage level for satisfactory performance is 18V±4V. See **Chapter 5: Service** to troubleshoot an antenna that cannot achieve voltage requirement.

DIP Switch Settings

The RF controller includes 3 DIP switches which are factory set.



Switch	DIP Switch Settings		
	1	2	3
S1	Off	Off	—
SW1	Off	Off	Off
MSW1	Off	Off	Off

Troubleshooting Tips

The following table contains suggested solutions for problems that might be encountered in the installation and operation of C•CURE Watch system components.

Symptom	Possible Cause	Action
System does not power on.	Defective power supply.	Replace the power supply.
	Blown fuse on the RF controller board.	Replace with 5A., 250V fuse manufactured by Semko or equivalent.
	Power supply safety cutoff input may be open.	If not using an external fire alarm, the safety cutoff must be jumpered. For installations using Sensormatic product codes C2623-27 or C2626-27, jumper **F1** and **F2** on the power supply.
System voltages are low.	Low input voltage to power supply.	Identify and eliminate the cause of the low input voltage.
Green status LED (DS1 near **On/Off** switch) on RF controller does not turn on when either a badge or a tag is present in antenna field.	Antennas are not connected to the RF controller.	Connect the antennas.
	Antenna control cable not connected to the RF controller.	Connect the antenna control cables to the RF controller.
	High noise levels.	Locate and eliminate noise source. Check following: 1. Video or computer monitors within 3m (10ft). 2. Large electrical wireways. 3. Other EAS or access systems within 15.2m (50ft). 4. Elevator motors. 5. RF controller not synchronized with other RF controllers.
No antenna LEDs are turned on.	Antenna control cable not connected to the RF controller.	Connect the antenna control cables to the RF controller.
No voltage on the antennas.	Antenna is not tuned correctly.	Tune the antenna. See **Tuning RF Passage Antennas** on page 5-2.
Cannot tune antenna or antenna voltage is too low (<14Vdc) when tuning.	Another RF passage antenna may be located within 4.6m (15ft) of antenna being tuned. This does NOT apply to antennas connected to same RF controller as antenna being tuned.	If possible, move antenna causing interference so it is more than 4.6m (15ft) from antenna being tuned.

Symptom	Possible Cause	Action
	Antenna is located near a metallic object.	Remove the metallic object. Reposition the antenna, if possible.
	Antenna is not tuned correctly.	Tune the antenna. See **Tune RF Passage Antennas** on page 5-2.
Antenna voltage measurement is fluctuating.	Antenna is located near a metallic object.	Remove the metallic object. Reposition the antenna, if possible.
	Possible noise source in the area, such as a computer monitor or ac power source.	Remove the noise source. Install a filter to eliminate the effects of the noise-source.
Unable to read badges or tags except when placed very close to an antenna.	High noise levels.	Locate and eliminate noise source. Check following: 1. Video or computer monitors within 3m (10ft). 2. Large electrical wireways. 3. Other EAS or access systems within 15.2m (50ft). 4. Elevator motors. 5. RF controller not synchronized with other RF controllers.
		Install a noise cancellation coil.
	Systems are not synchronized.	Make sure the synchronization cabling is correctly installed.
	System is not properly grounded.	Make sure the system is properly earth grounded.
	Asset tag is mounted too close to a metal edge.	Make sure the tag is correctly mounted and is not too close to a metal edge that might block the antenna field.
	Another EAS system, video monitor, or other noise source is located too close to the system	Identify noise source and relocate either noise source or system.
Badge is being read incorrectly, but tag is being read correctly.	Badge is not properly defined in the C•CURE 800/8000 system.	Check the badge definition in the C•CURE 800/8000 system.
C•CURE 800 properly indicates that a valid badge has been read, but the antenna LED flashes red and the door latch relay does not unlock the door.	C•CURE 800/8000 system may not be properly configured.	Check that RF reader configuration in C•CURE 800/8000.
	There may be a communications failure between RF controller and panel.	Check door status on C•CURE 800/8000 monitoring station.

Symptom	Possible Cause	Action
C•CURE 800 system reports the reader as offline.	RS-485 cabling is not properly connected.	Verify RS-485 communications connections, polarity, and grounding.
	Reader address is not properly configured.	Check address configured in C•CURE 800 host and the RF controller DIP switches.
	RS-485 cabling is damaged.	Replace cable.

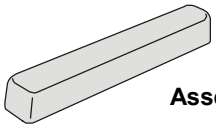
Appendix A

Asset Tag Installation

Note: Asset tags have not been evaluated by UL.

In This Chapter

Overview



Asset Tag

Asset tags are attached to external asset surfaces using *semi-permanent* adhesive tape or *permanent* plastic adhesive. Asset tags are shipped in two ways depending on how they will be attached. For semi-permanent applications, the adhesive tape is applied to asset tags before shipping—they are ready to install. For permanent applications, you must supply your own adhesive. The recommended adhesive is 3M 4475 Plastic Adhesive.

The product codes for asset tags are as follows:

- Without adhesive VL-ATRW-1
- With adhesive VL-ATRW-2

Procedures are provided for both adhesive tape and plastic adhesive application. Follow the instructions for the type of adhesive you are using at your site. *Read through all these instructions before you begin applying asset tags.*

CAUTION: Once the adhesive has set, removal of the tag from the asset might permanently damage the asset and/or tag.

Applying Adhesive Tape

1. Examine the asset to identify a suitable location for tag application. Guidelines for selecting a location are provided below.
2. Clean the surface of the asset using a clean cotton swab with isopropyl (70%) alcohol or an alcohol medical wipe. To avoid contamination when applying the alcohol to the asset's surface, wipe in one direction only. Allow the surface to dry completely.
3. Peel the liner from the tag's adhesive.
4. Position the tag against the clean asset surface. Apply uniform pressure to the tag, making sure there is full contact between the asset and the tag. Apply pressure for five seconds.

CAUTION: Adhesive application requires two hours to establish a permanent bond. Do not disturb the asset or tag for two hours.

5. Verify tag application after twenty-four hours.

Applying 3M 4475 Plastic Adhesive

These instructions are supplemental to the instructions supplied by the manufacturer of the plastic adhesive. Follow the manufacturer's instructions for proper use and safety precautions.

1. Examine the asset to identify a suitable location for tag application. Guidelines for selecting a location are provided below.
2. Clean the surface of the asset using a clean cotton swab with isopropyl (70%) alcohol or an alcohol medical wipe. To avoid contamination when applying the alcohol to the asset's surface, wipe in one direction only. Allow the surface to dry completely.
3. Using a zigzag motion, apply the 4475 Plastic Adhesive to the entire bottom surface of the tag.
4. Position the tag against the clean asset surface. Apply uniform pressure to the tag, making sure there is full contact between the asset and the tag. After the tag is positioned, use a paper towel to wipe off excess adhesive. Apply pressure for one to two minutes.

CAUTION: Adhesive application requires two hours to establish a permanent bond. Do not disturb the asset or tag for two hours.

5. Verify tag application after twenty-four hours.

Positioning Guidelines

How you position tags on assets can affect the success of your asset management program. You must ensure that the tag will not interfere with asset use and that the asset does not interfere with the tag's signal. The following guidelines will help you identify suitable locations for affixing tags:

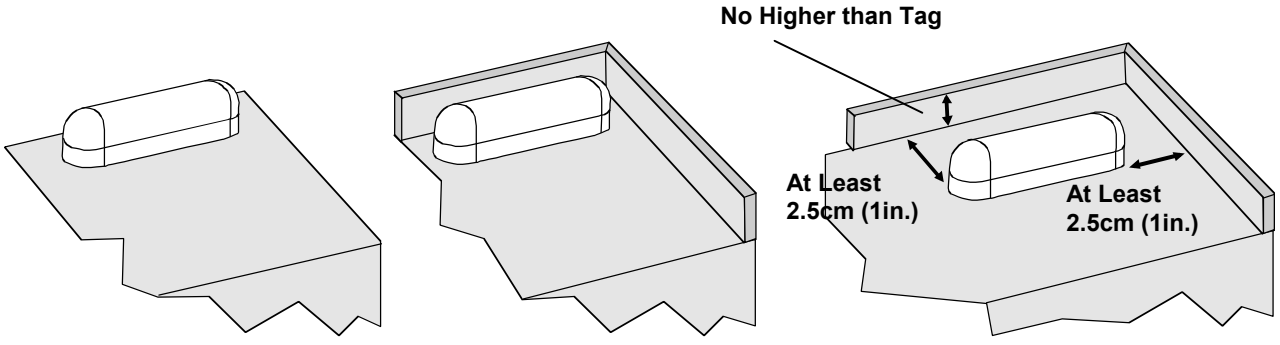
- The tag must be affixed to a flat, solid surface. A non-textured surface provides optimum performance.
- Ensure that the tag is affixed to a non-removable portion of the asset.
- Visibility of the tag is a matter of customer preference. You might wish to apply tags in highly visible locations or you might prefer to select less obvious locations.
- Proximity to adjacent non-metallic surfaces might discourage attempts to tamper with tag application.
- Special care should be taken when mounting asset tags on metal surfaces. Although the asset tag is designed to be mounted on a flat metal surface, performance might be degraded if it is surrounded by metal.

CAUTION: Do not mount asset tags in metal enclosures unless there is at least .5cm (1in.) clearance between the tag and any adjacent metal surface and the metal surface does not extend above the top of the tag.

- Examine the asset for opening covers and other moving parts. Select a location where the tag will not interfere with asset operation.
- Consider the asset's interaction with other assets, equipment and/or furniture. Allow adequate room for laptop computers to connect to a docking station.
- Select a site where the tag will not interfere with asset storage. Check for clearance in typical storage or transport situations such as desk drawers, cabinets, or briefcases.

Once the tag is applied to the asset, the asset must be defined in the system database. You will need the Cross Reference Sheet that is shipped with the tags. This sheet includes information (site code and tag ID) that is required to define assets using the correct data entry screen.

Note: You might want to make a copy of the Cross Reference Sheet, filing one copy with your system documentation and storing the other with the asset tags.



All Surfaces **Non-Metallic Surfaces** **Metallic Surfaces**

Appendix B

Managing RF Passage Antenna Performance

In This Chapter

Performance Overview

The C•CURE Watch system uses RFID (radio frequency identification) technology to gather information for access control and asset tracking applications. Under ideal conditions, RFID technology provides a reliable method of communicating information.

However, sometimes environmental conditions interfere with passage reader performance. Different conditions interfere with performance in different ways—each requiring a different performance management solution.

The first step in managing passage reader performance is to evaluate potential installation sites as part of a pre-installation site survey. The survey ensures that C•CURE Watch passage readers are installed in locations where environmental conditions are not a problem—or at least identifies potential problems before installation.

In some cases, performance problems become evident only after installation. This appendix provides tools, strategies, and suggestions for improving passage reader performance.

Troubleshooting RFID performance is not an exact science. The tools and techniques provided in this appendix provide a foundation for problem solving. Experience with RFID technology also plays an important role in this process; experience comes only with practice.

Environmental Conditions Affecting Performance

The following environmental conditions can interfere with the ability of a C•CURE Watch passage reader to detect a tag or card:

- Cable/line interference
- Antenna loading
- Antenna interference

Cable/Line Interference

Cable/line interference is conducted or induced into the system through its cabling. Sources of cable/line interference include:

- Switching power supplies such as ac/dc motors.
- Power spikes generated by input or output devices connected to the RF controller.
- Door latch relay, power, or data cable runs close to antenna wire cable runs.

Antenna Loading

Antenna loading occurs when a large metal object in close proximity to a passage reader alters the reader's electromagnetic fields in a way that interferes with performance.

Antenna Interference

Antenna interference occurs when radiated noise disrupts the transmission process in a way that prevents the tag or card signal from being detected by the receiver.

There are several variables associated with antenna interference. The closer the interference is to C•CURE Watch operating frequencies (134.2kHz and 123.2kHz), the greater its potential for degrading system performance. Antenna interference can be intermittent resulting in passage antenna performance that is excellent at some times and unacceptable at other times. In addition, some sources of antenna interference are directional so that their orientation in relation to the passage reader can play a significant role in the degree of interference.

Sources of antenna interference include:

- Equipment operating in the vicinity of a passage reader. Any system that operates at a set frequency is a potential source of interference. Examples include *but are not limited to*: computer or television monitors, automatic teller machines, and elevators.

  Generally, the closer the system or the more powerful the interfering signal, the more likely it is to cause a problem.

- Third-party RFID proximity readers operating in the vicinity of the passage reader such as Indala and HID.

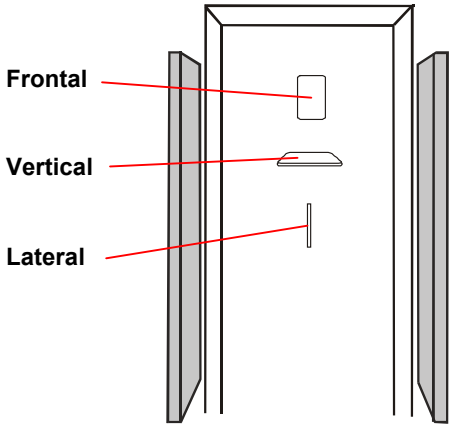
  C•CURE Watch system components can also interfere with system performance. Synchronizing all RF controllers at a site prevents this type of interference.

- Multiple C•CURE Watch tags or cards transmitting at the same time.

Antenna Performance

The following antenna detection distances have been verified by UL.

Note: "Top" means that detection occurred .6m (1.5ft) from the top of the antenna. "Bottom" means detection occurred .6m (1.5ft) from the floor. Detection occurred between the top and bottom in the indicated distances.



One Antenna, .9m (3ft)

Badge Orientation	Model A (CW-ANT-PA) with Wire Loop	Model A (CW-ANT-PA) without Wire Loop	Model B (CW-ANT-PB) without Wire Loop
Frontal	Top and bottom .9m (3ft)	Top .9m (3ft) Bottom .76m (2.5ft)	Top .9m (3ft) Bottom .76m (2.5ft)
Vertical	Top and bottom .76m (2.5ft)	Top .6m (2ft) Bottom .76m (2.5ft)	Top .76m (2.5ft) Bottom .6m (2ft)
Lateral	Top .76m (2.5ft) Bottom .6m (2ft)	Top .9m (3ft) Bottom .76m (2.5ft)	Top .76m (2.5ft) Bottom .9m (3ft)

One Antenna, 1.8m (6ft)

Badge Orientation	Model A (CW-ANT-PA) with Wire Loop
Frontal	1.8 m (6ft)

Two Antennas, .9m (3ft)

Badge Orientation	One Model A (CW-ANT-PA) and One Model B (CW-ANT-PB) with Wire Loop	One Model A (CW-ANT-PA) and One Model B (CW-ANT-PB) without Wire Loop
Frontal	Top and bottom .9m (3ft)	Top and bottom .9m (3ft)
Vertical	Top and bottom .76m (2.5ft)	Top and bottom .9m (3ft)
Lateral	Top .76m (2.5ft) Bottom .6m (2ft)	Top and bottom .76m (2.5ft)

Two Antennas, 1.8m (6ft)

Badge Orientation	Two Model A (CW-ANT-PA) with Wire Loop	Two Model A (CW-ANT-PA) without Wire Loop
Frontal	Top and bottom 1.8m (6ft)	Top and bottom 1.8m (6ft)
Vertical	Top and bottom 1.5m (5ft) [.76m (2.5ft) from each side]	Top and bottom 1.8m (6ft)
Lateral	Top 1.5m (5ft) [.76m (2.5ft) from each side] Bottom .9m (3ft) [.6m (1.5ft) from each side]	Top 1.5m (5ft) [.76m (2.5ft) from each side] Bottom .9m (3ft) [.6m (1.5ft) from each side]

Before You Begin

When installation is complete, each passage reader is tested with cards and/or tags that have been defined in the host system. Performance is acceptable if tags and cards are detected at a distance of .9m (3ft) from the antennas and anywhere between the antennas (no holes in center of field).

If performance is not acceptable, the cause must be identified. In many cases, poor performance is caused by improper installation. Before beginning what may be an unnecessary process, check the following:

- Verify that all installation procedures have been completed and that antennas are properly tuned.
- Examine status LEDs while system is running, the antenna LEDs associated with active antennas should be flashing sequentially.
- Tighten all antenna wire connections on antenna interface board—loose connections can affect system performance.
- Verify that all RF controllers are properly synchronized.

Investigating Performance

Although there are many ways to troubleshoot passage reader performance, the following suggestions are provided as a guideline. In some cases experience and site-specific conditions may dictate another approach.

The suggested procedures are sequenced so that the most easily identifiable problems are eliminated first. In most cases, the investigation process should be completed in the sequence presented.

Some of these procedures require two people.

This section includes the following topics:

- Check for obvious sources of interference
- Check for antenna loading
- Investigate antenna interference
- Troubleshooting tips

Check for Obvious Sources of Interference

In some cases, the source of interference can be identified by a careful inspection of the passage reader's environment. Check for equipment such as monitors, RFID readers (including unconnected passage antennas), machines or motors, and fluorescent lamps near passage antenna. Turn off suspicious devices and test reader performance. If performance improves when the device is turned off, see **Improve Performance** on page B-5 for suggestions about improving performance.

Check for Antenna Loading

When the possibility of cable/line interference has been ruled out, follow these steps to check for antenna loading:

1. Remove top caps from affected antennas.
2. Using a multimeter, measure antenna voltage.
3. If antenna is affected by antenna loading, the source (a large metal object in the vicinity of the antenna) must be determined and removed or the passage reader must be moved.

Investigate Antenna Interference

When the possibilities of cable/line interference and antenna loading have been ruled out, follow these steps to identify the source of antenna interference:

1. Record rotary switch settings.
2. Set rotary switches to 9-1-0-9.
3. Turn RF controller power **Off**, then back **On**.
4. Verify individual antenna performance with a badge or tag to identify affected antennas.
5. When source of antenna interference is discovered, implement a solution presented in **Control Antenna Interference** on page B-5.
6. When testing is complete, turn RF controller power **Off**, return rotary switches to original configuration.
7. Turn RF controller power **On**.

Troubleshooting Tips

The following suggestions may help troubleshoot passage reader performance in unusual situations.

Existing Installations

If a passage reader that has been performing well develops performance problems:

- Walk through area to see if there are evident changes in the physical environment. Has equipment been moved or new equipment installed?
- Check with facilities and department personnel regarding recent repairs. It is possible that performance is affected by rerouted wiring or other non-visible changes to existing equipment.

Intermittent Interference

The following may help identify intermittent interference:

- Test system performance at different times to pinpoint the problem to a specific time period. Check with facilities and department personnel regarding equipment and processes that occur during the periods when performance is an issue.
- Check whether equipment in the vicinity operates at different intensity at various times. If so, it may be producing an unacceptable level of interference only when operating at high setting.
- Consider whether potential sources of interference move in and out of the vicinity of the passage reader. A fork lift may affect performance only when it passes close to the passage reader.

Multiple Sources of Interference

In some cases, a passage reader is affected by more than one source of antenna interference. It may be necessary to repeat the cycle of investigation and control for antenna interference until all sources are identified.

Improve Performance

There are several ways to control the effect of interference on passage readers. Methods of control vary depending on the source of interference.

Control Cable/Line Interference

The following options may help control cable/line interference:

- Install a UPS (uninterruptible power supply) battery to filter RF controller power.
- Separate data and door latch relay cable runs from antenna cable runs by at least 15cm (6in.).
- Call tech support for assistance in troubleshooting interference related to inputs and/or outputs.

Control Antenna Loading

Avoidance is the only way to control antenna loading; either the metal object or the affected passage reader must be moved.

Control Antenna Interference

There are several ways to control antenna interference:

- Move reader or source of interference
- Install cancellation coils
- Consult your technical support representative.

Relocate the reader or the source of interference so that system performance is no longer affected. This is the most permanent solution.

In some cases, modifying the orientation of the source of interference can improve system performance—try changing the vertical/horizontal orientation or rotating it. Experiment with several positions to determine impact on passage reader performance.

Cancellation coils are used to control localized, well-defined sources of antenna interference. The coils are assembled and connected using standard 18AWG, plenum rated wire. A cancellation coil is connected to an affected antenna, then attached to the source of antenna interference.

Troubleshooting Procedures

One or more of the following procedures may be required to manage passage reader performance:

- Isolate an antenna.
- Use a communications receiver
- Install cancellation coils

Isolate an Antenna

1. Set rotary switches as specified below.

Antenna	Rotary Switch Settings
1	9-7-1-9
2	9-7-2-9
3	9-7-4-9
4	9-7-8-9

2. Turn RF Controller power off, then on.

Use a Communications Receiver

A communications receiver is used to search for a source of antenna interference after affected antennas have been identified and all obvious sources of interference have been eliminated.

Required Equipment

This procedure requires two people and the following equipment:

- Ground isolated or battery powered oscilloscope (200MHz Tektronix THS730A and 10X probes recommended).
- 4 jumpers with alligator clips on both ends.
- Digital multimeter.
- 100 feet of 50 ohm coax cable with BNC connector on one end and alligator clips on other end.
- C•CURE Watch proximity reader (VS-ANT-S2).
- ICOM IC-PCR1000 communications receiver and serial communications cable.
- Laptop computer with IC-PCR1000 software (revision 1.3 or later) installed. A fully charged internal battery is required.

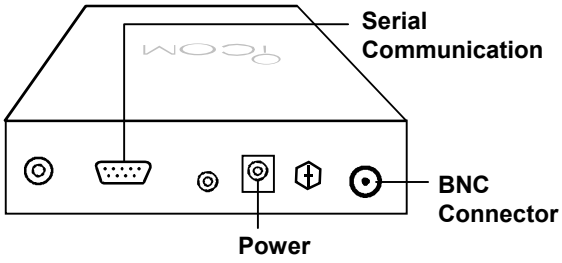
Set Up the Receiver

1. Turn **Off** power to RF controller and PC.

   Note: NEVER operate PC using external ac power. This will create a new source of interference that is detected by receiver.

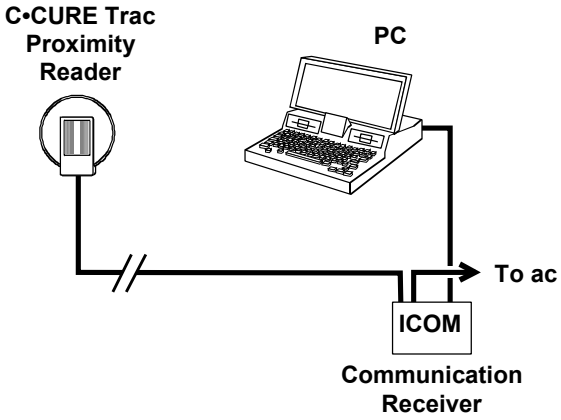
2. Connect serial communication and power to ICOM receiver.

   Use serial communication cable to connect ICOM receiver to PC.

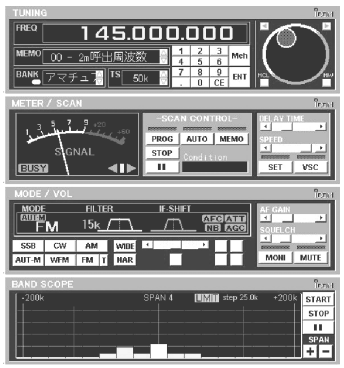


3. Connect coaxial cable to communication receiver and C•CURE Watch proximity reader.

   Connect BNC connector on coaxial cable to BNC connector on communication receiver. Connect alligator clips at end of coaxial cable to the antenna connectors of the C•CURE Watch proximity reader. DO NOT APPLY POWER TO THIS ANTENNA.



4. Turn on communication receiver and PC.
5. Start IC-PCR1000 software and change View settings to Component Screen.



6. Set IC-PCR1000 parameters.

   Tuning Components:

   Frequency to 130kHz (0.130.000).

   Tuning Step (TS) to 100 Hz.

   Meter/Scan Components:

   Delay Time to minimum.

   Speed to maximum.

   Mode/Vol Components:

   Modulation to AM.

   Narrow (NAR) filter to 3kHz.

   Turn on Automatic Gain Control (AGC).

   Audio Frequency (AF) gain to desired level (muting this feature is recommended to help determine strength of RF field being monitored).

   Attenuation (ATT) can be activated as needed if signal strength saturates receiver.

   Band Scope Components:

   Press Start and set Span to 1 by pressing the minus (–) sign. This sets span to ±25kHz.

   When all parameters are set, you are ready to search for sources of interference.

Searching for Source of Interference

Use RF antenna and feedback from the IC-PCR1000 software to search for source of interference. Two people are required for this process. One person to move C•CURE Watch proximity reader and another to monitor and relay information from the PC.

The reader picks up RF signals in the environment. The strength of these signals is monitored with IC-PCR1000 software.

The process is similar to the game of “Hot and Cold.” Hold the C•CURE Watch proximity reader vertically and stand next to the antenna most affected by the source of interference. Keeping the reader in a vertical position, note scope readings on PC as reader faces different directions.

The scope monitors signal strength and frequency. Readings are more significant as noise level increases (higher bars) and frequency approaches target frequency (center of scope).

Move in the direction being faced when most significant scope readings were noted. Slowly work through the area using this technique, always moving in the direction indicated by more significant readings.

Place the reader near potential sources of interference such as: electronic equipment, alarm modules, and power supplies. Include walls and columns in the test since interference sources may be hidden.

At some point, high noise levels close to the target frequency will pinpoint the source of interference. Confirm using one of the following procedures:

- Hold the reader close to the source while rotating 90 degrees (so it is parallel with the floor). If noise levels drop significantly, this is a source of antenna interference.
- If the suspected source is an electrical device, turn it on and off. If noise levels disappear or decrease significantly when the device is off, it is a source of antenna interference.

Install Cancellation Coils

The following procedure describes how to control antenna interference by installing cancellation coils on passage antennas.

The following topics are covered:

- Before you begin
- Required equipment
- Planning wiring configuration
- Making cancellation coils
- Making antenna coupling loop
- Installing antenna coupling loop
- Installing coils
- Finishing the installation

Before You Begin

Affected antennas and their associated sources of antenna interference must be identified before cancellation coils can be installed.

The following guidelines apply:

- Only localized, well-defined sources of antenna interference can be canceled with coils.
- The procedure is practical for canceling up to three different sources of interference per antenna. The cancellation process is more difficult when multiple sources of interference or multiple antennas are involved.
- The source of interference must remain absolutely fixed in position once the coil is

installed. Even small movements can compromise passage reader performance.

Required Equipment

The following equipment is required to create and install noise cancellation coils:

- Tools for removing and assembling the antenna cover
- 2-conductor, 18AWG, plenum cable
- A cylindrical object approximately 8cm (3in.) in diameter (such as a coffee mug)
- Electrical or transparent tape
- Packing or duct tape
- Wire nuts
- Ground isolated or battery powered oscilloscope

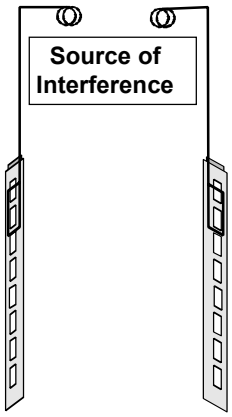
Plan Wiring Configuration

The noise cancellation process connects coils to affected antennas. The way you connect coils depends on the number of interference sources and the number of antennas. Use the following guidelines to plan the wiring configuration:

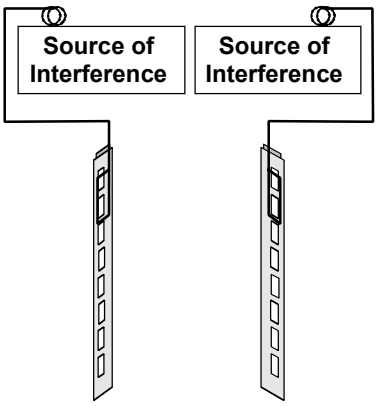
- Establish a connection between the source of interference and each antenna it affects.
- Provide a separate coil for each affected antenna.
- Attach only one antenna coupling loop to an antenna. When more than one source of interference affects an antenna, the coils must be connected in series.

The following examples illustrate these guidelines:

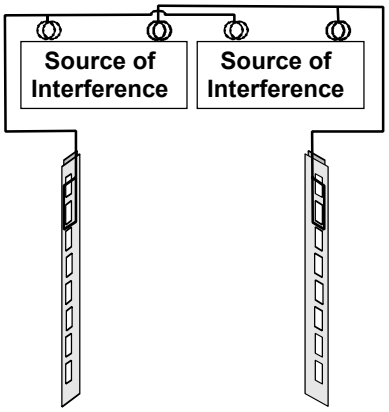
- One source of interference and two antennas — if both antennas are affected, two coils are needed.



- Two sources of interference and two antennas — if each source affects only one antenna, two coils are needed.



- Two sources of interference and two antennas — if both sources affect both antennas, four coils are needed.



Make Cancellation Coils

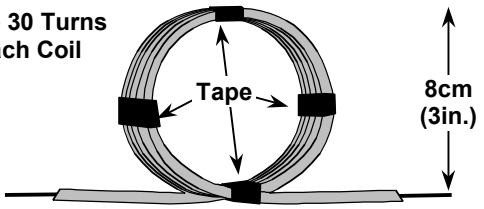
A coil is made with a single strand of insulated wire.

1. Cut a piece of 2-conductor wire approximately 7.6m (25ft) long and remove outer sheath to separate wires.
2. Take one of the wires and wind it into a circular coil with a diameter of approximately 8cm (3in.).

   Each coil should contain 25 to 30 turns. Leave approximately 8cm (3in.) of wire at each end of coil.

   Dimensions of coil are not critical. For convenience, use a coffee mug or roll of duct tape as a base for winding.

   Note: If needed, use second wire to make another coil.
3. Use electrical or transparent tape to secure coil in four spots to keep it from unwinding.
4. Strip about 2cm (.75 in.) of insulation from both ends of coil.



5. Make one coil for each source of interference/antenna combination.

   Set completed coils aside while you prepare antenna coupling loops and antenna wires.

Make Antenna Coupling Loop

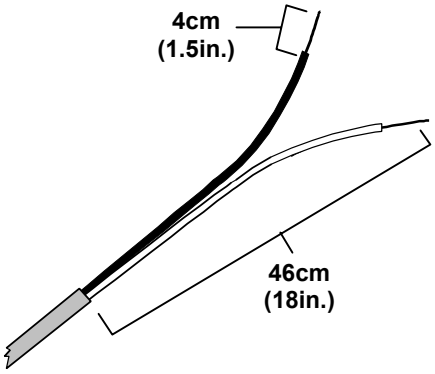
The antenna coupling loop is made using standard 2-conductor wire.

1. Begin with a piece of 2-conductor wire long enough to reach from antenna to source of interference.

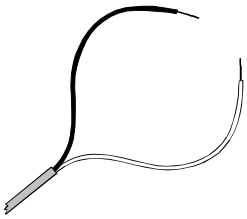
   Remember to measure installation path (not line of sight) from antenna to source of interference. Allow additional wire to create antenna coupling loop and for positioning coil.

   You may want to make/attach antenna coupling loop and run wire to source of interference before cutting it.

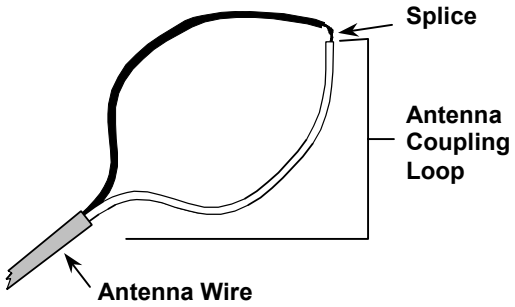
2. Remove 46cm (18in.) of outer sheath from one end of wire, so that wires can be separated.



3. Strip 4cm (1.5in.) of insulation from end of each wire.
4. Form a loop by splicing the two wires.



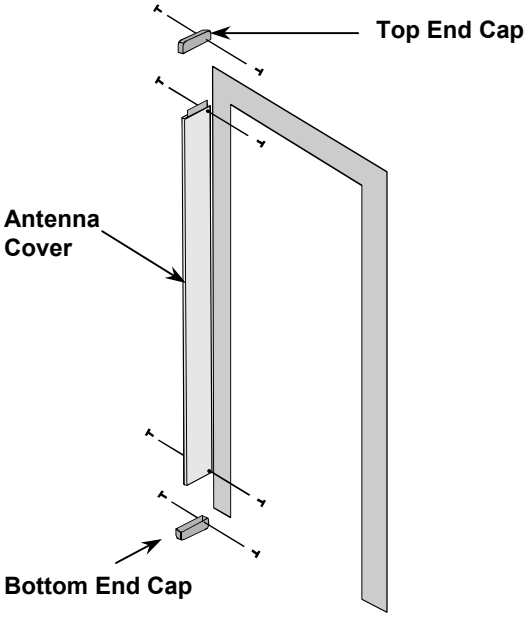
Antenna coupling loop is now ready to install. Remaining wire is referred to as antenna wire in the following steps.



Prepare Antenna for Cancellation

The noise cancellation process must be performed on one antenna at a time. Follow these steps to prepare the antenna.

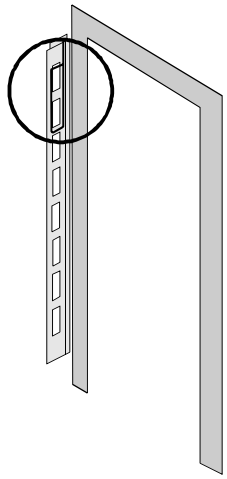
1. Isolate antenna being cancelled. For more information see **Isolate an Antenna** on page B-6.
2. Remove antenna end caps.
3. Remove antenna cover.



Install Antenna Coupling Loop

Installing the antenna coupling loop is a critical step in the noise reduction process. It is important to follow the recommended guidelines for positioning the loop.

The antenna coupling loop must be mounted just above the third cutout.

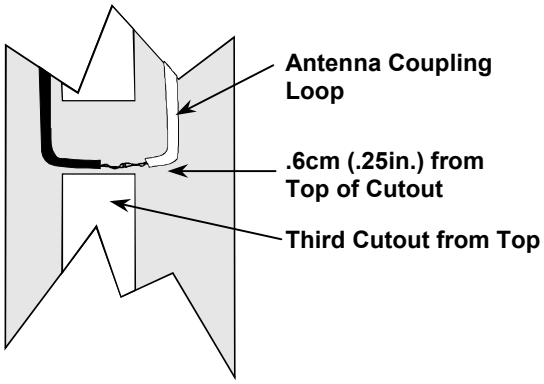


1. Determine how you will install antenna wire between antenna and source of interference.

   Site requirements for safety and appearance will influence how wire is installed. Antenna wire can exit antenna from top or bottom to meet installation requirements.

2. Attach antenna coupling loop to antenna. It is important to accurately position bottom of loop.

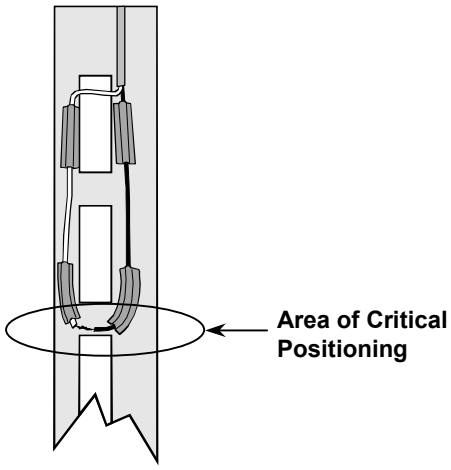
   Use packing or duct tape to attach loop to either side of antenna so that bottom of loop is .6cm (.25in.) above the top of third cutout and so that it extends the full distance between vertical antenna channels (from left to right).



   Once bottom of loop is secure, extend rest of loop vertically, along antenna channels and secure. Positioning of upper portion of antenna coupling loop is not critical.

   Note: Splice can be positioned at top or bottom of antenna to accommodate antenna wire exiting at top or bottom of antenna. *Be sure bottom of loop is positioned accurately.*

When installed, antenna coupling loop should look like this:



3. Run antenna wire to top or bottom of antenna.

   Route wire to back edge so that end caps can be installed when installation is complete.

4. Run antenna wire along selected installation route to source of interference.

5. Prepare wire for connection to coil.

   If cutting antenna wire at this point, leave a generous allowance for positioning coil. Strip about 4cm (1.5in.) of outer sheath. Strip 2cm (.75in.) of insulation from each wire.

Install Coils

For effective cancellation, coils must be positioned as close as possible to source of interference. As a general rule, the stronger the interference, the closer the coil will need to be positioned to it.

Consider the following guidelines when positioning coils for noise cancellation:

- Position coils to achieve the lowest possible noise level within the typical range.
- Test antenna performance in addition to adjusting noise levels. Noise levels affect system performance to different degrees based on the source of interference. A noise level of 1.3V may compromise system performance mildly or significantly, depending on its source.

Based on conditions at the site, you may need to connect one coil or multiple coils to the antenna wire. If there are several affected antennas, the wiring configuration may include both types of connections.

When multiple sources of interference and/or multiple antennas require cancellation coils, the positioning and fine tuning of coils is an iterative

process. Once you have installed and fine tuned all coils, recheck noise cancellation for each coil and reposition it if necessary. Repeat this process until you are satisfied with system performance.

Connecting One Coil

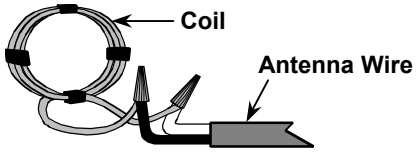
Follow these steps to connect one coil to an antenna.

1. Verify that source of interference is in its permanent operating position.

   It is important to avoid moving source of interference after installation is complete.

2. Connect coil to antenna wire.

   Twist wire at one end of coil with either antenna wire and secure it with a wire nut. Repeat with remaining coil and antenna wires.



3. Determine most effective placement for coil.

   Monitor cancellation effects as you experiment with potential mounting locations. Start by monitoring effects of gross position changes, gradually making smaller and smaller changes between test locations.

   Note: If possible when multiple sources of interference are involved, turn off all except one being tested.

4. Attach coil to source of interference using packing or duct tape.

   Use only enough tape to hold coil in position during installation process. You may need to reposition coil later.

5. Fine tune noise cancellation.

   Small changes in coil shape affect noise cancellation results. Fine tune by making small changes to shape of coil. Monitor effects of these changes until cancellation is optimized.

6. Install all coils before proceeding to section, **Finish the Installation** on page B-12 .

Connect Multiple Coils

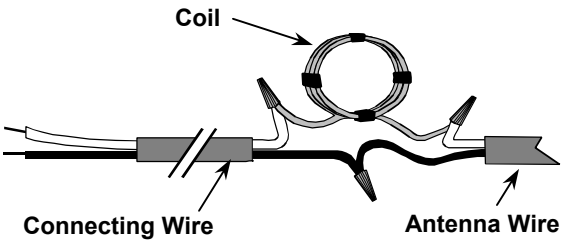
When more than one source of interference affects an antenna, you must connect coils to the antenna wire in series. For this configuration, use separate pieces of 2-conductor wire to connect one coil to another. In the following steps this wire is referred to as a *connecting wire*.

1. Verify that source of interference is in its permanent operating position.

   It is important to avoid moving sources of interference after installation is complete.

2. Connect first coil to antenna wire and connecting wire.

   Twist one coil wire with white antenna wire and secure with a wire nut. Twist other coil wire with white wire of connecting wire and secure with a wire nut.



   Twist black wire of the antenna wire with black wire of the connecting wire and secure with a wire nut.

   Set coil as close as possible to source of interference.

3. Run connecting wire to second source of interference and cut, leaving a generous allowance for positioning coil.

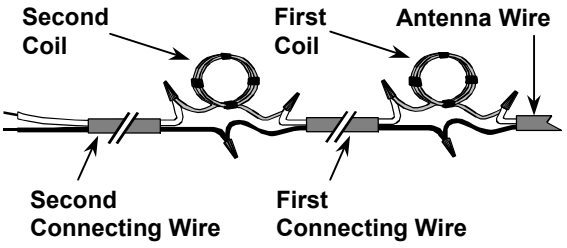
   Strip about 4cm (1.5in.) of outer sheath from cut end. Strip 2cm (.75in.) at end of each wire.

4. If only two coils are required in this series, proceed to Step 6.

   Or…

   If three coils are required, connect second coil to connecting wire from first coil and another connecting wire.

   Twist one coil wire from second coil with white connecting wire from first coil and secure with a wire nut. Twist other coil wire with white wire of another connecting wire and secure with a wire nut.



Twist black wire of connecting wire from first coil with black wire of new connecting wire and secure with a wire nut.

Set coil as close as possible to source of interference.

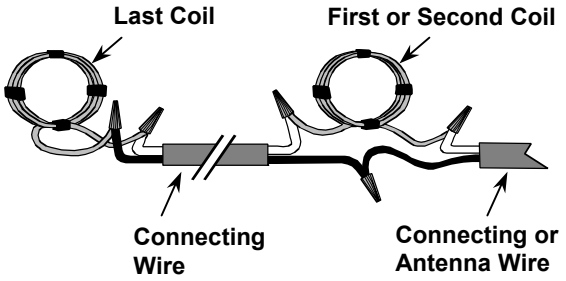
5. Run connecting wire to third source of interference and cut, leaving a generous allowance for positioning coil.

   Strip about 4cm (1.5in.) of outer sheath from cut end. Strip 2cm (.75in.) at end of each wire.

6. Connect last coil to connecting wire.

   Twist wire at one end of coil with one of connecting wires and secure with a wire nut. Repeat with remaining coil and connecting wire.

   Set coil as close as possible to source of interference.



7. Determine most effective placement for first coil.

   Be sure coils are located as close as possible to sources of interference.

   Monitor cancellation effects as you experiment with potential mounting locations. Start by monitoring effects of gross position changes, gradually making smaller and smaller changes between test locations.

   Note: If possible when multiple sources of interference are involved, turn off all sources except one being tested.

8. Attach coil to source of interference using packing or duct tape.

   Use only enough tape to hold coil in position during installation process. You may need to reposition coil later.

9. Fine tune noise cancellation for first coil.

   Small changes in coil shape affect noise cancellation results. Fine tune by making small changes to shape of coil. Monitor effects of these changes until cancellation is optimized.

10. Repeat steps 7–9 for second and (if needed) third coils.
11. Install *all* coils before proceeding to next section Finish the Installation.

Finish the Installation

When all required coils have been connected, you are ready to finish the installation.

1. Recheck noise cancellation for each coil.

   When multiple sources of interference must be canceled, the placement of subsequent coils can affect noise cancellation results for coils that are already installed.

   Use oscilloscope to monitor noise levels for each coil. Readjust positioning and/or fine tuning as needed.

   Repeat this step until you are satisfied with noise cancellation for all coils.

   Note: Remember to turn **Off** RF controller and set DIP switch for proper antenna when fine tuning results for multiple antennas.

2. Use packing or duct tape to permanently attach coils.

   Do not move sources of interference once coils have been installed. Even small changes in position can have a significant impact on noise cancellation results.

3. Reconfigure antennas for normal operation.

   Using your notes about reader connections and dip switch settings, reconnect antennas to the reader. If necessary, adjust the reader operating mode by setting the dip switches.

4. Verify antenna operation.

   Using a transponder, verify that all antennas are operating properly.

5. Replace antenna cover and end caps.