



**FEDERAL SIGNAL**  
Safety and Security Systems

# **FC, FCH, and FCU Models**

**One-Way Siren Controller**

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## ***Description, Specifications, Installation, Operation, and Service Manual***

## Limited Warranty

This product is subject to and covered by a limited warranty, a copy of which can be found at [www.fedsig.com/SSG-Warranty](http://www.fedsig.com/SSG-Warranty). A copy of this limited warranty can also be obtained by written request to Federal Signal Corporation, 2645 Federal Signal Drive, University Park, IL 60484, email to [info@fedsig.com](mailto:info@fedsig.com) or call +1 708-534-3400.

This limited warranty is in lieu of all other warranties, express or implied, contractual or statutory, including, but not limited to the warranty of merchantability, warranty of fitness for a particular purpose and any warranty against failure of its essential purpose.



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## Safety Messages

### **⚠ WARNING**

It is important to follow all instructions shipped with this product. This device is to be installed by trained personnel who are thoroughly familiar with the country electric codes and will follow these guidelines as well as local codes and ordinances, including any state or local noise-control ordinances. Listed below are important safety instructions and precautions you should follow:

#### **Important Notice**

Federal Signal reserves the right to make changes to devices and specifications detailed in the manual at any time to improve reliability, function, or design. The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for any inaccuracies.

#### **Publications**

Federal Signal recommends the following publications from the Federal Emergency Management Agency for assistance with planning an outdoor warning system:

- The “Outdoor Warning Guide” (CPG 1-17)
- “Civil Preparedness, Principles of Warning” (CPG 1-14)
- FEMA-REP-1, Appendix 3 (Nuclear Plant Guideline)
- FEMA-REP-10 (Nuclear Plant Guideline).

#### **Planning**

- If suitable warning equipment is not selected, the installation site for the siren is not selected properly, or the siren is not installed properly, it may not produce the intended optimum audible warning. Follow Federal Emergency Management Agency (FEMA) recommendations.
- If sirens are not activated in a timely manner when an emergency condition exists, they cannot provide the intended audible warning. It is imperative that knowledgeable people, who are provided with the necessary information, be available at all times to authorize the activation of the sirens.
- When sirens are used out of doors, people indoors may not be able to hear the warning signals. Separate warning devices or procedures may be needed to warn people indoors effectively.
- The sound output of sirens is capable of causing permanent hearing damage. To prevent excessive exposure, carefully plan siren placement, post warnings, and restrict access to areas near sirens. Review and comply with any local or state noise control ordinances as well as OSHA noise exposure regulations and guidelines.
- Activating the sirens may not result in people taking the desired actions if those to be warned are not properly trained about the meaning of siren sounds. Siren users should follow FEMA recommendations and instruct those to be warned of corrective actions to be taken.
- After installation, service, or maintenance, test the siren system to confirm that it is operating properly. Test the system regularly to confirm that it will be operational in an emergency.

- If future service and operating personnel do not have these instructions to refer to, the siren system may not provide the intended audible warning, and service personnel may be exposed to death, permanent hearing loss, or other bodily injuries. File these instructions in a safe place and refer to them periodically. Give a copy of these instructions to recruits and trainees. Also give a copy to anyone who is going to service or repair the siren.

### **Installation and Service**

- Electrocutation or severe personal injury can occur when performing various installation and service functions, such as making electrical connections, drilling holes, or lifting equipment. Therefore, only experienced electricians should install this product per national, state, and any other electrical codes having jurisdiction. Perform all work under the direction of the installation or service crew safety foreman.
- The sound output of sirens is capable of causing permanent hearing damage. To prevent excessive exposure, carefully plan siren placement, post warnings, and restrict access to areas near the sirens. Sirens may be operated from remote control points. Whenever possible, disconnect all siren power, including batteries, before working near the siren. Review and comply with any local or state noise control ordinances as well as OSHA noise exposure regulations and guidelines.
- After installation or service, test the siren system to confirm that it is operating properly. Test the system regularly to confirm that it will be operational in an emergency.
- If future service personnel do not have these warnings and all other instructions shipped with the equipment to refer to, the siren system may not provide the intended audible warning, and service personnel may be exposed to death, permanent hearing loss, or other bodily injuries. File these instructions in a safe place and refer to them periodically. Give a copy of these instructions to recruits and trainees. Also give a copy to anyone who is going to service or repair the sirens.

### **Operation**

Failure to understand the capabilities and limitations of your siren system could result in permanent hearing loss, other serious injuries, or death to persons too close to the sirens when you activate them or to those you need to warn. Carefully read and thoroughly understand all safety notices in this manual and all operations-related items in all instruction manuals shipped with the equipment. Thoroughly discuss all contingency plans with those responsible for warning people in your community, company, or jurisdiction.

Read and understand the information contained in this manual before attempting to install or service the siren.

Pay careful attention to notices located on the equipment.

## General Description

### Overview

The FC, FCH, and FCU are controllers that allow remote control of sirens, doors, gates, or lights. The FC Controller can be equipped with a one-way High Band or UHF radio receiver. The FC Controller can decode various signals and then activate one to four relays for control of external devices. The versatility of the FC Controller makes it an ideal choice for siren control applications or any other process that can be controlled through relay contacts.

The FC Controller consists of a NEMA 4 enclosure for indoor or outdoor use. The cabinet houses an aluminum backplane on which the FC Controller Board is mounted.

If using the one-way radio receiver model, the appropriate directional or omni-directional antenna system (antenna, cabling, and lightning protection) must be ordered separately.

### Features

The FC Controller has the following features.

- Optional one-way radio receiver (VHF or UHF)
- Two-tone sequential, DTMF, EAS, POCSAG, and digital AFSK decoding for security (requires radio receiver)
- Four individually programmable output relays
- Local activation via on-board buttons or externally wired (not supplied) buttons
- Audio output to drive external speaker and six built-in siren tone signals for standard alerting
- Four contact closure inputs for remote land line activation
- Four individually programmable output relays with selectable N.O. or N.C. contacts LED level meter to aid in setting receive level.
- Two RS232 Serial/Programming Ports
- Eight remote sensor inputs and a built-in monitor for AC voltage
- Local display of function counters and incoming decoded signals
- Single PCB reliability
- Powered via 120/240 Vac, 12 Vdc or 48 Vdc
- Six user-programmable functions in addition to the five preset functions: ARM, DISARM, REPORT, GROWL TEST, and MASTER RESET.
- Supports standard EAS codes and wildcards
- Supports Binary frequency shift keying 512 Baud numeric messages.



## **RF Receiver**

The Receiver Module (RF) is a fully shielded receiver that plugs into the FC controller. It is available in High (FCH) and UHF (FCU) bands.

The FC control board provides power and adjustments for the RX frequency of the receiver. The radio receiver provides over the air transmission signals to the FC Controller for decoding. The FC Controller can decode two-tone sequential, DTMF, EAS, POCSAG, and digital AFSK.

## **RF Receiver Features**

The RF Receiver has the following features.

- Small size
- Rugged construction using surface mount components
- Shielded receiver assembly to prevent interference
- Available in VHF and UHF bands
- Low current draw, excellent for battery-powered operation
- Synthesized frequency selection
- Wide temperature operating range
- Excellent selectivity, able to receive its signal while rejecting others
- Clean, low distortion recovered audio
- Noise-based squelch circuit does not open receiver in high radio noise environments, such as near computers

## **POCSAG Decode**

The FC Controller can decode POCSAG messages when equipped with a radio receiver. All POCSAG messages contain a Receiver Identity Code (RIC) or CAP code. This indicates which unit or group of units a message is intended for. The unit must have its RIC configured before it responds to a message.

The Standard Format for Federal Signal POSAG codes consists of a five-character numeric message preceded by an open bracket “[” and followed by a closed bracket “]” for a total of seven characters. The first three numbers are the unit number. Any unit number less than 300 activates only that unit number. A unit number of 300 activates all units. Unit numbers of 301 to 316 activate all units in zones 1 to zone 16, respectively. The unit must be configured for the zone in which it is to function.

The last two numbers in the message are the function number (01 through 06), which activates functions 1 through 6. Function numbers 96, 97, 98, and 99 activate Poll All, Reset, Quiet Test, or Cancel, respectively.

## Ordering Products

For special orders, contact Federal Signal. See “Getting Service” on page 33 for contact information. The following tables list the standard FC models.

**Table 1 FC Models**

FC Model	Description
FC	Controller with FC Control Board
FCH	Controller with one-way High-band (150-172 MHz) radio receiver
FCU	Controller with one-way UHF band (450-470 MHz) radio receiver

**Table 2 Optional Accessories**

Part Number	Description
FSPWARE	Federal programming software (Non-digital applications)
FS-PL1	Tone Coded and Digital Coded Squelch Decode
PBS-4	Outdoor NEMA 4 Pushbutton Panel
2001-AC	208-240 Vac Transformer Rectifier provides 48 Vdc to a NEMA4 enclosure with contactors for the Eclipse8 or 2001-130 siren head
RC2W-120 (Model 2)	Motor starter/cabinet NEMA 4 120 Vac
RC2W-240 (Model 2)	Motor starter/cabinet NEMA 4 240 Vac
2-120	Model 2, 120 VAC/DC Omni-directional Siren
2-240	Model 2, 240 VAC/DC Omni-directional Siren
PMS	Model 2 Pole Mount

**Table 3 Antenna**

Model	Description
RP164	Antenna Grounding Plane 132-928 MHz
AMB-RP164	Bracket, Antenna Mounting
10A3	Cable, ANT, 25 feet,VCR (used for RP164)
10A5	Cable, ANT, 35 feet,VCR (used for RP164)
10A6	ANT ARC 136-512 MHZ 24 inches (mounted directly on the cabinet)

**NOTE:** Standard antenna connections are PL259 connector.

# Specifications

## Control Board Specifications

**Table 4 Electrical Requirements**

AC Input Voltage (switchable)	120 or 240 Vac +/- 10%, 50-60 Hz
AC Current Draw	< 100 mA
DC Input Voltage	15-75 Vdc (JP5 9/10) 11-15 Vdc (JP5 11/12)
Current draw	200 mA maximum at 48 Vdc 400 mA maximum at 12 Vdc

**Table 5 Serial Communications**

<b>Serial Communications</b>	
Serial Port Configuration	RS232C 1200,N,8,1,DCE

**Table 6 Environmental and Dimensions**

<b>Environmental</b>	
Operating Temperature	-22°F to 149°F (-30°C to +65°C)
Humidity	0-98% non-condensing
Dimensions (H x W x D)	13.5 x 10 x 6 inches (34.3 x 25.4 x 15.3 cm)
Net Weight	12 lb (5.4 kg)
Shipping Weight	13 lb (5.9 kg)

**Table 7 Two-Tone Sequential**

Frequency range	282-3000 Hz
Tone timing	First Tone – 0.5 second (minimum) Second Tone – 0.25 second (minimum) 8 seconds maximum for both tones
Intertone Gap	400 ms (maximum)
Tone Accuracy	+/- 1.5%
Tone Spacing	5.0% preferred, 3% (minimum)

**Table 8 Single Tone**

Frequency range	282-3000 Hz
Tone timing	0.5 second - 8 seconds (maximum)
Tone Accuracy	+/- 1.5%
Tone Spacing	5.0% preferred, 3% (minimum)

## Inputs and Outputs

**Table 9 Relay Outputs**

Four relay outputs	Normally Open or Normally Closed
Contact Rating	8 A at 120/240 Vac 5 A at 24 Vdc

**Table 10 Audio Output (Optional)**

Output Voltage	$> 2 V_{p-p}$
Maximum Load	8 ohms
Total Harmonic Distortion	$< 10\%$ at 1 kHz sine wave

**Table 11 Remote Activation Inputs**

Quantity	4
Input Type	Dry contact closure $< 1 k \Omega$ (Requires $> 1$ second closure)

## For the FCH and FCU Models

**Table 12 RF Receiver Specifications**

Antenna Impedance	50 ohms, +/- 10 ohms
Frequency range	150-172 MHz, 450-470 MHz
Frequency stability over temperature range	$\leq 2.5$ ppm from $-30^{\circ}\text{C}$ to $+60^{\circ}\text{C}$
Spurious Response and Image Rejection	HB $\leq -70$ dBm UHF $\leq -70$ dBm (Measured per EIA-603, part 4.1.9)
Intermodulation Distortion Rejection	HB $\leq -70$ dBm UHF $\leq -70$ dBm (Measured per EIA-603, part 4.1.9)
Adjacent Channel Selectivity	HB $\leq -70$ dBm UHF $\leq -70$ dBm (Measured per EIA-603, part 4.1.6)
Sensitivity – 12 dB SINAD	$\leq 0.35 \mu\text{V}$ for 12 dB SINAD per EIA-603, Part 4.1.4
Sensitivity – 20 dB Quieting	$\leq 0.5 \mu\text{V}$ , 20 dB quieting
Squelch Sensitivity with 1 kHz tone at 3 kHz deviation	Minimum squelch setting = Open Squelch Maximum squelch setting = $< 29$ dB SINAD  Shall be set at the reference decode sensitivity (20 dB SINAD) Shall open and close in less than 250 ms per EIA-603, Part 4.1.13.2.4
Audio Output with 1 kHz tone at 3 kHz deviation	$0.8 V_{p-p} \pm 0.20 V_{p-p}$
Audio frequency response	300-3000 Hz, +/- 1 dB, with 6 dB per octave de-emphasis
Hum and Noise	-35 dB relative to full quieting signal with 1 kHz tone at 3 kHz deviation
Audio distortion with 1 Kc tone at 3 Kc deviation	$< 10\%$

## Signaling Format Specifications

**Table 13 DTMF**

<b>All timing in milliseconds</b>	
String length	3-12 standard DTMF characters
Mark/Space timing: Decoder Minimum Decoder Maximum Encoder	50 ms/50 ms (below 50/50 consult factory) 800 ms total mark/space timing per character 50 ms/50 ms mark/space timing
Space between Stacked codes, minimum	1.25 seconds

**NOTE:** Wildcard options for each of the DTMF strings via programming software. Optional fast DTMF 40 ms/20 ms via solder joint.

**Table 14 FSK**

Baud rate	1200 bps
Modem type	MSK (minimal shift key)
Mark frequency	1200 Hz
Space frequency	1800 Hz
Error checking	16 bit CRC

## Installation

### **⚠ DANGER**

**ELECTROCUTION HAZARD:** *Electrocution or severe personal injury can occur when making electrical connections, drilling holes, or lifting equipment. Therefore, experienced electricians should perform installation per national and local electrical codes and ordinances, including any state or local noise-control ordinances.*

## Siren Controller Installation

This section provides guidelines to aid you when using the FC Controller to activate a mechanical siren.

### **⚠ WARNING**

**SOUND HAZARD:** *The output level of this siren is capable of causing permanent hearing damage. Therefore, ALWAYS wear hearing protection when performing tests or maintenance on the siren.*

### **NOTICE**

**PROPERTY DAMAGE:** *Federal Signal recommends that all control devices be padlocked to discourage tampering and vandalism.*

### **NOTICE**

**STATIC-SENSITIVE DEVICE** *When servicing the board, avoid Electrostatic discharge by properly grounding yourself and the board.*

## **Electrical Code Compliance**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

**⚠ CAUTION**

***INSTALLATION PRECAUTIONS: Changes or modifications not expressly approved by Federal Signal could void the user's authority to operate the equipment.***

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used per the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio technician for help.

## **Preliminary**

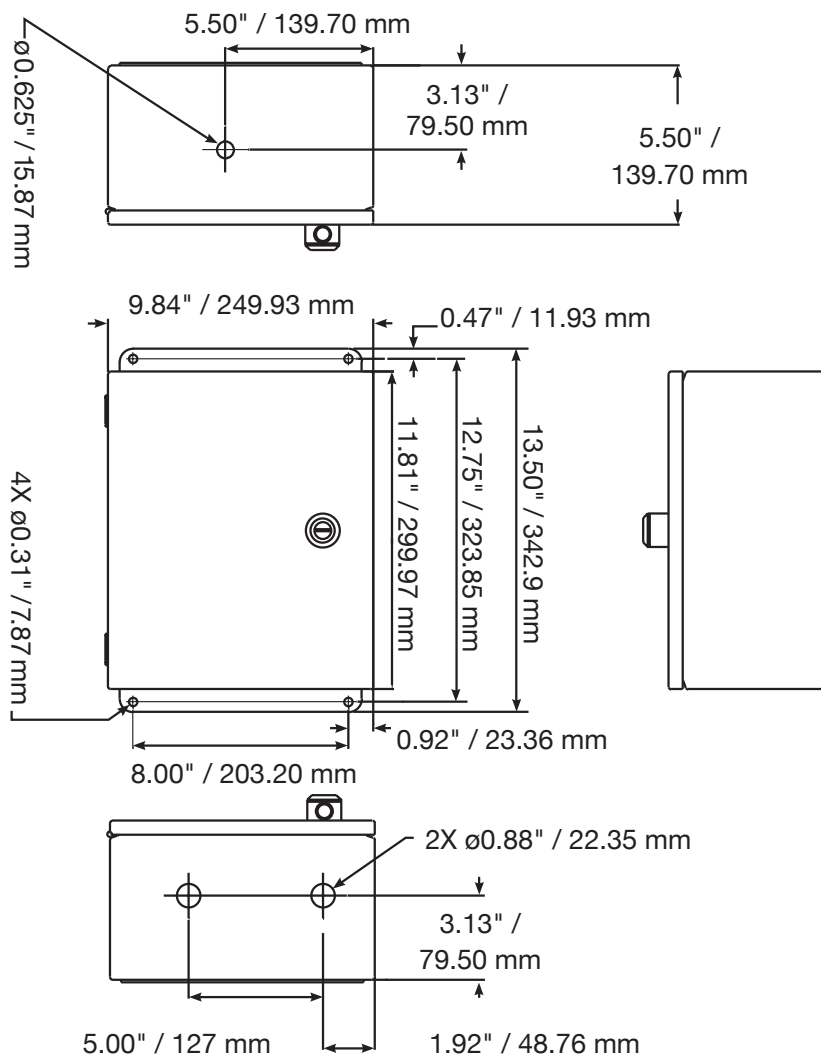
Carefully inspect the unit for signs of damage that may have occurred in transit. Should there be any evidence of physical damage to the unit or components, notify the carrier immediately stating the extent of the damage.

A typical installation showing the relative location of the controller is illustrated in Figure 3. There are numerous methods to use to mount the controller. In all cases, the installation must be rigid, secure, and free from physical shock or vibration.

If the controller is to be used in extremely hot climates, locate it out of the direct path of the sun. If the antenna is to be mounted directly to the controller cabinet, make sure the cabinet is mounted on the side of the pole facing the base station antenna.

The FC cabinet has four 5/16-inch mounting holes located on both the top and bottom mounting flanges that can be used to mount to a wall or other horizontal structure. In the bottom of the FC cabinet, two 1/2-inch conduit fitting knockouts are provided for AC power and siren control conduit connections. A ground stud is provided inside the FC cabinet at the bottom, which must be connected to earth ground.

Figure 1 FC Cabinet Dimensions



## General Mounting Guidelines

**NOTICE**

**INSTALLATION PRECAUTIONS:** Use good installation methods and follow local ordinances for mounting cabinet.

These general installation instructions are pertinent to all installations. Specific mounting methods and required installation materials are described in the next section.

- The FC cabinet has four 5/16-inch mounting holes located on both the top and bottom mounting flanges that can be used to mount to a wall or other horizontal structure.
- The total weight of the FC Controller Cabinet with batteries is listed in the Specifications section. It is important that the mounting surface and mounting method selected can safely sustain the weight of the assembly.

- Prepare the mounting surface for hanging the cabinet by predetermining the location of the mounting holes. Attach the cabinet to a wall or other substantial vertical surface.

If the mounting surface is not flat, the cabinet may require shimming to keep the cabinet square.

- Guidelines for various attachment methods to accommodate different wall types are described in the following section. Make provisions for spacing behind the cabinet when mounting to an exterior wall that is susceptible to condensation or other surface moisture.
- Lift the cabinet to the desired mounting height and lag to the wall using the prepared holes and anchors.

## **Installation Material List and Installation Guidelines**

The following material lists and guidelines describe basic installation details required to install the cabinet. This list varies depending on mounting methods, other options, local and national electrical codes, etc. Use the lists as reference guidelines only.

### **Concrete or Filled Cement Block Wall Mounting Guidelines**

**Table 15 Concrete or Filled Cement Block Wall Mounting Materials**

<b>Material Description</b>	<b>Purpose</b>	<b>Qty</b>
1/4 in x 2 in Pin/Sleeve/ Lock Washer/Nut Style Anchors	Anchor Bolts	4

To mount the cabinet on a concrete or filled cement block wall:

1. Mark the mounting hole locations on the wall for the cabinet.
2. Install the anchor bolts for the four cabinet corners according to the manufacturer's instructions.
3. Mount the cabinet to the wall.
4. Proceed to the following section.

**NOTE:** If the wall is not straight, use shims to ensure the enclosure maintains square and structural integrity.

### **Hollow Block Wall Mounting Guidelines**

**Table 16 Hollow Block Wall Mounting Materials**

<b>Material Description</b>	<b>Purpose</b>	<b>Qty</b>
1/4 in x 2 in Heavy Duty Toggle Bolts	Anchor Bolts	4

To mount the cabinet on a hollow block wall:

1. Mark the mounting hole locations on the wall for the cabinet.
2. Install the anchor bolts for the four cabinet corners according to the manufacturer's instructions.
3. Mount the cabinet to the wall.
4. Proceed to the following section



## Wood Stud Wall Mounting Guidelines

**Table 17 Wood Stud Wall Mounting Materials**

Material Description	Purpose	Qty
1/4 in x 1 in Lag bolts	Backboard and cabinet mounting bolts	8
2 ft x 2 ft x 3/4 in B/C or better plywood	Mounting backboard	1
Construction adhesive	Mounting backboard attachment	1

To mount the cabinet on a wood stud wall:

1. Locate the wall studs for attaching the mounting backboard to the wall. Attach the backboard to at least two studs.
2. Mark the wall stud location on the mounting backboard and drill four pilot holes for the lag bolts.
3. Apply construction adhesive to the back of the mounting backboard.
4. Attach the mounting backboard to the wall with four lag bolts.
5. Locate the mounting position of the cabinet on the mounting backboard.
6. Drill pilot holes for the lag bolts.
7. Mount the cabinet to the mounting backboard.
8. Proceed to the following section.

## Metal Stud Wall Mounting Guidelines

**Table 18 Metal Stud Wall Mounting Materials**

Material Description	Purpose	Qty
1/4 in x 2 in lag bolts	Cabinet mounting bolts	4
2 ft x 2 ft B/C or better plywood	Mounting backboard	1
#14 x 2 in metal stud screws	Backboard mounting	12
Construction adhesive	Backboard mounting	1

To mount the cabinet on a metal stud block wall:

1. Locate the wall studs for attaching the Mounting Backboard to the wall.
2. Mark the wall stud location on the mounting backboard and drill pilot holes for the #14 metal stud screws. Place three screws in each stud evenly spaced apart.
3. Apply construction adhesive to the back of the mounting backboard.
4. Attach the mounting backboard to the wall with #14 metal stud screws.
5. Locate the mounting position of the cabinet on the mounting backboard.
6. Drill pilot holes for the 1/4-inch lag bolts.
7. Mount the cabinet to the mounting backboard.
8. Proceed to the following section.

**Table 19 Suggested Installer Supplied FC Electrical Installation Material List**

<b>Material Description</b>	<b>Purpose</b>	<b>Qty</b>
NEMA 4 minimum if used outdoors.		1
30 A/250 V/ 2 Pole Solid Neutral/ Fused Disconnect with Ground Kit/ NEMA 1 Rating/ Lockable Cover Tang/ Lockable Operator	Optional Electrical Disconnect	1
1 A FRNR Fuse	Fuses for 120 V Service	1
0.5 A FRNR Fuse	Fuses for 240 V Service	2
12-14 AWG White Wire	AC Neutral from disconnect	8 ft
12-14 AWG Black Wire	AC Load from disconnect	8 ft
12-14 AWG Green Wire	Equipment ground from disconnect	8 ft
1/2 inch Seal Tight Conduit and Fittings	Electrical conduit from AC disconnect and separate conduit to interface with other equipment	Varies
Metal Ground Bushings	Equipment ground connections	2
Screws, appropriate to the mounting surface	Disconnect mounting	4
15 A Breaker	Service panel breaker serving unit	1
White Wire appropriately sized	AC neutral from breaker panel to disconnect	Varies
Black Wire appropriately sized	AC load from breaker panel to disconnect	Varies
Green Wire appropriately sized	Equipment ground from the breaker panel to disconnect	Varies
Conduit and fittings, appropriately type and size for particular installation requirements	Electrical conduit from the breaker panel to disconnect	Varies
6 AWG Stranded	Cabinet ground to earth ground for external antenna applications	Varies
18-26 AWG stranded wire pairs	Audio, Relay Output, and Remote System Operation Sense	Varies

**Figure 2 FC Control Board**

The following figure identifies the input and output connections on the control board.

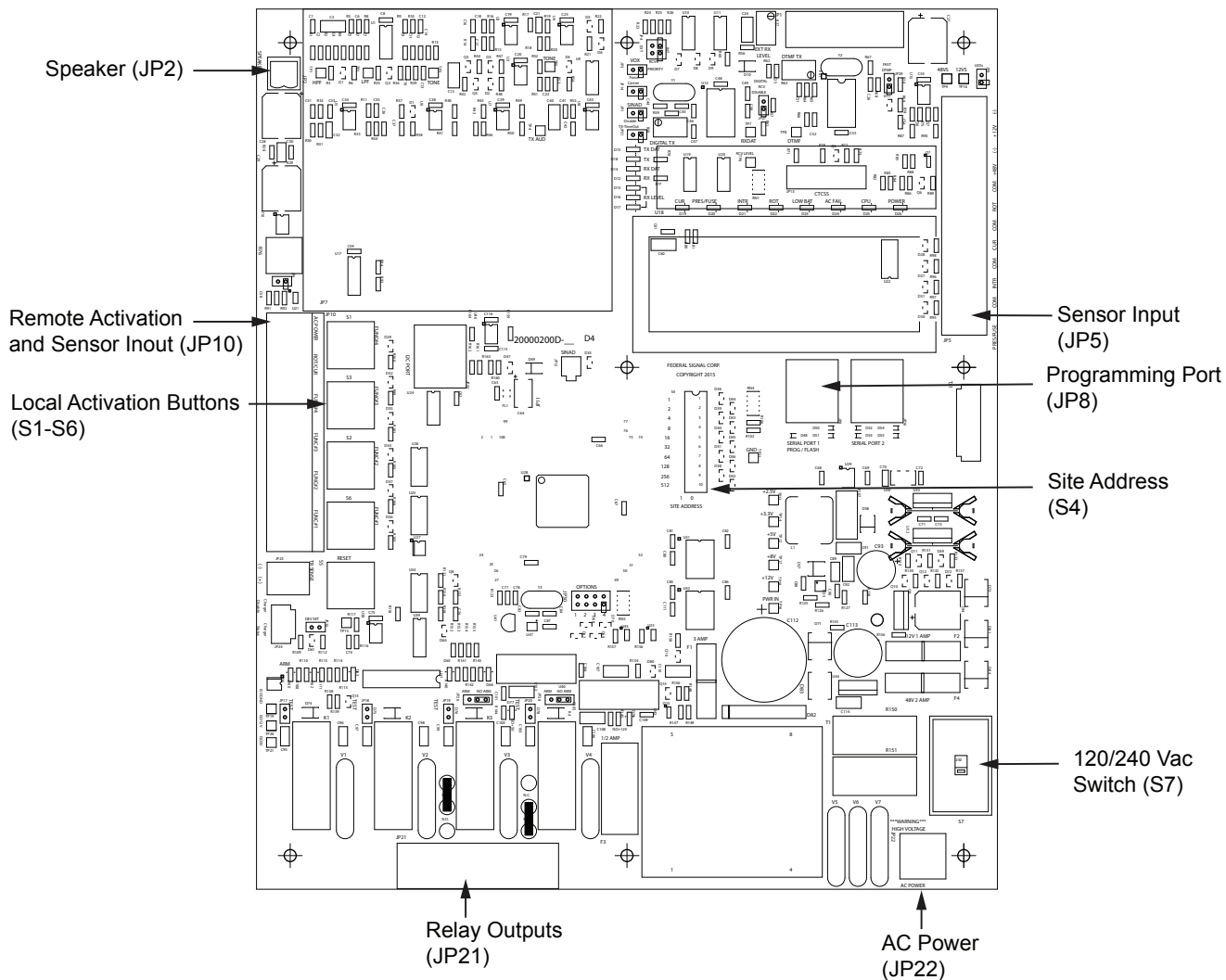
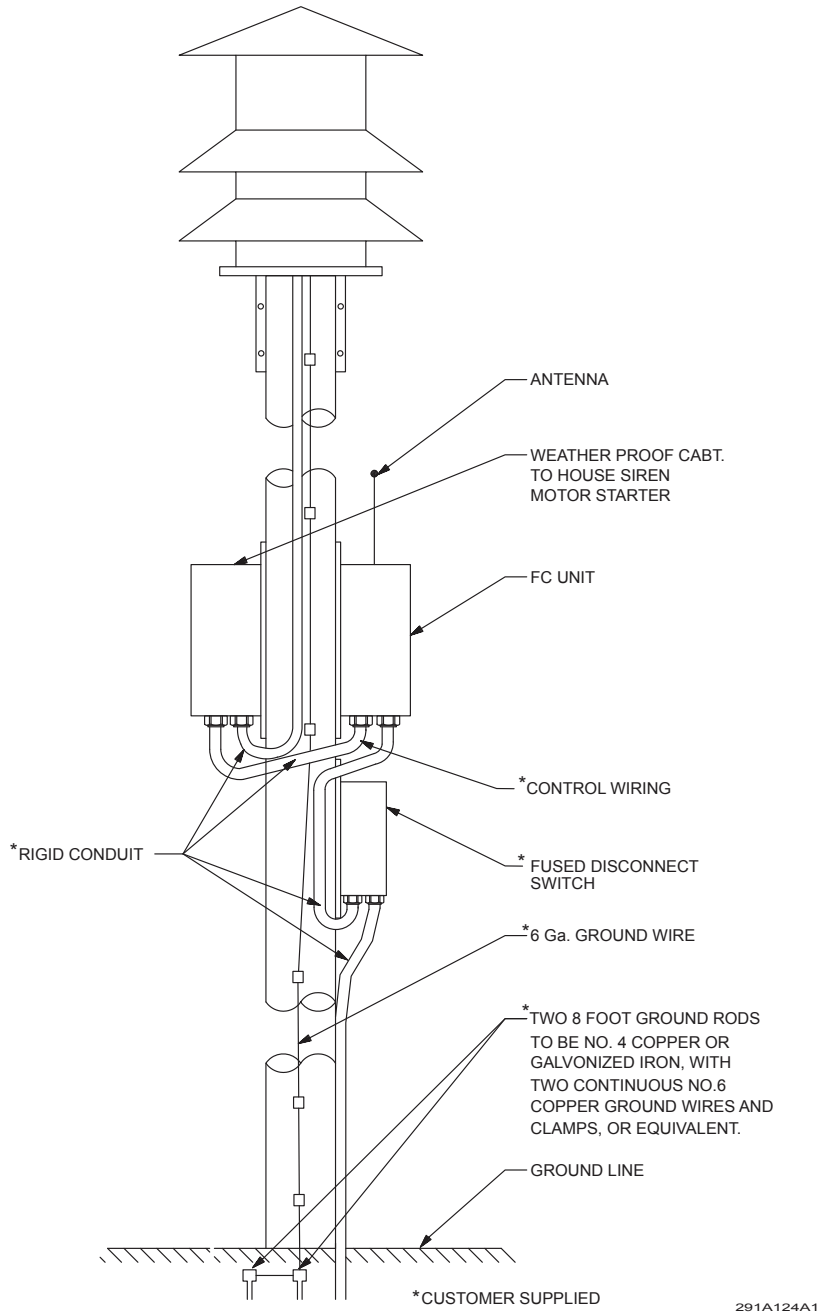


Figure 3 Typical FC Installation Example



## Installing the Antenna

### **⚠ DANGER**

***ELECTROCUTION HAZARD: To prevent electrocution or severe personal injury, install antenna away from power lines and install with proper grounding. Refer to section 810 of the National Electrical Code, ANSI/NAPA No. 70.***

A factory-installed, internally wired, antenna bulkhead adaptor is provided on the top side of the controller cabinet for ease of antenna cable interface. The bulkhead adaptor requires the installation of a male PL259 connector on the antenna cable for correct interface. It is essential that the installer follow all tuning (if applicable), installation and safety instructions provided by the antenna manufacturer.

For installation instructions on the Yagi and Omni Antennas, go to the Federal Signal's website.

## Electrical Connections

### **⚠ WARNING**

***INSTALLATION PRECAUTIONS: Install the siren electrical system in compliance with local electrical codes and NEC recommendations. Federal Signal also recommends that all user-installed conduit connections enter from the bottom of the cabinet. Disconnect all power and read all warnings at the beginning of this manual and before making connections.***

### **⚠ CAUTION**

***INSTALLATION PRECAUTIONS: The siren and control system must be solidly connected to an earth ground. If the siren is installed in a building, ground the system to a metallic object known to be grounded.***

***For pole mount installation, drive two ground rods separated by at least eight feet and into the ground by at least eight feet. Use a separate, continuous 6 AWG or larger wire from the siren frame to ground and from the cabinet of each siren control system to ground.***

## Connecting FC

To connect the FC:

1. Install two 1/2-inch user-supplied conduit fittings at the bottom of the FC cabinet.
2. Route 1/2-inch conduit (steel preferred) between a user-supplied fused disconnect switch and the conduit fittings in the bottom of the FC cabinet. Fuse the disconnect switch with a 1 ampere fast-acting fuse.
3. Follow the instructions included with the lightning protector (supplied with the controller) and install it in the AC service disconnect.

4. Set the AC input voltage selector switch located near the bottom right of the controller for either 120 or 240 Vac input voltage. Push the switch up for 120 Vac or down for 240 Vac. Route two 12 AWG wires between the fused disconnect and the AC input at JP22. (See Figures 4 and 5.)
5. Route a 6 AWG ground wire from the earth grounding rod to the FC Controller cabinet ground stud.
6. Route a 1/2-inch conduit between the conduit fittings on the bottom of the FC Controller cabinet and the siren motor starter cabinet, or alternatively to other equipment.

**NOTE:** The following wiring is for the RC2W motor starter. For the 2001-AC wiring, see the 2001-AC manual.

7. Route two 12 AWG wires between JP21 on the FC circuit board and the siren motor contactor as follows: (See Figures 4 and 5.)
  - Connect one wire between JP21-1 of the FC control and terminal 95 of the RC2W motor starter.
  - Connect one wire between JP21-2 and L1 of the RC2W motor starter.
8. If the siren is to be controlled remotely through a momentary contact closure, apply the contact closure to the appropriate input on JP10. The wire run from the contact to JP10 must not exceed 50 feet (15.24 meters). If longer wire runs are required, you can purchase a model TRC1020 for each function. The inputs on JP10 require 1-second contact closures.

**Figure 4 Contactor Wiring for Model 2 using 120 Vac**

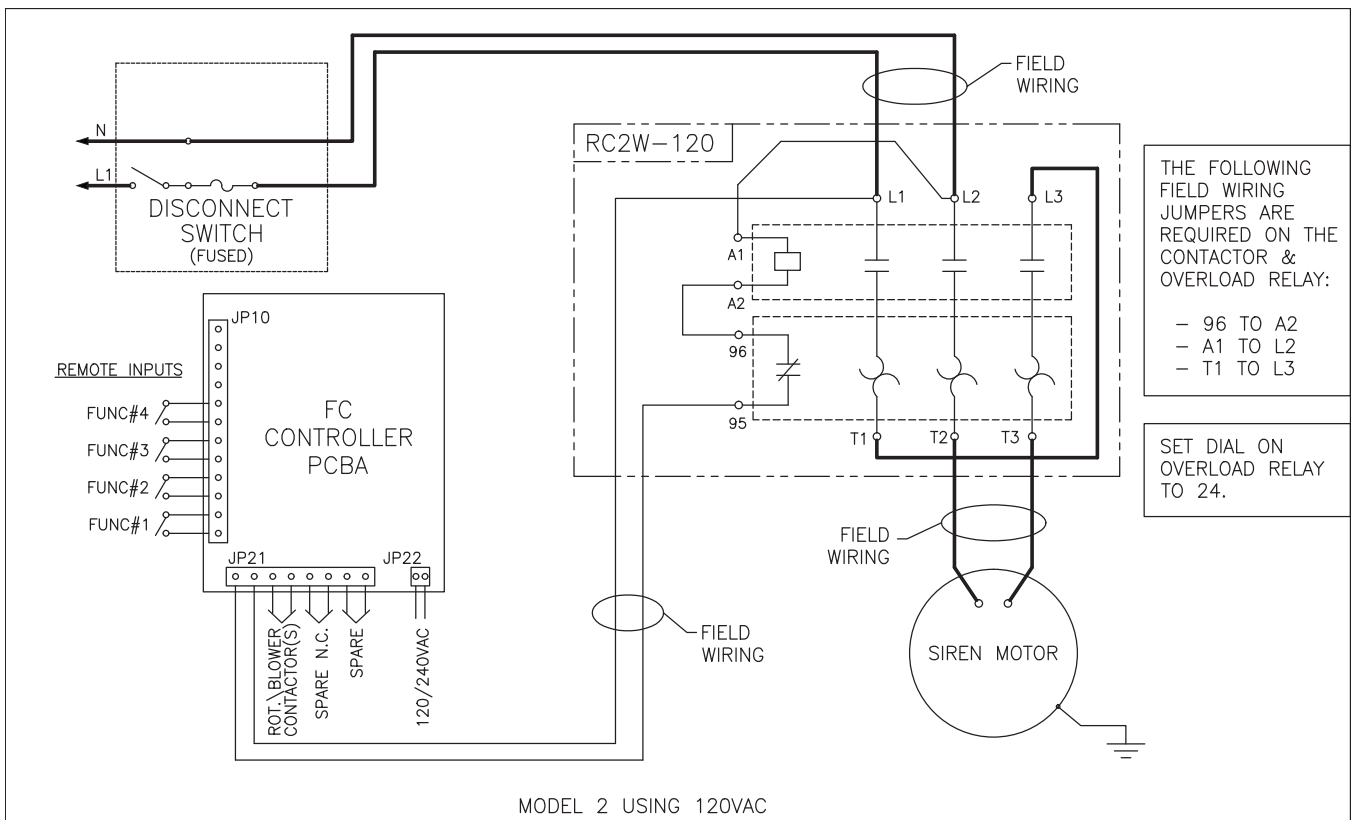
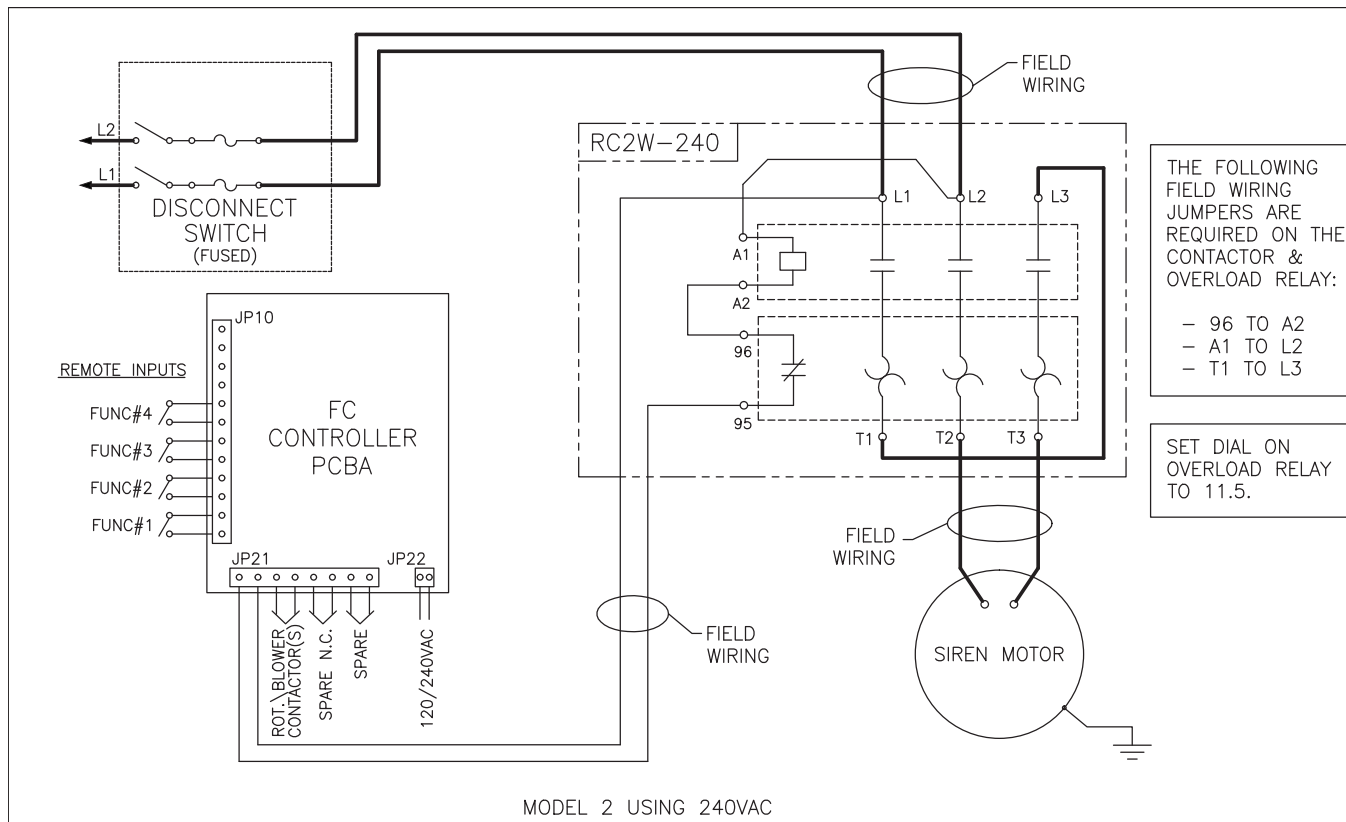


Figure 5 Contactor Wiring for Model 2 using 240 Vac



## Factors Affecting Radio Reception and Antenna Connection

### ⚠ WARNING

**CALIBRATION PRECAUTIONS:** *If the radio system is not installed and calibrated properly, the controller may not receive the activation signals. This may cause the siren to fail and not operate in an emergency, resulting in extensive property damage or death.*

### ⚠ CAUTION

**ACTIVATION CODE WARNING:** *Other local siren sites may have the same activation code. Take appropriate precautionary measures.*

### NOTICE

**CONNECTION WARNING:** *All antenna connections must be properly sealed.*

The radio network (transmitter, receiver and decoder) is the vital link to proper controller operation. Consider the following during installation.

- Individually evaluate all controller installations. Contact Federal Signal to discuss a suitable controller site location, the proper type and location of antenna and transmission line, and to answer any questions regarding the installation.
- Distance from the transmitter is not necessarily the only factor that determines signal quality. The effects of terrain and structures can result in weak or variable reception at a given siren site.

It is desirable to evaluate each proposed site under various weather conditions using a portable receiver. Distance of a few hundred feet can often make a significant difference in signal strength.

- Connect the antenna or antenna cable to the SO-239 connector.
- Mount the antenna on the side of the pole facing the base station location. Mount as high as possible. The tip of the antenna should, when possible, be no closer than three feet from any metal siren mounting brackets.

**NOTE:** For installation instructions on the Yagi and Omni Antennas, go to the Federal Signal's website.

- In general, use a gain antenna if a site must be located in a known weak signal area.
- The following paragraphs pertain to the operation of the transmitter, tone-generating equipment, and other equipment used at the base station.
  - Tone generating equipment used in a siren system requires frequency stability within  $\pm 1\%$  and a total distortion of less than 5%. Tone duration must be compatible with the siren tone-timing scheme selected by the user.
  - It is important to arrange the base station keying circuitry so that the microphone is disconnected when the tones are transmitted to prevent microphone noise from distorting the signal.
  - To ensure good frequency response, the output of the tone encoder must be properly matched to the transmitter. Adjust the transmitter according to the manufacturer's instructions to provide the proper level of deviation. The typical deviation level for narrowband is 1.5 kHz, and if using PL/DPL, add 375 Hz. If using wideband, such as EAS (NOAA), the modulating deviation is 3 kHz.

## Aligning the Receiver

To align the receiver:

1. In the RF receiver, insert jumper JP1 for narrowband receive.
2. Inject a 100  $\mu\text{V}$  signal into the receiver and modulate the signal with a 1 kHz tone at a 1.5 kHz deviation.
3. Monitor the receive audio at JP7 pin 7 on the FCM+ board. With an oscilloscope, carefully adjust coil L1 for the most level.
4. Set jumper JP1 on one pin for wideband receive.
5. Set the modulating deviation to 3 kHz.
6. The level at JP7 pin 7 should be 800 mVp-p +/- 200 mV.
7. Connect a SINAD meter to TP6 on the FCM board and reduce the level of the RF signal from the service monitor until the SINAD meter reads 12 dB.
8. Slowly adjust variable cap C46 (rev D or earlier), C39 (rev F), or C53 (rev G or later) for best SINAD. This is less than 0.35  $\mu\text{V}$  for all bands.
9. With the RF level at 12 dB SINAD, monitor Carrier Detect LED on the FCM board and adjust the squelch pot until the LED just comes on.



10. Configure the RF receiver for narrowband or wideband. For narrowband, JP1 should be present (typical). If used for wideband, such as EAS (NOAA), remove jumper JP1, making the RF receiver wideband.

## TCS/DCS Programming

Typically, the optional TCS/DCS decoder FS-PL1 comes preprogrammed from the factory. If field reprogramming is desired, see the Tone and Digital Coded Squelch Module FS-PL1 manual.

## Operations

### FC Controller Board Indicators

The following table provides a description of LED indicators on the FC Controller Board.

**NOTE:** The default FC does not come with sensors. The following sensor LEDs are ignored: pressure, intrusion, current, rotation, low battery, AC power fail.

**Table 20 FC Controller Board Indicators**

Component Number	Description	Indication
D25	CPU LED	Microprocessor Heartbeat
D12	RECEIVE LED	RF Carrier Indicator on with carrier
D18	TRANSMIT LED	Transmit
D60	RELAYS ARMED	Power to relays on
D62	RELAY #1 LED	Relay #1 closed
D63	RELAY #2 LED	Relay #2 closed
D65	RELAY #3 LED	Relay #3 closed
D66	RELAY #4 LED	Relay #4 closed, or PA mode
D20	PRESSURE LED	Pressure Sensor input
D21	INTRUSION LED	Intrusion Sensor input
D19	CURRENT LED	Current Sensor input
D22	ROTATION LED	Rotation Sensor input
D23	LOW BATTERY LED	Low Battery Sensor (internal)
D24	AC POWER FAIL LED	AC Power Fail Sensor (internal)
D26	POWER LED	12 V Operating Power
D79	ISO 12V	Isolated 12 V power
D77	ISO 5V	Isolated 5 V power
U18	LCD Display	Displays Function Counters, Decodes and Software Revision

## Connectors, Selections, and Switches for the FC Controller Board

The following tables provide descriptions of the FC Controller Board connectors, selections, and switches.

**Table 21 Configuration Jumpers on the Control Board**

JP1	<p>SINAD (optional)</p> <p>1 Receiver module carrier detect, short to pin 2 when using SINAD board along with both sides of JP4</p> <p>2 External transceiver carrier detect</p>
JP2	<p>Test Speaker/Audio Out (See R76 for output level adjustment)</p> <p>1 0 to 2 V<sub>p-p</sub> Audio Source: Receiver Audio during P.A. functions Siren Audio during Electronic Siren functions</p> <p>2 Ground</p> <p>Speaker Output. Passes radio audio or generates warning sounds, which are routed to the speaker output JP2</p>
JP3	<p>Short For VOX Carrier Detect</p> <p>1 and 2 Short together for VOX carrier detect (Not used in a one-way systems.) Jumper 1 and 2 to provide VOX carrier detect for radios that do not provide carrier detect.</p>
JP4	<p>Test Speaker</p> <p>1 and 3 Short pins 1 and 3 to give priority to the external transceiver 2 and 4 Short pins 2 and 4 to give priority to the internal receiver.</p> <p>With no shorting jumper, the first carrier detect has priority. Short both sides when using SINAD board along with JP1.</p> <p>Receiver Priority (For use with two-way systems.) Jumper JP4 sets the priority if an external transceiver and an on-board receiver are both used. The receiver with priority can interrupt the other receiver, and its audio passes through to the rest of the circuits in the controller. The receiver with priority cannot be interrupted. If neither receiver is given priority, then whichever receiver asserts carrier detect first will pass through, and the other receiver will not be able to interrupt it.</p> <p>If the EXT side is jumpered, then the external transceiver has priority.</p> <p>If the INT side is jumpered, then the on-board receiver has priority.</p> <p>If both sides of JP4 are jumpered, then the two receive audio signals are mixed together. This is done if the SINAD option is used as it allows receive audio from the external transceiver jack to pass through to the on-board receiver connector to feed the SINAD option board. JP1 must also be jumpered when the SINAD option is installed.</p>

JP5	<p>Sensor Inputs (#1 at left edge)</p> <p>1 Pressure sensor input, dry Contact closure &lt; 1 K (Not used in a one-way system.)</p> <p>2 ISO Ground</p> <p>3 Intrusion sensor input, dry Contact closure &lt; 1 K (Not used in a one-way system.)</p> <p>4 ISO Ground</p> <p>5 Current sensor input, dry Contact closure &lt; 1 K (Not used in a one-way system.)</p> <p>6 ISO Ground</p> <p>7 Rotation sensor input, dry Contact closure &lt; 1 K (Not used in a one-way system.) For legacy hall effect sensor in the 2001SRN.</p> <p>8 ISO Ground</p> <p>9 48 Volt input, 15-75 Vdc</p> <p>10 Ground</p> <p>11 12 Volt input, 11-15 Vdc</p> <p>12 Ground</p>
JP6	<p>Speaker Mute gate bypass</p> <p>1 and 2 Short pins 1 and 2 to bypass speaker mute gate, allow monitoring of radio channel with a local speaker</p> <p>The receiver audio coming out of JP2 is normally kept turned off until an activation signal has been received. Jumpering JP6 turns the receiver audio on all of the time. Jumper if you want to listen to the receive channel all the time.</p>
JP7	<p>Receiver Module for a one-way receiver</p> <p>The receiver module (JP7) is for receiving high-band VHF or low-band UHF signals to activate the FC controller when a two-way system is not required.</p>
JP8	<p>Serial and FLASH programming Port</p> <p>The RS232 serial port is used to transfer new code into the FC controller and configure the FC controller's activation codes and functions.</p>
JP9	<p>LEDs on with Intrusion</p> <p>1 and 2 Short pins 1 and 2 to disable LEDs when the Intrusion switch is closed</p> <p>When JP9 is shorted, the LED lights on the board turn off when the door is closed to reduce the current draw.</p> <p>Uses less power for Solar powered systems.</p> <p>Intrusion switch is only present on two-way systems.</p>

JP10	<p>Remote Activation and Sensor Inputs (#1 at left edge of connector)</p> <p>1 Spare Sensor Input #2, dry Contact closure &lt; 1 K <b>NOTE:</b> Typically used for transformer rectifier or AC sensor.</p> <p>2 ISO Ground</p> <p>3 Spare Sensor Input #1, dry Contact closure &lt; 1 K <b>NOTE:</b> Typically used for rotation sensor.</p> <p>4 ISO Ground</p> <p>5 Remote Activation Input #4, Activates Functions under code 4, dry Contact closure &lt; 1 K</p> <p>6 ISO Ground</p> <p>7 Remote Activation Input #3, Activates Functions under code 3, dry Contact closure &lt; 1 K</p> <p>8 ISO Ground</p> <p>9 Remote Activation Input #2, Activates Functions under code 2, dry Contact closure &lt; 1 K</p> <p>10 ISO Ground</p> <p>11 Remote Activation Input #1, Activates Functions under code 1, dry Contact closure &lt; 1 K</p> <p>12 ISO Ground</p> <p>You can activate the first four pre-programmed functions locally through the buttons, on the FC Controller Board, or remotely by grounding one of the landline activation inputs at JP10 for at least one second. The remote inputs are protected by limiting diodes and cannot exceed 5.1 Volt. JP10 is four contact closure activation inputs with two spare sensor inputs.</p>
JP11	<p>Used for special software applications</p> <p>1 and 2 Normally Jumpered</p> <p>3-8 Not used</p> <p>9 and 10 Normally Jumpered</p>
JP12	<p>SINAD Connector for engineering use only</p> <p>JP12 is used in special applications only.</p>
JP13	<p>CTCSS Encoder/Decoder (FS-PL1)</p> <p>The Tone Coded Squelch/Digital Coded Squelch board is a small plug-in board to add to existing products and provides decoding of Tone Coded Squelch (CTCSS) and Digital Coded Squelch (DPL) Signals. See the Tone and Digital Coded Squelch Module (FS-PL1) for more information.</p>
JP14	<p>Force Carrier Detect (Not used with one-way)</p> <p>1 and 2 Short to force carrier detect on</p> <p>Some radios do not provide a carrier detect signal to inform the FC controller that a receive signal is coming through. Jumpering JP14 forces the carrier detect to be active all of the time, allowing the FC controller to monitor the receive audio.</p>
JP15	<p>Short To Set Deviation (Not used with one-way)</p> <p>1 and 2 Short causes unit to transmit for setting deviation</p> <p>Shorting JP15 causes the FC controller to transmit a tone for setting the deviation of the transmitter attached.</p>
JP16	<p>I<sup>2</sup>C Port (Not used)</p>

JP21	Relay Outputs (#1 at left edge of connector) 1 Relay 1, Common 2 Relay 1, Normally Open Contact 3 Relay 2, Common 4 Relay 2, Normally Open Contact 5 Relay 3, Common 6 Relay 3, Normally Open Contact (Normally Closed when JU1 is shorted, default) 7 Relay 4, Common 8 Relay 4, Normally Open Contact (Normally Closed when JU2 is shorted) There are four relay outputs on the FC Controller Board, which are controlled by the microprocessor. The relays provide isolation and are spike protected to prevent voltage spikes from affecting the unit. As the relay coil is energized, the outputs close and the associated LED lights. The FC Controller Board comes standard with four DPST relays.
JP22	AC Power Input (Set S7) 1 and 2 120 or 240 Vac JP22 is the AC Power Input.

## Switches

Switches provide local activation via on-board button, master reset, site address, and AC voltage selection.

**Table 22 Switches**

S1	Local Activation #4 Press and hold for 1/2 second, Activates Functions under code 4
S2	Local Activation #2 Press and hold for 1/2 second, Activates Functions under code 2
S3	Local Activation #3 Press and hold for 1/2 second, Activates Functions under code 3
S4	Site Address Switch Sets units site number
S5	Processor Reset
S6	Local Activation #1 Press and hold for 1/2 second, Activates Functions under code 1
S7	120/240 Vac Selector switch

## Speaker Output

You can use the speaker output at JP2 to monitor received audio, route remote P.A. or provide a signal out when the tone generator option is used. You can adjust speaker output up to  $2.0 V_{p,p}$  into an 8-ohm load using R76.

**Table 23 Speaker Output**

R76	Test Speaker output level set
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### Radio Adjustment (Not used with one-way)

If a two-way radio is connected to the Transceiver Interface Connector P1, radio deviation level adjustments need to be completed using the potentiometers listed below. For the radio deviation level adjustment procedure, see the DCFCTB manual.

**Table 24 Radio Adjustment**

R27	External transceiver receive audio set to $1 V_{p-p}$ at TP6
R58	MSK modem transmit deviation level set
R63	DTMF transmit deviation level set

### Assigning Site Address (S4)

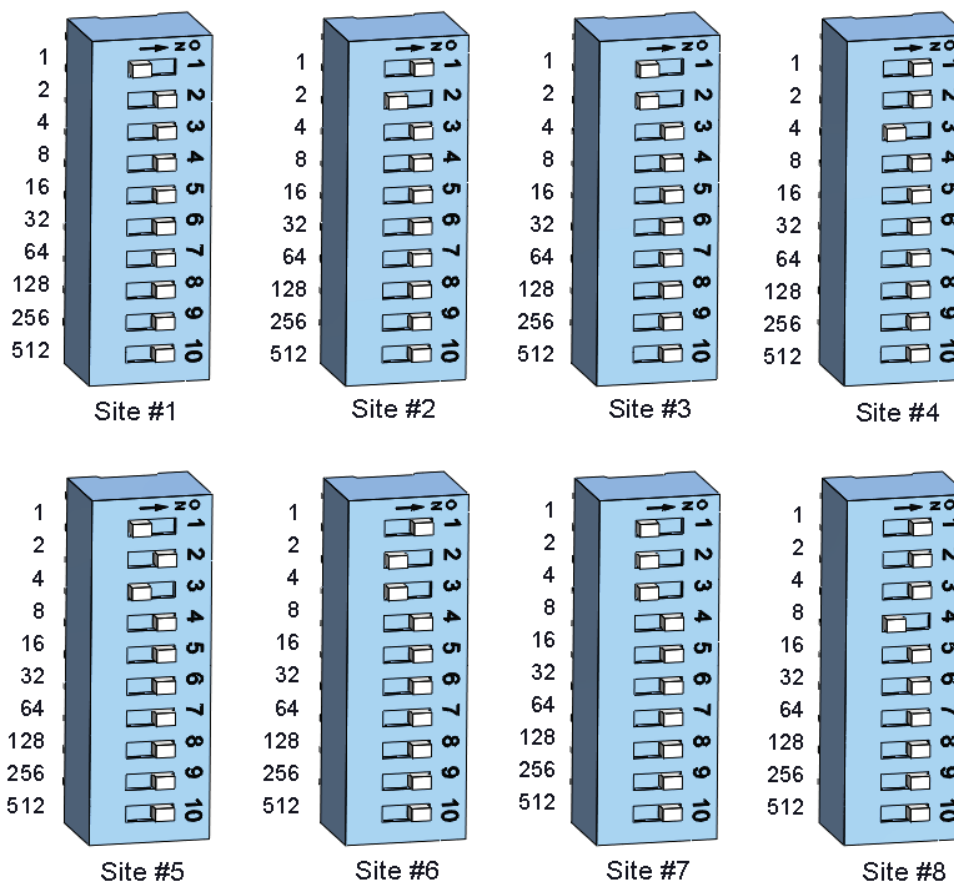
The site address switch gives each FC controller in a two-way system its unique unit number.

For use with Commander®: For the siren to report back with its identity, define the site address by setting DIP switches located on the board. The DIP switches have values of 1, 2, 4, 8, 16, 32, 64, 128, 256, 512. Add appropriate DIP switch values to define the site number address.

#### Example

To define the board for Site #1, toggle the first DIP switch to the left. All other DIP switches are to the right. For Site #2, toggle the second DIP switch to the left. For Site #3, toggle the first and second DIP switch to the left. For Site #4, toggle the third DIP switch to the left. For Site #5, toggle the first and third DIP switch to the left. Continue this method to define other site number addresses.

Figure 6 Setting the Switch Number Example



Switch number	1	2	3	4	5	6	7	8	9	10
Binary number	1	2	4	8	16	32	64	128	256	512

Example: Switch numbers 1, 2, and 3 are binary numbers 1, 2, and 4.

Add 1 + 2 + 4 = 7; 7 is the unit address.

**NOTE:**

- Set site address to one to program controller card with firmware (HEX code).
- To program a non-digital unit using FSPWARE Software, set site address to one. When programming is completed, change the DIP switch setting to the actual site address.
- The site address is stored at power up of the controller. If the site address is changed, cycle all power to the card (battery and AC).
- For DTMF, 2 Tone Sequential Systems and MOSCAD only: The unit address is defined in the programming; therefore, all DIP switches shall be positioned all to the right.

## Terminal Strips, Jacks, and Controls

### Connectors and Jacks for optional RF Receiver

For the FCH and FCU units.

**Table 25 Jacks**

J1	Shield Ground
	Center Antenna RF Input
J2	Radio to FC Controller Connector

**Table 26 Squelch Controls**

R1	Squelch control The squelch control adjusts the squelch threshold level.
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## Programming

All functions of the FC Controller are programmable from a computer with an RS232 port using Federal Signal's FSPWARE programming software. The software allows configuration, uploading, and downloading of control programs.

Programming options include:

- Radio Receiver Frequency
- Single and Two-Tone Sequential Decode Tones and Tone Lengths
- DTMF Decode Digits
- EAS Events and Locations
- POGSAG messages
- Output Relay Timing Patterns

Up to six (6) control timing sequences may be programmed into the controller. Standard siren control timings can be chosen, or custom relay output timings can be designed. The control functions can be activated from any combination of six (6) Single Tone, Two Tone Sequential and/or DTMF tones. Timing sequences can also be initiated using the local buttons and contact closure inputs.

Configuration programs are stored in nonvolatile memory to ensure retention even during a complete power failure.

The Function Counter values, last decoded signal, and current software revision are scrolled across the built-in LCD display.



## Maintenance

### Testing

Federal Signal recommends periodic testing of these systems to ensure the operation is performing as expected. Users should define the appropriate schedule for testing. FEMA can be used to identify good practices for periodic testing requirements.

### Inspection

To inspect the controller:

1. Check the integrity of the installation. Make sure mounting, conduit, antenna, and connections are secure and sealed.
2. Check enclosure for signs of water entry or corrosion. Seal any leaks, and repaint any flaws in the painted finish.
3. Check contacts of the control relay(s). Replace relay(s) if contacts are excessively worn.
4. Confirm the CPU is flashing. (D48) If the LED is not flashing, the control board may be defective or missing power.
5. Test the controller for proper operation. Test all functions of the controller locally and via radio when applicable.
6. If the controller is not operating properly, check the power supply.
7. Check the power supply and AC for proper voltage.

## Replacement Parts

To order replacement parts, call Customer Care. See Getting Service.

**Table 27 Replacement Parts**

Description	Part Number
Antenna Cable	Q175902A-07
Bulkhead	Q124A056A
Control Board	Q2005263B (for systems before October 2018) Q20000200D (for systems shipped after October 2018)
Radio Receiver High Band	Q2005240G-02
Radio Receiver UHF Band	Q2005240G-03

## Getting Service

If you are experiencing any difficulties, contact Federal Signal Customer Support at 800-548-7229 or 708-534-3400 extension 7511 or Technical Support at 800-524-3021 or 708-534-3400 extension 7329 or through e-mail at [techsupport@fedsig.com](mailto:techsupport@fedsig.com). For instruction manuals and information on related products, visit <http://www.fedsig.com/>



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