FEDERAL SIGNAL
Safety and Security Systems

DCB, DCFCB, and DCFCTB Models

Battery Operated Mechanical Siren Control System

Description, Specifications, Installation, Operation, and Service Manual

255360
Rev. L9 0620
Printed in U.S.A.
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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. 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 or call +1 708-534-3400.

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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 in order 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 effectively warn people indoors.
- 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 correct 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 injury. File these instructions in a safe place and refer to them periodically. Give a copy of these instructions to new recruits and trainees. Also give a copy to anyone who is going to service or repair the siren.

Installation and Service

- Electrocution 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 in accordance with 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 injury. File these instructions in a safe place and refer to them periodically. Give a copy of these instructions to new recruits and trainees. 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 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.

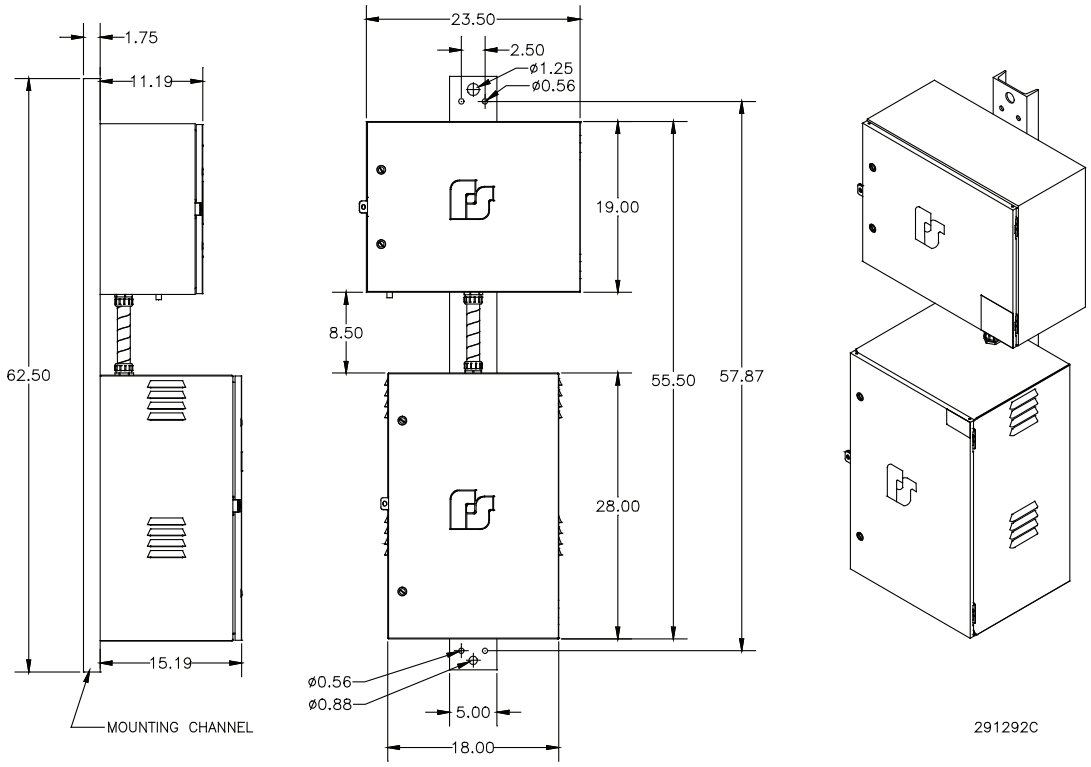
Pay careful attention to notices located on the equipment.

General Description

Introduction

This manual describes the features, specifications, technical description, installation, operation, maintenance, and options of the Federal Signal two-way controller (model DCFCTBD). Federal Signal DCFCTBD siren controllers are two-way digital, battery-operated/back-up and status monitoring systems for use with the Federal Signal 2001-130, Equinox, 508-128, and Eclipse8 sirens.

Figure 1 DCB, DCFCB, and DCFCTB Battery and Control Cabinets



Overview

The DC Series Siren Control System contains the following components:

- Aluminum Control Cabinet and Battery Cabinet (optional 304 or 316 stainless steel cabinets)
- 48 Vdc battery charging system
- Motor Contactors
- Fusing

If required, the antenna system is not included with the radio controller models. The appropriate directional or omni-directional antenna system must be ordered separately.

DCB Model

The DCB controller includes the following:

- Control Cabinet and Battery Cabinet
- 48 Vdc charging system
- Contactors (Chopper and Rotator)
- Fusing
- DIN rail terminal block
- Battery disconnect switch
- Wiring for components

DCFCB Model

The DCFCB controller includes all the components of the DCB controller plus an FC control board that can be equipped with a one-way receiver. IP board and landline board is optional. The following lists the DCFCB part numbers.

Table 1 DCFCB Models

Part Number	Description
DCFCB	Controller with FC Control Board, radio not included
DCFCBH	Controller with FC Control Board and High Band 148-174 MHz radio
DCFCBU	Controller with FC Control Board and UHF Band 403-470 MHz radio

For special orders contact Federal Signal. See “Getting Service” on page 69 for contact information.

DCFCTB Model

The DCFCTB controller includes all the components of the DCB controller plus additional wiring for two-way status monitoring of the DC Cabinet. The DCFCTB can be equipped with a two-way radio transceiver. IP board, landline board, and a one-way receiver are all optional. The following lists the standard DCFCTB part numbers.

Table 2 DCFCTBD Models

Part Number	Description
DCFCTBD	Two-way Controller with FC Control Board, radio not included
DCFCTBDH	Two-way Controller with FC Control Board and High Band 148-174 MHz radio
DCFCTBDU	Two-way Controller with FC Control Board and UHF Band 403-470 MHz radio
DCFCTBD-IP	Two-way FC Controller, IP-enabled

For special orders contact Federal Signal. See “Getting Service” on page 69 for contact information.

Table 3 Accessories

Description	Part Number
Federal programming software (Non-digital applications)	FSPWARE
Commander® Software System, *10, 25, 255, or 512 Site License	SFCD*
240 Vac operation	2001TRBP
Activation system	SS2000+
Solar powered option	Contact Federal Signal
Antenna	Contact Federal Signal

Control/Battery System

The Control/Battery System consists of two cabinets, which are channel mounted for ease of installation. (See “Figure 1 DCB, DCFCB, and DCFCTB Battery and Control Cabinets” on page 12.) The upper NEMA 4 cabinet houses the necessary electronics and controls for producing the siren signals, and the charging system for the four 12-Volt batteries.

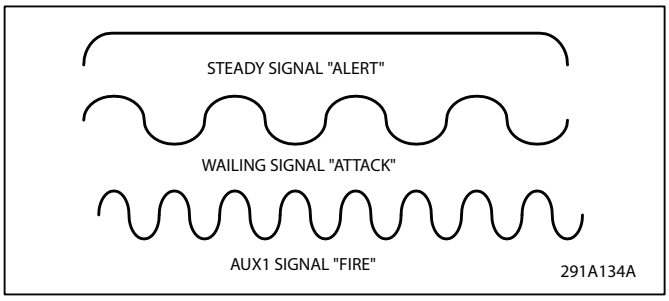
The lower vented NEMA 4X style enclosure houses four user-provided rechargeable batteries with optional lead-acid, AGM, or gel batteries. The lower and upper cabinets are interconnected through Liquid-Tight conduit, which is sealed to prevent harmful vapors from entering the control area. The four batteries are connected in series to provide 48 Vdc operating power to the siren, while the charger in the upper cabinet operates on 120 Vac to keep the batteries charged. This arrangement continues to provide power to the siren in the event of a power failure. The controller works primarily off the AC input voltage. In the event of an AC power failure, the controller automatically obtains power from a 48 V to 12 V DC-to-DC converter powered by the four 12 V batteries.

DCB and DCFCB Controller

The DCB and DCFCBs are one-way controllers. They have separately fused circuits to protect the siren controller. Two AC power fuses (F1 and F2) protect the charger and optional battery warmers respectively. The main siren motor is protected by a 200 A DC fuse. An in-line fuse connected to K1 fuses the rotator motor. The contactor coils are fused with in-line fuses. The charger output is protected with in-line fuses. (See “Figure 5 Battery Positioning and Wiring” on page 42, “Figure 12 DCB Wiring Diagram” on page 73 and “Figure 13 DCFCB Wiring Diagram” on page 74.)

The Models DCB and DCFCB siren controllers are capable of producing a steady signal, wailing signal, and a fast wail or fire signal. The steady signal is frequently used as a civil defense “Alert” signal. The wailing signal is often used as a civil defense “Attack” signal. The fast wail or fire signal is often used to summon the local fire department. You can use any of the signals for any desired application. These signals are shown graphically in the following figure.

Figure 2 DCB and DCFCB Signal Characteristics



One-Way Radio Control

You can remotely activate the siren by a radio signal when an optional radio receiver/ decoder is incorporated with the DCFCB System. The advantage of radio control activation is that control lines are not required between the siren control site and the siren location. For units equipped with the optional integral radio receiver, the RF Frequency configuration parameter sets the frequency of the radio channel. Changing this parameter from its factory setting requires re-alignment of the radio for maximum performance. The value entered must fall within the range specified for the receiver band equipped.

DCFCTB Controller

The DCFCTBs are two-way control and status monitoring siren controllers. The units interface to an off-the-shelf, two-way radio transceiver and communicate to a base control unit through either DTMF or FSK signaling depending on the model purchased.

The controllers decode any combination of Single-Tone, Two-Tone Sequential, DTMF, EAS, POCSAG or FSK for activation. This makes the two-way controller compatible with virtually any existing siren control system.

The digital DCFCTBs provide the capability of digital encoding and decoding with added security. Throughout this manual, all references to digital encoding, digital decoding, and FSK features and functions pertain only to the DCFCTBD series models. You can upgrade the DTMF version of the DCFCTB to the digital version DCFCTBD with a software update. All DCFCTB models come equipped with two useable relay outputs, which you can program independently to activate with various codes. Relay #3 is wired as a normally closed contact and is used to force the system into battery mode during a growl test (if applicable). Relay #4 is reserved for a low voltage disconnect.

There are also four inputs and four local buttons, which you can use to activate and cancel the unit.

The function codes, relay timing and optional warning sounds are programmed into the unit through a standard RS232 serial port.

The DCFCTBs contain six user programmable functions in addition to the five preset functions: ARM, DISARM, REPORT, QUIET TEST/GROWL TEST, MASTER RESET.

The DCFCTBs come equipped with the necessary sensors and wiring to provide information on the following areas of operation:

- AC Power Status
- Communications Status

- Low Battery Voltage Indication
- Siren Activation Current
- Intrusion into Control Cabinet and Battery Cabinet
- Siren Rotation
- Charger Status

The above information is returned in a Pass/Fail format. For example, if battery voltage is at proper operating level, then it is returned as “Battery Voltage OK.” This status information is made available for viewing at the Central Control Unit. This reporting feature greatly improves warning system reliability by quickly alerting operating personnel to problems that are encountered.

The integral LCD displays Function Counters, Decoded two-tone, DTMF, POCSAG, MSK Digital functions decoded, and the current software revision. The display constantly scrolls through the display items.

Two-Way Radio Control

The Federal Signal DCFCTBs are available in VHF and UHF models transceivers to provide two-way signaling capabilities. Other radio types are available. Contact Federal Signal Sales for additional information. Refer to the radio instruction manual for details concerning operation, specifications, and maintenance.

Features

The DCFCTB Controller has the following features.

- Two-way siren controller for 48 Vdc Sirens
- Two-way radio control and status monitoring
- AFSK Two-way signaling format
- Simultaneous single tone, two-tone sequential, and DTMF decoding
- Able to use multiple communication paths for redundancy
- Controls mechanical sirens, including models 2001-130, Equinox, 508-128 and Eclipse8
- Solar options available
- Buttons for local activation
- Landline, ethernet (IP) or radio control
- UL Listed for general signaling
- DNV Certified

Specifications

Controllers Specifications

Table 4 Input Power Requirements

Input Power Requirements	
AC Voltage	120 Vac +/- 10%, 50-60 Hz, 240 Vac +/- 10%, 50-60 Hz
Current draw	4.0 A at 120 Vac (nominal) 7 A with HTR4 option (not available with direct 240 Vac operation

Table 5 AC Power

2001TRB/TRBP/120246F-AC	**AC Primary Operation**
Input Voltage	208/220/240 Vac single phase
Input Current	30 A (approx.)
Output Voltage	46 Vdc/115 Vac (50 A service recommended, to be fused with 35 A Slo-Blow)
Output Current	120 A dc/10 A ac
Dimensions (H x W x D)	25.75 x 10.75 x 10.5 inches (654.05 x 273.05 x 266.7 mm)
Weight	150 lb (68 kg)

Table 6 Battery Warmer

HTR4: Battery Warmers	
Input Voltage	125 Vac single phase
Power Rating	80 watts each

Table 7 System Operating Power from the 4 Battery System

System Operating Power from the 4 Battery System	
Output Voltage	48 Vdc (nominal)
Operating Current during an activation	115 A (nominal)
Continuous Full Output Signaling Time	20 minutes (minimum)
Stand-by time on Reserve Battery Capacity that provides a full 3-minute siren activation	5 days minimum

Table 8 Charging System

Chargers (one for all four batteries)	
Charger Output Voltage	54.0 Vdc at 100 mA
Charger Output Current	4 A maximum

Recommended Batteries (user supplied)

Refer to Federal Signal Website (http://www.fedsig.com/) for current recommended batteries. Use of batteries other than those specified may degrade the operation of this product and void the warranty.

Table 9 Dimensions

Dimensions (H x W x D)	
Control Cabinet (NEMA 4)	19 x 23.5 x 11.19 inches (483 x 597 x 284 mm)
Battery Cabinet (Vented NEMA 4X)	18 x 28 x 15.19 inches (457 x 711 x 386 mm)
Overall (including channel)	62.5 x 23.5 x 16.94 inches (1588 x 597 x 430 mm)
Total Weight (including batteries)	364 lb (165 kg)
Shipping Weight (excluding batteries)	300 lb (136 kg)

Table 10 Environmental

Environmental	
Operating Temperature	-30°C to +65°C / -22°F to 149°F (with batteries maintained at -18°C minimum)
Humidity	0-98% non-condensing

Control Board Specifications

Table 11 Input Power Requirements

AC Power	
AC supply voltage (switchable)	120 Vac +/- 10%, 50-60 Hz or 220 Vac +/- 10%, 50-60 Hz
Current draw	0.2 A max.

Table 12 Backup Battery

Backup Battery	**DC Current Draw (Nominal 48 Vdc)**
FC PCBA	150 mA Standby (without two-way radio)
Two-way Radio*	Current draw is at the following: • Standby is at 350 mA • Active/Transmit is at 8 A nominal

*Typical current draw for a radio. Refer to radio manufacturer's manual for specific ratings.

Table 13 Serial Communications

Serial Communications	
Serial Port Configuration	RS232C 1200, N, 8, 1

Signaling Format Specifications

Six user programmable functions in addition to the five preset functions: ARM, DISARM, REPORT, GROWL TEST, and MASTER RESET. Wildcard options for each of the DTMF strings.

Table 14 Two-Tone Sequential

Frequency range	282 Hz - 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 15 Single Tone

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

Table 16 DTMF

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

Table 17 FSK

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

Table 18 EAS

EAS	Supports standard EAS codes and wildcards.

Table 19 POCSAG

POCSAG	Supports Binary frequency shift keying 512 Baud numeric messages.

Inputs and Outputs

Table 20 Relay Outputs

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

Table 21 Audio Output (Optional)

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

Table 22 Remote Activation Inputs

Quantity	4
Input Type	Dry contact closure <1 k ohm (Requires >1 second closure)

Transceiver Specifications

Programmable Frequency, Power Out, and Private Line options are available. For further details, consult the radio owner's manual.

Technical Description

Control Board Theory of Operation

Power Supply

MOVs V5, V6, and V7

The control unit can be powered by either 110 Vac or 220 Vac (on JP22). The control unit is protected by MOVs V9, V10 and V11, resistors R150 and R151 and by fuse F3. These absorb spikes and limit over-voltages. The power is stepped down by the transformer, rectified by D82 and filtered by C112. The voltage at this point is about 24 volts DC. Tranzorb D83 blows fuse F1 if the voltage exceeds 33 Vdc. This voltage is regulated to 12 Vdc by switching regulator U35. This voltage turns on Q11 through R133. The collector of Q11 sends a low to U34 pin 8 indicating the presence of AC Power.

DC Power Input and Low Voltage Cutout

U35 can also be powered by up to 75 Vdc through JP5 pin 9 from an external DC source. The 12 Vdc from U35 turns on Q10 through R130. This pulls the gate of switch Q9 low allowing it to pass voltage from the 12 volt battery through Q9 to the rest of the board if needed due to a power failure. The passed battery voltage turns on Q12 through R137 and Zener diode D72. Q12 also pulls the gate of Q9 low turning it on. If AC power fails, Q10 releases its low to Q9. Then if the battery voltage drops below about 9.6 Vdc, Q12 releases its low to Q9. This turns off the power to the board, which stays off until AC power is restored.

Regulated Supplies

U32 regulates the voltage further to 8 Vdc. U33 regulates the voltage further to 5 Vdc and U30 regulates it to a further 3.3 Vdc. An LED (D26) is tied to the 5 volts supply and indicates power. The regulated 12 volts passes through 12 volt regulator U44, which acts to limit the maximum voltage supplied to U40 and U43. U43 is an isolated DC to DC

converter, which converts the 12 volt supply to an isolated 5 volt supply. This is used for sensor and remote activation inputs. LED (D77) is also tied to this point and indicates isolated 5 volt power.

U40 is an isolated DC to DC converter, which converts the 12 volt supply to an isolated 12 volt supply. This is used for relay outputs. An LED (D79) is also tied to this point and indicates isolated 12 volt power. The Heartbeat signal from the processor passes through C107 and D80 keeping C110 charged and Q14 on. This keeps Q15 on allowing power to pass to U43, which powers the relay outputs. If the processor stops running, R148 will discharge C110 and turn off Q14 and Q15. This removes power from the relays so they cannot activate.

U41 monitors the voltage of the 5 volt power. If the power supply voltage falls below 3.3 volts, U14 resets the microprocessor.

CPU

The CPU is comprised of a microprocessor with a watchdog timer, a day/date clock, non-volatile EEPROM and FLASH memory, I/O pins and A to D convertors. The EEPROM is the non-volatile memory where all customer specific information is held while the FLASH is the non-volatile memory where the main program is held. U31 allows the microprocessor to communicate over serial port JP8 for programming.

For FSK and two-way DTMF units, the unit contains a ten position dip switch for setting the unit's site address.

Remote Activation, Sensor, and Battery Back-up Voltage Input

The remote activation inputs are available on connector JP10. Grounding any one of these pins activates the function associated with it. The inputs are protected by limiting diodes and are optically isolated. There is also a button on the board for each of these functions that activate the associated input.

The sensor inputs are available on connectors JP10 and JP5.

Rotation, Intrusion, Pressure, Current, and Spare sensor inputs #1 and #2 are all active low (shorting to isolated ground). When one of these inputs is shorted to isolated ground, the output of the associated optical-isolator pulls low. This is read by the processor. The 12 volt and 48 volt sensor inputs are analog voltages that are buffered by U15 and then passed on the A to D convertors in the processor to be read. These are not optically isolated and are referenced to ground.

The TR Voltage sensor input is an analog voltage that is buffered by U38 and then passed on the A to D convertors in the processor to be read. It is not optically isolated and is referenced to ground.

For an External Transceiver

The receive audio, from P1 pin 2 (the two-way connector) is routed to the output which is set to 1 V_{pp} at TP6 using R27. The CTCSS decoder option, if installed, gates U11:C on and allows audio to pass. U1B forms a highpass filter. This strips out any audio frequencies below 300 Hz. This filtered audio is then fed to the various decoders.

For an Onboard One-Way Receiver

The receive audio enters through U9:C and R60 to Carrier Detect Gate U11A and then to U1A. The output is about 1 V_{pp} at TP6. The CTCSS decoder option, if installed, gates U11:C on and allows audio to pass. U1B forms a highpass filter. This strips out any audio frequencies below 300 Hz. This filtered audio is then fed to the various decoders.

Receiver Priority

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.

If the “EXT” side is jumpered, then the external transceiver has priority. When it asserts carrier detect the low passes through D9 setting the output of U10:B high and turning on audio gate U11:D. This allows the received audio to pass through U11:D to U1A; the output goes to the decoder circuits. The high from U10:3 also passes through R25 to U10:B, which forces audio gate U11:A off thus preventing audio from the on-board receiver from coming through.

If the “INT” side is jumpered, then the on-board receiver has priority. When it asserts carrier detect, the low passes through D4 setting the output of U10:B high and turning on audio gate U11:A. This allows the received audio to pass through U11:A to U1A; the output goes to the decoder circuits. The high from U10:4 also passes through R25 to U10:A, which forces audio gate U11:D off, preventing audio from the external transceiver from coming through.

VOX

JP3 which can be jumpered to provide VOX carrier detect for radios that do not provide carrier detect. Receive audio is routed from the external transceiver connector to buffer amplifier U2A, which drives RMS to DC converter U4B. The DC voltage at the cathode of D6 represents the level of the incoming receive audio. U4A acts as a comparator whose output pulls low when the receive audio exceeds about 45 mV_{pp} or about 750 Hz of deviation (350 Hz for narrowband systems). This passes to JP3, which can be jumpered to provide VOX carrier detect for radios that do not provide carrier detect.

DTMF

Receive audio enters the DTMF decoder IC (U14) from the high pass filter through C51 and R64. When a proper DTMF digit is being decoded, TP8 will go low and a binary output will appear on pins 18, 19, 20, and 20 of U14.

Tone Decode

Receive audio from the high pass filter U1B, is passed on to low pass filter U1C. These form a band pass filter from 300 to 3000 Hz. When the processor is decoding a tone greater then 2100 Hz, it turns Q1 on. This makes the band pass filter from 1900 to 3000 Hz, which aids in the decoding of high-frequency tones. When the processor is decoding a tone less then 500 Hz, it turns Q2 on. This makes the band pass filter from 300 to 500 Hz, which aids in the decoding of low-frequency tones. After the band pass filter, the tone is amplified by U1D and then passed to U3B, a comparator that converts the tone to a square wave, and feeds it to the microprocessor to be measured. The square waves can be seen on TP5.

EAS Decode

Receive audio from the high-pass filter U1B is passed on to low-pass filter U1C. These form a band-pass filter from 300 to 3000 Hz. After the band-pass filter, the tones are amplified by U1D then passed to U3B, a comparator that converts the tone to a square wave, and feeds it to the microprocessor to be decoded. The square waves can be seen on TP5.

POCSAG Decode

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 a bracket "[" and followed by a 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 number of 301 to 316 activates all units in zones 1 to 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 one through six. Function numbers 96, 97, 98 and 99 activate Poll All, Reset, Quiet Test, or Cancel respectively.

Receive audio from the receiver module enters on JP7, pin 8. This audio is direct coupled and passes through lowpass filter U5A. R11 and C35 average the DC voltage present on U5A pin 1 and pass it to U5B pin 6. U5B acts a comparator converting the audio present on pin 5 into square waves. This is fed to the processor for decoding.

Digital

The receive audio is fed to the digital decoder IC (U12). U12 converts the alternating tones in the digital code to a string of highs and lows forming serial data. The data is sent to the processor's RXD port to be decoded.

Transmit Audio and PTT

The transmit audio is generated by U14 (the DTMF encoder), U12 (the digital encoder) and the CTCSS board (if present). PTT is generated by the processor taking pin 44 low. This gates U11:B on allowing the transmit audio to pass out to the transmitter.

The PTT also sets the collector of Q4 high, which allows R47 to turn on Q3 through R44. Q4 pulls the PTT line low and activates TRANSMIT LED D18. The collector of Q4, being high, also allows R48 to begin charging C15. When this exceeds 5 volts, U3A forces its output to ground and shuts off Q3. This provides a time-out timer to prevent the transmitter from getting stuck in transmit.

The PTT signal also sets the output of U17F high turning on Q5. This sends a ground to the CTCSS board, telling to encode rather than decode.

Serial Ports

Transmit serial data from pin 3 of the micro (U28) passes through switch U24 to U31 - pin 7, which converts the TTL level to +/- 12 volts RS232 levels and passes the transmit data to serial port JP8. Receive data from JP8 is likewise converted from RS232 levels to TTL levels and sent through switch U24 to the micro on pin 2.

Transmit serial data from pin 13 of the micro (U28) and RTS from pin 14, pass to U42 - pins 7 and 10, which converts the TTL levels to +/- 12 volts RS232 levels and passes them to auxiliary serial port JP16. Receive data and CTS from JP8 are likewise converted from RS232 levels to TTL levels and sent to the micro on pins 12 and 15.

Relay Outputs

There are four relay outputs that are controlled by the processor. They are driven through opto-isolator U37 and spike protected to prevent voltage spikes from affecting the unit. The outputs appear on a connector at the bottom of the board with contact ratings up to 5 A and 240 Vac RMS. K3 and K4 outputs have jumpers to select if they are to be operated only when the unit is Armed (the unit has been activated) or anytime without being Armed.

Speaker Output

The microprocessor (U28) generates warning sounds, on pin 26, which are routed out through amplifier U16 to the speaker output JP2.

Software Description of FCTBD Encoding Format

The FCTBD Controller Board encodes a nine-digit DTMF string that includes the RTU's unit type, ID number, function status, and sensors status.

Table 23 FCTBD Encording Format

Digit #	Description
1	Start Character, always a DTMF "*"
2	Unit type programmed into unit (see unit types)
3	Function status (see function currently running)
4	Unit number: BCD most significant digit
5	Unit number: BCD middle digit
6	Unit number: BCD least significant digit
7	BCD of sensor status: (see decoding of sensor status)
8	BCD of sensor status: (see decoding of sensor status)
9	Terminating Character "*"

Table 24 Conversion of DTMF Digit to BCD

DTMF Character	BCD equivalent
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
0	1 0 1 0
*	1 0 1 1

DTMF Character	BCD equivalent
#	1 1 0 0
A	1 1 0 1
B	1 1 1 0
C	1 1 1 1
D	0 0 0 0

Table 25 Unit Types

DTMF Character	FCTBD types
A	Single motor mechanical
B	Three motor mechanical
C	2001AC or DCB

Table 26 Function currently running

DTMF Character	Function
0	Standby
1	Function 1
2	Function 2
3	Function 3
4	Function 4
5	Function 5
6	Function 6

Decoding sensor status

Sensor status decoding using the DTMF digit to BCD reports current sensor status. Depending on the type of unit selected the sensors required vary.

Table 27 Digit 7

Digit 7	DCB or 2001AC	Single Motor Siren	Three Motor Siren
Bit 1 (LSB)	Rotation	N/A	Rotation
Bit 2	Intrusion	Intrusion	Intrusion
Bit 3	Not used, always 1	Not used, always 1	Not used, always 1
Bit 4	AC power	AC power	AC power

Table 28 Digit 8

Digit 8	DCB or 2001AC	Single Motor Siren	Three Motor Siren
Bit 1	Battery voltage*	Battery voltage*	Battery voltage*
Bit 2	AUX 1	AUX 1	Blower motor
Bit 3	Activation current	Activation current	Activation current
Bit 4	Not used, always 1	Not used, always 1	Not used, always 1

* Battery voltage refers to the 48 V siren voltage

Table 29 Bit Status

0	**1**
Rotation did occur	Rotation did not occur
Cabinet door is closed	Cabinet door is open
AC power is ON	AC power is OFF
AUX 1 closed	AUX 1 open
Blower did operate	Blower did not operate
Activation current detected	Activation current not detected
Battery voltage okay	Battery voltage low
Local activation occurred	Local activation did not occur

Example

Received DTMF report string * C 1 D D 2 4 A *

where:

* Starting character

C Unit type FCTBD with 2001 siren

1 Currently running function 1

DD2 Siren site number (0000) (0000) (0010), which equals site number 002

4 Sensor status is (0100)

Bit 1 is 0, rotation occurred

Bit 2 is 0, cabinet door is open

Bit 3 is 1, not used, always 1

Bit 4 is 0, AC power is on

A Sensor status is (0101)

Bit 1 is 1, battery voltage is low

Bit 2 is 0, AUX 1 is closed

Bit 3 is 1, activation current not detected

Bit 4 is 1, not used, always 1

Chopper Motor Current Sensor Theory of Operation

Overview

The adjustable current sensor 2001062B is a window comparator device that uses a current sensor and window comparator. The output is opto-coupled and the circuit is powered by a voltage regulator. The ground for the circuit is selected by way of jumper J2 between isolated or earth ground. The operation of the circuit is such that if the current passing through the probe of the current sensor is larger than the lower preset level and is less than the upper preset level, an active high output results turning on the opto-coupled output, indicating that the sensed current is within the acceptable range.

Circuit Description

The circuit is energized when 12 Vdc (nominal) is applied to J1-3 and ground is applied to J1-1. The 12 Vdc at J1-3 is applied directly to the voltage regulator. The regulated 8 Vdc output of IC1 is applied to the dual op amp at pin 8 and also to the Hall-Effect current sensor at its (+) input.

Current probe CS1 is designed to generate a reference voltage of 1/2 the supply voltage on its (0) output pin. With 8.0 Vdc at the (+) input of CS1 and ground applied at the (-) input of CS1, CS1 outputs 4.0 Vdc on the (0) output when the current passing through the probe of CS1 is zero. This voltage is applied to R2, through which C4 is charged to 4.0 volts, and this voltage is applied to the non-inverting input of IC2B and the inverting input of IC2A. The output of the current sensor is linearly scaled such that a change of 100 A in sensed current results in a change of 1.0 volt at the output, and a change of 1.0 A results in a change of 0.01 volts at the output. Using this calibration, you can adjust the POT1 and POT2 to set upper and lower current thresholds, respectively.

A typical application of the current sensor could be to set the device for an upper current threshold of 300 A, and a lower current threshold of 50 A.

Using these values, the voltage at TP1 corresponding to 300 A is the following:

4.0 V + (300 A * 0.01 V/A) = 7 V

The voltage at TP1 corresponding to 50 A is the following:

4.0 V + (50 A * 0.01 V/A) = 4.5 V

Adjusting POT1 sets the upper current threshold voltage of 7 V at TP2, and adjusting POT2 sets the lower current threshold voltage of 4.5 V at TP4. With a sensed current value between 50 and 300 A, the voltage at TP1 is between 4.5 and 7 volts. Since the voltage at the inverting input of IC2B (pin 6, also TP2) is set to 7 volts, and the voltage at the non-inverting input (pin 5) is less than 7 volts, the output of IC2B (pin 7) is logic low. Similarly, since the voltage at the non-inverting input of IC2A (pin3, also TP4) is set to 4.5 volts, and the voltage at the inverting input (pin 2) is greater than 4.5 volts, the output of IC2A (pin 1) is also logic low.

The outputs of IC2A and IC2B are applied directly to the inputs of NOR gate IC3. With a logic low at both inputs of IC3 (pins 1 and 2), the output of IC3 at pin 3 is a logic high, approximately 8 volts. 8 volts applied through R1 to the input (pin 1) of opto-coupler IC4 causes the output transistor of IC4 to be saturated and a logic low is applied to J1-2, indicating that the sensed current is within the preset acceptable range.

In the case that the sensed current exceeds the upper current limit, the voltage at TP1

is larger than 7 volts, putting the non-inverting input of IC2B at a higher potential than the inverting input, resulting in a logic high at the output of IC2B, which is applied to pin 1 of IC3. A logic high at either or both inputs of IC3 yields a logic low at the output of IC3, which causes the output transistor of IC4 to be cut off and a logic high is applied to J1-2, indicating that the sensed current is outside the acceptable range. J2-1 must be pulled high by whatever circuit it is connected to. In similar fashion, if the sensed current falls below the lower current limit, the voltage at TP1 is less than 4.5 volts, putting the inverting input at a lower potential than the non-inverting input, resulting in a logic high at the output of IC2A, which is applied to pin 2 of NOR gate IC3. As described above, this results in an active high applied to J1-2, indicating that the sensed current is outside the acceptable range.

Rotator Motor Current Sensor Theory of Operation

Overview

The Current Sensor board is a convenient snap-track mountable way to measure DC currents in the 0 to 10 ampere range. It scales the voltage reading to allow direct reading of the current passing through the sensor and employs a window comparator, which signals that the current is between a lower and an upper limit.

Features:

- Easy direct reading of current passing through the sensor
- Jumper selectable fixed window comparator, no adjustment needed
- UNDER, GOOD, and OVER indication LEDs
- Accurate to +/- 5% at 2 to 8 ampere DC

Electrical Specifications for Rotator Motor Current Sensor

Table 30 Electrical Specifications for Rotator Motor Current Sensor

Input Voltage	12.5-20 Vdc
Input Current	< 80 mA maximum
Measurement Accuracy	+/-10% at 0.5-1.0 A +/- 5% at 2-8 A
Measurement Current Ranges	0-10 A, 0-10 Vdc at TP3
Window Comparator Thresholds	Selectable: from 0.33-5.0 A for the minimum to 2.0-10.0 A for the maximum
Window Comparator Output	Open collector, sink </= 10 mA

Table 31 Environmental and Physical for Rotator Motor Current Sensor

Environmental	
Operating Temperature	-30°C to +65°C / -22°F to 149°F
Humidity	0-98% non-condensing
Size	2 x 3 in
Weight	< 6 oz

Connections for Rotator Motor Current Sensor

Table 32 Connectors for Rotator Motor Current Sensor

JP1	Current Measurement Pass-Through 2(+) voltage source 1 0-10 A output to motor
JP2	Lower Threshold Selection 15 and 16 0.33 A 13 and 14 1 A 11 and 12 1.5 A 9 and 10 2.0 A 7 and 8 2.5 A 5 and 6 3 A 3 and 4 4 A 1 and 2 5 A
JP3	Upper Threshold Selection 19 and 20 2 A 17 and 18 3 A 15 and 16 4 A 13 and 14 5 A 11 and 12 6 A 9 and 10 7 A 7 and 8 8 A 5 and 6 9 A 3 and 4 10 A 1 and 2 Disable Upper Threshold
JP4	Ground Select Jumpered ties isolated ground to circuit ground
JP5	Interface, Power In and Signal Output 1 Circuit Ground 2 Window comparator output, open collector, pulls low when current is above min and below max current 3 DC supply voltage input (12-35 Vdc) 4 Iso Ground

Circuit Description

Power Supply

Power enters through D1, is regulated down to 5 Vdc +/- 2%, by U4 and is filtered by C2 and C3.

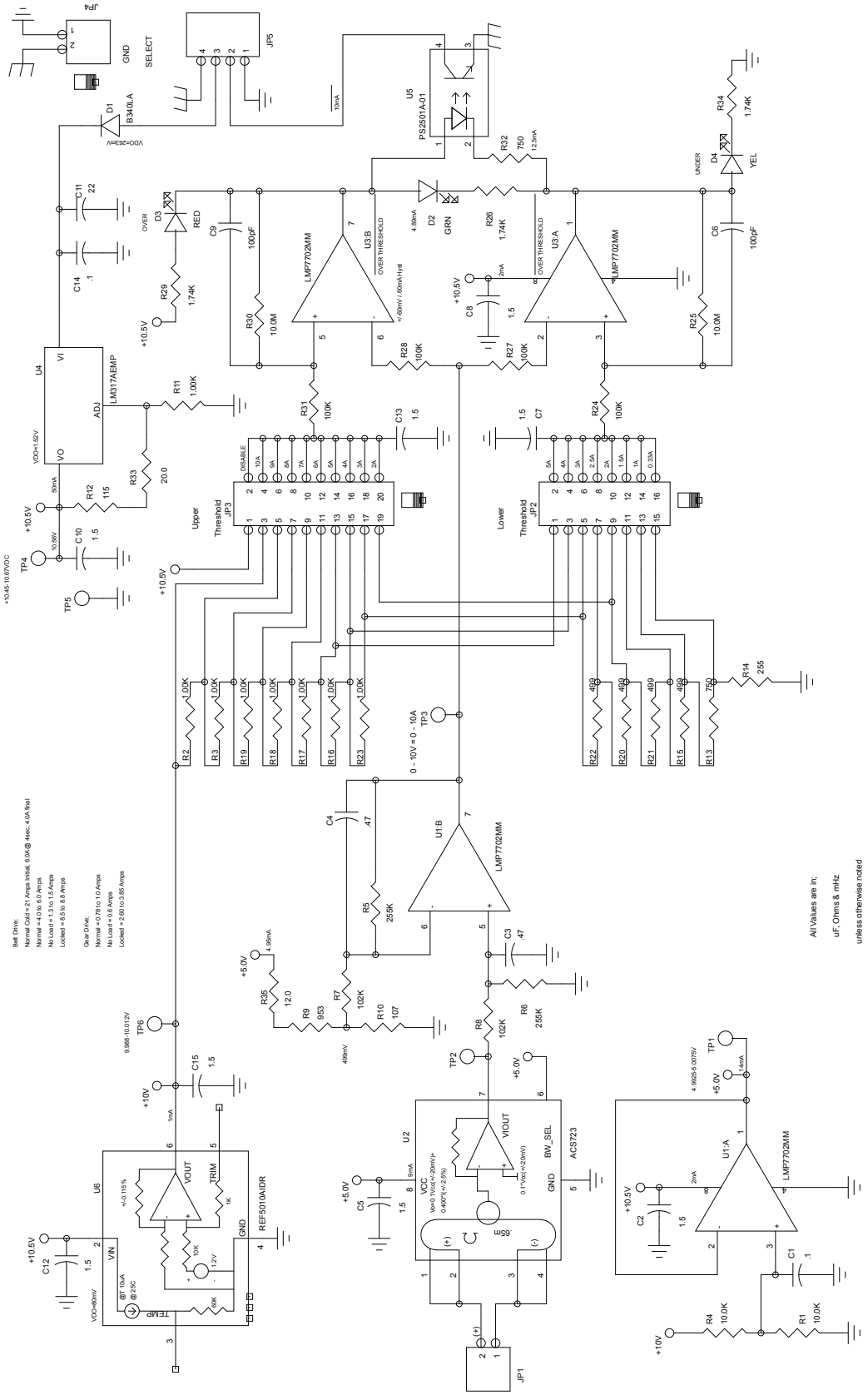
Current Measurement Path

The current sensor, U1, outputs a fixed DC voltage (2.5 V) plus a variable voltage representing the current being measured. For the 0 to 5 ampere input a 2 ampere current draw would = 2.5 Vdc + 0.625 Vdc or 3.125 Vdc.

U3B generates an offset voltage. This voltage is summed through U3A with the voltage from the current sensor. This subtracts off the 2.5 Vdc from the current sensor leaving only the voltage representing the current being measured. U3A multiplies this voltage and scales it so that 1 ampere of current being measured = 1 Vdc at TP3 (3 A = 1 Vdc for the 0-15 A input).

The output of window comparator U2A and U2B goes high if the voltage is greater than the voltage at U2 pin 6 and less than the voltage at U2 pin 3. This turns on Q1 which pulls the output at JP2 pin 2 low.

Figure 3 Schematic Rotation Current Sensor Board 2005221C



Battery Charger Theory of Operation

Overview

The charger features a switch mode voltage/current regulator to improve efficiency and reduce heat. The charger incorporates a three-stage charge algorithm to charge four series 12 volt batteries without gassing and maintain the batteries at the optimum charge level.

The charger delivers a constant 2 A trickle charge until the batteries reach 40 volts. The charger then raises the charge voltage until the charge current increases to 4 A. This is the bulk charge. This is maintained until the batteries' voltage reaches the float voltage of 54 volts. The float voltage is temperature compensated to prevent over charging the batteries during hot conditions.

The charger also incorporates a temperature sensor that limits the charge current to 2 A if the ambient temperature of the charger reaches 105°C.

The charger monitors for faults. If the charger has AC power and is producing charge voltage and if no fault is detected, the charge status output is on. If the charger is in trickle or bulk mode and the charge current is low (not charging) a fault is detected. If the battery voltage is at least 1/2 volt lower than the charger voltage (blown fuse), a fault is detected. If the charge voltage is too high (charger regulation failure), a fault is detected. If a fault is detected, the FAULT LED lights and the charge status output is off.

Electrical Specifications for Battery Charger

Table 33 Electrical Specifications for Battery Charger

AC Power	108-132 Vac, 120 Vac nominal, 2.4 A nom. 216-264 Vac, 240 Vac nominal, 1.3 A nom.
Bulk Charge Current, I_{BULK}	4 A, +/- 10% at 25°C
Float Charge Voltage	V_{FLOAT} Jumper Selectable from 52.8 to 55.2 V, +/- 0.75%
Trickle Charge Current	2.0 A, +/- 20%

Table 34 Connectors for Battery Charger

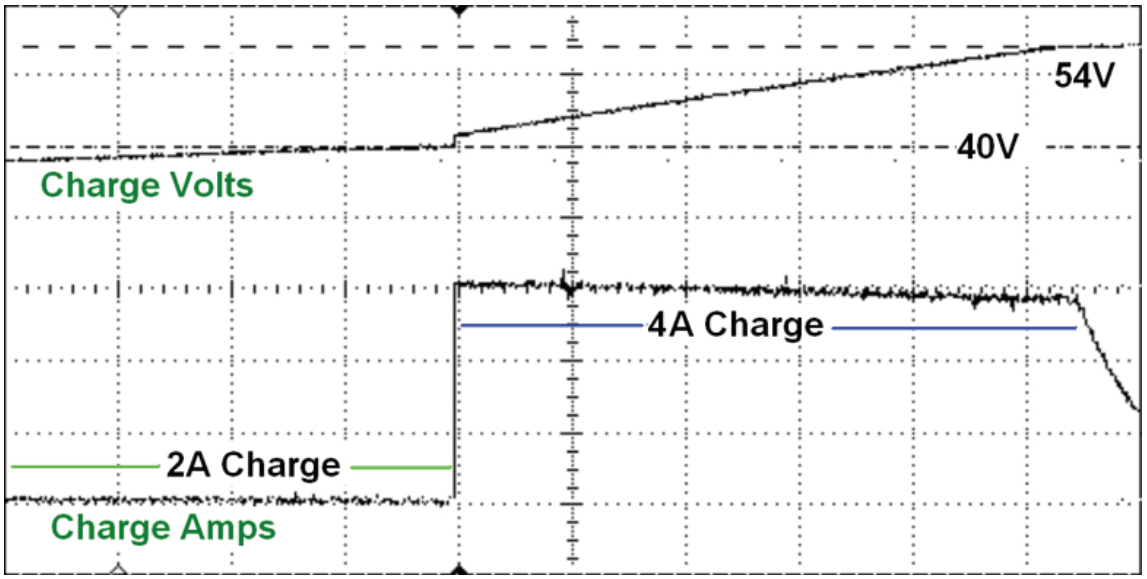
JP7	**Select the float voltage for batteries**	
	Jumper pins 1 and 2	13.2 V
	Jumper pins 3 and 4	13.3 V
	Jumper pins 5 and 6	13.4 V
	Jumper pins 7 and 8	13.5 V – Default Position
	Jumper pins 9 and 10	13.6 V
	Jumper pins 11 and 12	13.7 V
	Jumper pins 13 and 14	13.8 V

The AC power enters through fuses F1 and F2.
These are FS# 148186-02, BUSSMAN # GDC-5A, 5 A, 250 Vac, 5 x 20 mm fuses with cULus, IMQ, MITI/JET approvals.

The power from the charger to the batteries passes out through F3.
This is FS# 148A142A-06, LITTLE FUSE # 287015, 15 A, 32V, Blade ATO/ATC automotive fuse.

Circuit Description

The charger implements a three-stage charging algorithm. The three stages are trickle charge, bulk charge, and float charge. The stages operate as follows.



Trickle Charge

In the trickle charge state, the charger supplies a steady 2 A current to the batteries until they reach 40 V. The purpose behind trickle charging is to prevent a potentially hazardous condition caused by continuously pumping bulk charge current into a damaged battery. Too heavy a charge when a battery is in this severely discharged state can cause gassing, which is corrosive, explosive, and shortens the life of the battery. When the batteries reach 40 V the charger enters the bulk charge state.

Bulk Charge

In the bulk charge state, the charger sets the charge voltage to 60 volts and limits the charge current to 4 A. When the voltage has reached 99% V_{FLOAT}, the charger switches to the float charge state.

Float Charge

In the float charge state, the charger sets the charge voltage to the selected float voltage (adjusting for battery temperature). While in the float state, the charger supplies up to 7.35 A to a load and the battery. The charger remains in the float charge state until the voltage of the batteries drops below 90% V_{FLOAT} at which time it switches back to the bulk charge state.

Current Limiter

The circuit monitors the current output of the charger by watching the voltage develop and limits the current to 4 A. If the voltage is less than 40 V, the circuit changes the current limit to 2 A.

Thermal Limiter

A circuit monitors the temperature of the PC board. If the temperature exceeds 105°C, the circuit changes the current limit to 2 A. This helps prevent the charger from overheating.

Charge Voltage Temperature Compensation

A thermostat monitors the temperature of the batteries. Its resistance changes with temperature.

This circuit adjusts the output charge voltage reducing it during hot conditions to prevent the batteries from being overcharged. The output charge voltage is listed below.

- 54.00 V =/< 30°C
- 53.56 V at 31°C
- 53.48 V at 32°C
- 53.44 V at 33°C
- 53.36 V at 34°C
- 53.28 V =/> 35°C

Fault Detection

If the output voltage is less than 10 V, this indicates that the regulator may have failed.

The charger's output current is monitored. If the charge current drops below 1/2 A, the circuit allows it only if the charger is in trickle or bulk mode. The result being that, if the charger is in trickle or bulk mode and there is little or no charge current, indicating that the regulator may have failed and that the batteries are being under-charged, a fault condition is indicated.

The circuit monitors the output voltage of the charger and the battery voltage on either side of the fuse. If the battery voltage is 1/2 V or more less than the charger output voltage, indicating a blown fuse, a fault condition is indicated.

The circuit monitors the output charge voltage. If it exceeds 2.3 V per cell, indicating that the regulator may have failed and that the batteries are being overcharged, a fault condition is indicated.

Fault conditions are indicated with a fault indicator light on the board.

Installation

⚠ DANGER

ELECTROCUTION HAZARD: Electrocution or severe personal injury can occur when making electrical connections, drilling holes, or lifting equipment. Therefore, experienced electricians in accordance with national and local electrical codes, acting under the direction of the installation crew safety foreman, should perform installation.

EXPLOSION HAZARD: Explosive gases and corrosive materials may be present. To prevent explosion or severe personal injury, installation technicians must be experienced with the safe installation of lead-acid type batteries.

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

Locating the Control/Battery System

First consider the siren location and method of activation before determining Control/Battery System location. You can activate the DCFCB and DCFCTB system remotely through radio or landline controls and locally using buttons provided in the Control Cabinet. Refer to the Landline Control section for additional information on remote activation using landline controls.

Since the controls are in a NEMA 4 rated enclosure and the batteries are protected, you may install the controls indoors or outdoors. If you install indoors, ensure adequate ventilation is provided for the four lead acid batteries to prevent buildup of explosive gas.

To ensure proper siren power is maintained, it is recommended that the Control/Battery System location be within a 50 feet wire run to the siren. If a longer run is necessary, use a 1 AWG or larger wire for the siren motor.

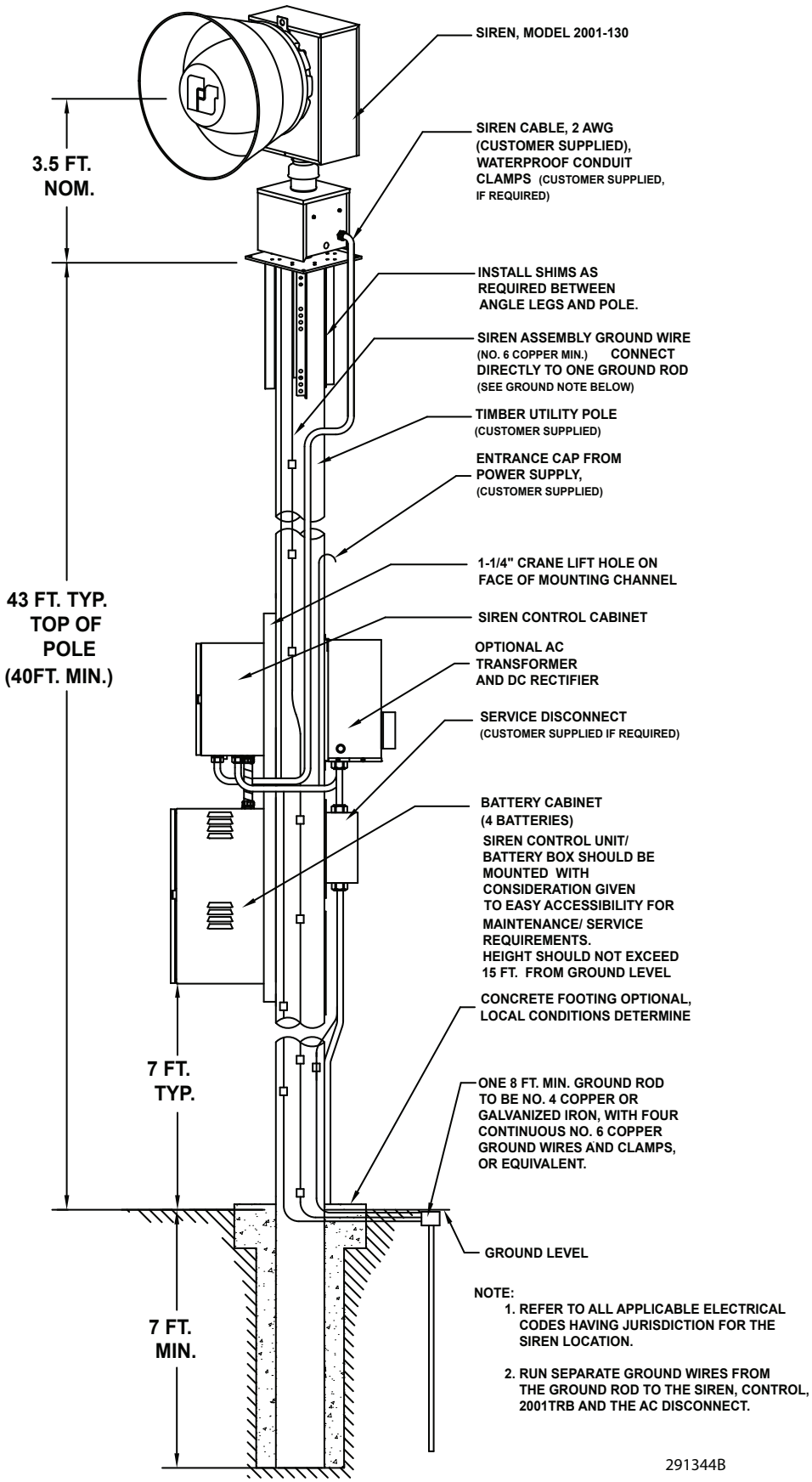
When mounting the Control/Battery System, it is recommended that the units be out of reach to avoid vandalism but accessible to service personnel. Both cabinets come equipped with padlock hasps. Use these for added security.

The Control and Battery Cabinets are shipped mounted on an aluminum channel with four mounting holes for 1/2-inch bolts. The total weight of the Control/Battery System is approximately 364 pounds including the batteries. Therefore, ensure that the mounting surface and fasteners can safely sustain the weight of the assembly and any additional environmental stresses placed on it.

See "Figure 4 Typical DCFCB or DCFCTB with 2001TRBP Installation Drawing" on page 36.

NOTE: When installing this product, insure that Local and NEC guidelines are followed.

Figure 4 Typical DCFCB or DCFCTB with 2001TRBP Installation Drawing



Installing the Control/Battery System

The Control Cabinet and Battery Cabinet is attached to a length of 5-inch channel. There are five pre-drilled holes in the channel:

- One 1-1/4-inch convenient lifting point
- Four 5/8-inch mounting holes

The total weight of the Control/Battery System including batteries is approximately 364 lb (165 kg). Therefore, it is imperative that the mounting surface and mounting method selected can safely sustain the weight of the assembly. In addition, the mounting method and surface used must be able to withstand external mechanical stresses that may be applied to the assembly.

Installer Supplied Material List

The following is a general list of material required to install the model DCB/DCFCB/DCFCTB with a mechanical siren (2001-130, Equinox, 508-128, and Eclipse8) and the 2001TRBP option. This list varies depending on mounting methods, length of pole, other options, local electrical codes, etc. Therefore, use this list as a reference guide only. Stainless steel hardware is recommended.

Table 35 Installer Supplied Material List

Material Description		QTY
1. 240 Vac, 1 phase/3 wire, fused disconnect		1 each
2. FRN 30, 30 A time delay fuse		2 each
3. 100 A meter socket	(if required)	1 each
4. 1-inch meter hub	(overhead service only)	1 each
5. 1-inch service entrance	(overhead service only)	1 each
6. Fork bolt	(overhead service only)	1 each
7. 1/2-inch Liquid-Tight, 90 degree connectors	(2001TRBP option primary feed)	2 each
8. 1-inch Liquid-Tight 90 degree connector	(2001TRBP option secondary feed)	1 each
9. 1-inch Liquid-Tight 45 degree connector	(2001TRBP option secondary feed)	1 each
10. 1/2-inch EMT compression box connector	(disconnect/meter ground)	1 each
11. 1-inch heavy wall compression fittings	(rotator cabinet/OH meter)	1 each
12. 1/2-inch Liquid-Tight flexible conduit	(2001TRBP option primary feed)	18 inches
13. 1-inch Liquid-Tight flexible conduit	(2001TRBP option secondary feed)	7½ inches
14. 1/2-inch EMT thin wall conduit	(disconnect/meter ground)	10 feet
15. 1-inch aluminum rigid	(if applicable in your area/cabinetry-siren raceway)	50 feet
16. 1/2-inch nail drive straps	(securing ½ inch ground pipe)	4 each
17. 1/2-inch jiffy straps	(substitute for nail straps)	4 each
18. 1-inch heavy wall 2-hole straps	(1 inch raceway clamping)	15 each
19. 1-inch lock rings	(1 inch raceway tightening)	5 each
20. 1-inch plastic bushings		2 each
21. 1/2-inch plastic bushings		2 each
22. 1-inch close nipple	(1 inch raceway/cabinet-siren)	1 each
23. 1-inch chase nipple	(1 inch LB-cabinet connection)	1 each

Material Description		QTY
24. 1-inch LBs with gaskets and covers	(1 inch raceway/cabinet-siren)	2 each
25. Split bolts, 10 AWG wire	(2001TRBP option primary connection)	2 each
26. Mechanical lugs, 2 AWG wire	(2001TRBP option/siren motor feed)	6 each
27. Mechanical lugs, 6 AWG wire	(system ground)	4 each
28. #6 copper ground wire	(system ground)	75 feet
29. 5/8 x 8 inch Copper Ground rod	(system ground)	1 each
30. Ground rod connector cold water type/ acorn style	(system ground)	1 each
31. 1-1/4 inch to 1 inch Reducing washer	(meter socket/O.H. service)	2 each
32. 1-1/4 inch Galvanized staples	(securing ground wire to pole)	30 each
33. 3/4-inch Galvanized staples	(securing antenna cable)	30 each
34. 12 AWG THHN stranded CU wire	(orange/rotator motor feed)	40 feet
35. 14 AWG THHN stranded CU wire	(black/charger circuit)	40 inches
36. 14 AWG THHN stranded CU wire	(white/charger circuit)	40 inches
37. 10 AWG THHN stranded CU wire	(black/TR option primary)	30 inches
38. 16 AWG THHN stranded CU wire	(optional, black/proximity sensor)	45 feet
39. 16 AWG THHN stranded CU wire	(optional, brown/proximity sensor)	45 feet
40. 16 AWG THHN stranded CU wire	(optional, blue/proximity sensor)	45 feet
41. 2 AWG, 600V, stranded CU wire	(optional, 2001TRBP 48 V and ground)	12 feet
42. Green electrical tape (33+)	(ground wire identification)	1 roll
43. Red electrical tape (33+)	(48+ wire identification)	1 roll
44. White electrical tape (33+)	(neutral wire identification)	1 roll
45. Black electrical tape (33+)	(connector insulating wrap)	1 roll
46. Blue electrical tape (33+)	(identification marking)	1 roll
47. Rubber tape	(insulating connections)	1 roll
48. Spade crimp connector	(red-14 ga. wire/charger circuit)	2 each
49. Ring crimp connector	(1/4 inch stud size 12 ga. wire/rotator feed)	1 each
50. 1/4 x 20-3/4 inch hex head bolt	(ground connection on siren leg)	1 each
51. 1/4 x 20 standard flat washer	(ground connection on siren leg)	1 each
52. 1/4 x 20 inch intern/ extern star washer	(ground connection on siren leg)	1 each
53. 1/4 x 20 split washer	(ground connection on siren leg)	1 each
54. 1/4 x 20 hex head nut	(ground connection on siren leg)	1 each
55. 5/16 hex head nut	(ground connection on Control Cabinet)	1 each
56. 1/2 x 4 inch hex head lag bolt	(securing TR option to utility pole)	3 each
57. 1/2 x 6 inch hex head SS lag bolt	(securing siren/Control Cabinet to utility pole)	16 each
58. 1/2 inch SS (stainless steel) flat washers	(backing ½ inch lag bolts)	19 each
59. 10 x 1 inch hex head, slotted, sheet metal screws (securing straps/equip to pole)		1 box
60. 10 x 2 inch hex head, slotted, sheet metal screws (securing straps/equip to pole)		1 box
61. 10 x 3 inch hex head, slotted, sheet metal screws (securing straps/equip to pole)		1 box

Pole Mounting

To install the Control/Battery System to a pole:

1. Remove any batteries from the Battery Cabinet before lifting the Control/Battery System.
2. Use a crane to lift the Control/Battery System to the desired mounting height along the pole.
3. Use the crane to hold the Control/Battery System against the pole so that the four mounting holes on the mounting channel can be used as a template to drill four 3/8-inch holes at least 3-1/2 inches deep.
4. Attach the Control/Battery System to the pole using four user supplied 1/2 by 5 inch lag bolts. Slide a user supplied 1/2 inch flat washer onto each bolt before threading the bolt into the pole. Ensure the channel is plumb and straight. Do not bend the mounting channel by over tightening the lag bolts. Notch the pole or use shims if necessary to provide a flat stable mounting surface.
5. Mount a user supplied fused disconnect switch on the pole beneath or opposite the Control/Battery System assembly in accordance with Local and National Electrical Codes.
6. If the optional Transformer/Rectifier is required, drill three 3/8-inch holes at least 3-1/2 inches deep using the Transformer/Rectifier as a template. Attach the cabinet to the pole using three user-supplied 1/2 by 5 inch lag bolts. Slide a user-supplied 1/2 inch flat washer onto each bolt before threading into pole.

Flat Surface Mounting

To install the Control/Battery System to a flat surface:

1. Remove any batteries from the Battery Cabinet before up righting the Control/Battery System.
2. Prepare the mounting surface for hanging the assembly using the steel channel as a template.
3. Attach the Control/Battery System to a wall or other substantial vertical surface using the four 5/8-inch mounting holes.
4. Mount a user-supplied, fused disconnect switch in accordance with Local and National Electrical Codes.
5. If the optional Transformer/Rectifier is required, attach the cabinet to a wall or other substantial vertical surface using the three mounting holes. Make sure that the mounting surface and mounting method selected can safely sustain the weight of the transformer. The weight of the Transformer/Rectifier is approximately 150 lb.

Electrical Connections

⚠ WARNING

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 on the batteries before making connections.

⚠ CAUTION

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 installations, drive a metal rod or bar at least 8 feet into the ground, as close as practical to the base of the pole. 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 the Siren

The complete system wiring diagrams are shown in “Figure 12 DCB Wiring Diagram” on page 73, “Figure 13 DCFCB Wiring Diagram” on page 74, and “Figure 14 DCFCTB Wiring Diagram” on page 75. All interconnections between the Siren and Control System are accomplished using three wires. Two 2 AWG wires provide operating power to the siren motor. A single 12 AWG wire provides operating power to the rotator motor. There are two terminal blocks located in the rotator housing of the siren that accept stripped wire, and a terminal block and relays in the control box that accept 1/4-inch and 5/16-inch ring terminals. These points provide convenient locations for making connections. See “Options” on page 62 for wiring of options.

Interconnecting the Siren to the Control Cabinet

To connect between the siren and the Control Cabinet:

1. Install a 1-inch user-supplied electrical conduit fitting in the bottom of the Control Cabinet and in the bottom of the siren rotator housing.
2. Install 1-inch user-supplied electrical conduit between the conduit fitting in the bottom of the siren rotator housing and the conduit fitting at the bottom of the Control Cabinet.
3. Route the interconnecting wiring (user-supplied) from the siren rotator housing to the Control Cabinet through the conduit.
4. Connect a red 12 AWG wire from terminal 1 of the three position terminal block (TB1) in the rotator housing to the bottom open terminal of the rotator control relay, K1, using a 1/4-inch ring terminal (user-supplied) at K1.
5. Connect a red 2 AWG wire from terminal 2 of the three-position terminal block (TB1) in the rotator housing to the open left side of the 200 A fuse (148A147A) using a 1/4-inch ring terminal (user-supplied). See “Figure 12 DCB Wiring Diagram” on page 73, “Figure 13 DCFCB Wiring Diagram” on page 74, and “Figure 14 DCFCTB Wiring Diagram” on page 75.
6. Connect a black 2 AWG wire to terminal 3 of the three position terminal block (TB1) in the rotator housing. Run the black 2 AWG wire to a 5/16 inch backplane ground stud in the Control Cabinet (labeled GND) using a 5/16 inch ring terminal (user-supplied).
7. Ground the Siren and Control System to earth ground using separate continuous runs of wire. (Do not “T” from another ground wire.)
8. Tighten all connections securely to provide good electrical connections.

Connecting to AC Power

To connect the wires in the Control Cabinet:

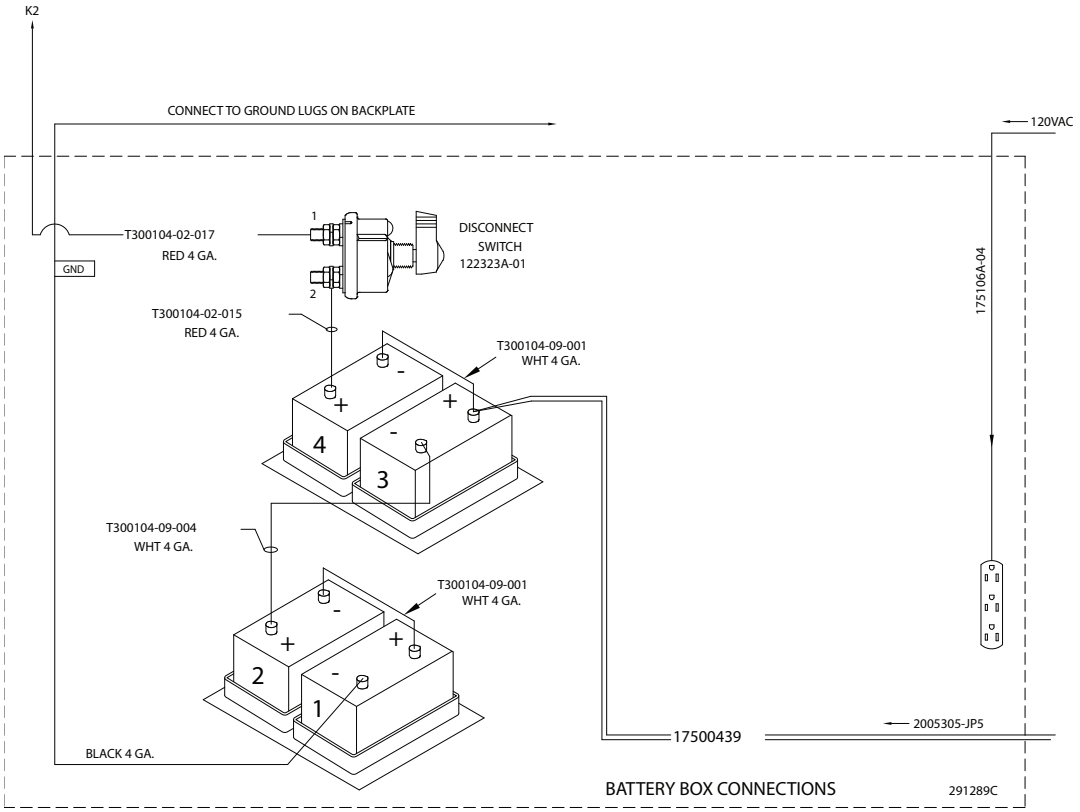
1. As shipped from the factory, the Control Cabinet is configured for 120 Vac operation. Set the AC selector switch, S7 on the siren control board and charger, to the appropriate voltage.
2. After drilling or punching an appropriate sized hole in the bottom of the Control Cabinet, install a user supplied 1/2-inch electrical conduit fitting. Route 1/2-inch conduit (steel preferred) between a user-supplied fused disconnect switch and user-supplied conduit fitting in the bottom of the Control Cabinet.
3. Route three user-supplied wires through the conduit that was just installed between the Control Cabinet and the fused disconnect switch. Use 14 AWG wire or larger.
4. Connect Neutral (white wire) from service disconnect to F1 on the DIN rail in Control Cabinet. (See “Figure 12 DCB Wiring Diagram” on page 73, “Figure 13 DCFCB Wiring Diagram” on page 74, and “Figure 14 DCFCTB Wiring Diagram” on page 75).
5. Connect Line (black wire) from service disconnect to F2 on the DIN rail in Control Cabinet. (See “Figure 12 DCB Wiring Diagram” on page 73, “Figure 13 DCFCB Wiring Diagram” on page 74, and “Figure 14 DCFCTB Wiring Diagram” on page 75.)
6. Connect Ground (green wire) from service disconnect to the green ground block on the DIN rail in Control Cabinet. (See “Figure 12 DCB Wiring Diagram” on page 73, “Figure 11 DCFCB Wiring Diagram” on page 51, and “Figure 14 DCFCTB Wiring Diagram” on page 75.) A small screwdriver must be pushed into the square opening in the terminal block to open the contacts of this block.
7. Follow the instructions included with the lightning protector (supplied) and install it in the service disconnect.
8. Size fuse or circuit breaker in service disconnect to 15 A max.

Installation and Wiring the Battery

To install the batteries and connect the wiring:

1. Install the batteries in the Battery Cabinet, per illustration Figure 5 Battery Positioning and Wiring, taking care not to touch the battery terminals against cabinet. It may be necessary to temporarily relocate the wiring in the enclosure before installing the batteries. The polarity of the battery terminals is clearly marked on the battery case. See "Figure 5 Battery Positioning and Wiring" for correct orientation. (For optional battery warmers, see "Model HTR4 (Battery Warmers)" on page 66 and "Figure 11 HTR4 Wiring Diagram" on page 67.)
2. There are several wires entering the Battery Cabinet: a red 4 AWG, a black 4 AWG, and a multiple conductor cable. The red and black 4 AWG wires provide 48 Vdc operating power to the siren. The multiple conductor cable provides the charge current for the batteries. Several white wires with lugs on each end are also packaged with the batteries. These white wires are used to connect the batteries in series.
3. Connect the wires to the batteries using "Figure 5 Battery Positioning and Wiring" and securely fasten all connections.
4. Apply user-supplied silicon grease or other oxide inhibiting compound to the battery terminals.

Figure 5 Battery Positioning and Wiring



Landline Control

You may activate the controller by applying contact closures to the remote activation inputs. See “Landline and Local Button Activation” on page 61 for a functional description and details on interfacing and wiring connections.

Installing the Antenna

⚠ WARNING

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 Type N bulkhead is provided on the bottom side of the Control Cabinet for ease of antenna cable interface. The bulkhead requires the installation of a male Type N 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.

Pre-operational System Testing

⚠ WARNING

SOUND HAZARD: The output sound level of a siren is capable of causing severe hearing discomfort or permanent hearing damage. Therefore, always wear adequate hearing protection and minimize exposure when performing any testing or maintenance on the siren.

⚠ WARNING

Failure to properly test the siren system before placing into service may prevent the siren from operating in an emergency. The following tests and calibrations must be performed by an experienced technician prior to using the siren system.

Initial Sensor Adjustments and Testing

To ensure proper and reliable two-way status operation, the operation and alignment of the sensors must be confirmed when the siren and control are installed. All of the sensors are factory adjusted and the following alignment instructions may only pertain to tuning replacement sensors.

Rotation Current Sensor

Locate the rotation current board (2005221) on the backplane of the Control Cabinet with the blue current sensor. (See “Figure 14 DCFCTB Wiring Diagram” on page 75.) This board is preset at the factory and should not be adjusted.

To check the board for proper operation:

1. Verify that the output at JP5-2 is high (4 Vdc to 5 Vdc).
2. Activate a siren function by momentarily depressing one of the function buttons on the controller board.
3. Measure the DC voltage on TP3. The voltage should correspond to the DC current draw of the siren motor (0.8 Adc, +/- .3 A).
4. Verify the output JP5-2 is low (0-1 Vdc) for the duration of the siren function.

Chopper Current Sensor

Locate the chopper current board (2001062) on the backplane of the Control Cabinet. (See “Figure 14 DCFCTB Wiring Diagram” on page 75.)

Adjustment Procedure

To adjust the chopper current board, do the following while the system is in idle mode:

1. Using Pot 1, adjust the voltage at TP2 to 7 Vdc.
2. Using Pot 2, adjust the voltage at TP4 to 4.5 Vdc.

Activate a siren function by momentarily depressing one of the function buttons on the controller board. Verify that input #4 indicator on the controller board turns on for the duration of the siren function.

AC Power Sensor

Verify that the AC power indicator on the controller board is on while AC power is active. Measure across F1 TB5-1 and TB5-5 for 120 Vac. Confirm that with the AC power source turned off (using service disconnect), the AC power indicator is off.

Intrusion Sensor

With one cabinet door open, verify that the intrusion indicator is ON. Press the intrusion switch located on the cabinet door. With the switch pressed, confirm that the intrusion indicator is OFF. Verify the switches on both cabinet doors operate correctly.

NOTE: A jumper preset at JP9 also causes all of the LEDs to go dim when the intrusion switch is pressed.

Measuring Battery Voltage

To measure the battery voltage:

1. Allow the batteries to charge for 24 hours to ensure they are fully charged.
2. Turn off AC power to the battery charger by disconnecting power at the service disconnect or opening F1 and F2 in the Control Cabinet.
3. Using a digital multimeter (Fluke model 75 or equivalent), measure the batteries individually inside the Battery Cabinet. (See “Figure 14 DCFCTB Wiring Diagram” on page

75 for details.) Each battery should measure approximately 13.5 Vdc.

Voltage reflects battery float voltage and varies depending on state of charge.

4. While monitoring the voltage in at TB4-1, manually activate a steady siren function by depressing the appropriate function button on the controller board. If the measured voltage drops below 40 Vdc, it is an indication of weak batteries and causes the controller to terminate the siren function. If a low battery condition is indicated, follow up by load testing each battery with an automotive type battery load tester (180 A load recommended).
5. Turn AC power on by connecting F1 and F2 and turning on the service disconnect switch.

Measuring Battery Charger Voltage

To measure the charger output voltage, it must be connected to the batteries. Since the battery's state of charge affects the output voltage of the charger, the measured voltages varies. Use a digital multimeter to measure the charger at TB1-4; the voltage should be between 53.6 Vdc and 54.4 Vdc when connected to fully charged batteries.

2001TRBP Transformer/Rectifier 48 Vdc testing (optional)

To test the 2001TRBP Transformer/Rectifier, do the following:

1. With the AC service turned on, measure for 46.0 Vdc, +/- 0.5 Vdc between K3-3 and chassis ground. (See "Figure 9 Transformer Rectifier Wiring to Control Cabinet" on page 65.)
2. Confirm that K3 is energized.
3. Shut off the AC service disconnect and confirm that K3 de-energizes.

Manual Siren Activation

Manually press each programmed function button and confirm correct siren operation. Refer to the controller programming and test data sheet (shipped with controller) for siren function details.

Landline Siren Activation (optional)

Confirm that the user-supplied telephone control relay provides each appropriate remote function input with a momentary contact closure (1 second nominal) and observe proper siren activation.

Transceiver Audio Level Adjustments and VSWR Testing

Due to the test equipment requirements and RF control systems knowledge required to perform the following controller testing, only a qualified two-way radio service technician should conduct the following test steps.

To ensure reliable radio controlled siren operation, the following testing must be conducted upon initial controller installation.

For the following steps, connect the Communications Service Monitor to the RF bulkhead mounted on the bottom side of the Control Cabinet.

DTMF Transmit Level Adjustments (DTMF versions of DCFCTB only)

To adjust the DTMF transmit level:

1. To transmit and generate a DTMF test tone, apply a jumper across JP15 on the FCT controller board.
2. Confirm the deviation level is at 3.0 kHz (or 1.5 kHz for a 12.5 kHz spaced channel). This level has been pre-set at the factory; however, if adjustment is required, set R61 on the controller board for the required deviation.
3. Using an Inline Watt Meter, confirm that the forward radiated power output matches the specified power output listed on the final test data sheet supplied with unit within 20%. Also verify that the VSWR is less than 5%. See “Installation” on page 35 if the VSWR is excessive.

Adjusting the FSK Transmit Level (Digital FSK versions of DCFCTDB only)

To adjust the FSK transmit level:

1. To Transmit and generate an FSK modem tone, apply a jumper across JP15 on the FCT controller board.
2. Confirm the deviation level is at *3.0 kHz. This level has been pre-set at the factory; however, if adjustment is required, set R57 on the controller board for the required deviation. If CTCSS is used, set the CTCSS level to 0.75 kHz.
3. Using an in-line Watt meter, confirm that the forward radiated power output matches the specified power output listed on the final test data sheet supplied with unit within 20%. Also verify that the VSWR is less than 5%. See “Installation” on page 35 if the VSWR is excessive.

*__NOTE__: Deviation levels are cut in half on 12.5 kHz spaced channels.

Adjusting the Receive Level

To adjust the receive level:

1. Inject a 100 µV carrier signal modulated with a 1 kHz tone at *3.0 kHz deviation for DTMF systems. Use *3.0 kHz deviation for digital systems.
2. Connect an oscilloscope to TP6 on the controller board and confirm a clean, undistorted sine wave of 1 V_{p-p}. The level has been pre-set at the factory; however, if adjustment is required, set R27 on the controller board to 1 V_{p-p} for the external transceiver. The level of the on-board receiver module is fixed and does not need to be adjusted.

*__NOTE__: Deviation levels are cut in half on 12.5 kHz spaced channels.

Testing Two-tone and DTMF Controller Sensitivity

To test two-tone and DTMF controller sensitivity:

1. Unplug JP21 to disable the siren.
2. With the transmit modulation level set to *3 kHz from the communication monitor inject a 0.5 µV carrier signal.

   *__NOTE__: Deviation levels are cut in half on 12.5 kHz spaced channels.
3. Encode the appropriate DTMF strings and or two-tone tones required to activate the desired siren function. Confirm reliable decoding of at least ten of ten tries.
4. Plug JP21 back in.

Confirming Controller Auto-Reporting

By toggling one of the following sensor inputs, confirm that the controller sends a correct report to the SS2000+/R base controller. Note that with digital systems the DCFCTDB must be programmed to auto-report the following sense points to perform this test.

Intrusion

Press the intrusion switch for at least 5 seconds. Release the switch. Verify the door closed and door open reports we received at the SS2000+/R.

AC Line Voltage

Remove AC power at the service disconnect to confirm that a report is generated within 5 minutes. Confirm that another report is generated when power is restored.

⚠ WARNING

SOUND HAZARD: The output sound level of a siren is capable of causing severe hearing discomfort or permanent hearing damage. Therefore, always wear adequate hearing protection and minimize exposure time when performing any testing or maintenance on the siren.

Test Activation Codes

Test all siren functions from the siren control point. This test must be performed to ensure all desired siren functions have been properly entered at the control station and at the siren site. Request a report from the control station during the siren function. Verify the report indicates the proper status conditions for the site being tested.

Operations

System Operating Description

Siren Activation

The DTMF versions of DCFCTBs enable the user to program an ARM string into the controller for extra security. If an arm string is not programmed, then an ARM command is not required to activate a function. Digital versions of DCFCTBs do not use the ARM function.

Activation Using the ARM function

To start siren activation through the radio, it is necessary to ARM the siren before initiating a siren function such as a wail or steady. Once the siren is ARMed, it remains ARMed for 255 seconds or 4.25 minutes. Upon activation of the siren, it runs until the function times out, is canceled, or is reset. If the siren function is greater than 4.25 minutes, you must send another ARM command prior to sending a CANCEL command to shut off the siren. The ARM command is not required prior to sending a RESET command.

To start a function by either landline or button, it is necessary to provide a one second closure on the landline or a one second depression of the buttons.

Site Status Monitoring (DTMF only)

The siren controller reports when polled from the SS2000+/R or when one of its sensors changes state. The status of the site is encoded in a 9-digit DTMF string that is designed to work with a Federal Signal SS2000+/R to decode, format, and time and date stamp the received string. For detailed information about the DTMF coding format, see “Software Description of FCTBD Encoding Format” on page 24.

Automatic Reports

The DCFCTB automatically sends back a report if one of the following sensors has a change of state: AC, Low Battery, Intrusion, Stuck Relay detected, Motor Fuse fail, or the siren is activated locally. The control station can also be set to automatically poll the system at a predefined interval. Automatic reporting may be optionally disabled on DCFCTBD systems. The DCFCTB is equipped with a carrier detect transmit hold off that causes the unit to wait until the channel is clear before an automatic report is transmitted.

The thresholds are in the following table.

Table 36 Thresholds

Input	Threshold	Time
AC fail internal	57 Vac +/- 5%	57 sec +/- 1
AC fail external TR	40 Vrms +/- 1%	2.2 sec + 1 sec x site #
Battery 12 V	12.7 V +/- 3%	20 sec
Battery 48 V	43.5 V +/- 3%	20 sec
Intrusion	Door Open	555 ms
Stuck Relay Detect	relays off & current = 50 300 A	222 ms
Motor fuse	1.0-3.4 V	5 sec
Local Activation	Button	10 sec

Growl Test

The Standard Growl Test runs the rotator for 12 seconds and the chopper motor until the sensors latch or a maximum of 2 seconds. This function is commonly used when doing periodic testing to verify proper operation while generating minimal sound.

Control Cabinet Functional Descriptions

The DC Control Cabinet has the following main parts:

- Motor Contactors
- Battery Charger
- Power Distribution and Fusing
- Radio Transceiver (optional)
- FC Controller Board (optional)

Motor Contactors

Two 200 A motor contactors are used for switching the 48 Vdc power to the siren motor through K2, and the rotator motor through K1. The contactors are controlled by the relay outputs on the controller.

A third optional contactor, K3, is used to switch between the rectified 48 Vdc provided by the 240 Vac transformer option and the 48 Vdc provided by the four batteries in the Battery Cabinet. The switching occurs automatically when the 48 Vdc provided by the 240 Vac transformer fails.

The wiring to the siren and rotator motor is protected by a 200 A fuse.

Battery Charger

One charger is used to charge all of the batteries in the Battery Cabinet. The charger is connected to all four series connected batteries to provide 48 Vdc to the siren and rotator motors. The charger has a built-in 15 A fuse, and the charger wire is fused with a 10 A fuse within the Battery Cabinet.

Power Distribution and Fusing

The DIN rail is used to distribute and fuse various voltages. The following is a description of the terminals at the DIN rails.

Table 37 Terminals at the DIN rails

Terminal	Description	
TB6	4	+48 Vdc, from Charger
TB2	1	Ground
	2	Ground
	3	Ground
TB3	1	12 Vdc from Converter
	2	12 Vdc from Converter
TB4	1	48 Vdc
TB5	F1	10 A fuse for 120 Vac Neutral
	F2	10 A fuse for 120 Vac Line
	1	FUSED AC Neutral
	2	FUSED AC Neutral
	3	Ground
	4	FUSED AC Line
	5	FUSED AC Line

Radio Transceiver

When a radio transceiver is equipped, the transceiver is factory installed, programmed and aligned to work with Federal Signal DCFCTB. The 12 V transceiver is powered by the 48 V to 12 V DC-to-DC converter. The converter is powered by the four 12 V batteries that continue to run the controller in case of a power failure. Consult the radio's operating manual for further operating details.

FC Controller Board

The FC Controller Board is located on the backplane of the Control Cabinet. This board controls all functions of the DCFCB and DCFCTB. The board consists of seven main sections:

- Transceiver Interface
- Digital Inputs
- Relay Outputs
- Speaker Output
- Landline and Local buttons
- Power Inputs and Power Supply
- Encoder and Decoder Sections

FC Controller Board Indicators

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

Table 38 FCTBD 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	+5 V Operating Power
D79	ISO +12 V	Isolated 12 V power
D77	ISO +5 V	Isolated 5 V power
U18	LCD Display	Displays Function Counters, Decodes and Software Revision

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

JP1	SINAD 1 Receiver module carrier detect, short to pin 2 when using SINAD board along with both sides of JP4 2 External transceiver carrier detect
JP2	Test Speaker 1 0 to 2 Vp-p, Audio Source: Receiver Audio during P.A. functions, Siren Audio during Electronic Siren functions 2 Ground
JP3	Short For VOX Carrier Detect Short pins 1 and 2 for VOX carrier detect
JP4	Test Speaker 1 VCC, +5 V 2 VCC, +5 V 3 Short pins 1 and 3 to give priority to the external transceiver 4 Short pins 2 and 4 to give priority to the internal receiver. With no shorting jumper, first carrier detect has priority. Short both sides when using SINAD board along with JP1.
JP5	Sensor Inputs (#1 at left edge) 1 Pressure sensor input, dry Contact closure < 1 K 2 ISO Ground 3 Intrusion sensor input, dry Contact closure < 1 K 4 ISO Ground 5 Current sensor input, dry Contact closure < 1 K 6 ISO Ground 7 Rotation sensor input, dry Contact closure < 1 K 8 ISO Ground 9 48-Volt Battery input to 48-Volt sensor and to power supply, 15–75 Vdc 10 Ground 11 12 Volt Battery input to 12 Volt sensor and to power supply, 11–15 Vdc
JP6	Speaker Mute gate bypass Short pins 1 and 2 to bypass speaker mute gate, allow monitoring of radio channel with local speaker
JP7	Receiver Module for one-way receiver
JP8	Serial and FLASH programming Port
JP9	LEDs on with Intrusion

JP10	Remote Activation and Sensor Inputs (#1 at left edge of connector) 1 Spare Sensor Input #2, dry Contact closure < 1 K 2 ISO Ground 3 Spare Sensor Input #1, dry Contact closure < 1 K 4 ISO Ground 5 Remote Activation Input #4, Activates Functions under code 4, dry Contact closure < 1 K 6 ISO Ground 7 Remote Activation Input #3, Activates Functions under code 3, dry Contact closure < 1 K 8 ISO Ground 9 Remote Activation Input #2, Activates Functions under code 2, dry Contact closure < 1 K 10 ISO Ground 11 Remote Activation Input #1, Activates Functions under code 1, dry Contact closure < 1 K 12 ISO Ground
JP11	Used for special applications 1 and 2 See Options for JP11 3-8 Not used 9 and 10 See Jumper pins 9 and 10 (Normally Jumpered)

Options for JP11

Jumper pins 1 and 2

Table 39 2001 DC Solar mode

AC (Power)	AC power and external power or 50 Vdc (AC power or 48 V battery/charger) latching
Battery	>12.7 V (DC-DC) and > 43.7 V (48 V battery)
Pressure	Motor fuse (low = pass)

Table 40 2001 DC Non-Solar mode

AC (Power)	AC power and external AC power (not looking at 48 Vdc)
Battery	>12.7 V (DC-DC) and > 43.7 V (48 V battery) (either 12 or 48 fail will cause a fail) Transfer switch low voltage detect (External AC input Sense2, low=voltage pass)
Pressure	Motor fuse (low = pass)

Table 41 FCD Repeater Solar mode

AC (Power)	AC power and external power or 50 Vdc (AC power or 48 V battery/Charger) latching
Battery	12.7 Vdc (connects to 12 V battery or DC-DC convertor)
Pressure	Charger = External charger sense contact (low = pass)

Table 42 FCD Repeater Non-Solar mode

AC (Power)	AC and external power or 50 Vdc (AC power or 48 V battery/charger) latching
Battery	12.7 Vdc (connects to 12 V battery or DC-DC convertor)
Pressure	Charger = External charger sense contact (low = pass)

Jumper pins 9 and 10 for NXDN Mode or Transformer Rectifier and Control Mode

NXDN Mode

When the NXDN mode is polled, the system responds over the port which received the poll request only.

Transformer Rectifier and Control Mode

Use relay number 3 to switch from Transformer Rectifier (TR) to batteries in order to conduct a battery test. Remote AC power sense debounce fixed at 4 seconds (normally 28 seconds).

Standby:

- If low voltage occurs, JP10 on pins 11 and 12 get an open contact from the TR contactor.
- If the voltage is normal, TR gives a contact closure across JP10 on pins 11 and 12.

JP12	SINAD 1 Directly to processor pin #58 (ADC7) 2 Ground
JP13	CTCSS Encoder/Decoder 1 Receive audio, not DC isolated, set to 1 Vp-p with 1 kHz tone at 3 kHz deviation for wideband 1.5 kHz deviation for narrowband 2 Ground 3 +8 Vdc, < 100 mA current 4 Decode not & PTT line, low with decode, set low by processor during transmit 5 Transmit audio, 0 to 2 Vp-p of Digital data or Tone
JP14	Force Carrier Detect 1 Short to (JP14, pin 2), to force carrier detect on 2 Ground
JP15	Short To Set Deviation 1 Short to ISO Ground (JP15, pin 2), causes unit to transmit for setting deviation 2 ISO Ground
JP16	Aux Serial Port 1 2 TXD, standard RS232 levels 3 RXD, standard RS232 levels 4 Ground 5 CTS 6 RTS

JP21	Relay Outputs, 3 A, up to 240 Vac, (#1 at left edge of connector) 1 Relay 1, Common 2 Relay 1, N.O 3 Relay 2, Common 4 Relay 2, N.O 5 Relay 3, Common 6 Relay 3, N.O. or N.C., depending on jumper JU1 7 Relay 4, Common 8 Relay 4, N.O. or N.C., depending on jumper JU2
JP22	AC Power Input 1 and 2 120 or 240 Vac +/- 10%, 60 Hz (Set S7)
JP23	TR Sensor Input 1 Ground 2 TR voltage input, 0-50 Vdc, 0-79.4 Vp full wave rectified AC
JP24	Charger Disable Output 1 Isolated Emitter, pulls to isolated Ground to disable 2 Isolated Open Collector
JP25	Charger Status Input 1 Isolated active low input, pulls to isolated Ground when status is OK 2 Isolated Ground
JP26	Relay Output #3 Arm Select Jumper pins 1 and 2, no Arm required (not need a function activated to run) Jumper pins 2 and 3, requires Arm (a function must be activated) to work
JP27	Digital Receive Disable Jumper pins 1 and 2 to disable receiving AFSK digital signals
JP28	Relay Output #3 Arm Select Jumper pins 1 and 2, no Arm required (not need a function activated to run) Jumper pins 2 and 3, requires Arm (a function must be activated) to work
JP29	Fast DTMF Decode Jumper pins 1 and 2 to enable decoding of fast DTMF
JP30	Option header Jumper pins 1 and 2 to enable option #1 Jumper pins 3 and 4 to enable option #2 Jumper pins 5 and 6 to enable option #3 Jumper pins 7 and 8 to enable option #4
JP31	Disable Transmit Time-Out-Timer Jumper pins 1 and 2 to disable transmit time-out-timer
JP32	I^2C Port 1 +5 V 2 SDA / SCL 3 SCL / SDA 4 INT input, active low 5 Ground 6 Ground

P1	Transceiver Interface 1 Transmit audio, DC isolated, 0 to 1 V_{p-p} 2 Receive audio, DC isolated, 350 mV_{p-p} to 3 V_{p-p} 3 PTT not, goes low (<0.65 V) during transmit 4 Ground 5 +12 Vdc, 100 mA max, 2 A with battery 6 Carrier Detect not, set low (< 0.65 V) during receive 7 No connection 8 Ground 9 Ground

TP1	Two-Tone Decoder, HighPass Filter Enable Goes high when processor is decoding a tone > 2100 Hz
TP2	Two-Tone Decoder, LowPass Filter Enable
	Goes high when processor is decoding a tone < 400 Hz
TP3	Receive audio to Two-Tone Decoder Audio at last stage before two-tone comparator, 1 to 3 V_{p-p}
TP4	Transmit audio 0.1 to 3 V_{p-p}
TP5	Receive audio from Two-Tone Decoder to processor Audio after two-tone comparator, square waves to processor, 0 to 5 V_{p-p}
TP6	Receive audio level set External transceiver receive audio set to 1 V_{p-p} using R27
TP7	RX Data Receive data from digital modem IC, 0 to 5 volts
TP8	DTMF Decoder STD Goes low whenever a DTMF digit is being decoded
TP9	Voltage at 48 volt Battery Input 0 – 70 Vdc = 0 – 5 Vdc
TP10	Voltage at 12 volt Battery Input 0 – 20 Vdc = 0 – 5 Vdc
TP11	Ground
TP12	5 V, +/-2% Regulated power supply
TP13	2.5 V, +/-2%, Regulated reference supply
TP14	3.3 V, +/-5%, Regulated power supply
TP15	TR sense input, 0-50 Vdc or 0-79 Vp (full wave rectified AC) = 0-5 Vdc
TP16	Incoming unregulated 17 volt power supply, 14.4-75 Vdc
TP17	8 V, +/-5%, Regulated power supply
TP18	12 V, +/10%, Regulated power supply
TP19	Isolated Ground
TP20	Isolated +12 V, +/10%, Regulated power supply
TP21	Isolated +5 V, +/10%, Regulated power supply

Switches

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

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 ½ second, Activates Functions under code 1
S7	120/240 Vac Selector switch

Speaker Output

R27	External transceiver receive audio set to 1 Vp-p at TP6
R76	Test Speaker output level set
R58	MSK modem transmit deviation level set
R63	DTMF transmit deviation level set

Assigning Site Address (S4)

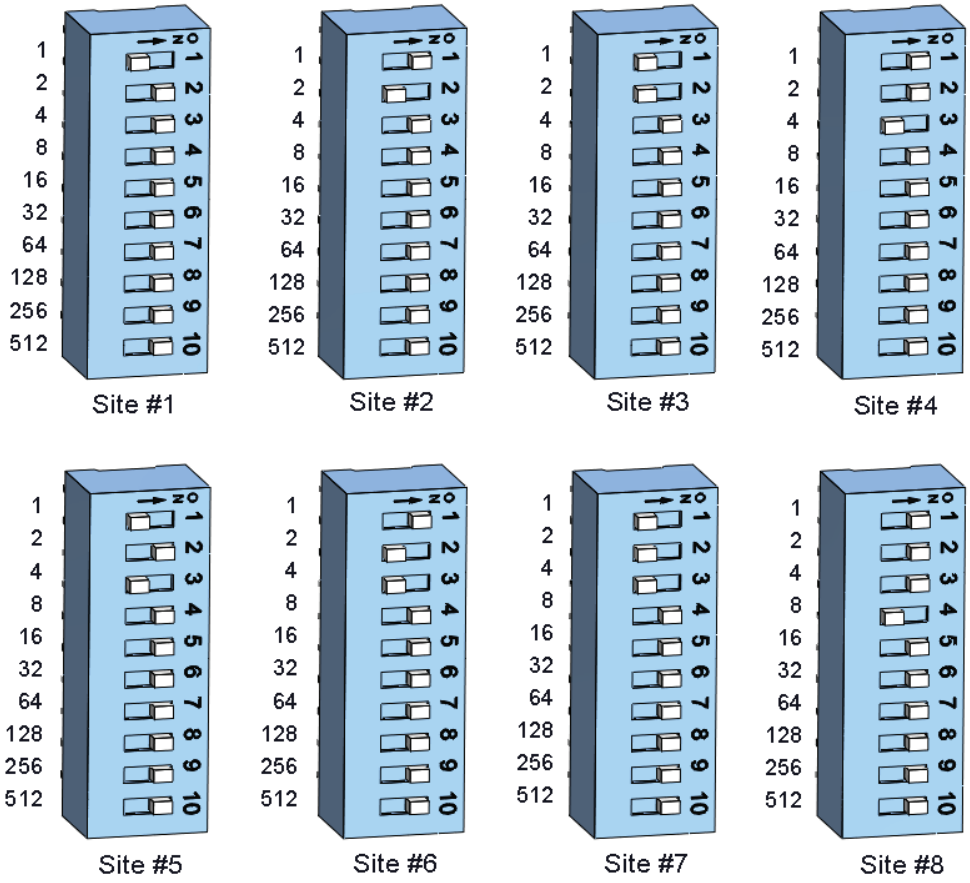
The site address switch gives each FCTBD controller in a two-way system its unique unit number.

For use with Commander: In order 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 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

NOTES:

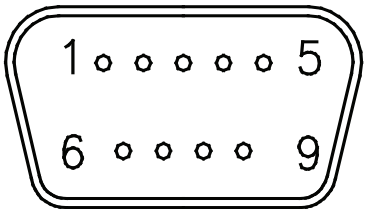
- Set site address to one to program controller card with firmware (HEX code).
- To program a non-digital unit using FSPWARE Software, set site address to one. When programming is completed, change the dip switch setting to the actual site address.
- The site address is stored at power up of the controller. If the site address is changed, cycle all power to the card (battery and AC).

Transceiver Interface

You can interface a transceiver through the male DB9 connector, P1.

Position	Description
1	Transmit Audio
2	Receive Audio
3	PTT
4	Ground
5	12 Vdc (unregulated)
6	Carrier Detect
7	Not used
8,9	Ground

Figure 7 Transceiver Interface Connector P1



Transmit Audio

You can adjust the encoded audio from 0 to 1.2 V_{pp} (O.C.) using the DTMF Deviation Potentiometer, R63 and Digital Deviation Potentiometer, R58. Use to set the audio output level to the transceiver. You can connect the transmit audio to the radio's line level (flat) audio input or its mic (pre-emphasized) audio input, but the flat or non-pre-emphasized input is preferred and is easier to adjust. The transmit deviation is adjusted as follows:

- DTMF–Adjust R63 for 3 kHz deviation (add 0.75 kHz deviation if CTCSS is used)
- Digital–Adjust R58 for 3 kHz deviation (do not exceed 4 kHz)

NOTE: Deviation levels are cut in half when using 12.5 kHz channel spaced radios.

The transmit audio is generated by U14 (the DTMF encoder), U12 (the digital encoder) and the CTCSS board (if present). PTT is generated by the processor taking pin 44 low. This gates U11:B on allowing the transmit audio to pass out to the transmitter.

The PTT also sets the collector of Q4 high, which allows R47 to turn on Q3 through R44. Q4 pulls the PTT line low and activates TRANSMIT LED D18. The collector of Q4, being high, also allows R48 to begin charging C15. When this exceeds 5 volts, U3A forces its output to ground and shuts off Q3. This provides a timeout timer to prevent the transmitter from getting stuck in transmit.

The PTT signal also sets the output of U17F high turning on Q5. This sends a ground to the CTCSS board, telling to encode rather than decode.

Receive Audio

Connect the receive audio to the radio's de-emphasized audio out. You can adjust the audio level of an external transceiver by R27 and when receiving a properly modulated signal as described above, adjust to 1 V_{pp} at TP6.

PTT

Push-to-talk pulls to ground to place the transceiver into transmit mode.

+12 Vdc

The +12 Vdc is an unregulated, 1.0 A supply that can vary from 11.5 to 13.6 Vdc.

Carrier Detect

Carrier Detect input requires a pull to ground to indicate when carrier is present.

Sensors and Sensor Inputs

The FC Controller Board comes with the following inputs to work with external sensors and two built-in sensors to report the following conditions.

AC	JP22
AC (External Sensor Input)	JP10-1
Low Battery, 12 Vdc	JP5-11
Low Battery, 48 Vdc	JP5-9 (only used with 48 V type sirens)
Rotation (Proximity Switch)	JP5-7
Rotation (Current Sensor)	JP10-3
Main Siren Motor Current	JP5-5
Intrusion	JP5-3

AC Sensor

During normal operation (when AC is present) the built-in AC sensor does not light. If AC is lost, the AC LED lights. The AC sensing logic is dependent on both the built-in AC sense and the external AC sense points. If an AC loss is detected at either point, a report is sent. A loss of AC is not reported immediately. The controller makes sure the loss lasts at least 2 seconds then it adds (1 second * Site #) before reporting. Each siren with an AC failure reports by site number in sequential order with a two second delay between sites. Once AC is restored, another automatic report is sent in the same order to show change of state. If AC is restored before the automatic report is sent, the report is canceled.

Low Battery Sensor

The low battery sensor input measures the voltage across the four series batteries. If the battery voltage goes below ~44 V for 20 seconds, the controller reports a low battery condition. The controller does not automatically report when the battery voltage returns to normal to eliminate the possibility of multiple reports when a battery is very weak. The low battery condition remains latched in memory until the controller is reset or a function is run and the battery voltage is restored.

Digital Inputs for Rotation Sensor

Two rotation sensor inputs exist. Depending on the sensor option purchased, either the current sensor or proximity switch input is used.

- Standard Rotation Sensor Input: JP10-3 is used for the rotation motor current sensor. This input latches when current is detected. During a siren rotation this input is pulled low. The latch is reset by the RESET command.
- Proximity Switch Rotation Sensor Input: JP5-7 is used to connect a proximity switch to detect siren rotation. You may leave this input unconnected if a non-rotating siren

is used or if JP10-3 is used to detect rotation. During a normal siren activation (when the siren is rotating), the external rotation sensor, which is usually an open collector proximity device mounted in the siren to detect gear movement, provides active low pulses. Once this input receives more than 11 low pulses during a siren activation, this input will latch active until a reset command is received.

Digital Input for Current Sensor

Use JP5-5 to detect the main siren motor operating current during siren activation. This input is pulled low when the external current sensor detects proper running current during a siren activation. If this input is pulled low for 1/4 second, the input is latched active until another activation command is received or a Reset command is sent.

Digital Input for Intrusion Sensor

Use JP5-3 to detect an intrusion into the Control Cabinet. With the Control Cabinet closed, the intrusion switch is in a normally closed position. If the intrusion condition changes state for more than one second, an auto-report is sent.

Digital Input for Pressure Sensor (not used with 2001-130 sirens)

Use JP5-1 to detect blower pressure on Thunderbolt sirens during siren activation. This sensor input latches when operating current is detected (input is pulled low) and resets when a RESET command is received.

Relay Outputs

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 two DPST relays. Relay #3 is reserved for testing the system while using batteries. Relay #4 is reserved for the low voltage cutoff feature.

Speaker Output

You can use the speaker output at JP2 to monitor received audio, route remote P.A. or provide signal out when the tone generator option is used. You can adjust speaker output up 2.0 $V_{p\text{-}p}$ into an 8-ohm load using R61.

Monitor Received Audio

When carrier is present, the received audio is routed to the test speaker output at JP2.

Remote Public Address

You need to program the P.A. as a function through the software if it is to be used. When the P.A. function is activated, the FC Controller Board routes the received audio to the speaker output as long as the carrier is detected. If the carrier drops out for more than 15 seconds, the unit goes back to standby mode.

Audio Function Generator Option

To use this feature, you need to program one of the standard signals or a custom signal through the software. When the audio function is activated, the audio from the function generator is routed to the speaker output until the function finishes or a cancel code is sent.

Landline and Local Button Activation

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. Each button is labeled with its associated function.

Control Board Power Input

The FC Controller Board has a switch selectable nominal 120/240 Vac power input. When the proper voltage is applied, the POWER LED is lit. Set S7 to the appropriate voltage input level. Verify charger is also set accordingly. See “Installation” on page 35 for installation details.

DTMF Decoding and Encoding Formats

Decoding Format

DTMF

Receive audio enters the DTMF decoder IC (U14) from the high pass filter through C51 and R64. When a proper DTMF digit is being decoded, TP8 will go low and a binary output will appear on pins 18, 19, 20, and 20 of U14.

Two-Tone

The FC Controller Board decodes two-tone codes with tone accuracy within 1.5%. Timing must be at least 80% of what has been programmed. The inter tone gap must be less than 400 milliseconds. The recommended minimum tone spacing is 5%. You can use tone timings between 0.5 seconds and 8 seconds for the A tone and between 0.25 seconds and 8 seconds for the B tone.

DTMF Encoding Format

The FC Controller Board encodes a nine-digit DTMF string that includes the RTU’s unit type, ID number, function status, and sensors status. Refer to the Software Description of DCFCTB Encoding Format section for detailed information.

Programming Software

FSPWARE

FSPWARE is software for two-tone and DTMF controlled systems. This software requires a direct connection between the siren and the computer’s RS232 port through the use of a PCB universal cable adapter.

The Commander® Digital System Software (SFCDWARE)

Commander (SFCDWARE) software is used to control, monitor, and configure the siren controller. The software communicates with the siren controller over an RS232 port. Refer to the Help menu provided with the software for operational details.

Service and Maintenance

⚠ WARNING

The siren has moving parts, high operating current, explosive gases, corrosive materials, and high output sound levels which could cause severe personal injury, electrocution, or death.

Qualified personnel familiar with the siren, associated controls, and power sources being used, should perform service or maintenance.

Before servicing or maintaining, ensure that remote activation cannot occur and disconnect power to the siren and the associated control equipment.

Preventative Maintenance

To ensure that the warning system is fully operational and to maintain the highest possible level of reliability, perform the following monthly testing and annual inspection. In order to maintain the integrity of the warning system, prompt investigation of any reported failures must be researched and corrected promptly.

Monthly Testing

The following is a typical monthly test outline:

1. Reset all sirens to clear latched sensor status inputs (DTMF systems only).
2. Activate one of the siren functions (3 minute activation recommended). If the 240 Vac transformer/rectifier option is used, test both AC and DC operation. Test sirens using battery power. Ensure transfer relay operation is successful.
3. Poll the system for siren status reports.
4. Examine each site report for any failed condition. If you detect a failure condition, notify designated service personnel.

Annual Inspection

Perform the pre-operational system test procedure on an annual basis. See “Pre-operational System Testing” on page 43 for details.

Options

Model 2001TRBP

The 2001TRBP is a transformer/rectifier for primary system power with battery back up and allows the siren to operate from a 208, 220, or 240 Vac power source when AC power is available. During normal operation, the 2001TRBP maintains a charge to the standby batteries. During an AC power failure, an automatic switch to battery operation occurs to maintain the siren’s normal operation. Specify the AC line voltage when ordering.

The 2001TRBP has a 115 Vac secondary tap to provide power to the siren Control Cabinet.

2001TRBP Mounting Location

Mount the transformer assembly as close as possible to the Control/Battery System to keep cabling distance as short as possible.

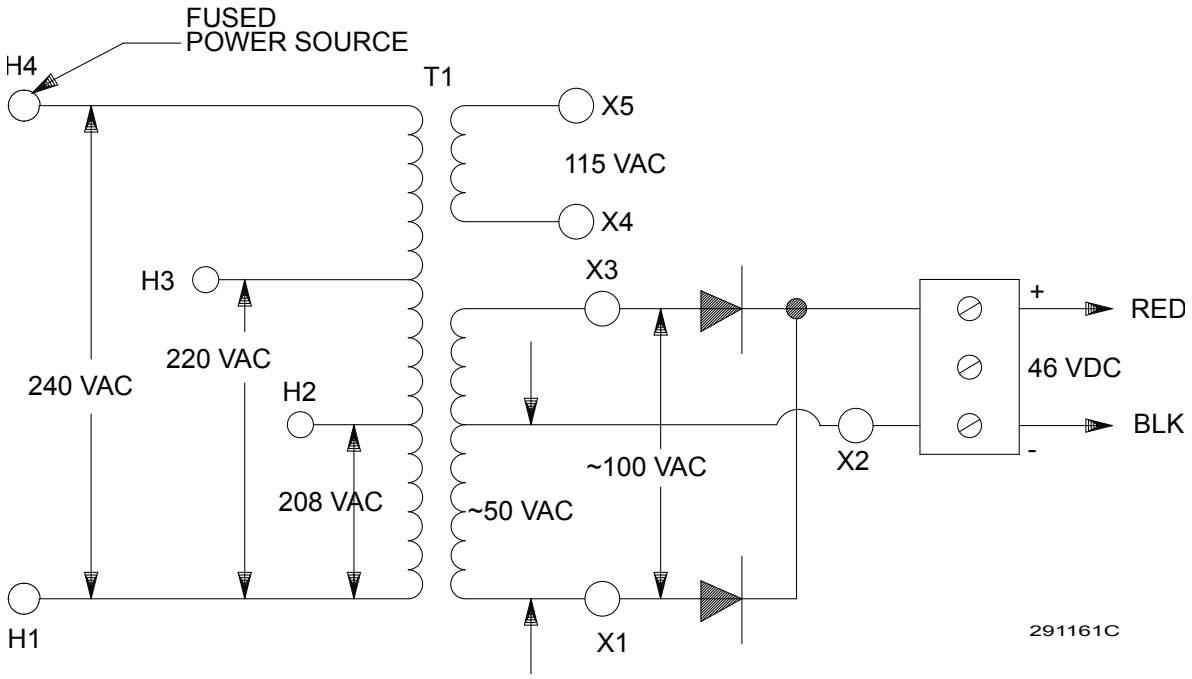
2001TRBP Wiring

⚠ DANGER

ELECTROCUTION HAZARD: Electrocution or severe personal injury can occur when making electrical connections, drilling holes, or lifting equipment. Therefore, only experienced electricians should install this product in accordance with local and National Electrical Codes.

NOTE: Federal Signal recommends using wire no smaller than 3 AWG between the transformer and the Control/Battery System. To perform the wiring, proceed as follows. (See "Figure 8 Schematic Diagram 2001TRBP" on page 63 and "Figure 9 Transformer Rectifier Wiring to Control Cabinet" on page 65.)

Figure 8 Schematic Diagram 2001TRBP



⚠ DANGER

When wiring the Model 2001TRBP to the Control Cabinet, the installer must follow wiring instructions as in Figure 10 Transformer Rectifier Wiring to Control or damage may occur to Control System and/or batteries.

Preparation

To wire the 2001TRBP:

1. See "Figure 4 Typical DCFCB or DCFCTB with 2001TRBP Installation Drawing" on page 36, "Figure 12 DCB Wiring Diagram" on page 73, "Figure 13 DCFCB Wiring Diagram" on page 74, and "Figure 14 DCFCTB Wiring Diagram" on page 75.
2. Remove the 2001TRBP transformer from its shipping crate and stand the transformer on its top to expose the inspection covers located on the bottom side. (See "Figure 10 2001TRBP Transformer Rectifier" on page 66.)
3. Remove the four 3/8-inch hex head bolts that secure the inspection covers and remove the inspection covers from the transformer.

4. Pull the four primary lines marked H1, H2, H3, and H4 and secondary lines X4 and X5 from the inside of the transformer.
5. Punch or drill the plate, use one 1/2-inch conduit for AC in and one 1-inch conduit for 120 V and 48 V out to the controller.
6. Install a 1-inch 45 degree Liquid-Tight connector into the 1-inch opening on the transformer. Face the connector to the rear of the transformer and tighten the 1-inch lock ring. Put a 1-inch plastic bushing over the exposed thread end on the 1-inch connector.
7. Cut a section of 1-inch Seal-Tight, 7 inches in length. This provides raceway for the 48 Vdc secondary and for Control Cabinet 120 Vac input.
8. Cut a section of 1/2-inch Seal-Tight 18 inches in length. This provides A/C input voltage from the AC disconnect to the transformer. If the AC disconnect does not have 120 Vac available, the X4 and X5 taps in the 2001TRBP may be used to provide AC voltage to the Control Cabinet. In this case, run the Seal-Tight between the 2001TRBP and the siren controller.

Table 43 Transformer Wiring

Transformer Primary	(2 each) 10 AWG, CU, stranded, black 40 inches in length
Rectifier Output	(1 each) 2 AWG, CU, Black, 30 inches in length–48 Vdc Negative
	(1 each) 2 AWG, CU, Red, 40 inches in length–48 V dc Positive
Control Cabinet	(1 each) 14 AWG, CU, stranded, black 60 inches in length–120 Vac Line
	(1 each) 14 AWG, CU, stranded, white 60 inches in length–Neutral

To connect the transformer wiring:

1. The (2 each) 40-inch black 10 AWG lines provide 208/220/240 Vac for transformer primary input.
2. The 60-inch black and 60-inch white lines provide the AC input to the Control Cabinet. These wires will pass through the transformer as a raceway then be routed into the Control Cabinet unless the X4 and X5 taps are used in the 2001TRBP. (See “Figure 4 Typical DCFCB or DCFCTB with 2001TRBP Installation Drawing” on page 36, “Figure 12 DCB Wiring Diagram” on page 73, “Figure 13 DCFCB Wiring Diagram” on page 74, and “Figure 14 DCFCTB Wiring Diagram” on page 75.)

   The 60-inch black and 60-inch white lines provide the 120 Vac input to the DC Control Cabinet. It connects the terminal block in the 2001TRBP labeled X4 and X5 to TB5 F1 and F2.
3. The 30-inch black 2-AWG line provides the 48 Vdc negative to the DC Control Cabinet. It connects the terminal block in the 2001TRBP labeled “-” and the 5/16-inch ground stud on the backplane of the siren controller.
4. The 40-inch red 2 AWG line provides 48 Vdc positive voltage to the DC Control Cabinet. It connects to the terminal block in the 2001TRBP labeled “+” and to the labeled terminal (#3) at K3.

AC Line Wire Terminations

Table 44 AC Line Wire Terminations

	Service disconnect	Transformer
240 Vac operation Transformer Primary: 2 each #10 black wires	L1 L2	H1 H4
220 Vac operation Transformer Primary: 2 each #10 black wires	L1 L2	H1 H3
208 Vac operation Transformer Primary: 2 each #10 black wires	L1 L2	H1 H2
115 Vac Tap Transformer Secondary		X4 X5

NOTE: Cap all unused taps with wire nuts

Figure 9 Transformer Rectifier Wiring to Control Cabinet

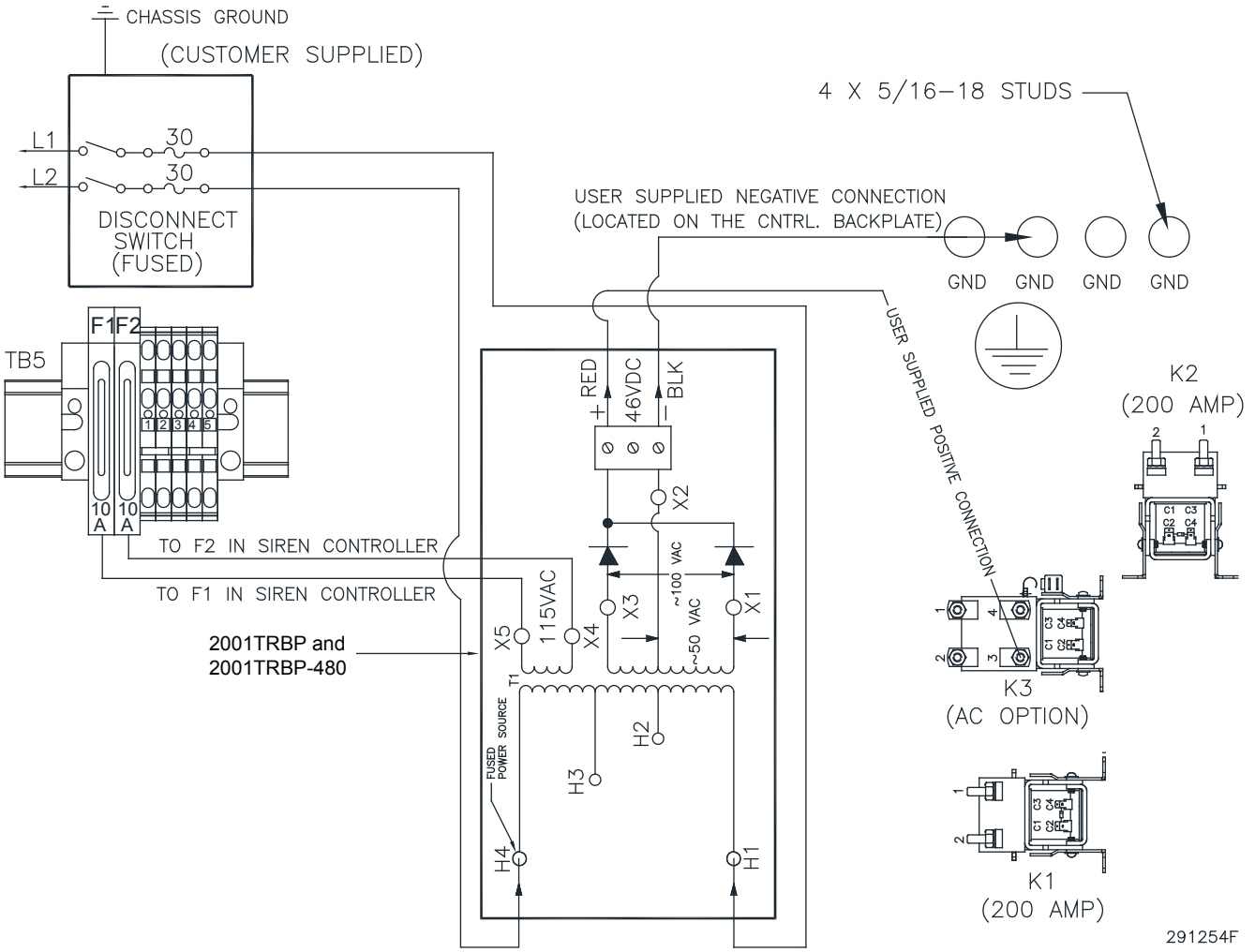
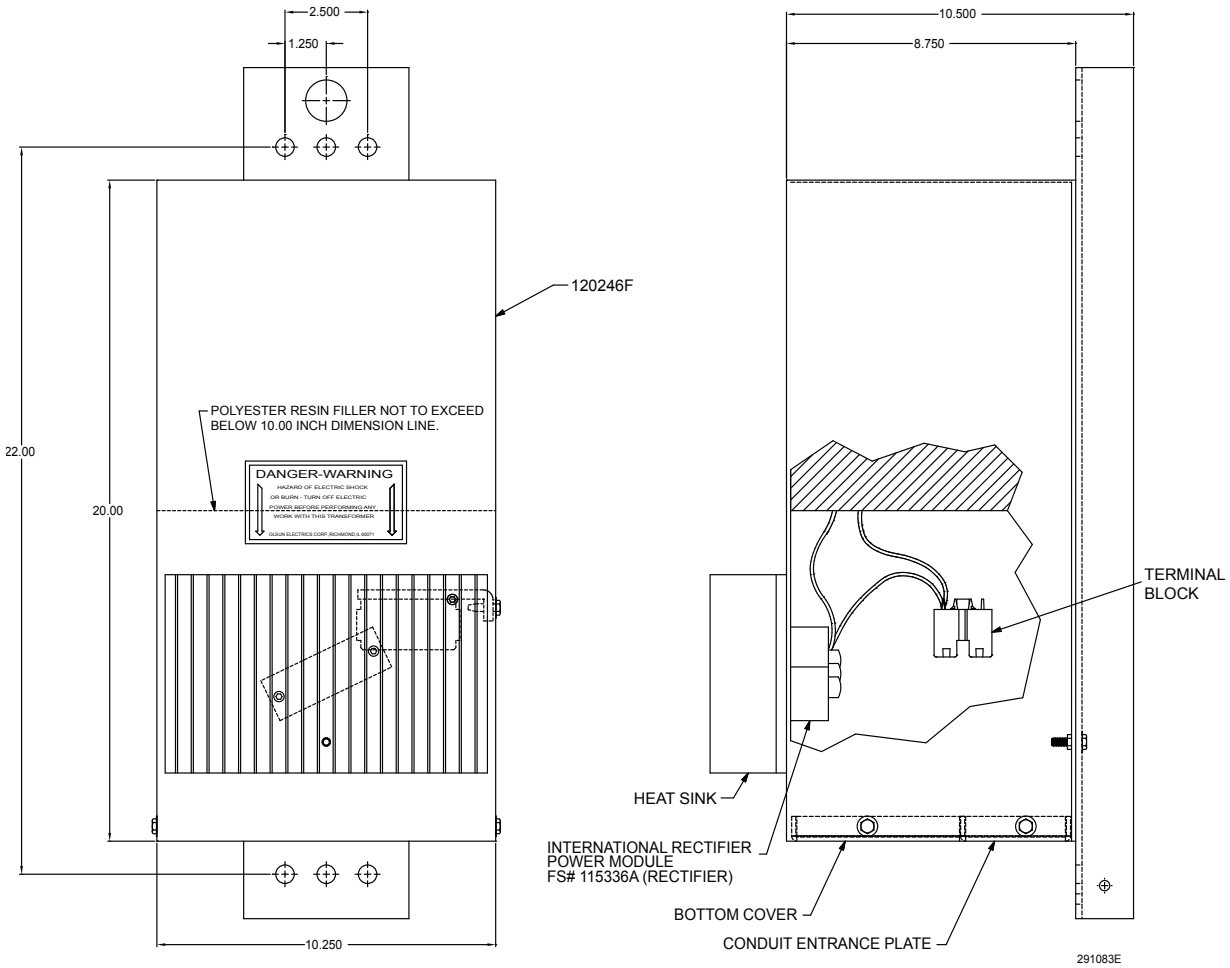


Figure 10 2001TRBP Transformer Rectifier



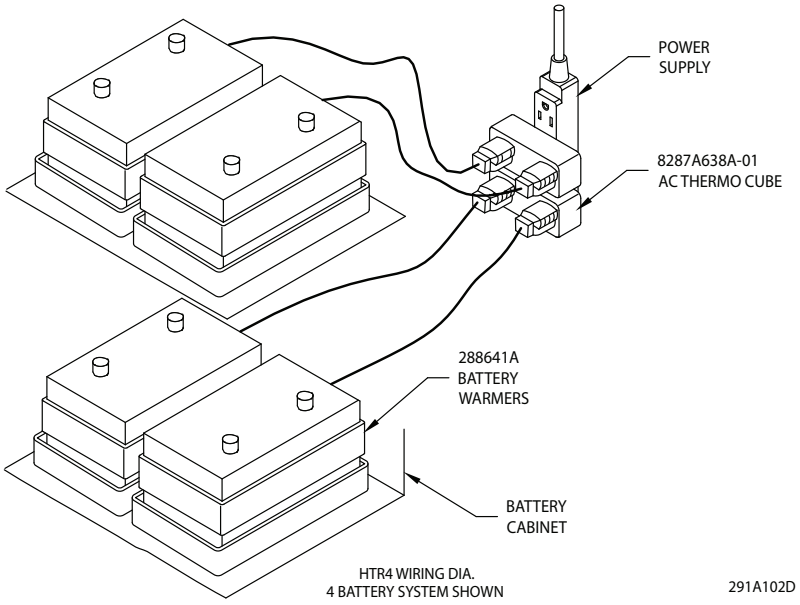
Model HTR4 (Battery Warmers)

⚠ CAUTION

Battery warmers require 120 Vac. If 240 Vac is used to power the FC board and charger directly, battery warmers are not allowed.

In locations where temperatures may drop below freezing for extended periods, the optional battery warmers are recommended to maintain battery efficiency. A thermostat provides on/off control of the warmers that senses the inside temperature of the Battery Cabinet. The battery warmer option is equipped with four battery warmers that are wrapped around each of the four batteries in the Battery Cabinet. The warmers are plugged into the cube taps, which plug into the thermostat cube, which is plugged into a 120 Vac outlet that is provided for in the Battery Cabinet. No other connection or mounting is required for this option.

Figure 11 HTR4 Wiring Diagram



⚠ DANGER

ELECTROCUTION HAZARD: Electrocution or severe personal injury can occur when making electrical connections, drilling holes, or lifting equipment. Therefore, only experienced electricians should install this product in accordance with national and local electrical codes.

Model 2001HR (Holding Relay)

This option enables the control of both of the siren motors from a single contact closure on one-way models. This feature is typically required for telephone line control systems and is only required if an FC is not purchased. The 2001HR is a holding relay, which holds the rotator motor on for 15 seconds after the control contact is released, keeping siren rotation active during wail signals. The control contact is wired between K2-C1 and ground.

Solar Power

When purchased, the solar option allows the siren to operate in areas where AC power is not available. You can also use the solar option in locations where AC power is available. In the event that AC power is lost, the solar option serves as a backup power source. The solar option maintains a battery charge until the AC power is restored. The PVS220W-48 model for the DCFCB and DCFCTB controllers includes a solar regulator and solar panel kit. When installed, the batteries are charged by the photovoltaic charging system, instead of a battery charger, to provide operational power to the siren. See the Solar Power Option Manual (255379) for drawings.

Model DCFCTBD-IP

General

The DCFCTBD-IP combines the characteristics of a DCFCTBD with serial to Ethernet conversion capabilities. This allows serial devices to communicate over an Ethernet network and provides audio decoding of digitized audio sent over the network.

The converter is configured with its own fixed IP address and port number. When packets of data are received over the Ethernet port that are addressed to the board's IP and port number, they are converted to serial data and sent out over the serial port. Likewise, any data coming into the serial port is converted to TCP/IP data packets and sent out over the Ethernet port to the server's IP address. The unit also contains a digital to analog converter. This allows specially configured incoming data packets to be converted to audio, which is then filtered and sent out over a 600 ohm audio port.

Ethernet Board Specifications

Table 45 Ethernet Board Specifications

Electrical	
Input Voltage	10.5 to 95 Vdc
Current Draw	< 150 mA
Serial Port	
Serial Port Protocol	RS232C, N, 8, 1 baud rate configurable
Ethernet Port	
Protocol	IEEE 802.3, 10 Base-T connection
600 Ohm Audio Output Port	
Protection	MOV and Transorb surge protection
Impedance	600 ohms
Audio Output Level	Adjustable from 0.30 to 3.00 V_{p-p}, (-17 dB to +2.7 dB) into 600 ohms
Environmental	
Operating Temperature	-30°C to +65°C
Humidity	0 to 95% non-condensing
Physical	
Dimensions (H x W x D)	~ 2 x 4 x 6.5 inches
Weight	< 2 lb

Connections

Table 46 Connectors

JP1	600-ohm Audio Output Port
	Balanced line output.
JP2	JTAG Emulation port
JP3	Audio Output Expanded or Flat Selection Jumper Jumpers pins 1 and 2 for flat audio output. Jumpers pins 2 and 3 for expanded dynamic range audio output.
JP4	RS232 Serial Port
JP5	FLASH Programming and Converter Configuration Port

JP6	10.5-95 Vdc Power Input
JP7	Resets board back to factory default settings
J1	Ethernet Network Port

Table 47 Indicators

D1	CPU Heartbeat indicator, green.
D2	Transmit data indicator, red.
D3	Receive data indicator, yellow.
D4	Power indicator, green.

Table 48 Controls

R1	600 ohm audio output level set.

Network Information

Protocols Supported

- TCP/IP
- UDP (optional)
- XML (optional)
- XMPP (optional)

IP Ports Used

- 16887 (SmartMsg TCP/IP)
- 80 (HTTP)
- 3100 (optional UDP Serial Over IP)
- 3101 (optional UDP Voice Over IP)

IP Address

User selectable

TOS/DSCP (Type of Service)

User selectable

Bandwidth Requirements

Voice Over IP	150 K baud per connection
Siren Activation	50 bytes per connection
Siren Poll Response	74 bytes per connection

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. For instruction manuals and information on related products, visit http://www.fedsig.com/

Appendix A Stainless Steel Care and Maintenance

Type 316 Stainless Steel is a durable material with strong anti-corrosion properties. With proper care and maintenance, it maintains an optimal appearance over a long service life. Exposure to high-saline environments, chlorides, abrasive chemicals, or carbon steel diminishes its anti-corrosion properties and increase the risk of damage.

⚠ CAUTION

Improper care of stainless steel diminishes its anti-corrosion properties and may result in surface damage.

- Use only stainless-steel components (that is, washers, bolts, etc.) and tools when installing stainless steel products.
- Never use carbon steel or galvanized fasteners to install stainless steel products.
- Do not use cleaning products containing chlorides (that is, hydrochloric acid) or other abrasive chemicals.
- When power washing nearby surfaces, wrap stainless steel to prevent contact with concrete detergents.
- If chloride solutions or concrete detergents contact stainless steel, immediately rinse away with water.
- Always wear clean gloves when handling stainless steel products.
- Do not use abrasive brushes or scouring pads to wipe stainless steel.
- Unless otherwise specified, apply all cleaners and polishers with a soft, lint-free cloth or soft nylon brush. For heavier rust deposits, a nylon scouring pad may be required; however, buffing with nylon pads may alter stainless steel finishes. To minimize alteration, use only “ultra-fine” nylon pads and rub with the grain. Avoid excessive scrubbing.
- Do not clean stainless steel in direct sunlight or excessive temperatures.
- Do not weld, cut, drill, or grind carbon steel near stainless steel. Resulting particles will contaminate and rust stainless steel.
- Stainless steel care and maintenance may require the use of harmful chemicals. Follow all use and safety instructions provided with cleaning or polishing agents. Ensure personal protective equipment is worn in accordance with occupational health and safety guidelines stipulated by your local governing authority.

Cleaning

Routine cleaning with soap and water is usually sufficient to maintain the corrosion resistance and appearance of 316 Stainless Steel. Use a soft nylon brush to remove any accumulated dirt. Wash with mild soap or detergent, then rinse in clean water and wipe dry with a soft cloth.

Iron or Carbon Steel Contamination

Passivated stainless-steel surfaces can be compromised by contact with iron or carbon steel products. This can result from exposure to nearby welding, cutting, drilling, or grinding of carbon steel. Grit from iron or carbon steel will quickly rust in the presence of moisture. If left unattended, contaminates may compromise passivation, leading to stainless steel rust. To remove contaminants from stainless steel surfaces, use a soft cloth to apply a solution of Oxalic Acid. Leave solution on surface for a few minutes to dissolve contaminating particles. Once clean, thoroughly rinse away all residual solution with clean water.

Corrosion

Type 316 Stainless Steel does not corrode with proper care. If signs of corrosion appear, clean immediately.

- Minor: Use an all-purpose lubricant, such as WD-40, to wipe affected stainless steel. Domestic stainless steel cleaners containing calcium carbonate or citric acid, such as Citisurf 77 Plus, can also be used. Rinse thoroughly with clean water. If rust remains, treat as moderate. If rust returns in a short time, treat for iron or carbon steel contamination.

- Moderate: Use E-NOX CLEAN or another Phosphoric Acid based stainless steel cleaner. Spread cleaner evenly over the surface, wait 30-60 minutes, and then neutralize the acid with an alkaline cleaner like UNO S F. Thoroughly rinse away all residue with clean water. If rust remains, stainless steel may need to be treated for severe corrosion or be replaced. If rust returns in a short time, treat for iron or carbon steel contamination.

- Severe: Due to the highly corrosive nature of severe rust treatments, and the inherent risks to personnel and surrounding environments, a professional service provider is recommended. Severe rust is treated with a pickling bath, typically containing highly corrosive hydrofluoric acid. Once treated, stainless steel can be passivized with mild nitric acid.

Mortar and Cement Spatter

If mortar or cement comes into contact with stainless steel, remove immediately. Use E-NOX CLEAN or another Phosphoric Acid based stainless steel cleaner. Spread cleaner evenly over the surface, wait 30-60 minutes, and then neutralize the acid with an alkaline cleaner like UNO S F. Thoroughly rinse away all residue with clean water.

Graffiti Removal

Remove graffiti from stainless steel with a biodegradable graffiti-cleaning spray or wipe. Avoid using knives or hard scraping tools to remove graffiti, as these may damage stainless steel surfaces.

Oil and Grease Marks

Remove oil or grease from stainless steel with hydrocarbon solvents such as methylated spirit (Bartoline is a common brand), isopropyl alcohol (that is, rubbing alcohol) or acetone. Apply solvent several times with a clean, non-scratching cloth until all oil or grease is removed.

Heavily Neglected or Tarnished Surfaces

Use domestic metal polish to improve the appearance of tarnished stainless steel. Chrome polishes for automotive parts are suitable for stainless steel and are widely available. Treat entire stainless-steel surface to avoid discolored patches.

Heavily Damaged Products

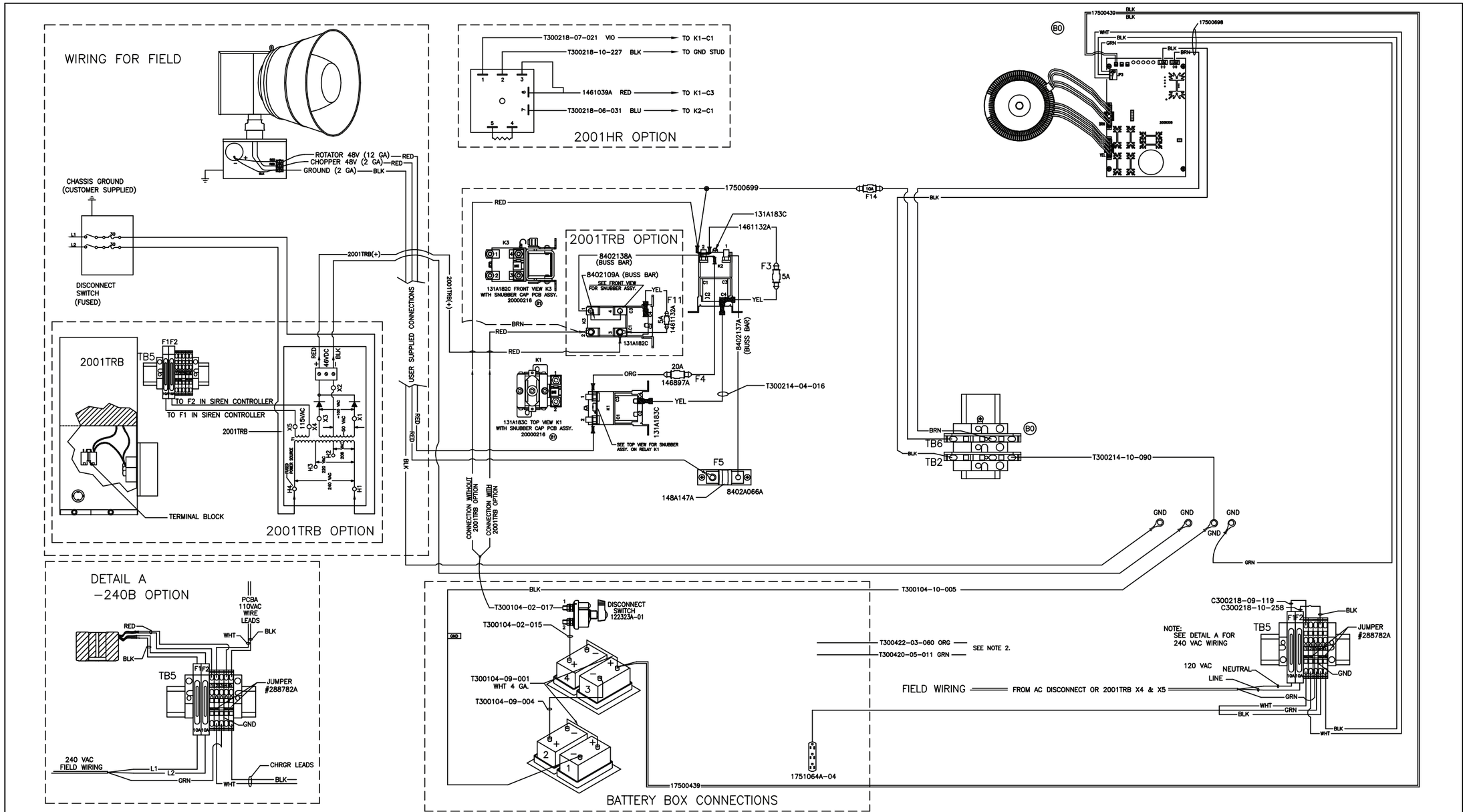
To avoid progression of damage, identify and address problems as early as possible. Heavy damage includes structural compromises such as visible dents, cracks, breaks and rust that can undermine the integrity of a product. Heavily damaged products should be removed from service until a repair or replacement can be made. To prevent worsening of damage, remove any significant rust as soon as possible.

NOTICE

This content is provided for informational purposes only. Any mention of a specific product is not a guarantee of quality or effectiveness. Federal Signal is not responsible for any improper use or handling of hazardous chemicals.

Appendix B Drawings

Figure 12 DCB Wiring Diagram



NOTES:

1. FIELD WIRING IS WRAPPED AND SHIPPED IN BATTERY CABINET WITH BATTERY TRAYS.
2. T300422-03-060 AND T300420-05-011 TO BE COILED AND WIRE TIED IN CABINETS AFTER BEING RTV'D FOR POSSIBLE FUTURE USE.
3. LENGTH OF WIRES IN BATTERY CABINET (MEASURED FROM CONDUIT END TO TERMINAL START ±0.5").
   - T300420-05-011, GREEN, 32"
   - T300422-03-060, ORANGE, 32"
   - T300104-02-017, RED, 13"
   - T300104-10-005, WHITE, 26"
   - 1751064A-04, 11.5" TO END OF PLUG

REV.	CHANGE	DATE	BY
B1	SEE ECR# 3273	7/28/15	MJF
B0	SEE ECR# 3067	4/6/15	VT
A4	SEE ECR #2294	9/3/14	MJF
A3	SEE ECR #2317 (RE-ACTIVATED)	7/30/14	MAF
A2	SEE ECO #07-4054	4/12/07	MAF
A1	SEE ECO #07-4009	1/25/07	MAF
A	SEE ECO #06-4083	8/4/06	MAF

Tolerances Unless Otherwise Specified: Angles ±0.5°; X.XX ±.015; X.XXX ±.005

SIGNAL DIVISION, Federal Signal Corporation, 2645 FEDERAL SIGNAL DRIVE – UNIVERSITY PARK, IL 60466

FINISH: N/A
REMOVE BURRS, SHARP CORNERS AND EDGES

MATERIAL: N/A

UNIT OF MEASURE: RF

NAME: WIRING DIAGRAM, DCB MODELS

DRAWN BY: MAF DATE 8/4/06

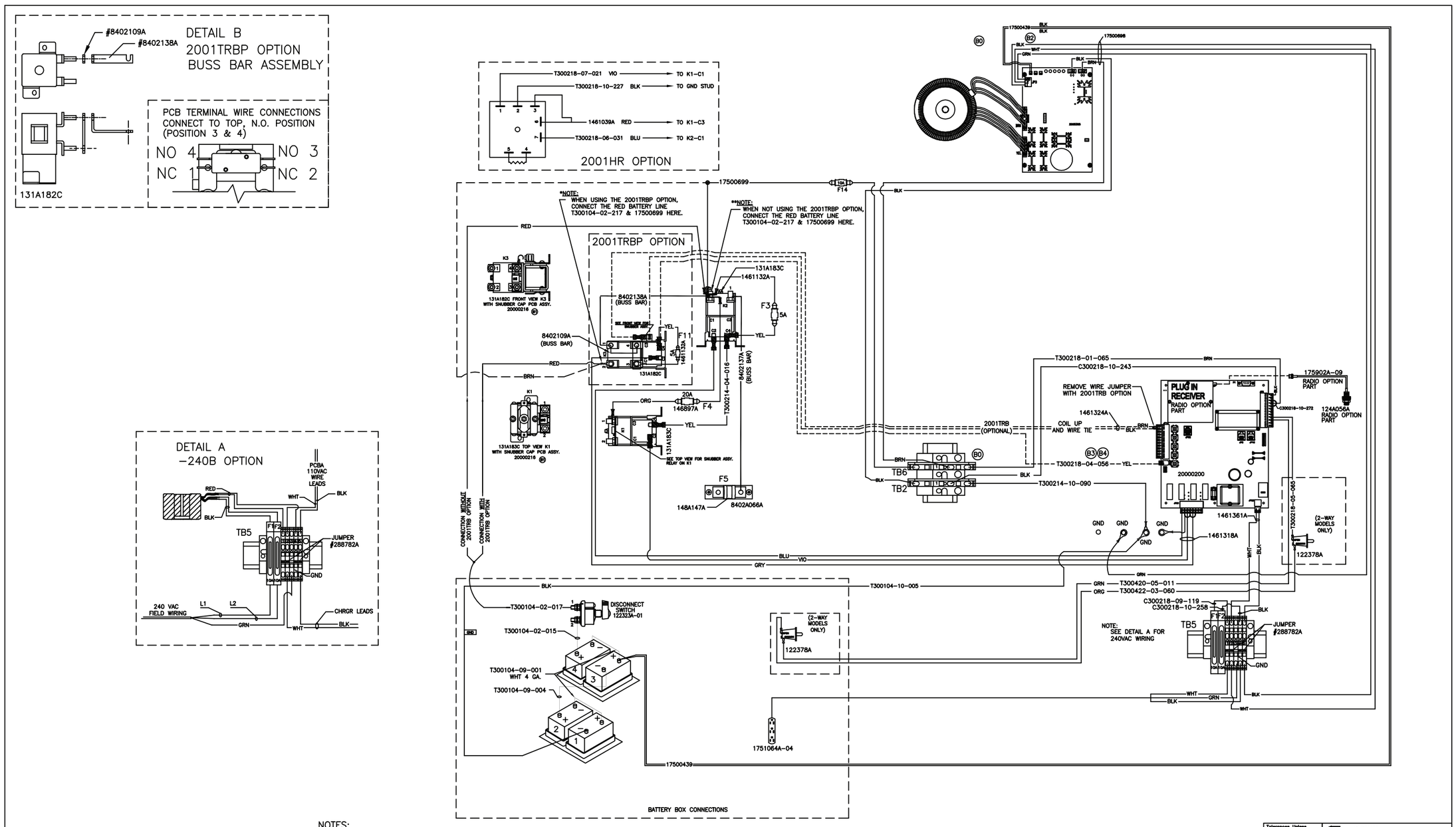
CHKD. BY: MJF DATE 8/4/06

SCALE AT D SIZE: NONE DO NOT SCALE DRAWING

DRAWING NUMBER: 259197

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Figure 13 DCFCB Wiring Diagram



NOTES:

1. FIELD WIRING IS WRAPPED AND SHIPPED IN BATTERY CABINET WITH BATTERY TRAYS.
2. LENGTH OF WIRES IN BATTERY CABINET (MEASURED FROM CONDUIT END TO TERMINAL START ±0.5").
   T300420-05-011, GREEN, 32"
   T300422-03-060, ORANGE, 32"
   T300104-02-017, RED, 13"
   T300104-10-005, WHITE, 26"
   1751064A-04, 11.5" TO END OF PLUG

REV.	CHANGE	DATE	BY
B4	SEE ECR #12829	2/4/20	MAF
B3	SEE ECR #11848	6/17/19	MAF
B2	SEE ECR #7081	2/14/17	MAF
B1	SEE ECR #3273	5/3/16	MAF
B0	SEE ECR# 3067	2/13/15	VT

FINISH: N/A
REMOVE BURRS, SHARP CORNERS AND EDGES
MATERIAL: N/A
UNIT OF MEASURE: RF
NAME: WIRING DIAGRAM, DCFCB MODELS
DRAWING NUMBER: 259035

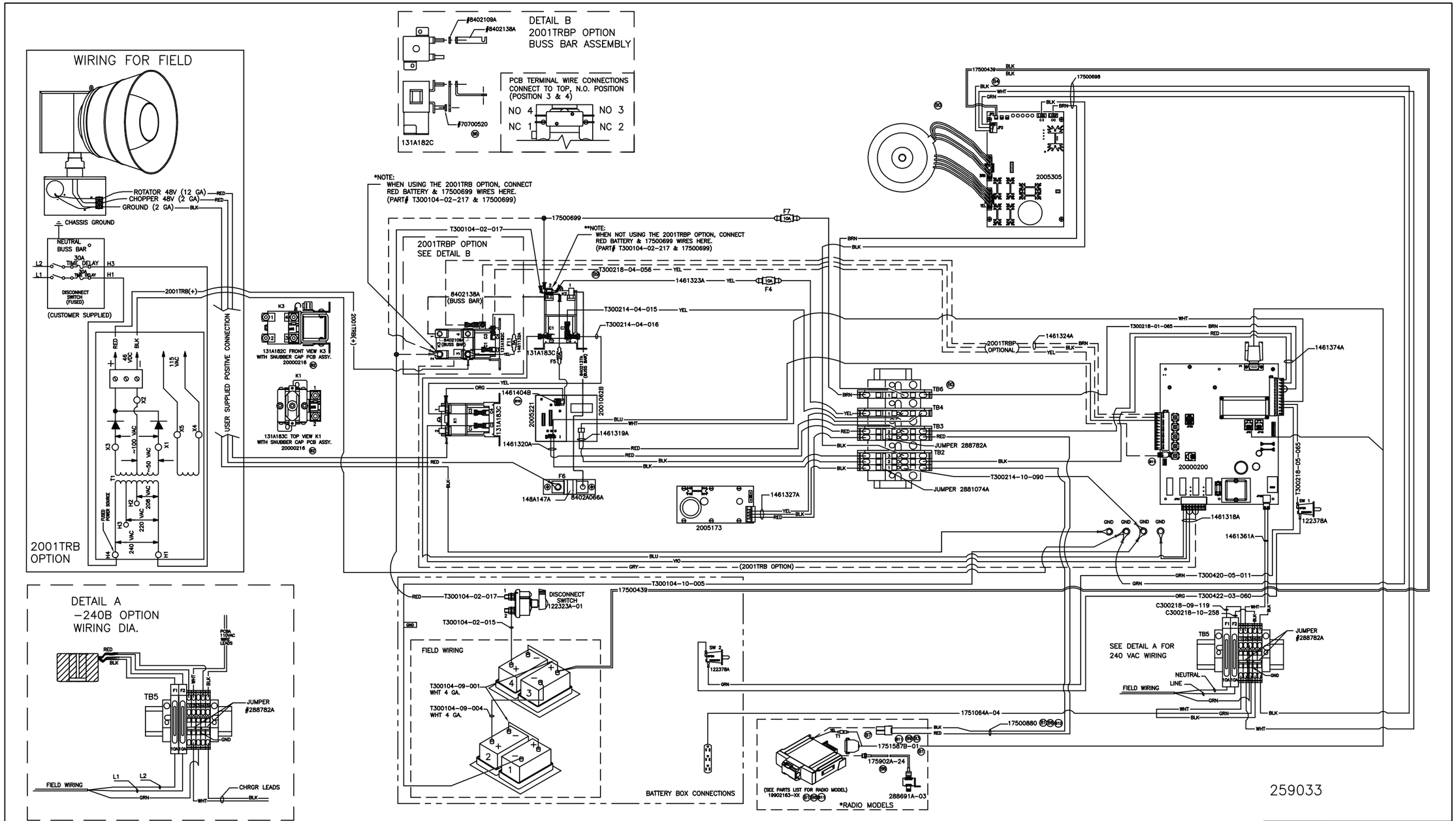
Tolerances Unless Otherwise Specified
Angles ------ ±0.5°
X.XX ---------- ±.015
X.XXX ------- ±.005

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DRAWN BY SRG DATE 11/04/02 | CHKD. BY SC DATE 11/04/02 | SCALE AT 0 SIZE: NONE DO NOT SCALE DRAWING

Figure 14 DCFCTB Wiring Diagram



259033

1. THIS DIAGRAM INCLUDES MODELS DCFCTB, DCFCTBH, DCFCTBU DCFCTBD, DCFCTBDH & DCFCTBDU
2. FOR -240B OPTION "SEE DETAIL A"
3. FOR 2001TRB OPTION "SEE DETAIL B"
4. FOR SINAD OPTION "SEE DETAIL C"
5. COIL UP THE BLACK & BROWN WIRE ON #1461324A, AND WIRE TIE WHEN NOT USING 2001TRB OPTION
6. COIL UP THE GREY WIRE ON #1461318A, AND WIRE TIE WHEN NOT USING 2001TRB OPTION
7. TO PRINT LAYOUT FOR MANUAL, TURN ON LAYER "FIELD" AND TURN OFF LAYERS "SHEET" AND "SHEET-TXT".
8. LENGTH OF WIRES IN BATTERY CABINET (MEASURED FROM CONDUIT END TO TERMINAL START ±0.5").
   T300420-05-011, GREEN, 32"
   T300422-03-060, ORANGE, 32"
   T300104-02-017, RED, 13"
   T300104-10-005, WHITE, 26"
   1751064A-04, 11.5" TO END OF PLUG

REV.	CHANGE	DATE	BY
B12	SEE ECR #13145	3/2/20	MAF
B11	SEE ECR #12829	2/3/20	MAF
B10	SEE ECR #12518	11/1/19	MAF
B9	SEE ECR #11848	6/17/19	MAF
B8	SEE ECR #10974	1/4/19	MAF
B7	SEE ECR #10237	8/13/18	MAF
B6	SEE ECR #9210	2/23/18	MAF

Tolerances Unless Otherwise Specified: Angles ------ ±0.5°; X.XX ------ ±.015; X.XXX ------ ±.005

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FINISH: N/A
REMOVE BURRS, SHARP CORNERS AND EDGES

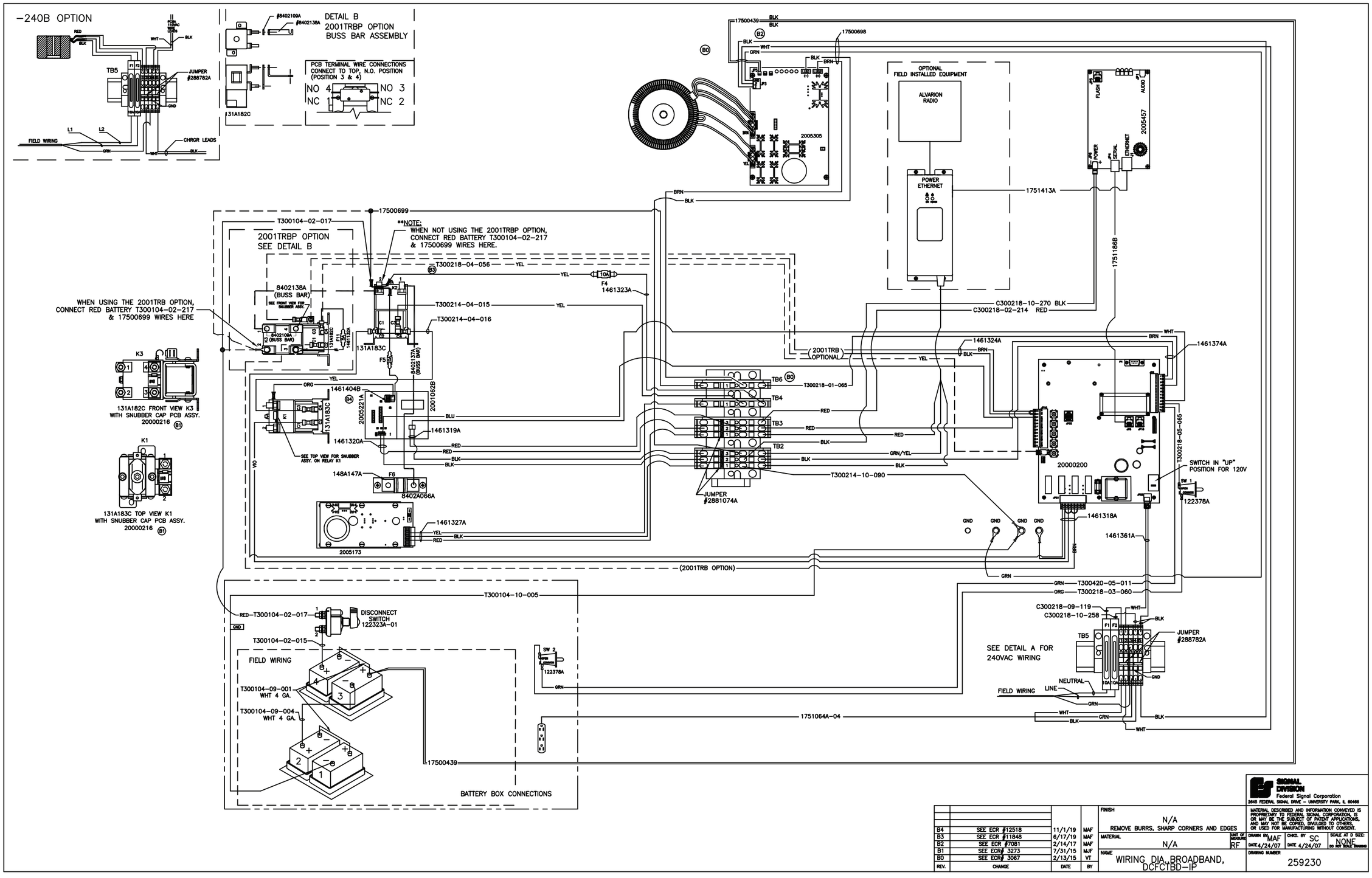
MATERIAL: N/A
UNIT OF MEASURE: PC

NAME: DCFCTB MODELS WIRING DIAGRAM

DRAWN BY: SRG DATE 5/13/02
CHKD. BY: SC DATE 5/13/02
SCALE AT D SIZE: NONE DO NOT SCALE DRAWING
DRAWING NUMBER: 259033

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Figure 15 DCFCTB-IP Wiring Diagram



REV.	CHANGE	DATE	BY
B4	SEE ECR #12518	11/1/19	MAF
B3	SEE ECR #11848	6/17/19	MAF
B2	SEE ECR #7081	2/14/17	MAF
B1	SEE ECR# 3273	7/31/15	MJF
B0	SEE ECR# 3067	2/13/15	VT

FINISH: N/A
REMOVE BURRS, SHARP CORNERS AND EDGES
MATERIAL: N/A
UNIT OF MEASURE: RF
NAME: WIRING DIA.,BROADBAND, DCFCTBD-IP

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DRAWN BY: MAF DATE 4/24/07
CHKD. BY: SC DATE 4/24/07
SCALE AT D SIZE: NONE
DO NOT SCALE DRAWING
DRAWING NUMBER: 259230