MOTOROLA

Global Telecom Solutions Sector

iDEN™

Gen 3 Site Controller

SYSTEM MANUAL

FCC INTERFERENCE WARNING

The FCC requires that manuals pertaining to Class A computing devices must contain warnings about possible interference with local residential radio and TV reception. This warning reads as follows:

> Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INDUSTRY OF CANADA NOTICE OF COMPLIANCE

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.
“ATTENTION – BATTERY DISPOSAL: The Site Controller Motherboard contains an integral lithium battery. Refer to local regulatory requirements for proper disposal”

COMMERCIAL WARRANTY (STANDARD)

Motorola radio communications products (the “Product”) is warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR (except for crystals and channel elements which are warranted for a period of ten (10) years) from the date of shipment. Parts including crystals and channel elements, will be replaced free of charge for the full warranty period but the labor to replace defective parts will only be provided for One Hundred-Twenty (120) days from the date of shipment. Thereafter purchaser must pay for the labor involved in repairing the Product or replacing the parts at the prevailing rates together with any transportation charges to or from the place where warranty service is provided. This express warranty is extended by Motorola, 1301 E. Algonquin Road, Schaumburg, Illinois 60196 to the original end use purchaser only, and only to those purchasing for purpose of leasing or solely for commercial, industrial, or governmental use.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

In the event of a defect, malfunction or failure to conform to specifications established by Motorola, or if appropriate to specifications accepted by Motorola in writing, during the period shown, Motorola, at its option, will either repair or replace the product or refund the purchase price thereof. Repair at Motorola's option, may include the replacement of parts or boards with functionally equivalent reconditioned or new parts or boards. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts or product shall become the property of Motorola.

This express commercial warranty is extended by Motorola to the original end user purchaser or lessee only and is not assignable or transferable to any other party. This is the complete warranty for the Product manufactured by Motorola. Motorola assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of Motorola. Unless made in a separate agreement between Motorola and the original end user purchaser, Motorola does not warrant the installation, maintenance or service of the Products.

Motorola cannot be responsible in any way for any ancillary equipment not furnished by Motorola which is attached to or used in connection with the Product, or for operation of the Product with any ancillary equipment, and all such equipment is expressly excluded from this warranty. Because each system which may use Product is unique, Motorola disclaims liability for range, coverage, or operation of the system as a whole under this warranty.

This warranty does not cover:

a) Defects or damage resulting from use of the Product in other than its normal and customary manner.

b) Defects or damage from misuse, accident, water or neglect.

c) Defects or damage from improper testing, operation, maintenance installation, alteration, modification, or adjusting.

d) Breakage or damage to antennas unless caused directly by defects in material workmanship.

e) A Product subjected to unauthorized Product modifications, disassemblies or repairs (including without limitation, the addition to the Product of non-Motorola supplied equipment) which adversely affect performance of the Product or interfere with Motorola's normal warranty inspection and testing of the Product to verify any warranty claim.

f) Product which has had the serial number removed or made illegible.

g) A Product which, due to illegal to unauthorized alteration of the software/firmware in the Product, does not function in accordance with Motorola's published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from Motorola.

This warranty sets forth the full extent of Motorola's responsibilities regarding the Product. Repair, replacement or refund of the purchase date, at Motorola’s option is the exclusive remedy. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OR TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGE ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

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ATTENTION: BATTERY DISPOSAL This site controller contains a lithium-ion battery. Refer to local regulatory requirements for proper battery recycling and or/disposal.

Contents

Contents i
List of Figures ..... LOF-i
List of Tables ..... LOT-i
Service Information ..... LOT-iii

Chapter 1 Manual Overview 1-1
Chapter Overview 1-1
Scope of the Manual 1-2
Quality Standards 1-4
Repair and Technical Support 1-5
Before calling... 1-5
Technical support 1-5
Repair procedure 1-5
Static Sensitive Precautions 1-7

Chapter 2 System Description 2-1
Chapter Overview 2-1
EBTS Site Description 2-2
Site Controller 2-5
Site Controller CPU Board 2-5

Chapter 3 Pre-Installation 3-1
Chapter Overview 3-1
Receipt of Equipment 3-2
Equipment Inspection 3-2
Equipment Inventory 3-2
Site Planning 3-3
Site Considerations 3-3
Rack Configurations 3-4
19 Inch Rack 3-5
23 Inch Rack 3-5
Special Considerations 3-8
Telephone Company (Telco) line interface 3-10
Environmental Considerations 3-10
Electrical Requirements 3-12
AC service 3-12
Emergency Generator and Transfer Switch 3-12
Rectifier Drops 3-13
Surge Arrestors 3-13
48 Vdc Power System 3-13
Cabinet Requirements 3-14

Grounding Requirements 3-15
Ground Rings 3-15
Tower Grounding 3-15
Site Building and Equipment Grounding 3-16
Antenna Installation 3-19
GPS Antenna Planning 3-19
Alarm Wiring 3-22
Alarm System Wiring 3-23
Recommended Tools, Equipment, and Parts 3-29
Recommended Tools 3-29
Recommended Test Equipment 3-33
Recommended parts 3-35

Chapter 4 Installation 4-1
Chapter Overview 4-1
Installation Overview 4-2
Cell/Sector Sites 4-2
Cabinet Installation 4-3
Cabinet Bracing Considerations 4-3
Cabling Considerations 4-4
Access Considerations 4-4
Cabinet Position Considerations 4-5
Cabinet Installation Instructions 4-5
Intercabling Connections 4-7
Junction Panels 4-8
Cavity Combining RFDS Intercabinet Cabling 4-8
800 MHz Duplexed RFDS Intercabinet Cabling 4-12
800 MHz Duplex Hybrid Expansion RFDS intercabinet cabling 4-13
800 MHz GEN 4 Duplexed RFDS and
900 MHz Duplexed RFDS Intercabinet Cabling 4-14
5 MHz/1 PPS Intercabling 4-18
Ethernet intercabling 4-24
Alarm Intercabling 4-29
Primary Control Channel Redundancy Intercabling 4-39
GPS Antennas 4-40
Alarm System Cabling 4-40
Alarm System Cabling 4-41
Site Controller to Telephone Network T1/E1 Cabling 4-56
Site Controller and iDEN Smartjack Option Setting Requirements 4-58

Chapter 5 Final Checkout 5-1
Chapter Overview 5-1
Final Checkout Setup 5-2
Powering the Site Controller Rack 5-3
Circuit Breakers 5-4

Chapter 6 System Testing 6-1
Chapter Overview 6-1
Testing Overview....6-2
MMI commands 6-2
Test procedures 6-2
Site Controller Verification 6-3
Site Controller Test Equipment 6-4
Service Computer Startup 6-4
Site Controller Startup Sequence 6-5
E1/T1 Configuration 6-7
ACG# help 6-9
Loading the Base Radios 6-12
Standby Site Controller Status....6-14
Base Radio Registration 6-15
T1 Connection Test....6-17
Remotely Looping Back the T1 Site Controller for BER Testing....6-20
Two Types of T1 Loop-Back 6-20
Three Different Ways to Start and Stop a T1 Line Loop-Back on the Site Controller 6-21
How Payload Loop-Back Works on the Site Controller 6-21
Starting and Stopping Loop-Backs 6-22
Remotely Looping Back the E1 Site Controller for BER Testing....6-23
Two Different Ways to Start and Stop a E1 Line Loop-Back on the Site Controller 6-23
Front Panel Line Loop-Back Switch 6-24
EAS/EAS2 Alarm Checkout....6-25
GPS Status 6-29
Site Reference 6-31

Chapter 7 System Troubleshooting 7-1
Chapter Overview 7-1
Troubleshooting....7-2
Controller....7-3
EAS/EAS2 Unit 7-6

Chapter 8 Software Commands 8-1
Chapter Overview 8-1
MMI Commands....8-2
Access Level 8-2
Conventions 8-2
Site Controller Commands 8-4

Chapter 9 Controller 9-1

Chapter Overview 9-1
Controller 9-2
Indicators 9-3
Switches 9-4
Connectors 9-5
Performance Specifications 9-7

Chapter 10 Environmental Alarm System 10-1

Chapter Overview 10-1
EAS Functional Description 10-2
Indicators 10-2
Performance Specifications 10-3
Theory of Operation 10-3
Connectors 10-5

Chapter 11 Gen 2 Environmental Alarm System 11-1

Chapter Overview 11-1
EAS2 Functional Description 11-2
Indicators 11-2
Performance Specifications 11-3
Theory of Operation 11-3
Connectors 11-5

Chapter 12 FRU Replacement Procedures 12-1

Chapter Overview 12-1
Environmental Alarm System Replacement 12-2
Removal 12-2
Installation 12-2
Site Controller Replacement 12-3
Removal 12-3
Installation 12-4
Gen 3 Site Controller Retrofit 12-5
Stand Alone Control Rack 12-5

Appendix A Acronyms A-1

Appendix B Parts & Suppliers B-1

Overview B-1
Surge arrestors B-2
RF attenuators B-3

Emergency generator B-4
Portable generator connection B-5
GPS evaluation kit B-5
GPS antenna amplifier B-6
Site alarms B-6
Site alarm wiring B-8
Cabinet mounting hardware B-8
Cable connections B-9
Battery system connections B-10
Intercabinet cabling B-13
Equipment cabinet power connections B-15
Other recommended suppliers B-16
Ordering spare parts B-17

Appendix C Cabling Diagrams C-1

Overview C-1
Site Controller Cabling C-2

Index Index-1

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List of Figures

Figure 2-1 *iDEN system diagram* *2-2*
Figure 2-2 *Inside the EBTS* *2-3*
Figure 2-3 *EBTS Control Cabinet* *2-4*
Figure 2-4 *Site Controller Block Diagram* *2-5*
Figure 2-5 *Site Controller front view* *2-7*
Figure 2-6 *Site Controller rear view* *2-8*
Figure 4-1 *Typical Cabinet layout* *4-4*
Figure 4-2 *Site Controller junction panel (rear view)* *4-8*
Figure 4-3 *5 MHZ/1 PPS Connections for Single RF Cabinet Omni Sites* *4-22*
Figure 4-4 *5 MHz/ 1PPS Connections for 2 RF Cabinet Omni Expansion Sites* *4-22*
Figure 4-5 *5 MHz/1 PPS Connections for 3 RF Cabinet Omni Expansion Sites* *4-22*
Figure 4-6 *5 MHz/ 1PPS Connections for Omni Sites Using More Than 15 Channels* *4-23*
Figure 4-7 *5 MHz/1 PPS Connections for Sectored Sites* *4-23*
Figure 4-8 *5 MHz/1 PPS connections* *4-24*
Figure 4-9 *Ethernet Connections for Single RF Cabinet Omni Sites* *4-27*
Figure 4-10 *Ethernet Connections for 2 RF Cabinet Omni Expansion Sites* *4-27*
Figure 4-11 *Ethernet Connections for Sites Using 3 or More RF Cabinets* *4-28*
Figure 4-12 *Ethernet Connections for Sectored Sites* *4-28*
Figure 4-13 *Alarm Connections for 800 MHz Duplexed RFDS (0182020V06 and earlier) Sectored Sites* *4-34*
Figure 4-14 *Alarm Connections for GEN 4 RFDS / 900 MHz Duplexed RFDS Sites* *4-35*
Figure 4-15 *Alarm Connections for Cavity Combining RFDS Omni Sites* *4-36*
Figure 4-16 *Alarm Connections for Cavity Combining RFDS Sectored Sites* *4-37*
Figure 4-17 *Alarm Connections (Systems with 4-8 RF Racks)* *4-38*
Figure 4-18 *Alarm connections on the EAS/EAS2* *4-40*
Figure 4-19 *EAS/EAS2 to punch block 1 and punch block 2 connections* *4-41*
Figure 4-20 *EAS/EAS2 rear panel connectors* *4-42*
Figure 4-21 *Punch block jumpering examples* *4-51*
Figure 4-22 *Telco (T1/E1) interface with the system* *4-57*
Figure 4-23 *T1 interface cable configuration* *4-58*
Figure 5-1 *Cabinet Breaker Panel for standard site controller rack or SRRC (front view)* *5-2*
Figure 5-2 *Power Supply Rack Breaker Panel (front view)* *5-3*
Figure 5-3 *Cabinet Breaker Panel (front view)* *5-4*
Figure 6-1 *Pin-outs for the T1 test cable* *6-17*
Figure 6-2 *T1 test connections* *6-18*
Figure 6-3 *Site Reference - 25% and 75% duty cycle pulse mask* *6-32*

Figure 9-1 *Controller (front view)* *9-2*
Figure 9-2 *Controller (rear view)* *9-2*
Figure 9-3 *Front Panel LEDs* *9-3*
Figure 9-4 *Controller rear connectors* *9-6*
Figure 10-1 *Environmental Alarm System (front view)* *10-2*
Figure 10-2 *EAS Block Diagram* *10-4*
Figure 10-3 *EAS (rear view)* *10-5*
Figure 11-1 *Gen2 Environmental Alarm System (front view)* *11-2*
Figure 11-2 *EAS2 Block Diagram* *11-4*
Figure 11-3 *EAS2 (rear view)* *11-5*
Figure B-1 *Portable generator connector* *B-5*
Figure C-1 *Power, Ethernet, and Site Reference Cabling Diagram* *C-5*
Figure C-2 *EAS or EAS2/iSC Interconnect Cabling Diagram* *C-6*
Figure C-3 *75Ω E1 (2.048 Mb) Cabling* *C-7*
Figure C-4 *120 Ω (2.048 Mb) E1 Cabling* *C-8*

List of Tables

Table 1-1 *Manual contents* *1-2*
Table 3-1 *Controller and EAS/EAS2 dimensions* *3-4*
Table 3-2 *48Vdc power bus color coding* *3-14*
Table 3-3 *Cabinet power system requirements* *3-14*
Table 3-4 *GPS antenna identification* *3-21*
Table 3-5 *Required alarm system equipment* *3-24*
Table 3-6 *Punch block 1 pin-outs* *3-26*
Table 3-7 *Punch block 2 pin-outs* *3-28*
Table 3-8 *Recommended tools for installation* *3-29*
Table 3-9 *Recommended test equipment for installation* *3-33*
Table 3-10 *Recommended parts for installation* *3-35*
Table 4-1 *1-5 Channel Omni Site Intercabling* *4-8*
Table 4-2 *6-10 Channel Cavity Omni Site Intercabling* *4-9*
Table 4-3 *11-15 Channel Cavity Omni Site Intercabling* *4-10*
Table 4-4 *16-20 Channel Cavity Omni Site Intercabling* *4-11*
Table 4-5 *Sectored Site Intercabling* *4-12*
Table 4-6 *1-4 Channel Omni Site Intercabling* *4-12*
Table 4-7 *Sectored Site Intercabling* *4-13*
Table 4-8 *5-8 Channel Duplex Hybrid Expansion Intercabling* *4-13*
Table 4-9 *9-12 Channel Duplex Hybrid Expansion Intercabling* *4-14*
Table 4-10 *1-6 Channel 800 MHz GEN 4 / 900 MHz RFDS Site Intercabling* *4-15*
Table 4-11 *7-12 Channel 800 MHz GEN 4 / 900 MHz RFDS Expansion Site Intercabling* *4-15*
Table 4-12 *13-18 Channel 800 MHz GEN 4 RFDS Expansion Intercabling* *4-16*
Table 4-13 *19/20 Channel 800 MHz GEN 4 RFDS Expansion Intercabling* *4-17*
Table 4-14 *5 MHz/1 PPS intercabling* *4-21*
Table 4-15 *Ethernet intercabling* *4-26*
Table 4-16 *Alarm intercabling* *4-31*
Table 4-17 *User Alarm Inputs* *4-43*
Table 4-18 *System Alarm Inputs* *4-44*
Table 4-19 *Internal Alarm Inputs* *4-45*
Table 4-20 *User Relay Outputs* *4-46*
Table 4-21 *System Relay Outputs* *4-46*
Table 4-22 *Internal Relay Outputs* *4-47*
Table 4-23 *Punch block pinouts* *4-47*
Table 4-24 *Punch block 1 (system alarm) pinouts* *4-52*
Table 4-25 *Punch block 2 (user alarm) pinouts* *4-54*
Table 4-26 *EAS/EAS2 modular alarm connection pinouts* *4-56*

Table 6-1 *Test equipment for cabinet testing* *6-4*
Table 6-2 *RS-232 port configuration* *6-5*
Table 6-3 *Settings for the T1 test set* *6-18*
Table 6-4 *Alarm action and alarm responses* *6-27*
Table 7-1 *Controller Troubleshooting* *7-3*
Table 7-2 *EAS/EAS2 troubleshooting* *7-6*
Table 9-1 *Front Panel LED's* *9-3*
Table 9-2 *Front Panel Switches* *9-5*
Table 9-3 *Front Panel Connectors* *9-5*
Table 9-4 *Rear Connectors* *9-6*
Table 9-5 *Controller performance specifications* *9-7*
Table 10-1 *EAS Indicators* *10-2*
Table 10-2 *EAS Performance Specifications* *10-3*
Table 10-3 *EAS Connectors* *10-6*
Table 11-1 *EAS2 Indicators* *11-2*
Table 11-2 *EAS2 Performance Specifications* *11-3*
Table 11-3 *EAS2 Connectors* *11-6*
Table B-1 *Recommended master ground bar lugs* *B-10*
Table B-2 *Recommended Junction Panel ground lugs* *B-10*
Table B-3 *Battery system wire size* *B-11*
Table B-4 *Power Supply Rack connection lugs* *B-12*
Table B-5 *Battery connection lugs* *B-12*
Table B-6 *Supplied intercabinet cabling* *B-13*
Table B-7 *Parts for Ethernet and 5 MHz cables* *B-14*
Table B-8 *Parts for alarm cables* *B-14*
Table B-9 *Parts for extending PCCH redundancy control cables* *B-14*
Table B-10 *Recommended power connection lugs for Power Supply Rack* *B-15*
Table B-11 *Power connection wire size* *B-16*
Table B-12 *Power connection wire size for Cabinets* *B-16*
Table C-1 *T1 Site Controller cabling* *C-2*
Table C-2 *Site Controller E1 75 Ω (2.048 Mb) cabling* *C-7*
Table C-3 *Site Controller E1 120 Ω (2.048 Mb) cabling* *C-8*

Service Information

This equipment complies with part 68 of the FCC Rules. On the rear of this equipment is a label that contains the FCC registration number for this equipment.

- **Registration Number:** ABZUSA-43041-DE-N

If requested, this information must be provided to the telephone company.

An FCC compliant modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack, which is part 68 compliant. See installation instructions for details.

- **USOC:** RJ48C
- **Facility Interface Code:** 04DUO-ISN
- **Service Order Code:** 6.0N

If the terminal equipment, site controller, causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify you as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If you experience trouble with this equipment, site controller, please contact the Customer Support Center at 1-800-499-6477 for repair or warranty information. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

None of the site controller boards are field repairable. For assistance in sending the boards back for repair, contact the Customer Support Center.

This equipment cannot be used on public coin phone service provided by the telephone company. Connection to party line service is subject to state tariffs. For information, contact the state public utility commission, public service commission, or corporation commission.

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1

Manual Overview

Chapter Overview

This chapter briefly describes the contents of the Gen 3 Site Controller System Manual. The following table lists this chapter's topics.

Section	Page	This section . . .
Scope of the Manual	1-2	defines the intended audience and briefly describes the chapter contents of this manual
Quality Standards	1-4	discusses guidelines that should be observed to ensure a quality installation of the site controller
Repair and Technical Support	1-5	describes how to contact technical support and the procedure for returning faulty equipment or boards
Static Sensitive Precautions	1-7	briefly describes the steps necessary to handle static sensitive devices

Scope of the Manual

This manual is a supplement to the EBTS System Manual. (On CD: 98P80800A17.) The Gen 3 Site Controller System Manual is intended for trained technicians experienced with Motorola base radio equipment or similar types of equipment. Motorola recommends reading the entire manual before attempting to install or operate system controller equipment.

This manual is divided and organized into twelve major sections plus appendices. The user of this manual can quickly locate each of these sections by locating the appropriate tab. Some sections are divided even further into subtabs. All major sections are listed in Table 1-1.

Table 1-1 ***Manual contents***

Chapter	This chapter . . .
Manual Overview	briefly describes the contents of the site controller manual
System Description	identifies the major components and functions of each unit in the integrated Dispatch Enhanced Network (iDEN™) system.
Pre-Installation	describes pre-installation considerations for the site controller
Installation	includes detailed procedures for installation of the site controller
Final Checkout	includes a detailed checkout procedure that is performed after installation of the site controller
System Testing	covers test procedures for various functions of the site controller
System Troubleshooting	contains troubleshooting tables used to help isolate faults to a Field Replaceable Unit (FRU)

Table 1-1 ***Manual contents — continued***

Chapter	This chapter . . .
Software Commands	defines each of the Man-Machine Interface (MMI) commands and presents the proper syntax
Controller	describes the site controller and its associated hardware
EAS	describes the Environmental Alarm System (EAS) and its associated hardware
EAS2	describes the Generation 2 Environmental Alarm System (EAS2) and its associated hardware
FRU Replacement Procedures	includes removal and installation procedures for the FRUs in the site controller and associated hardware

Quality Standards

The installation section of this manual requires the *Quality Standards-Fixed Network Equipment (FNE) Installation Manual (R56)* as a reference. The R56 contains on-site installation, integration, optimization, and maintenance information for trunked radio equipment. Technicians and installation personnel must be familiar with procedures and guidelines presented within that manual.

To order the Quality Standards Manual, contact:

Motorola Literature Distribution Center
2290 Hammond Drive
Schaumburg, Illinois 60173

847 576-2826

Repair and Technical Support

Motorola provides technical support services for installation, optimization and maintenance of site controller equipment.

Before calling...

Be sure to have the following information available prior to contacting Motorola Technical Support to help minimize down-time:

- location of the system
- date the product was put in service
- software versions of affected equipment
- symptoms of the problem
- date the problem was first noticed
- if the problem can be reproduced
- what causes the problem to occur
- any unusual circumstances contributing to the problem (i.e., loss of power)

Technical support

For support of Motorola infrastructures, call the following phone number. This phone number is not valid for technical support of mobile communications equipment.

(US) 1-800-499-6477

(International) 1-847-538-6898

Repair procedure

If a board should require service or repair, be sure to note the following:

- always use a static grounding wrist strap before handling any board or module

- include the warranty, model, serial, and kit numbers
- give a clear return address, including:
  - contact person
  - phone number
  - alternate contact and phone number (if possible)
- securely package the board or module in the original shipping carton, if available. Otherwise, package in a static protection bag in a well padded carton.

Note: iDEN equipment boards are not field repairable. Do not attempt to repair iDEN equipment boards in the field. For assistance, contact the iDEN Customer Support Center at the phone number listed in the *Technical support* paragraph.

Static Sensitive Precautions

The static grounding wrist strap (Motorola p/n 42-80385A59) supplied with the site controller must always be used when handling any board or module. Many of the boards or modules used in the site controller are vulnerable to damage from static charges.

Extreme care must be taken while handling, shipping, and servicing these boards or modules. To avoid static damage, observe the following precautions:

- Prior to handling, shipping, and servicing site controller equipment, always wear a conductive wrist strap connected to the grounding clip on the Cabinet. This discharges any accumulated static charges.

⚠ WARNING

USE EXTREME CAUTION WHEN WEARING A CONDUCTIVE WRIST STRAP NEAR SOURCES OF HIGH VOLTAGE. THE LOW IMPEDANCE PROVIDED BY THE WRIST STRAP ALSO INCREASES THE DANGER OF LETHAL SHOCK SHOULD ACCIDENTAL CONTACT WITH HIGH VOLTAGE SOURCES OCCUR.

- Handle modules by the edges and avoid touching any conductive parts of the module with your hands.
- Never remove boards or modules with power applied to the unit (hot-pull) unless you have verified it is safe to do for a particular board or module. Make sure the unit will not be damaged by this. Several boards and modules require that power be turned off prior to removal.
- Avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) during service or repair due to the possibility of static buildup.
- Apply power to the circuit under test before connecting low impedance test equipment (such as pulse generators, etc.). When testing is complete, disconnect the test equipment before power is removed from the circuit under test.

- Be sure to ground all electrically powered test equipment. Connect a ground lead (-) from the test equipment to the board or module before connecting the test probe (+). When testing is complete, remove the test probe first, then remove the ground lead.
- Place all circuit boards and modules on a conductive surface (such as a sheet of aluminum foil) when removed from the system. The conductive surface must be connected to ground through 100kΩ.
- Never use non-conductive material for packaging modules for shipment or storage. All modules should be wrapped with anti-static (conductive) material. Replacement modules shipped from the factory are packaged in a conductive material.
- If possible, retain all original packing material for future use.

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2

System Description

Chapter Overview

This chapter provides a brief overview of the site control equipment and its function within the iDEN system. The following table lists this chapter's topics.

Section	Page	This section . . .
EBTS Site Description	2-2	provides an overview of the EBTS system
Site Controller	2-5	provides an overview of the site controller
Environmental Alarm System (EAS/EAS2)	2-6	provides an overview of the environmental alarm system

EBTS Site Description

iDEN (integrated Digital Enhanced Network) is a digital communications system which combines the capabilities of a standard analog dispatch system with that of a cellular interconnect system. iDEN uses an advanced proprietary modulation technology consisting of a speech compression scheme enabling three or six communication paths over a single 25 kHz rf channel.

iDEN allows users with mobile and portable subscriber units to communicate with one another over the Public Switched Telephone Network (PSTN) using the rf system as the medium. The rf system consists of strategically located Enhanced Base Transceiver Systems (EBTS) which are linked to the Mobile Switching Office (MSO). The MSO in turn provides the connectivity to the PSTN. Refer to Figure 2-1.

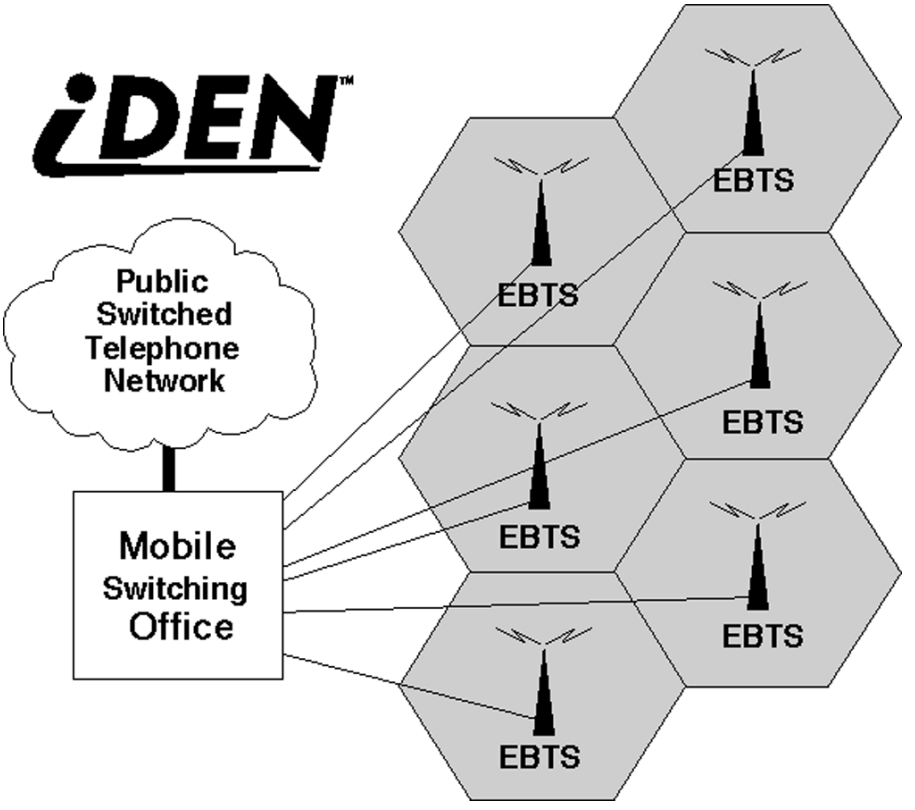

Figure 2-1 ***iDEN system diagram***

The EBTS site contains rf and control equipment. It provides the radio communication link between the land network and the mobile and portable units. Each EBTS site consists of one or more rf cabinets and one site controller cabinet. In the case of the SRSC and SRRC, the site control equipment resides in the rf cabinet. The site controller and rf cabinets are interconnected via an Ethernet LAN. The site controller also terminates the connection between the EBTS and MSO via a T1 span (or E1 for international markets). Refer to Figure 2-2. A diagram of a typical control rack appears in Figure 2-3.

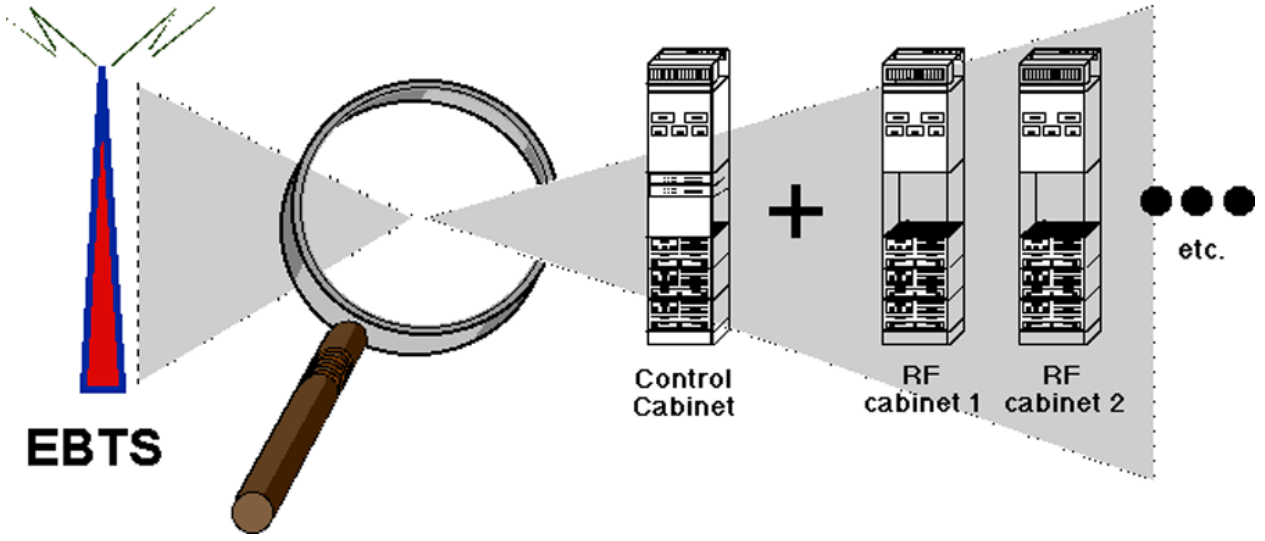

Figure 2-2 ***Inside the EBTS***

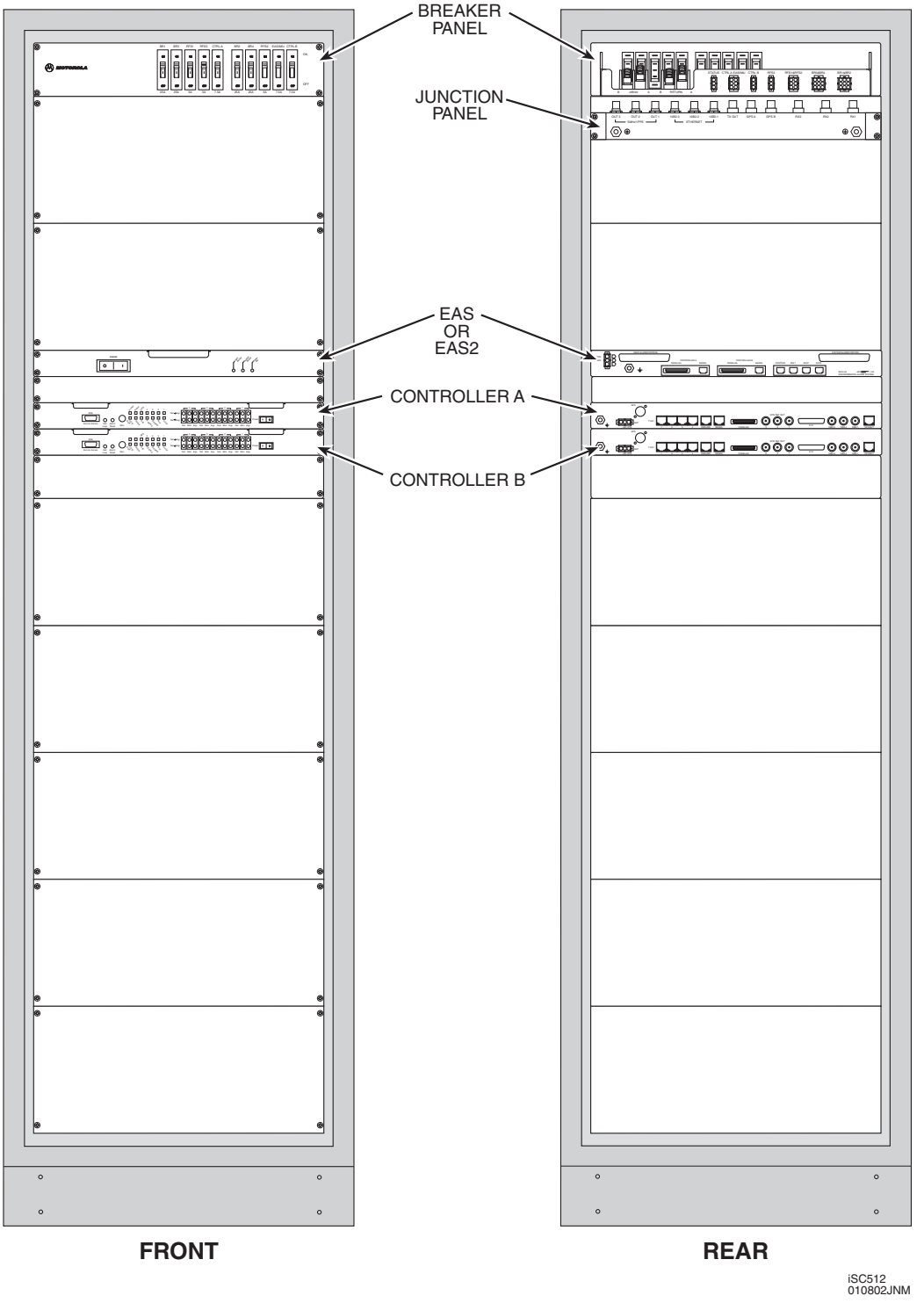

Figure 2-3 ***EBTS Control Cabinet***

Site Controller

The site control equipment consists of at least two assemblies: a site controller and an EAS/EAS2. Most systems are configured with two controllers (an active and a standby) and an EAS/EAS2. Refer to Figure 2-5 and Figure 2-6 for the front and rear views. For a complete description of each assembly, refer to the appropriate chapter.

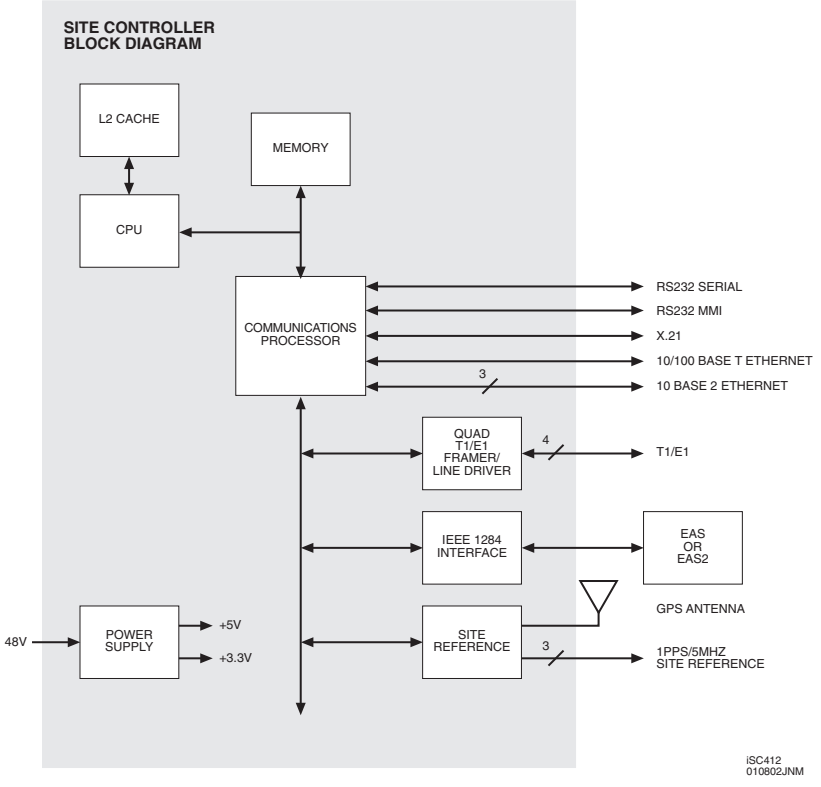

Figure 2-4 ***Site Controller Block Diagram***

Site Controller CPU Board

The following is a list of CPU Board main features:

- PPC750 host processor with 1MByte L2 cache
- MPC8260 communications processor for all serial I/O

- 32 MBytes of FLASH on the PPC bus
- 64 MBytes of SDRAM on the PPC bus
- 16 MBytes SDRAM on the MPC8260 local bus
- 32 KBytes battery backed SRAM with real time clock on the MPC8260 local bus
- Four E1/T1 span lines supported by a single quad E1/T1 framer/line driver IC
- One 10/100BaseT ethernet port
- Three 10Base2 ethernet ports
- One X.21 port
- One IEEE 1284 parallel port
- Two RS232 serial ports
- Internal or remote GPS Receiver
- Three time/frequency reference outputs

Environmental Alarm System

EAS/EAS2 Functional Description

The EAS/EAS2 (Environmental Alarm System) provides a central location for site alarm signal processing. The EAS/EAS2 monitors site environmental conditions, including AC power, smoke alarms, intrusion alarms, antenna tower lights, etc.

Alarm wiring routes directly from the EBTS equipment and power supply equipment to the EAS/EAS2. The EAS/EAS2 sends alarm status to the site controller via the IEEE 1284 parallel connection.

The EAS/EAS2 can monitor up to 48 inputs, each of which must be a contact closure between the alarm input and its return. Alarm inputs are optically isolated. The EAS/EAS2 also provides eight relay outputs. Four RJ45 connectors replicate the physical interfaces to the three RF cabinets

and one control cabinet. The remaining alarm inputs and relay outputs are accessible via two 50-pin connectors. These connectors are cabled to punch blocks to allow simple installation of the remaining site alarm and control I/O.

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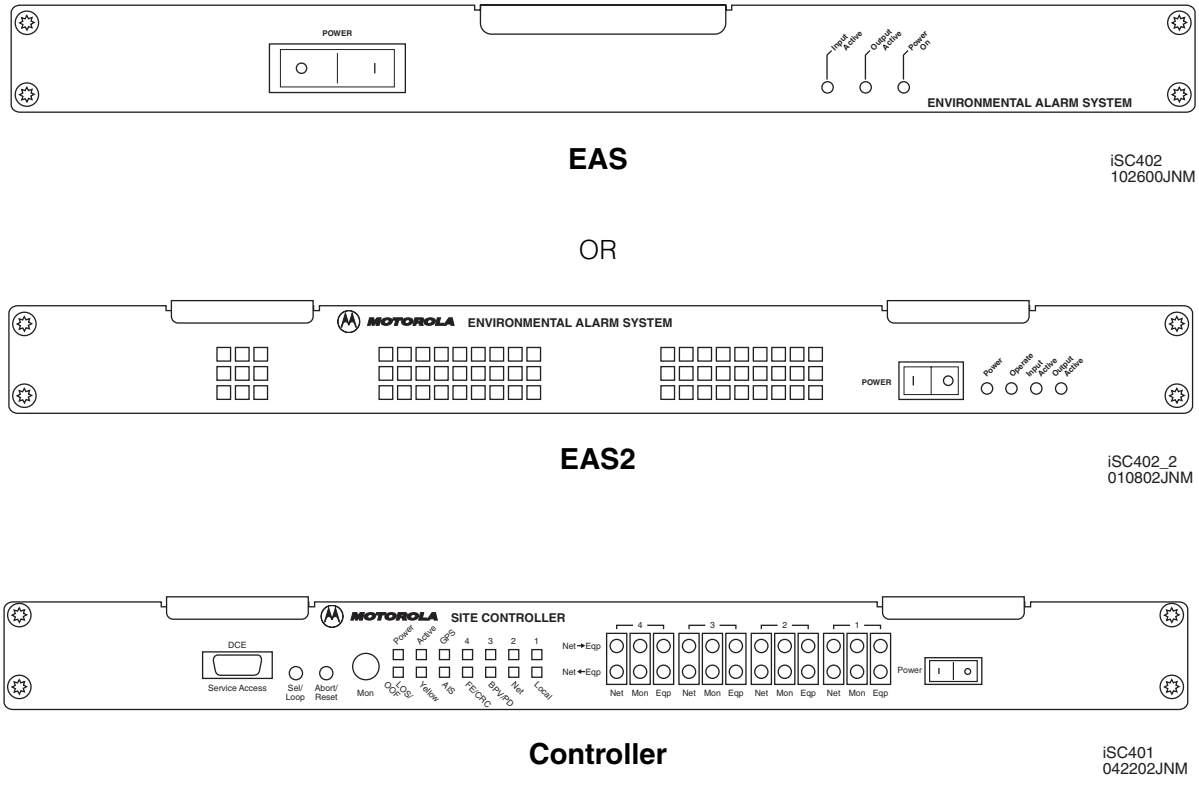
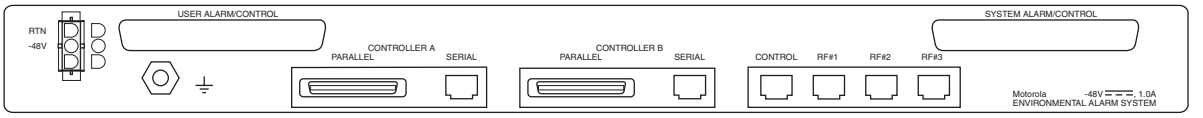


Figure 2-5 ***Site Controller front view***

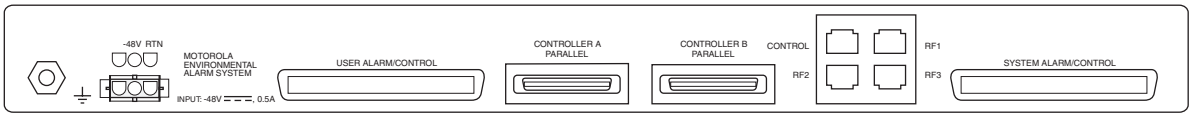
Site Controller



EAS

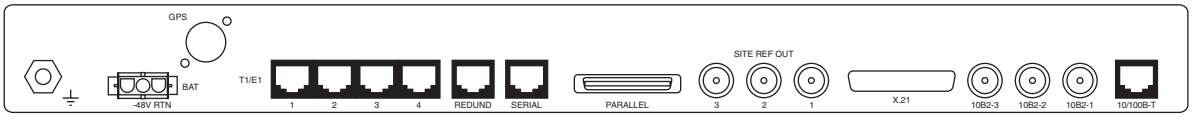
iSC403
102600JNM

OR



EAS2

iSC403_2
041202JNM



Controller

iSC400
102600JNM

Figure 2-6 ***Site Controller rear view***

Pre-Installation

Chapter Overview

This chapter provides pre-installation information for a site controller. Refer to the *EBTS System Manual (on CD: 98P80800A17)* for EBTS-wide pre-installation issues.

A pre-installation site review and evaluation helps prevent potential equipment installation problems. Consider every subject discussed in this chapter before site controller installation.

The following table lists this chapter's topics

Section	Page	This section . . .
Receipt of Equipment	3-2	describes unpacking procedures, equipment inventory, and equipment inspection
Site Planning	3-3	covers site considerations relating to the site controller
Electrical Requirements	3-12	defines the requirements for AC power, transfer switch, breaker panel configuration, rectifier wiring, surge arrestors, cabinet power, and an optional back-up generator
Grounding Requirements	3-15	defines the grounding standards, installation of ground rings, antenna tower grounding, site grounding, and equipment grounding
Antenna Installation	3-19	describes GPS antenna considerations, color coding and identification, and surge suppression
Alarm Wiring	3-22	describes the connection of smoke detectors, burglar alarms, and temperature sensors
Recommended Tools, Equipment, and Parts	3-29	lists the recommended tools, equipment, and parts required for installation

Receipt of Equipment

Equipment Inspection

Inspection of the site control equipment must be performed as soon as all equipment is unpacked.

Note: If obvious damage has occurred to shipping containers before unpacking, contact the shipping agent. Ask that a representative of the shipping company be present while the equipment is unpacked.

Observe guidelines for safe handling of electro-static sensitive devices or equipment to prevent electrostatic discharge damage. A conductive wrist strap is provided with the site controller and should always be worn when handling any electrical component. Connect the wrist strap to the grounding clip on the Cabinet.

Inspect the following upon receipt of the site controller:

- check for loose or damaged equipment
- check all sides of each cabinet for dents, scratches, or other damage
- check all cabinet wiring to insure connections are in place
- check modules and boards for physical damage to controls or connectors
- verify that ground straps are secure

If any equipment is damaged, contact the shipping company immediately, and then your Motorola representative.

Equipment Inventory

Check the site control equipment against the itemized packing list to insure receipt of all equipment. If available, check the sales order with the packing list to account for all equipment ordered. Contact your Motorola representative to report missing items and for additional information.

Site Planning

Licensing and availability of space help to determine a site selection. On a Motorola owned or controlled site, field engineering and program management plan the system and site layouts. Planning helps to prevent potential on-site and off-site interference from other RF systems. Site layouts should always be planned to minimize inter-cabling lengths between RF equipment.

Site Considerations

The site building should not contain windows and must be able to resist extreme weather conditions. It should be designed to meet the requirements of the American National Standards, *Building Code Requirements for Minimum Design Loads in Buildings and Other Structures*.

Motorola recommends the following considerations when selecting a site:

- A minimum floor space of at least 200 square feet is recommended to allow enough space for front and rear access to the equipment cabinets.
- The minimum ceiling height of at least 8’-6” above a finished floor is required to allow enough space for the height of the equipment cabinets and cable access at the top of the cabinets.
- The ceiling structure should be able to support a cable tray assembly for routing the intercabinet cabling and other site cabling. The cable tray assembly is mounted to the site ceiling and walls per site plan and should be at least 7’-6” from the site floor to allow for the height of equipment cabinets.
- The minimum door dimensions should be at least 3’ wide and 6’-8” high.
- All exterior doors should have tamper proof locks installed for security purposes.
- The interior site environment should be maintained at a constant 78° F (25.6° C). The site should be capable of maintaining this temperature in an outside ambient temperature range of -10 to +105° F (-23.4 to +40.6° C). iDEN equipment is not approved or recommended for outdoor use.
- Proper surge protection is required for all antennas and power inputs to prevent potential damage to site equipment.

- The site floor should be level to within 1/8” and able to support the weight of site equipment.

Rack Configurations

Table 3-1 lists the dimensions for the Controller and EAS/EAS2. Figure 3-1 shows the racking arrangement for the Controller and EAS/EAS2.

Table 3-1 ***Controller and EAS/EAS2 dimensions***

Equipment	Chassis Width (inches)	Depth (inches)	Height (inches)
Controller	17	9	1.75
EAS	17	15	1.75
EAS2	17	9	1.75

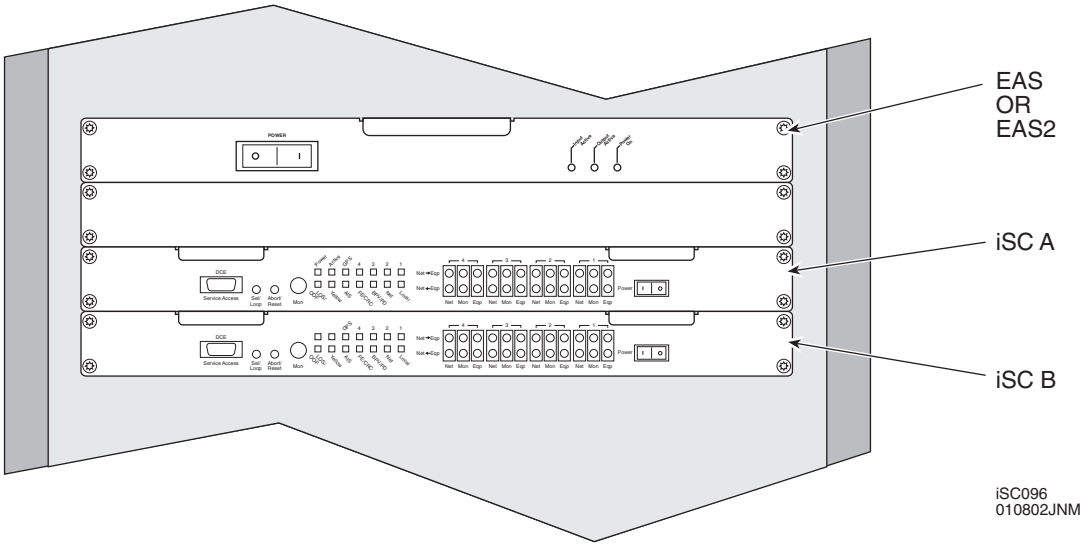


Figure 3-1 ***Typical site controller racking arrangement***

19 Inch Rack

The front panel of the site controller and EAS/EAS2 is 19” wide to allow for installation into 19” wide cabinets. The site controller and EAS/EAS2 are typically installed into a 19” wide cabinet prior to shipment.

23 Inch Rack

Hardware is available to allow for installation of the site controller and EAS/EAS2 into either a larger 23” wide cabinet or a three, five or six inch deep rack. The cabinet type is a Cabtron Systems, Inc. cabinet supplied as part of the Power Conversion Products DC Power System.

The Field Replaceable Unit for the hardware is CLN1680A. Hardware is contained in the sub-kit, CLN7694A. The CLN7694A kit contains 2 main brackets and 4 angle brackets. The angle brackets are mounted to the main brackets with M4 screws. Placement of the angle brackets on the main brackets is adjustable to fit rack depths of 3-inches, 5-inches or 6-inches (Figure 3-2) as well as Cabtron cabinets (Figure 3-3).

The CLN7694A kit also contains both 10-32 and 12-24 screws to attach the angle brackets to the cabinet or rack. Both sizes are common in racks. Choose the correct screw for the rack being used, or use screws provided by the cabinet or rack supplier.

A ground bracket to which a static strap can be attached is also provided. This bracket should be placed, where convenient, under one of the Junction Panel mounting screws.

Only a trained technician who is familiar with the installation of electronic infrastructure or similar type equipment should perform the following procedure:

Installation of the site controller/EAS/EAS2 in a Cabinet/Rack

1. Determine the correct position for mounting the 4 angle brackets to the 2 main brackets based on dimensions of the cabinet/rack. Attach the angle brackets using M4 screws (12 places).

2. Attach the assembled brackets in the cabinet or rack using the appropriate hardware provided, or hardware provided by the cabinet or rack supplier (16 places). For the Cabtron cabinet, attaching angle brackets to both the front and rear cabinet rails is preferable. For racks, it is desirable to attach angle brackets to both the front and rear of the rack.

3. Attach the junction panel to the bracket assembly using zinc plated M6 screws provided (4 places). The junction panel mounts at the top-rear of the bracket assembly with the ground studs facing away from the assembly.

4. Install the panel mount equipment in the following arrangement from top to bottom: 1U blank panel, EAS/EAS2, 1U blank panel, Controller A, Controller B. Secure the equipment to the main brackets with black M6 screws (20 places).

5. Cable the units as shown in sections 3 (Pre-Installation), 4 (Installation), and Appendix C (Cabling Diagrams) of this manual. Note the following exceptions to ground and power connections. Cable ties are provided to appropriately dress cables.

6. Attach the ground cables from the Integrated Site Controller components to the M6 ground studs on the junction panel; secure the ground cables with the M6 nuts provided (3 places).

7. Attach a single dedicated #2 AWG stranded copper green-insulated ground cable from the Site Ground to the M10 ground stud on the junction panel. Secure the ground cable with the M10 nut provided.

8. Motorola offers a standard EBTS cabinet circuit breaker panel that receives an external —48V DC power source and provides DC distribution/overload protection and signal interconnection for the Site Controllers and EAS/EAS2, however, customers may prefer to design their own DC power system. In this instance, the customer is responsible for ensuring that their power source is capable of sourcing the total power needed for the units. Table 3-3 shows the power system requirements for the Site Controllers and EAS/EAS2. Two cables are provided to connect the site controllers and the EAS/EAS2 to the standard Motorola EBTS circuit breaker panel. The 3083609X01 cable supplies power to both Controller A and the EAS/EAS2 while cable 3082082X02 supplies power to Controller B. Both cables employ keyed 3 position female receptacles that properly plug into the “RTN —48V” input power connectors at the rear of the Site Controllers and EAS/EAS2. The opposite ends of these cables employ male connectors that are compatible with the output of the standard Motorola EBTS circuit breaker panel. For this installation, the male connectors should be removed. Cut off the connectors at an appropriate cable length and attach the wire ends to the power source for the Site Controllers and EAS/EAS2. Table 3-2 shows the proper color coding for these wires.

Note: The DC power wires provided are suitable for routing within a single equipment rack or cabinet. They should not be used to connect to a power source external to the equipment rack that houses the Site Controllers and EAS/EAS2. If your installation requires a sourcing power from an external supply, use appropriate wiring and installation in strict accordance with the National Electrical Code NFPA 70 or the applicable codes and regulations for your site.

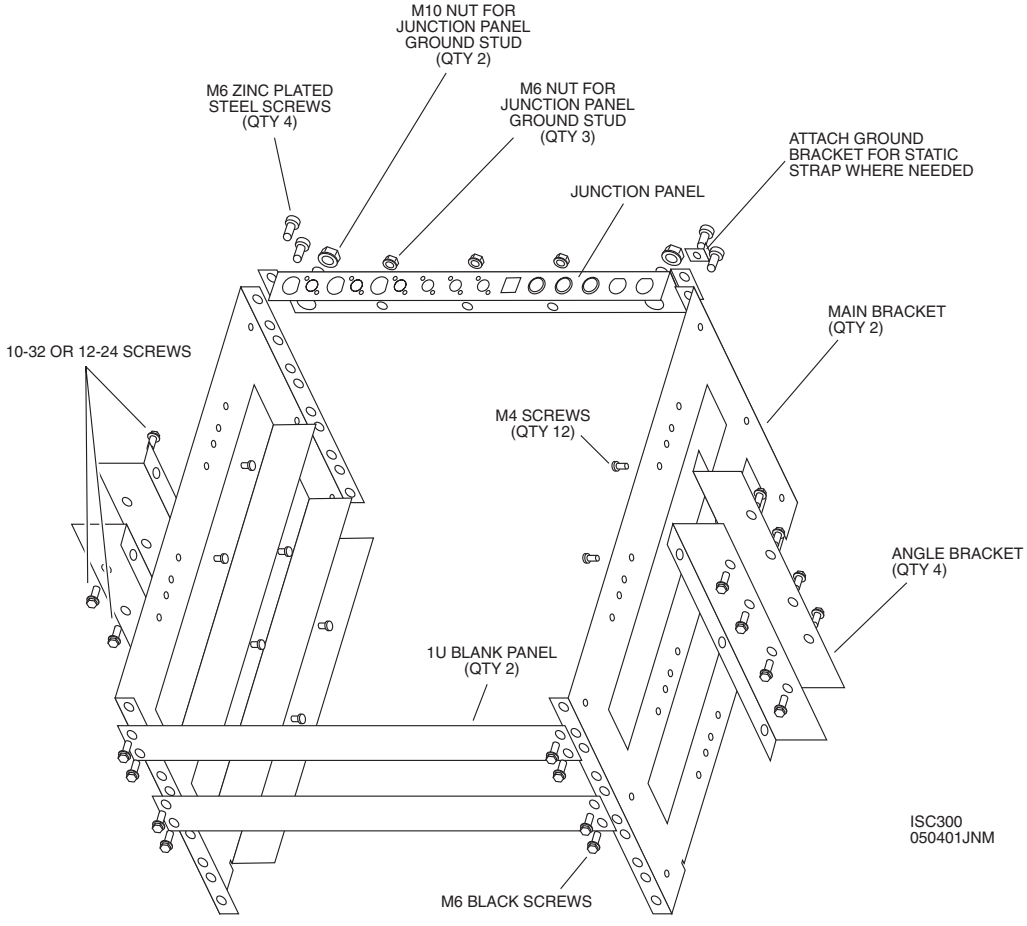


Figure 3-2 ***Assembly for mounting on a 3 to 6 inch deep rack***

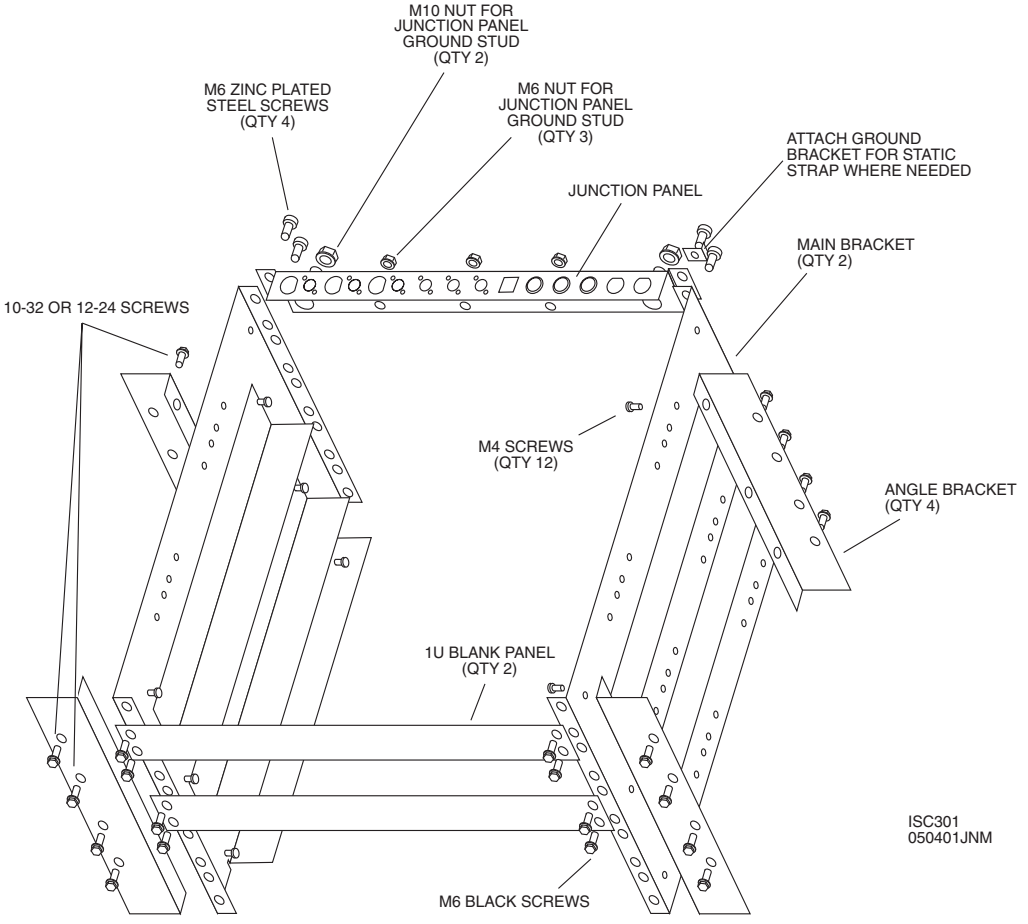


Figure 3-3 ***Assembly for mounting in a Power Supply cabinet***

Special Considerations

Breaker Panel Access

The National Electrical Code (NEC) requires a 36” clearance for electrical service access to all fuse panels, breaker panels, etc., and requires that all doors to this equipment open to at least 90˚.

Disabled Personnel

The customer is responsible for determining applicable Americans with Disabilities Act (ADA) requirements for the site. The ADA requires certain clearances for handicapped personnel.

Particularly consider the ADA requirement for a 36” wide aisle for wheelchair-bound personnel. The aisle must include an adjacent “T” shaped area to allow room for maneuvering a wheelchair.

Hazardous Materials and Equipment

Note: The following information is provided as an aid for site planning. Compliance with all local, state, and federal regulations concerning handling and use of hazardous materials and equipment is the sole responsibility of the customer and associated agents.

The proposed site must not have imminent hazards present in the form of hazardous materials (stored or spilled), harmful or dangerous conditions, or exposure to RF energy levels in excess of ANSI Occupational Guidelines.

If asbestos removal is required, it must be removed by a certified asbestos remover from the site improvement area or from places where it would be disturbed during site construction.

Floors containing asbestos may be left intact. However, drilling or penetration of the floor must be done in accordance with federal and state clean air guidelines. It is recommended that drilling be performed by a certified asbestos remover.

After any removal of asbestos, a certificate of air cleanliness for the site must be obtained from the contractor.

The standard battery system uses valve-regulated batteries which are designed for telecommunication applications. These batteries are also referred to as sealed or maintenance-free lead-acid batteries. Motorola recommends that these batteries be stored, transported, and installed by a certified hazardous material handler. Many regulatory agencies classify batteries as hazardous material. Special permits and safety equipment may be needed.

Seismically Active Areas

Sites that are in seismically active areas may require additional bracing of the equipment cabinets. This manual does not contain specific procedures related to seismic bracing.

Telephone Company (Telco) line interface

Telco Surge Arrestor

A surge arrestor must be installed at the T1/E1 service entrance. The arrestor must be designed for operation with a T1/E1 telephone circuit. The arrestor must only be installed on the customer side of the T1/E1 service entrance. It should be wired per manufacturer instructions.

Telco Service Entrance

A rigid conduit sleeve must be installed to provide the service entrance into the site building. The conduit must be 2” in diameter and a PVC elbow should be attached (pointing down) on the outside end of the conduit. The conduit must be grounded in accordance with the *Quality Standards-Fixed Network Equipment (FNE) Installation Manual (R56)*.

Telco Backboard

A wall mounted AC grade fire-rated plywood backboard (1/2”x4’x4’) must be provided within the site. Reserve a two square foot area on the Telco backboard for dedicated system use.

A 117 VAC dual receptacle outlet (3 prong) should be installed on or adjacent to the Telco backboard. This outlet can be used for accessories, such as modems and other AC powered devices. It may also be used as a general service outlet.

Environmental Considerations

Temperature Control

The environment in which the site controller operates is an important consideration. The temperature should be regulated to ensure trouble-free operation. Lower temperatures will reduce battery capacity, but prolong life. Excessive temperatures result in generated heat that may reduce the life span of electronic equipment, and could cause permanent damage.

To combat temperature problems, a Heating/Ventilation/Air-Conditioning (HVAC) system must be used. All HVAC systems should be thermostatically controlled.

To prolong equipment life, the internal temperature of the system site should be maintained at a constant 78° F ±10° F (25.6° C ±5.5° C). The site should be capable of maintaining this temperature in an outside ambient temperature range of -10 to +105° F (-23.4 to +40.6° C). iDEN equipment is not approved or recommended for outdoor use.

The environmental equipment must be rated such that it is able to maintain the environment to meet the equipment heat dissipation values, which are given in British Thermal Units (BTUs)/per hour.

BTU/h can be figured by multiplying the power rating of the equipment by a factor of 3.414. For example; a Cabinet with a standby Controller produces 160 Watts, which is equivalent to 546 BTU/h (160 x 3.414 = 546 BTU/h).

The site control equipment operates on a -48 Vdc power system including batteries. Should AC power be lost, the DC power system continues to supply the site control equipment with the necessary power. Because the site control remains operational during loss of AC power, heat is still generated by the equipment. Unless the site HVAC is on a backup system, the generated heat will affect the operation of the equipment. The operation of the site control equipment degrades when temperatures exceed 140˚ F (60˚ C).

For sites containing more than one-hour battery backup, the effect of generated heat should be considered. The HVAC system design should be evaluated to insure the proper operating environment is maintained during loss of AC power.

Redundant HVAC Systems

A redundant HVAC system may be installed, if necessary. It must be wired on a delayed circuit to prevent both HVAC systems from starting up simultaneously. The HVAC system should be capable of automatically switching between the heating and cooling modes in response to the thermostat. The controls must ensure that both modes never operate simultaneously.

Existing HVAC Systems

Existing building HVAC systems may be programmed to turn off during non-occupied hours. This type of HVAC system must be evaluated to insure that the site temperature is maintained.

Humidity Control and Air Cleanliness

The relative humidity within the site should be less than 95% non-condensing, non-operating; 90% non-condensing while operating. The site should also be a relatively dust-free environment. Take proper measures to ensure the cleanliness of the site and that it remains a relatively dust-free environment.

Electrical Requirements

All electrical wiring for the site must meet the requirements of NEC and all applicable local codes.

AC service

The DC power system operates from a 50-60 Hz AC service. Either of the following services are required:

- 240/120 V single-phase, 3-wire
- 208/120 V three-phase, 4-wire

Equipment rooms constructed inside existing buildings that use higher voltage systems require a step-down transformer. A main disconnect switch located within the site is recommended.

Emergency Generator and Transfer Switch

Some sites may contain permanently installed emergency generators, however, most telecommunications sites are equipped with connections for portable generators. Sites with permanently installed generators usually have an automatic transfer switch used to transfer the AC service from the utility power to the generator after the generator has started. Sites with connections for a portable generator require a manual transfer switch and external connector.

Generators and transfer switches must be capable of supporting the maximum load for the customer defined service area of the generator. Start-up loads that include the HVAC and rectifiers must also be taken into consideration when selecting a generator size. Motorola offers several different generators for the site.

In a shared site with multiple emergency power switches installed, each should be labeled with the associated system name with a weatherproof placard attached to or mounted next to the switch.

The site contains an Environmental Alarm System (EAS/EAS2) that has eight dry contact closure outputs and 48 customer defined inputs. The relay closures are controlled from the Operations and Maintenance Center (OMC) and one may be used as a remote start for permanent generators, if desired. The customer defined inputs may be used to monitor permanent generator operation if desired.

Rectifier Drops

The conduit for the rectifier drops should be sized to support a maximum of six individual 30 Amp, 240 VAC rectifier circuits. Wire drops to power the rectifiers must be installed per site plan and should reach within 5' above the site floor. Mark these wire drops with the appropriate circuit breaker panel numbers. Terminate the drops in an AC electrical junction box.

Each rectifier requires a single wire drop. The standard configuration contains two rectifiers. Up to four additional rectifiers may be added at the customers option. Motorola recommends installation of four separate rectifier drops to facilitate future expansion requirements.

Surge Arrestors

A Motorola-approved surge arrestor must be installed adjacent to the AC power panel. Very short wire lengths between the arrestor and the power panel are required for proper operation.

For sites using a transfer switch, the arrestor must be installed on the panel side of the transfer switch. Additional arrestors may also be installed at the customer's option on the line or generator side of the switch.

Motorola has developed a functional specification that can be used to help select various surge arrestors. This specification is available to all customers and can be obtained by contacting your iDEN System Manager.

48 Vdc Power System

The site controller operates on a DC power system that includes a -48 Vdc battery system. Motorola offers a DC power system to compliment the site controller. All references to the DC power system within this manual assume the use of the Motorola power system; however other systems may be used.

This manual only provides procedures for the -48 Vdc battery system. If other DC power systems are used, then consult the manufacturer's documentation supplied with the equipment.

DC Power Reference

The site controller operates from positive ground, 48 Vdc power. Reference is made throughout this manual to the -48 Vdc (hot) and the DC return power leads. The hot and return leads are kept isolated from chassis grounds in the equipment.

The positive (+) return lead is grounded at a single point on the rectifier load return bus. Table 3-2 shows the color coding for these wires.

Table 3-2 ***48Vdc power bus color coding***

Description	Battery connection	Wire color
-48 Vdc (nominal)	negative (-)	red
DC return	positive (+)	black
NOTE: The hot side is negative polarity (-) in the 48 Vdc system power bus and the ground side is positive polarity (+).		

Cabinet Requirements

Proper sizing of the rectifiers and batteries is accomplished by the iDEN System Manager when the site controller is ordered. The information in Table 3-3 is provided for customers that prefer to design a unique DC power system. This table lists the power system requirements of the Cabinet.

Table 3-3 ***Cabinet power system requirements***

Configurations	Requirement
DC power system: *	
minimum	-40 Vdc
maximum	-60 Vdc
Cabinet:	
Site Controller	40 Watts
EAS/EAS2	50 Watts
* Voltage is measured at the circuit breaker panel input of the equipment cabinets.	

Grounding Requirements

The site must meet certain specifications for adequate protection from lightning induced transients. Proper ground installation methods are outlined in the Motorola *Standards and Guidelines for Communication Sites* 68P81089E50 manual (formerly 'R56').

Note: Should inconsistencies exist, grounding requirements specified in the Motorola *Standards and Guidelines for Communication Sites* 68P81089E50 manual shall supercede the requirements in this manual.

Ground Rings

Two separate ground rings should surround the site building and antenna tower. Ground rods (8') should be driven into the ground at 10' intervals for average soil. The two ground rings should be bonded together with one wire, buried at least 18" underground, or below frost level.

These ground rings are referred to as the exterior primary ground and must be at least #2 AWG tinned copper wire, solid or stranded. All connections to the rings should be made by exothermic welding. All exothermic welded connections should be treated with cold galvanizing spray.

Inspection wells should be provided for access to the buried ground system to allow verification of ground resistance. The ground resistance should be less than 5Ω .

Tower Grounding

Ground each leg of the antenna tower with an 8' ground rod driven near each leg. All ground connections to the antenna tower must be exothermically welded. Do not weld directly on tower structural members; weld only to provided tower grounding tabs or to tower feet.

Note: Make sure that welding ground connections to the antenna tower does not void the warranty of the tower.

Metal monopole towers require a minimum of three 8' long ground rods to be driven into the ground, spaced approximately 10' apart. These ground rods may be exothermically welded to the bottom portion of the mast itself, to the monopole footing, or to the grounding connection tabs provided.

Site Building and Equipment Grounding

On stand-alone site buildings, a PVC (typically 3/4”) conduit must be provided for the interior ground wire to exit the building. For site buildings with floors at ground level, the conduit must exit a side wall at a 45˚ angle or less. For buildings with space below the floors for a ground connection, the conduit may exit through the floor. In both cases, the location of the opening should be close to the master ground bar inside the building.

Use of metal conduit is discouraged as the conduit provides inductance to a surge, raising the impedance of the ground. If metal conduit is required by local building codes, both ends of the conduit must be bonded to the ground wire through the use of grounding clips or other suitable means to eliminate the inductance of the conduit.

Cabinet Grounding

Within the site, ground the cabinets with a single dedicated connection between each cabinet and the master ground bar. The connecting wire must be a #2 AWG green-insulated copper wire.

Use appropriate lugs (and split ring lock washers when possible) with an anti-oxidant grease applied for interior grounding connections and exterior secondary grounding connections. If lock washers are used, they should be placed between the nut and the lug to ensure the mechanical integrity of the connection. The washer must not be secured between the lug and the surface to which it is connected. Painted connections must be scraped clean before applying the anti-oxidant grease and lug.

⚠ WARNING

NEVER USE A BARE OR DAMAGED WIRE FOR THE CONNECTION OF CHASSIS GROUND OR OTHER ELECTRICAL WIRING TO PREVENT DAMAGE TO EQUIPMENT OR POTENTIAL INJURY TO PERSONNEL.

Note: The Control Cabinet (Rack Ground Bus) must be connected to the site ground using a single dedicated ground wire. Refer to the EBTS System Manual (68P81099E10) for RF Cabinet grounding.

The site ground wire should drop into the top of the cabinet and be connected to a single designated grounding stud. Single hole lugs (1/2" diameter) are used for these grounding connections.

Note: #6 AWG ground wires are attached from the ground studs on the rear of the EAS/EAS2 and Controller housings to the cabinet ground bus bar system.

⚠ CAUTION

DO NOT DAISY-CHAIN MULTIPLE EQUIPMENT CABINET GROUNDS USING A SINGLE GROUND WIRE. DOING SO INCREASES THE OVERALL INDUCTANCE OF THE GROUND WIRE WHICH CAN DISTRIBUTE SURGE ENERGY AMONG THE CABINETS INSTEAD OF TO THE MASTER GROUND BAR.

The equipment cabinets are classified as surge producers due to external coaxial cable connections. Surges from outside the site can enter the site grounding system via the coaxial cables. To prevent damage to the equipment, each cabinet must be connected to master ground bar through a minimum wire size of at least #2 AWG. Green insulated wire must be used to identify all ground wiring.

Cable Tray Grounding

The cable tray assembly must be designed and installed so that it does not come into contact with metal conduits, pipes, or other metal objects. The cable tray assembly must also be connected to the master ground bar through the use of a single dedicated wire. The connecting wire shall be a minimum size of #6 AWG green-insulated copper wire.

Any metal-to-metal joints on the cable tray assembly must be bonded together with a wire jumper to prevent electrical discontinuity, unless the tray connectors are specifically designed to insure continuity. Painted surfaces on the cable tray assembly must be scraped clean at the point where the jumper wire is attached to ensure a good electrical connection. Repaint cable tray assembly surfaces, if necessary.

Electrical System Grounding

The site electrical system should be connected to the master ground bar by a single connection. This should be from the panel/sub-panel in the equipment room with a #2 AWG stranded green insulated wire. For sites with sub-panels, the utility green Multi-Grounded Neutral (MGN) wire may not be present. In this situation, an electrician may need to be consulted to extend the MGN from the service entrance to the sub-panel. If this is done in metal conduit, then grounding clips should be used at both ends of the conduit to minimize inductance.

If metal conduit is used for the electrical system, all connections must be bonded together through conduit compression or screw fittings designed for such purposes. The metal conduit system must not be in contact with other metal on the site, including cable ladder or equipment cabinets, to minimize ground loops and sharing of surge energy. Small pieces of rubber or other insulating material may be used on conduit clamps to eliminate any inadvertent connections.

⚠ CAUTION

NEC PROHIBITS GROUNDING THE AC POWER SYSTEM NEUTRAL (WHITE WIRE) ANYWHERE OTHER THAN AT THE SERVICE ENTRANCE PANEL. HOWEVER, GROUNDING OF THE MGN (GREEN WIRE) AT MULTIPLE LOCATIONS IS ALLOWED.

ENSURE A GOOD CONNECTION BETWEEN THE ELECTRICAL SYSTEM GROUND AND SITE GROUND TO PREVENT EXCESSIVE VOLTAGE POTENTIAL BETWEEN THE TWO GROUND SYSTEMS DURING LIGHTNING STRIKES.

Antenna Installation

The site controller requires antennas for the Global Positioning System (GPS) receivers.

Antenna Surge Arrestors

All antenna feed lines should terminate with a suitable surge arrestor within 12” inside of the entry window. Each arrestor must connect to the master ground bar located below the entry plate. It is recommended that the arrestors be mounted to a mounting bracket to simplify grounding and cable installation.

GPS Antenna Planning

The site controller obtains precise timing information from the GPS. This system permits all sites in the area to synchronize to a common timing reference. The EBTS cannot operate properly without tracking satellites. The site planner must evaluate the proposed site antenna locations prior to the installation of the system.

GPS Antenna Evaluation

The GPS receiver, mounted within the controller, must locate and track at least four satellites during initial power-up. The four satellites are used to establish a three dimensional fix (latitude, longitude, and altitude) for the site. This process takes approximately 13 to 25 minutes to complete.

Once the position of the site has been established, the corresponding data is stored in memory and normal operation resumes.

GPS Tracking Criteria

To allow a system to successfully initialize, a minimum of four satellites must be tracked.

Once a system is operating and the Base Radios have been keyed, at least one satellite must be tracked to maintain site synchronization. However, to maintain maximum reliability, three satellites should be tracked at all times. Note that the system is capable of maintaining site synchronization for short periods during the loss of satellite tracking.

The system must be capable of the following:

- Tracking a minimum of four satellites during initial start-up or after loss of power.
- Tracking three satellites continuously for maximum reliability.

GPS Evaluation Kit

The Motorola GPS evaluation kit can be used to evaluate the site and antenna mounting location prior to site acceptance. Although many GPS receivers are available, the Motorola GPS evaluation kit includes the same receiver and antenna used in the system. The data reported by this kit is the same as that used by the system, if the antennas were installed in the test locations.

The evaluation kit includes software programs and the instructions for collecting the necessary site evaluation data. The necessary data includes:

- number of visible satellites
- number of satellites being tracked

GPS Antenna Requirements

The two GPS antennas should be mounted at least 10’ apart with an unrestricted aerial down view to within 10° of the horizon in all directions. This provides a degree of redundancy in case the antennas are damaged by falling objects or inadvertent shadowing.

The antennas must be mounted high enough to clear the peak of the site roof. For systems in the northern hemisphere, GPS antennas should be mounted so that a clear view of the southern sky is maintained. For systems in the southern hemisphere, GPS antennas should be mounted so that a clear view of the northern sky is maintained.

Isolate the GPS antennas from RF interference by mounting the antennas at least 12’ horizontally from other transmitting antennas.

Adjacent structures, such as trees or buildings, are obstructions due to their wide, solid profiles. Mount the GPS antennas to clear these obstructions and provide a clear path. Adjacent antenna towers at the RF site which protrude into the required view have a minimal effect on GPS satellite reception and are not obstructions.

Note: The color coding schemes identified within this manual are a recommendation only. The purpose for identifying specific colors is an attempt to obtain uniformity between sites. Other color schemes may be used.

GPS antennas are color coded yellow. The same identification technique used for RF antennas is also used to identify the GPS antennas, refer to Table 3-4. Antenna 1 should always be the northern-most antenna.

Table 3-4 ***GPS antenna identification***

Band	Description
one yellow band	GPS antenna 1 (northern-most)
two yellow bands	GPS antenna 2

GPS Antenna Line Loss

The maximum allowable line attenuation between the antenna and the GPS receiver is 6 dB. In addition, there is a 4 dB foliage margin. Installations in which the antenna has an unobstructed view of the sky may have a maximum line attenuation of 10 dB. In a typical installation using 1/2" low density foam coaxial cable, the length of the cable run should never exceed 150'. This is sufficient for most installations.

When considering the use of larger cables, calculate the cable lengths allowing a maximum allowable line attenuation of 4.5 dB at 1.5 GHz. The remaining 1.5 dB of attenuation is provided by interior site cabling and connectors.

Another option is the use of in-line amplifiers to overcome excessive line loss. The in-line amplifiers are powered by the 5 Vdc supplied by the GPS receiver and are inserted somewhere between the GPS antenna and the site controller, preferably near the antenna. Either the connector on the coaxial line must be changed to fit the amplifiers, or a short jumper cable must be field fabricated.

Alarm Wiring

Various alarms or sensors are installed within the site building. All alarm wiring terminates at the EAS/EAS2. The electrical contacts for the alarms must be dry contacts and remain normally closed (open on alarm).

Motorola recommends site installation of the following alarms:

- smoke detector (120 Vac)
- intrusion alarm
- high temperature sensor
- low temperature sensor

The high temperature sensor should be capable of monitoring temperatures above 80˚ F (26.7° C). The low temperature sensor should be capable of monitoring temperatures below 70° F (21.1° C). Temperature sensors should be mounted to the Telco wiring board at a convenient height to facilitate the setting and inspection of the trigger points.

Local codes may require an additional contact closure to deactivate the HVAC system and prevent circulation of smoke in the event of a fire. An additional smoke detector may be used to provide this contact. It can also be configured to trigger an external alarm, if required.

If a second alarm closure is used, it must be completely isolated from the dedicated smoke alarm circuit. Parallel connection of the HVAC controller through these contacts may damage the HVAC and equipment. This is because the HVAC low voltage controller typically has 5 Vdc negative ground, which opposes the -48 Vdc supply.

If specialized automatic fire suppression systems are installed within the site, water flow alarms or Halon release alarms may also be required. These systems may also have to be remotely monitored for unattended facilities. Check your local codes for additional information and requirements.

Note: The use of Halon is now prohibited within the United States of America. However, if a Halon fire suppression system is currently in use, there may be alarm requirements that must be satisfied.

Alarm System Wiring

Alarm wiring fitted with modular (8-pin Telco) connectors terminate at the EAS/EAS2. All other connections are designed to terminate at a punch block.

Each of the site alarm contacts are normally closed and connected to the EAS/EAS2 through a 50-pin Champ cable that connects to a punch block. All alarm contact pairs must be dry (isolated from ground). Most alarm connections are inputs. Outputs provide a dry relay closure rated at 0.5 Amps, 30 Vrms or 60 Vdc, 10VA max.

Four outputs on the User Alarm/Control and System Alarm/Control connectors are available for customer-defined applications. Diode suppression of inductive surges is required if anything but a resistive load is connected to this output.

Eighteen customer-defined alarm inputs are available on the User Alarm/Control connector. The alarms are reported to the Operations and Maintenance Center (OMC) by the respective alarm code. The OMC must be programmed with the proper alarm name corresponding to each code. All connections on User Alarm/Control and System Alarm/Control connectors must be defined and provided to the OMC to insure the effectiveness of monitoring those alarms.

The punch blocks are wired during pre-installation. Each alarm is connected to a pair of terminals on the punch block, the upper one of the pair represents the return and the lower one represents the hot side. For example, on the first numbered pair of the punch block 26 represents return and 1 represents the hot side. The punch block wiring as it appears within this manual is the recommended wiring.

Table 3-5 lists the equipment required for pre-installation of alarm system wiring.

Table 3-5 ***Required alarm system equipment***

Part number	Description
3083892X04	50 pin Champ cable, 25' (for alarms) for EAS
3083892X07	50 pin Champ cable, 25' (for alarms) for EAS2
0183652P01[1]	punch block
3084966K06[2]	50 pin Champ cable, 3' (to modular plug adapter)
2882174W03[2]	6 modular plug adapter

[1] Punch Block 2 is used strictly for customer defined inputs and outputs for systems with 3 or fewer RF racks. If 4 or more RF racks are used, see Chapter 4-50 for redefinitions of Punch Block 2 pins for use with additional RF racks.

[2] Used only for systems with 4 or more RF racks. See Figure 4-17 for cabling information and diagram.

Connect site alarm wiring using the following procedures. Refer to Figure 3-4 and Figure 3-5. Table 3-6 and Table 3-7 list the punch block pinouts.

1. Connect the necessary wires (alarms) to the punch blocks.
2. Connect the 50 pin Champ (alarm) cables to the punch blocks.

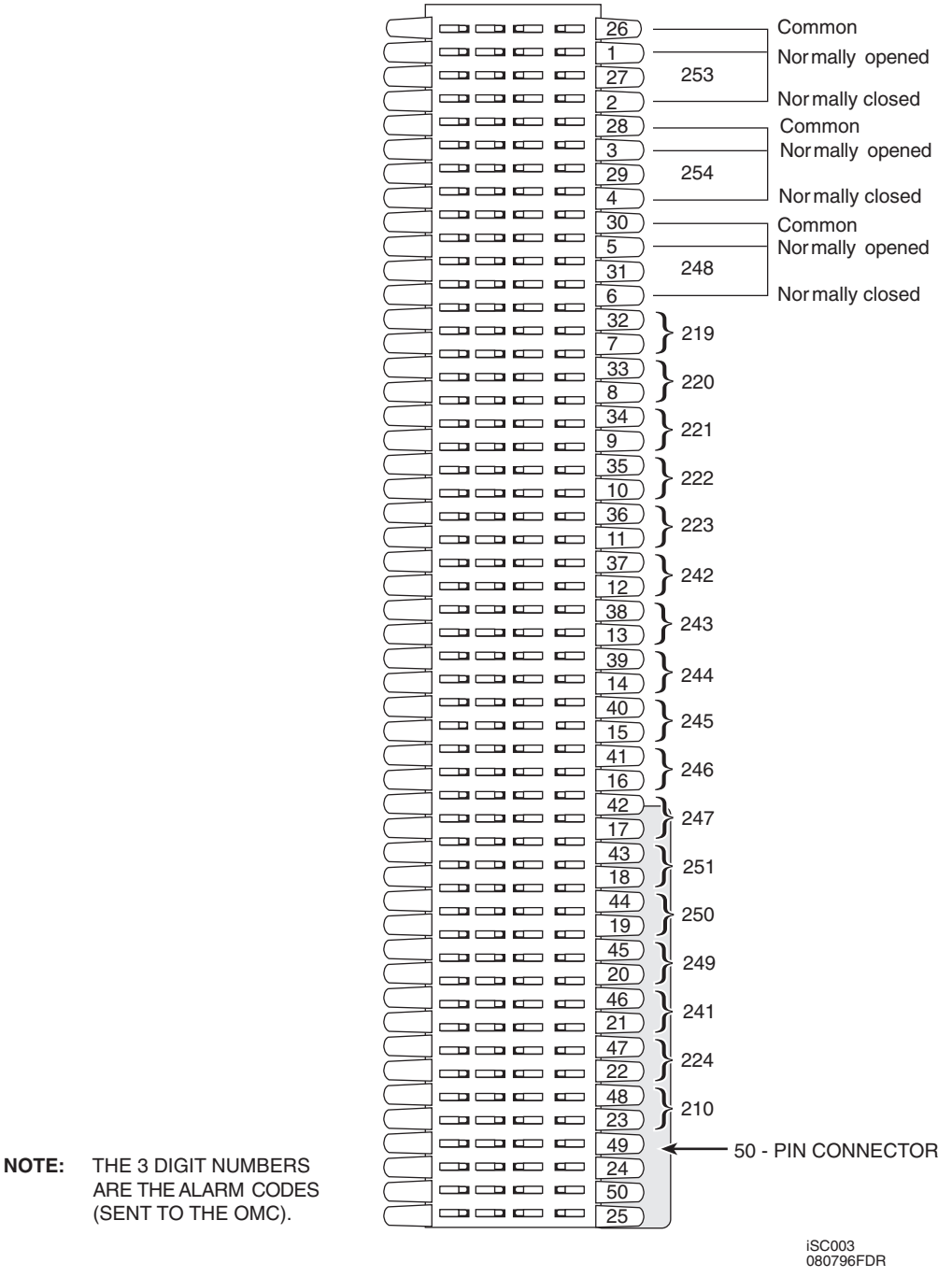


Figure 3-4 ***Punch block 1 - EAS/EAS2 pinouts***

Punch Block 1 - Alarm Connections

The EAS/EAS2 connector and pin label information refers to the connectors on the EAS/EAS2 itself. Only the alarm code number is passed to the OMC. Table 3-6 shows those alarms that connect from the System/Alarm/Control connector on the back of the EAS/EAS2 to punch block 1.

Table 3-6 ***Punch block 1 pin-outs***

Alarm code	Punch block pairs	EAS/EAS2 standard alarm connection
210	23, 48	reserved for system use
219	7, 32	predefined input, site entry
220	8, 33	predefined input, site high ambient temperature
221	9, 34	predefined input, site low ambient temperature
222	10, 35	predefined input, site smoke detector
223	11, 36	predefined input, site AC surge protector
224	22, 47	reserved for system use
241	21, 46	reserved for system use
242	12, 37	AC Power failure
243	13, 38	low DC voltage
244	14, 39	high DC voltage
245	15,40	breaker failure alarm
246	16, 41	minor rectifier module failure
247	17, 42	major rectifier failure
248*	30, 6, 5	pre-defined output generator remote start
249	20, 45	reserved for system use
250	19, 44	reserved for system use
251	18, 43	reserved for system use
253*	26, 2, 1	customer defined output
254*	28, 4, 3	customer defined output
* These alarms are outputs controlled by the EAS/EAS2 and/or OMC.		

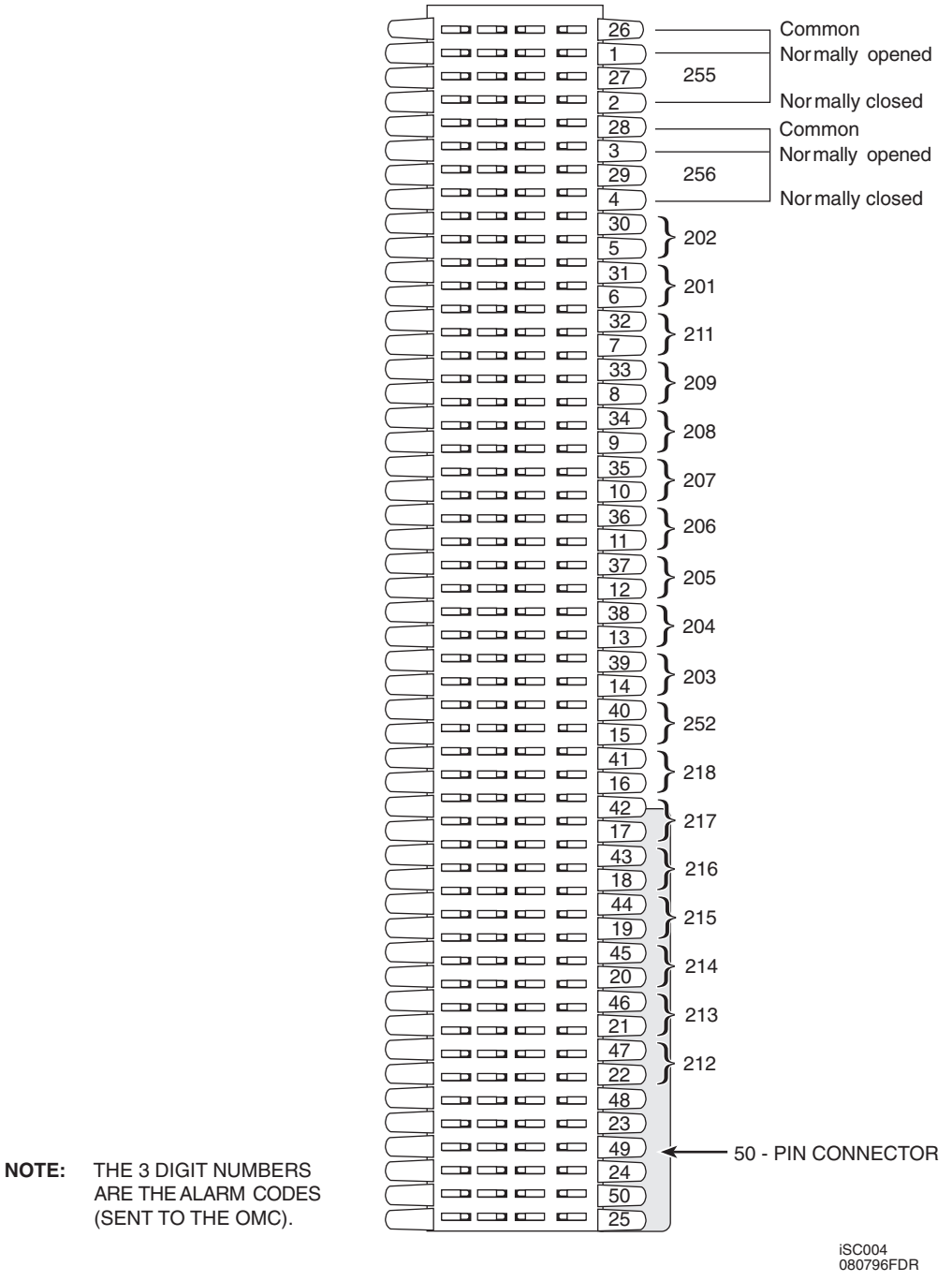


Figure 3-5 ***Punch block 2 - EAS/EAS2 pinouts***

Punch Block 2 – Alarm Connections

The EAS/EAS2 connector and pin label information refers to the connectors on the EAS/EAS2 itself. Only the alarm code number is passed to the OMC. Table 3-7 shows those alarms that connect from the User Alarm/Control connector on the back of the EAS/EAS2 to punch block 2.

Table 3-7 ***Punch block 2 pin-outs***

Alarm code	Punch block pairs	EAS/EAS2 standard alarm connection
201	6, 31	customer defined input
202	5, 30	customer defined input
203	14, 39	customer defined input
204	13, 38	customer defined input
205	12, 37	customer defined input
206	11, 36	customer defined input
207	10, 35	customer defined input
208	9, 34	customer defined input
209	8, 33	customer defined input
211	7, 32	customer defined input
212	22, 47	customer defined input
213	21, 46	customer defined input
214	20, 45	customer defined input
215	19, 44	customer defined input
216	18, 43	customer defined input
217	17, 42	customer defined input
218	16, 41	customer defined input
252	15, 40	customer defined input
255*	26, 2, 1	customer defined output
256*	28, 4, 3	customer defined output

* These alarms are outputs controlled by the EAS/EAS2 and/or OMC.

Recommended Tools, Equipment, and Parts

Table 3-8 through Table 3-10 list the tools, test equipment and locally procured parts that are required for the installation procedure. The model numbers listed are recommended, but equivalent tools and equipment made by other manufacturers are acceptable.

When selecting tools and equipment, always choose those which have insulated grips and handles. This helps prevent potential injury resulting from electrical shock.

Recommended Tools

Table 3-8 lists the recommended tools for installation. These are not included as part of the site control equipment and must be procured locally. All model numbers are Motorola part numbers, unless noted otherwise.

Table 3-8 ***Recommended tools for installation***

Tool	Model/type	Supplier	Purpose
banding cutter	n/a	locally procured	n/a
cable crimp tool	TBM5 S	Thomas & Betts	crimping lugs on power cables
calculator	n/a	locally procured	n/a
cart, two-wheeled (luggage type)	6680387A47	Motorola	transportation of tools and test equipment
circuit cooler spray	0180334B46	Motorola	low temperature alarm testing
cellular tool kit	RPX4286A	Motorola	miscellaneous tools
crimping tool	8-pin modular cable	locally procured	customizing T1 connections
digital level	24” w/module	Pro Smartlevel	antenna downtilt measurements

Table 3-8 ***Recommended tools for installation — continued***

Tool	Model/type	Supplier	Purpose
driver tools	2” hex to hex extension (2)	locally procured	n/a
	6” hex to hex extension (2)		n/a
	T10 TORX bit (APEX)		n/a
	Long T10 TORX bit		n/a
	T15 TORX bit (APEX)		n/a
	T20 TORX bit (APEX)		n/a
	T25 TORX bit (APEX)		n/a
	T30 TORX bit (APEX)		n/a
electric drill	0180371B44	Motorola	drilling holes
electric screwdriver (only 1 required)	RLN4053A/ heavy duty	Motorola	tightening screws/ nuts
	RLN4051A/ heavy duty (variable speed)	Motorola	tightening screws/ nuts
	0180320B28/ light duty	Motorola	tightening screws/ nuts
flashlight, small	n/a	locally procured	n/a
hammer drill	RLN4315A	Motorola	drilling concrete floor for mounting studs
heat gun	0180320B51	Motorola	high temperature alarm testing
hole punch	1”	locally procured	wiring 240 VAC to power supply cabinet
ISO T BNC	n/a	locally procured	tower top amp sensitivity testing

Table 3-8 ***Recommended tools for installation — continued***

Tool	Model/type	Supplier	Purpose
knife, utility	n/a	locally procured	n/a
markers (2)	n/a	locally procured	n/a
nut driver, 3/16”	n/a	locally procured	n/a
nut driver, 10 mm	n/a	locally procured	n/a
pliers	n/a	locally procured	n/a
pliers, connector	n/a	Snap-on	n/a
pliers, needle nose	n/a	locally procured	n/a
screw driver, torque hand tool	5 in-lbs	Ind Pneumatic	n/a
drives for torque screw driver	1/4” drive, 7/16” deep socket	Ind Pneumatic	n/a
	1/4” drive, 5/16” deep socket		n/a
	1/4” drive, 3/16” socket		n/a
	1/4” drive, 1” blade screwdriver		n/a
	1/4” hex to 1/4” hex drive		n/a
screw drivers	#0 Phillips	locally procured	n/a
	#2 Phillips		n/a
	3/16” blade		n/a
	#1 blade		n/a
	1/4” blade		n/a
step ladder	7’	locally procured	to gain access to cable tray assembly
tarpaulin	approximately 8’ x 10’	locally procured	protect equipment during installation

Table 3-8 ***Recommended tools for installation — continued***

Tool	Model/type	Supplier	Purpose
tie wrap gun	n/a	locally procured	n/a
tool box	n/a	locally procured	n/a
torque wrenches	6680388A27	Motorola	tightening battery lug nuts
	5/16” breaking type, 5 in-lbs	locally procured	for SMA connectors
drives for 5/16” torque wrench	6” extension, 3/8” drive	Snap-on	n/a
	1” deep 6 point socket, 3/8” drive		n/a
	5/8” deep socket, 3/8” drive	Ind Pneumatic	n/a
	9/16” deep socket, 3/8” drive		n/a
	1” deep socket, 3/8” drive		n/a
	1/4” hex to 3/8” hex drive		n/a
TORX driver with bits (handle storage)	n/a	locally procured	n/a
tweezers	n/a	locally procured	n/a
vacuum cleaner	0180382A11	Motorola	general clean-up
wire cutters	n/a	locally procured	cutting power cables (#6 AWG to 250 MCM)
wrenches, open end	3/8”	locally procured	n/a
	1-1/16”		n/a
wrist strap	n/a	locally procured	n/a

Recommended Test Equipment

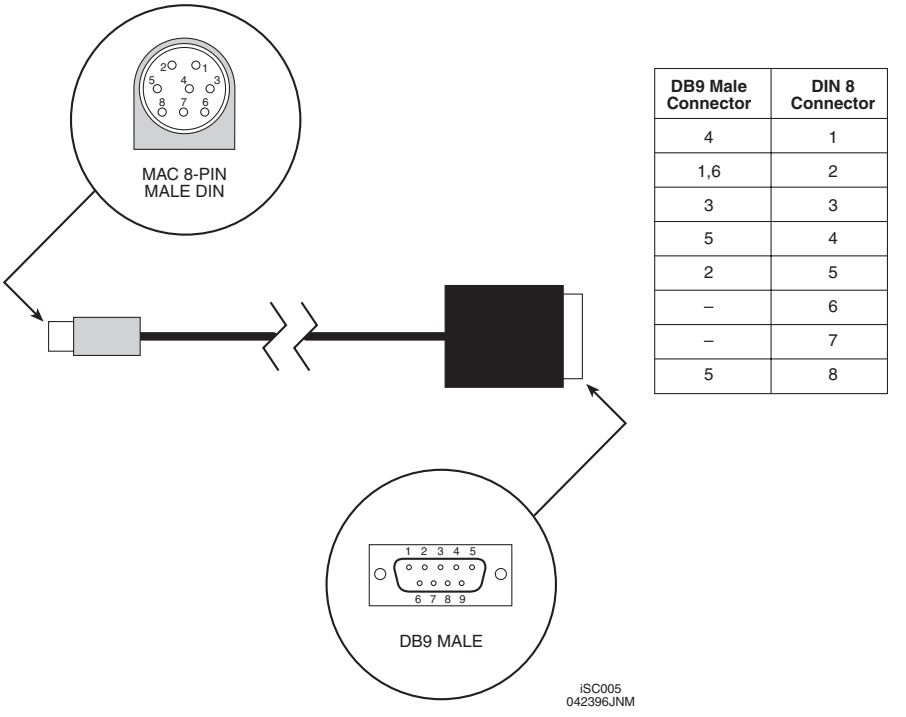
Table 3-9 lists the recommended test equipment for installation. These are not included as part of the system shipment and must be procured locally. All model numbers are Motorola part numbers, unless noted otherwise.

Table 3-9 ***Recommended test equipment for installation***

Test Equipment	Model/Type	Supplier	Purpose
communication software	Procomm Plus (or equivalent)	DataStorm	host communication
digital multimeter (only 1 required)	Fluke 77	Fluke	DC measurements
	R1037A	Motorola	DC measurements
	R1073A	Motorola	DC measurements
file compression software	PKUnzip	PKWare	compress/ decompress large files
ground resistance ohmmeter	AEMC 3700 clamp-on ground tester	locally procured	measure for adequate ground
RF attenuators	refer to the Parts and Suppliers appendix		protection for R2660 and used with the equipment for RF attenuation
service computer	refer to the Systems Testing chapter		local service terminal
communication cable between PC service computer and the equipment	n/a	n/a	DB9 male / RS232 male used with RS232 female / DB9 male. Pinouts from DB9 to DB9 must be straight through
communication cable between Macintosh® service computer and the equipment	n/a	n/a	Din 8 male / DB9 male
service monitor	R2660 w/ iDEN	Motorola	station alignment

Table 3-9 ***Recommended test equipment for installation — continued***

Test Equipment	Model/Type	Supplier	Purpose
test cable used with R2660	n/a	n/a	12’ of typhlon cable type N male both ends
T1 tester/protocol analyzer	209A T	T-Berd	testing T1 lines



DB9 Male Connector	DIN 8 Connector
4	1
1,6	2
3	3
5	4
2	5
–	6
–	7
5	8

Figure 3-6 ***MAC 8-pin male DIN to DB9 male connector***

Recommended parts

Table 3-10 lists the recommended parts for installation. These are not included as part of the system shipment and must be procured locally. All model numbers are Motorola part numbers, unless noted otherwise.

Table 3-10 ***Recommended parts for installation***

Part	Type/size	Supplier	Where used
anchor kit	#02100-13	Hendry	cabinet floor anchors
bolts	3/8x16x3/4”	locally procured	Breaker Panel on Power Supply Rack
	1/4x20x1/2”	locally procured	DC return bus, Power Supply Rack
colored vinyl tape	red, black, green, brown, yellow, and white	locally procured	wire identification
grease	anti-oxidant	locally procured	battery terminal corrosion control
lockwashers	split - 3/8”	locally procured	Breaker Panel, Power Supply Rack
	split - 1/4”	locally procured	DC return bus, Power Supply Rack
lugs	2 hole 1” center various sizes	locally procured	battery connection; 3/8” bolt, 4/0 Cu
lugs	2 hole 1” center	locally procured	DC return connection; 1/4” bolt, #6 Cu
power cables	#6 AWG stranded Cu (red and black)	locally procured	Power Supply wiring
	4/0 stranded Cu (red and black)	locally procured	Power Supply wiring
ground cables	#2 AWG stranded Cu (green)	locally procured	cabinet grounding
	#6 AWG stranded Cu (green)	locally procured	cabinet grounding

NOTE: Refer to the Parts and Suppliers appendix for other cable sizes needed where equipment cabinets are not next to each other.

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Installation

Chapter Overview

This chapter provides procedures required to permanently install the system into the selected site. The following table lists this chapter's topics.

Section	Page	This section . . .
Installation Overview	4-2	provides general information for the installation procedures
Cabinet Installation	4-3	defines the methods for installing wheeled and non-wheeled equipment cabinets
Intercabling Connections	4-7	provides step-by-step instructions for connecting power, ground, timing, Ethernet, alarm, T1/E1, and antenna connections

Installation Overview

The procedures described in this chapter assume the field technician or installer has knowledge of the installation techniques contained in the *Quality Standards Fixed Network Equipment - Installation Manual (R56)*.

Note: Prior to performing the installation procedures, prepare the site with all associated antennas, phone lines, and other related site equipment. This information is covered in the Pre-Installation chapter.

The site controller and several RF Cabinets may be installed, depending on the configuration.

Cell/Sector Sites

Two terms are used interchangeably when discussing site configurations: cell and sector sites.

- Sector is commonly used when discussing antenna radiation patterns.
- Cell is commonly used when discussing configuration files.

In an iDEN system, the two are synonymous. Some sites may be configured with one, two, or three sectors (cells). In this chapter, the term sector is used.

Single sector sites usually provide omni-directional RF coverage and are referred to as omni sites. Two or three sectored sites have different coverage patterns for the sectors and are referred to as sector sites. Each site requires a site controller.

In a typical site, the term cabinet is a generic term used to refer to Fixed Network Equipment (FNE) mounted in different types of frames. It does not refer in any way to building electrical cabinets, outdoor utility cabinets, or some types of equipment shelters commonly known as cabinets.

The site controller can be shipped in one of two ways: compatible with Schroff Eurorack or EIA 23” power rack.

Cabinet Installation

This section provides installation instructions for cabinets already containing site controllers and provides procedures for permanently mounting the equipment cabinets within a site. This section contains the following sections.

Section	Page	This section . . .
Cabinet Bracing Considerations	4-3	describes considerations for properly bracing cabinets
Cabling Considerations	4-4	describes considerations for intercabling between cabinets
Access Considerations	4-4	describes considerations for access to cabinets during servicing
Cabinet Position Considerations	4-5	describes considerations and mounting procedures for cabinets

Note: This section does not refer to the Power Supply Rack or battery rack. Refer to the manufacturer's installation manual for information relating to these cabinets.

Cabinet Bracing Considerations

Installation for each type of cabinet is slightly different. The cabinets are self-supporting structures. The cabinets require additional bracing during shipment of prefabricated sites.

In seismically active areas, additional bracing of the cabinet may be required to prevent it from tipping. However, the bracing hardware must be locally procured. There are no specific procedures within this manual for bracing cabinets in active seismic areas.

⚠ WARNING

ALWAYS USE TWO OR MORE PERSONS WHENEVER MOVING A CABINET. A FULLY CONFIGURED EQUIPMENT CABINET WEIGHS APPROXIMATELY 800 LBS (360 KG).

Cabling Considerations

Intercabinet cables used in the installation are manufactured at a predetermined length. The length of the cables restrict the height of the site cable tray to no more than 6” above the cabinets. This also restricts the spacing between cabinets to no more than 5”.

The intercabling requires a cabinet layout configuration similar to Figure 4-1. If the site cannot accommodate this layout, the intercabinet cables shipped with the system may not be long enough. Custom site fabricated cables may need to be manufactured.

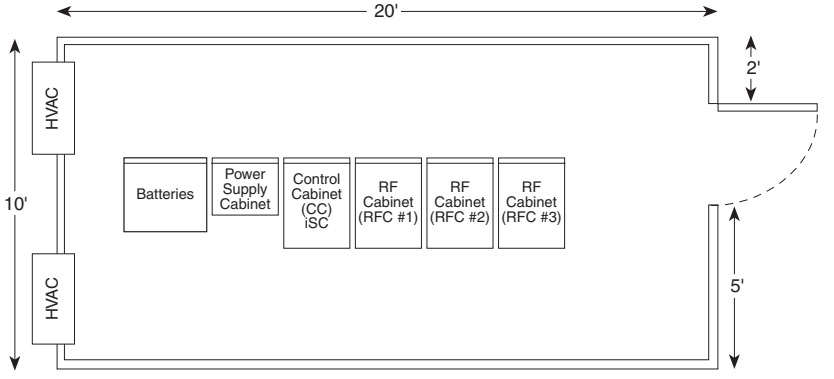


Figure 4-1 ***Typical Cabinet layout***

Access Considerations

Allow at least 2’ of floor space in front and behind the cabinets to permit access during installation. Although most maintenance is performed from the front of the equipment cabinets, access to the rear is required for expansion, cabling, and antenna connections.

Cabinet Position Considerations

Sector Identification

Refer to the *EBTS System Manual (in print: 68P81099E10; on CD: 98P80800A03)* for details on sector identification.

Cabinet Installation Instructions

The following procedures describe how to mount non-wheeled cabinets in a system site building. Be sure to read all of the procedures carefully to ensure a quality installation.

Cabinets must be secured to the floor for optimum stability. Since the cabinets are very heavy, this procedure is written so that each cabinet is moved only once.

Motorola recommends installing the first cabinet at the far end of the row, and then installing adjacent cabinets until the row is completed.

Perform the following steps to properly install the cabinets within the site building:

1. Measure the mounting location for the first cabinet in the row.
2. Carefully mark the mounting holes with a pencil, as indicated on the appropriate cabinet footprint.
3. Drill the marked mounting holes to the appropriate depth of the mounting hardware with a hammer drill and bit.

   Refer to the Parts and Suppliers appendix for recommended mounting hardware.
4. Insert an anchor into the drilled hole.

   If necessary, tap the anchor into place using a hammer.
5. Remove the four screws securing the bottom kick panel to the front and back of the cabinet.

   Remove the kick panel and set aside during installation.

⚠ WARNING

ALWAYS USE TWO OR MORE PERSONS WHENEVER MOVING A CABINET. A FULLY CONFIGURED EQUIPMENT CABINET WEIGHS APPROXIMATELY 800 LBS (360 KG).

6. Carefully move the cabinet into the position indicated by the holes in the floor.

   Adjust and level the cabinet as necessary to align the cabinet mounting holes with the pre-drilled holes in the floor.

7. Secure the cabinet to the site floor with the locally procured mounting hardware.

8. If required, connect adjacent cabinets to each other using the ganging hardware (kit no. 0182098V01).

Intercabling Connections

This section describes the cabling procedures for each of the intercabinet connections.

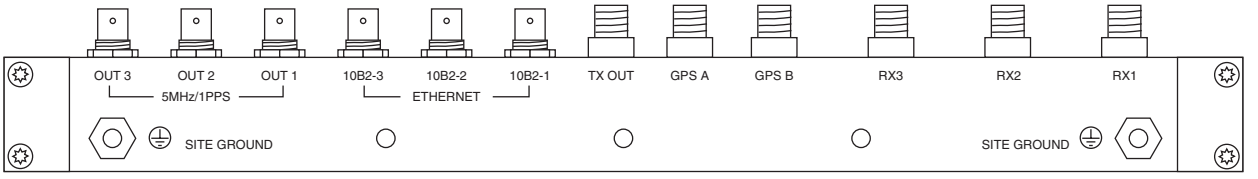
For Single Rack, Redundant Controller GEN 4 EBTS, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (6881099E10)*. For Single Rack, Single Controller GEN 4 EBTS, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (6881099E10)*.

Section	Page	This section . . .
Cavity Combining RFDS Intercabinet Cabling	4-9	describes and lists cabling quantities and types required for various Cavity Combining systems
800 MHz Duplexed RFDS Intercabinet Cabling	4-12	describes and lists cabling quantities and types required for various 800 MHz Duplexed systems
800 MHz Duplex Hybrid Expansion RFDS intercabinet cabling	4-13	describes and lists cabling quantities and types required for various 800 MHz Duplex Hybrid Expansion systems
800 MHz GEN 4 Duplexed RFDS and 900 MHz Duplexed RFDS Intercabinet Cabling	4-14	describes and lists cabling quantities and types required for various 800 MHz GEN 4 and 900 MHz Duplexed systems
5 MHz/1 PPS Intercabling	4-18	describes the 5 MHz/1 PPS connections
Ethernet intercabling	4-20.3	describes the Ethernet connections
Alarm Intercabling	4-20.6	describes the individual cabinet alarm connections
Primary Control Channel Redundancy Intercabling	4-20.14	describes the connection of the primary control channel redundancy control cable from the EAS/EAS2 to the RF Cabinet
GPS antennas	4-21	describes the connection of GPS antennas
Alarm system cabling	4-24	describes the connection of site and Power Supply Rack alarm connections to the EAS/ EAS2
Site controller to telephone network T1 cabling	4-28	describes T1 connections and settings made on customer side of demarcation point
Site controller to telephone network E1 cabling	4-32	describes E1 connections and settings made on customer side of demarcation point

Junction Panels

Most of the intercabling is accomplished on the junction panel located at the top-rear of the equipment cabinet. Figure 4-2 shows the junction panel.

The junction panel is accessed from the rear of the cabinet. All intercabinet cabling runs up and out the top of each cabinet into the cable tray assembly. The OUT connection for each cable has been connected by the factory. Installation of intercabinet cabling is completed by connecting the free end of each cable into the appropriate IN connector of adjacent cabinets.



NOTE: Three additional groud studs are used for SRRC, SRSC, and 23" Racks.

EBTS315
032801JNM

Figure 4-2 ***Site Controller junction panel (rear view)***

Cavity Combining RFDS Intercabinet Cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with Cavity Combining RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

1-5 Channel Omni Site Cables

Table 4-1 lists the required cables for an omni site (single sector).

Table 4-1 ***1-5 Channel Omni Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Site controller to RF Cabinet #1
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #1
3082070X01	PCCH Redundancy	1	Site controller to RF Cabinet #1

6-10 Channel Cavity Omni Site Cables

Table 4-2 lists the required cables for a 6-10 channel cavity omni site.

*Table 4-2**6-10 Channel Cavity Omni Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Site controller to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet
3084225N42	Alarms	1	Control Cabinet to Main RF Cabinet
3084225N42	Alarms	1	Control Cabinet to Expansion RF Cabinet
0182004W04	Phasing Harness	1	Main RF Cabinet/Expansion RF Cabinet
0112004B24	Receive Expansion Cabling	3	Main RF Cabinet to Expansion RF Cabinet

11-15 Channel Cavity Omni Site Cables

Table 4-3 lists the required cables for an 11-15 channel cavity omni site.

Table 4-3 ***11-15 Channel Cavity Omni Site Intercabling***

Cable PN	Description	Qty.	Connections
0112004Z29	Ethernet	3	Site controller to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	3	Site controller to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
3084225N42	Alarms	3	Control Cabinet to Main RF Cabinet
			Control Cabinet to Expansion RF Cabinet #1
			Control Cabinet to Expansion RF Cabinet #2
0182004W04	Phasing Harness	1	Main RF Cabinet/Expansion RF Cabinet #1
0112004B24	Receive Expansion Cables	6	Main RF Cabinet to Expansion RF Cabinet

16-20 Channel Cavity Omni Site Cables

Table 4-4 lists the required cables for a 16-20 channel cavity omni site.

Table 4-4 ***16-20 Channel Cavity Omni Site Intercabling***

Cable PN	Description	Qty.	Connections
0112004Z29	Ethernet	4	Site controller to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
			Expansion RF Cabinet #2 to Expansion RF Cabinet #3
0112004Z29	5 MHz/1 PPS	4	Site controller to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
			Expansion RF Cabinet #2 to Expansion RF Cabinet #3
3084225N42	Alarms	4	Control Cabinet to Main RF Cabinet
			Control Cabinet to Expansion RF Cabinet #1
			Control Cabinet to Expansion RF Cabinet #2
			Control Cabinet to Expansion RF Cabinet #3
0182004W04	Phasing Harness	2	Main RF Cabinet/Expansion RF Cabinet #1
			Expansion RF Cabinet #2/Expansion RF Cabinet #3
0112004B24	Receive Expansion Cables	9	Main RF Cabinet to Expansion RF Cabinets

Sectored Site Cables

Table 4-5 lists the required cables for a three sectored site.

Table 4-5 ***Sectored Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to RF Cabinet #1
0112004Z29	Ethernet	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	Ethernet	1	RF Cabinet #2 to RF Cabinet #3
0112004Z29	5 MHz/1 PPS	1	Site controller to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #2 to RF Cabinet #3
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #1
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #2
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #3
3082070X01	PCCH Redundancy	1	Site controller to RF Cabinet #1 Site controller to RF Cabinet # 2 Site controller to RF Cabinet #3

800 MHz Duplexed RFDS Intercabinet Cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with Duplexed RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

1-4 Channel Omni Site Cables

Table 4-6 lists the required cables for an omni site (single sector).

Table 4-6 ***1-4 Channel Omni Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Site controller to RF Cabinet #1
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #1

Sectored Site Cables

Table 4-7 lists the required cables for a three-sectored site.

Table 4-7 ***Sectored Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to RF Cabinet #1
0112004Z29	Ethernet	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	Ethernet	1	RF Cabinet #2 to RF Cabinet #3
0112004Z29	5 MHz/1 PPS	1	Site controller to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #2 to RF Cabinet #3
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #1
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #2
3084225N42	Alarms	1	EAS/EAS2 to RF Cabinet #3

800 MHz Duplex Hybrid Expansion RFDS intercabinet cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with Duplex Hybrid Expansion RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

5-8 Channel Duplex Hybrid Expansion Site Cables

Table 4-8 lists the required cables for a 5-8 channel duplex hybrid expansion site.

Table 4-8 ***5-8 Channel Duplex Hybrid Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Site controller to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet
3084225N42	Alarms	1	Site controller to Main RF Cabinet
3084225N42	Alarms	1	Site controller to Expansion RF Cabinet

9-12 Channel Duplex Hybrid Expansion Site Cables

Table 4-9 lists the required cables for a 9-12 channel duplex hybrid expansion site.

Table 4-9 ***9-12 Channel Duplex Hybrid Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	Ethernet	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	Site controller to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
3084225N42	Alarms	1	EAS/EAS2 to Main RF Cabinet
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet #1
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet #2

800 MHz GEN 4 Duplexed RFDS and 900 MHz Duplexed RFDS Intercabinet Cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with 900 MHz Duplexed or 800 MHz GEN 4 RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

1-6 Channel GEN 4 or 900 MHz RFDS Site Cables

Table 4-10 lists the required cables for a 1-6 channel GEN 4 or 900 MHz RFDS site.

Table 4-10 ***1-6 Channel 800 MHz GEN 4 / 900 MHz RFDS Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Site controller to Main RF Cabinet
3084225N42	Alarms	1	Site controller to Main RF Cabinet

7-12 Channel GEN 4 or 900 MHz RFDS Expansion Site Cables

Table 4-11 lists the required cables for a 7-12 channel GEN 4 or 900 MHz RFDS expansion site.

Table 4-11 ***7-12 Channel 800 MHz GEN 4 / 900 MHz RFDS Expansion Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Site controller to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet
3084225N42	Alarms	1	EAS/EAS2 to Main RF Cabinet
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet

13-18 Channel 800 MHz GEN 4 RFDS Expansion Site Cables

Table 4-12 lists the required cables for a 13-18 channel GEN 4 RFDS expansion site.

Table 4-12 ***13-18 Channel 800 MHz GEN 4 RFDS Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	Ethernet	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	Site controller to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
3084225N42	Alarms	1	EAS/EAS2 to Main RF Cabinet
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet #1
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet #2
0112004B24	Receive Expansion Cables	3	Main RF Cabinet to Expansion RF Cabinet

19/20 Channel 800 MHz GEN 4 RFDS Expansion Site Cables

Table 4-13 lists the required cables for a 19/20 channel GEN 4 RFDS expansion site.

Table 4-13 ***19/20 Channel 800 MHz GEN 4 RFDS Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	Site controller to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	Ethernet	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	Ethernet	1	Expansion RF Cabinet #2 to Expansion RF Cabinet #3
0112004Z29	5 MHz/1 PPS	1	Site controller to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #2 to Expansion RF Cabinet #3
3084225N42	Alarms	1	EAS/EAS2 to Main RF Cabinet
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet #1
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet #2
3084225N42	Alarms	1	EAS/EAS2 to Expansion RF Cabinet #3
0112004B24	Receive Expansion Cables	6	Main RF Cabinet to Expansion RF Cabinets

5 MHz/1 PPS Intercabling

⚠ CAUTION

A POWERED-DOWN BR CONNECTED TO THE 5 MHZ/1 PPS SYSTEM CAN DEGRADE THE 5 MHZ/1 PPS SIGNAL FOR THE OTHER BRS, POSSIBLY CAUSING MALFUNCTIONS.

BEFORE POWERING-DOWN A BR, ALWAYS FIRST DISCONNECT THE BR FROM THE 5 MHZ/1 PPS SYSTEM. MAKE CERTAIN POWERED-DOWN BRS ARE NOT CONNECTED TO THE 5 MHZ/1 PPS SYSTEM. (5 MHZ/1 PPS "T" CONNECTIONS AT A POWERED-DOWN BR CAN BE LEFT OPEN; TERMINATION AT THESE POINTS IS NOT REQUIRED.)

5 MHz/1 PPS intercabling is the 5 MHz/1 PPS cabling from the cabinet containing the site controller to the RF Cabinet(s). Figures 4-3 through 4-7 show the required intercabling for various EBTS site configurations. Table 4-14 correlates the specific types of systems and sites to Figures 4-3 through 4-7.

Intercabinet Connections

The 5 MHz/1 PPS signal originates in the site controller. All 5 MHz/1 PPS connections between the Site Controller and the RF Cabinet(s) are made on the junction panel of the Site Control and RF Cabinets.

The site controller has three identical buffered outputs available at connectors **SITE REF OUT 1, SITE REF OUT 2** and **SITE REF OUT 3**.

The **SITE REF OUT** connectors should be utilized in a manner that distributes the BR load evenly between the three outputs.

To properly distribute the BR load and ensure site reliability in the event of a failure, follow the general guidelines specified below:

- Distribute the load as evenly as possible between the three **SITE REF OUT** output connectors.
- As with all 5 MHz/1 PPS cabling, the far-end of each daisy-chain must be terminated with the specified 50Ω load.

- In sectored sites with multiple RF Cabinets serving a single sector, do not drive all cabinets within a single sector from the same output.

The following examples illustrate possible RF Cabinet 5 MHz/1 PPS intercabling that balances the BR load and provides site reference output redundancy within a sector.

Example 1 — Assume a 24-BR, three-sector site consisting of the following arrangement:

- 12 BRs in Sector 1
- 8 BRs in Sector 2
- 4 BRs in Sector 3

The table below shows a proper distribution of the site reference outputs to the RF Cabinets (RFCs).

Site Ref Output	Sector 1 (12 BRs)	Sector 2 (8 BRs)	Sector 3 (4 BRs)
1	RFC 1 (4 BRs)	RFC 4 (4 BRs)	
2	RFC 2 (4 BRs)		RFC 6 (4 BRs)
3	RFC 3 (4 BRs)	RFC 5 (4 BRs)	

Note that in the above example, each output drives 8 BRs, while utilizing all three outputs within sector 1.

Example 2 — Assume a 16-BR, two-sector site with the following arrangement:

- 8 BRs in Sector 1
- 8 BRs in Sector 2

The table below shows a proper distribution of the site reference outputs to the RFCs.

Site Ref Output	Sector 1 (8 BRs)	Sector 2 (8 BRs)
1	RFC 1 (4 BRs)	RFC 3 (4 BRs)
2	RFC 2 (4 BRs)	RFC 4 (4 BRs)

Note that in the above example, each output drives eight BRs, while utilizing two different outputs within a given sector.

Example 3 — Assume a 20-BR omni site with four RFCs, each containing five BRs. The table below shows a proper distribution of the site reference outputs to the RFCs.

Output	Omni 20
1	RFC 1 (5 BRs) RFC 2 (5 BRs)
2	RFC 3 (5 BRs) RFC 4 (5 BRs)

- Note that in the above example, each output drives 10 BRs.

5 MHz/1 PPS Cabling Procedure

Noting the general guidelines discussed above, perform 5 MHz/1 PPS cabling between cabinets as follows:

1. On the cabinet that contains the site controller, connect cable (PN 0112004Z29) to the **5 MHz/1 PPS OUT 1** connector on the junction panel. Connect an additional cable (PN 0112004Z29) to the **5 MHz/1 PPS OUT 2** and **5 MHz/1 PPS OUT 3** connectors on the junction panel as required.

   Connect free end of cable(s) to **5 MHz/1 PPS IN** connector on RF Cabinet(s).

2. Starting at the first RF Cabinet, daisy-chain connect cables (PN 0112004Z29) from the **5 MHz/1 PPS OUT** connectors to the **5 MHz/1 PPS IN** connectors on each cabinet junction panel in accordance with Table 4-14 and Figures 4-3 through 4-7, as applicable.

3. Connect a 50 Ω BNC Terminator (PN 0909906D01) to the **5 MHz/1 PPS OUT** connector on the last RF Cabinet of each daisy-chain in the configuration. (Systems using OUT 1, OUT 2 and OUT 3 site reference outputs will have **three** 50Ω end terminations.)

4. Proceed to Ethernet intercabling.

Table 4-14 ***5 MHz/1 PPS intercabling***

System/Site Type	RF Cabinet Configuration	Perform Cabling As Shown In:
DUPLEXED RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-3
5-8 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-4
9-12 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-5
Sectored	3 Main RF Cabinets	Figure 4-7
CAVITY COMBINING RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-3
6-10 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-4
11-15 Channel Omni Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-5
16-20 Channel Omni Expansion	1 Main RF Cabinet 3 Expansion RF Cabinets	Figure 4-6
Sectored	3 Main RF Cabinets	Figure 4-7
800 MHz GEN 4 / 900 MHz RFDS		
1-6 Channel Omni	1 Main RF Cabinet	Figure 4-3
7-12 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-4
13-20 Channel Omni Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-6

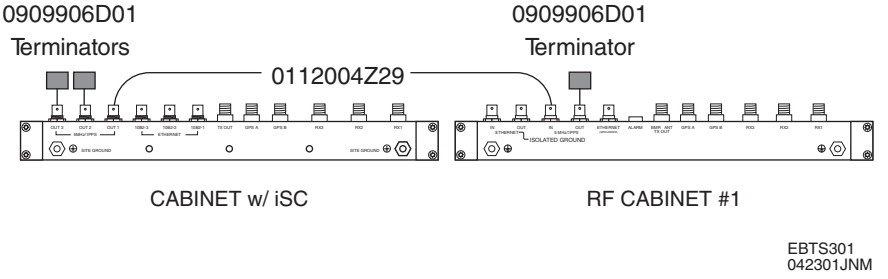


Figure 4-3 ***5 MHZ/1 PPS Connections for Single RF Cabinet Omni Sites***

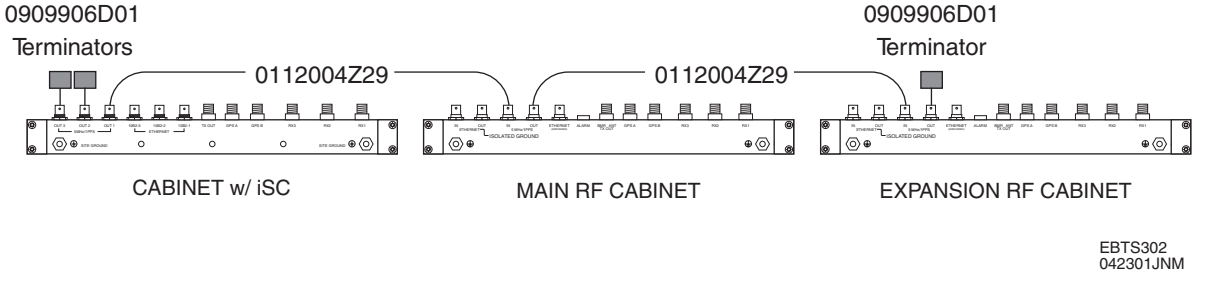


Figure 4-4 ***5 MHz/ 1PPS Connections for 2 RF Cabinet Omni Expansion Sites***

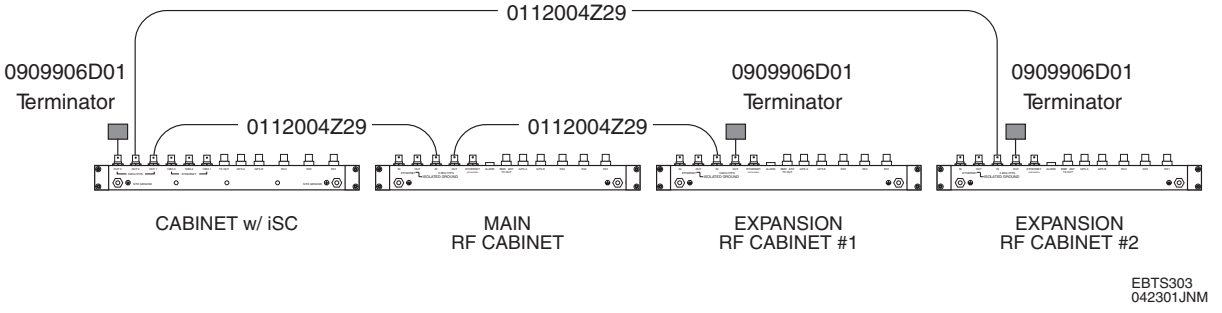


Figure 4-5 ***5 MHz/1 PPS Connections for 3 RF Cabinet Omni Expansion Sites***

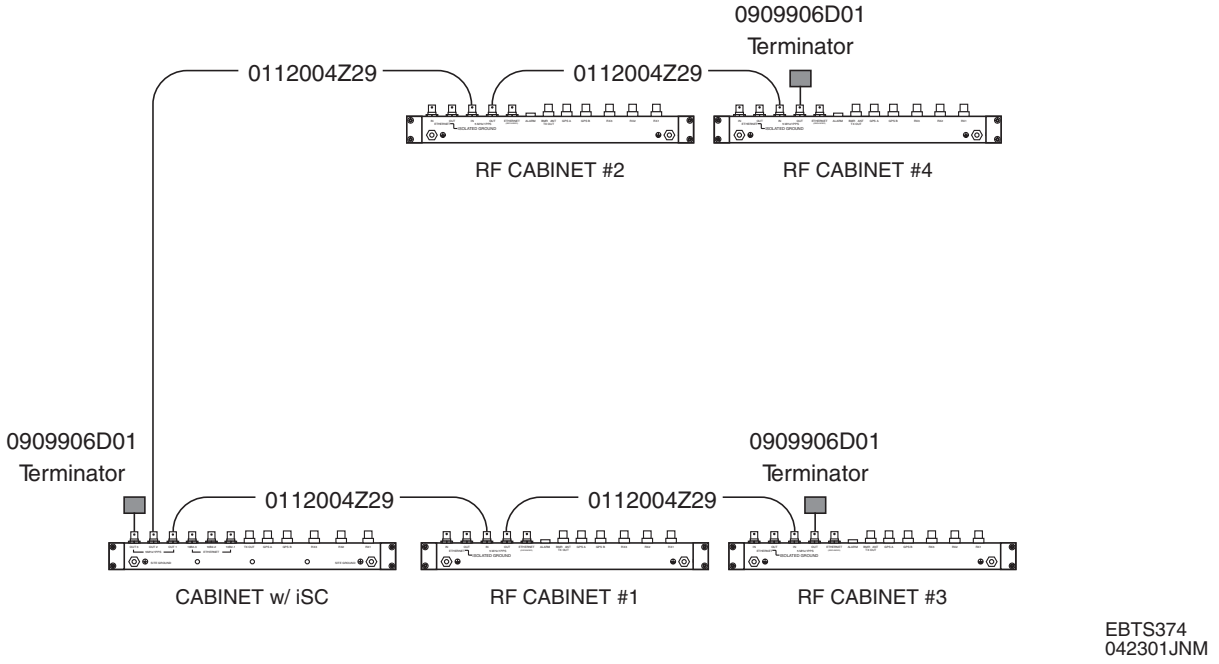


Figure 4-6 ***5 MHz/ 1PPS Connections for Omni Sites Using More Than 15 Channels***

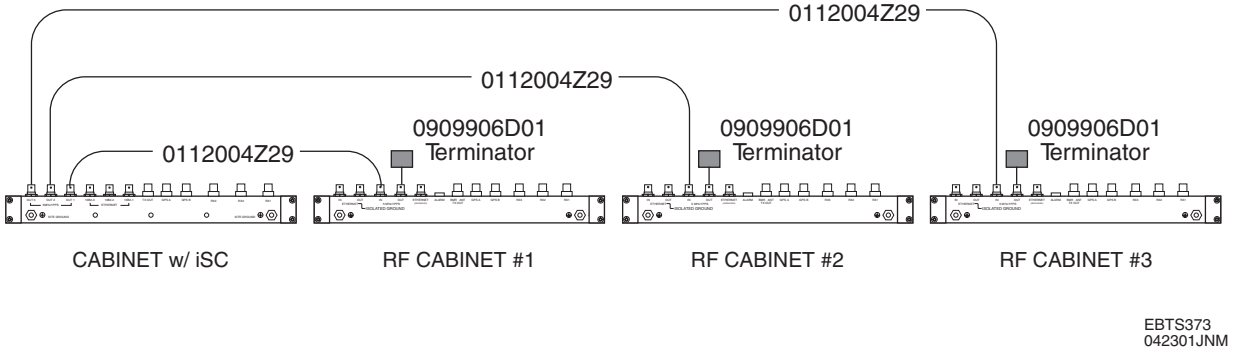


Figure 4-7 ***5 MHz/1 PPS Connections for Sectored Sites***

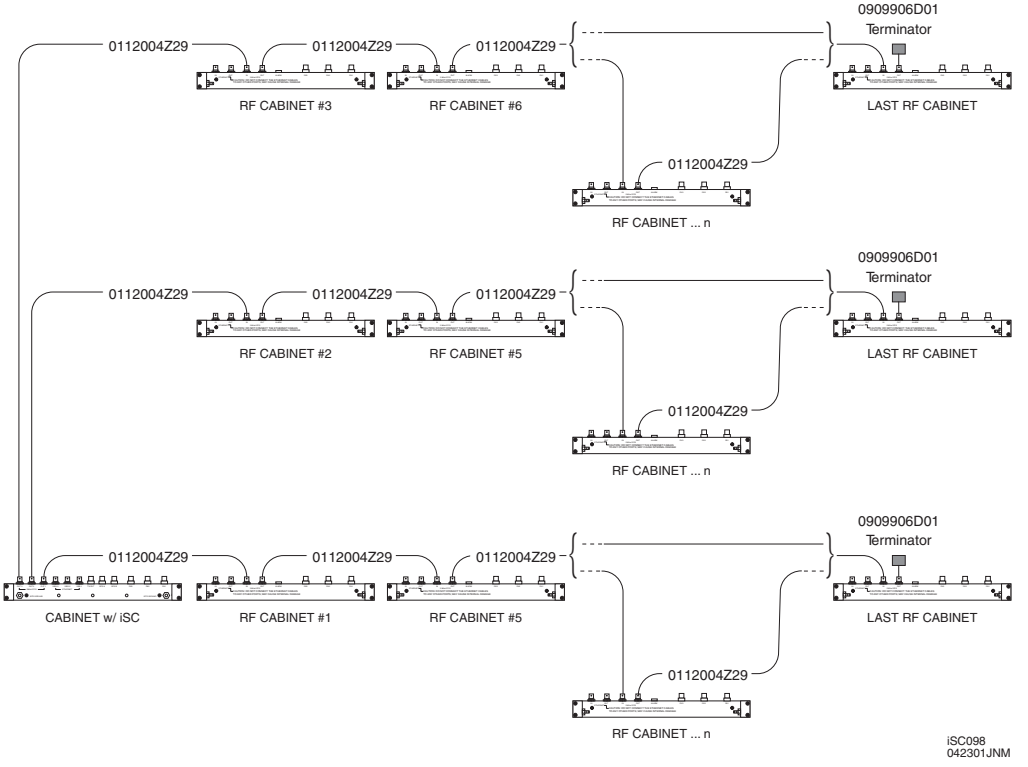


Figure 4-8 ***5 MHz/1 PPS connections***

Ethernet intercabling

All Ethernet connections are made on the junction panels of the cabinets. The connections are labeled ETHERNET IN and ETHERNET OUT. Figures 4-9 through 4-12 show the required intercabling for various EBTS site configurations. Table 4-15 correlates the specific types of systems and sites to Figures 4-9 through 4-12.

Ethernet Cabling Procedure

Perform Ethernet cabling between cabinets as follows:

1. On the cabinet containing the site controller, locate the free end of the cable
(PN 0112004Z29) connected to the **10B2-1** connector on the junction panel.

   Connect free end of cable to **ETHERNET IN** connector on RF Cabinet(s).

2. Starting at the first RF Cabinet, daisy-chain connect cables (PN 0112004Z29) from the **ETHERNET OUT** connectors to the **ETHERNET IN** connectors on each cabinet junction panel in accordance with Table 4-15 and Figures 4-9 through 4-12, as applicable.

3. Connect a 50Ω BNC Termination (PN 0909906D01) to the **ETHERNET OUT** connector on the last RF Cabinet in the configuration.

4. Proceed to Alarm Intercabling.

Table 4-15 ***Ethernet intercabling***

System/Site Type	RF Cabinet Configuration	Perform Cabling As Shown In:
DUPLEXED RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-9
5-8 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-10
9-12 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-11
Sectored	3 Main RF Cabinets	Figure 4-12
CAVITY COMBINING RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-9
6-10 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-10
11-15 Channel Omni Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-11
16-20 Channel Omni Expansion	1 Main RF Cabinet 3 Expansion RF Cabinets	Figure 4-11
Sectored	3 Main RF Cabinets	Figure 4-12
800 MHz GEN 4 / 900 MHz RFDS		
1-6 Channel Omni	1 Main RF Cabinet	Figure 4-9
7-12 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-10
13-20 Channel Omni Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-11

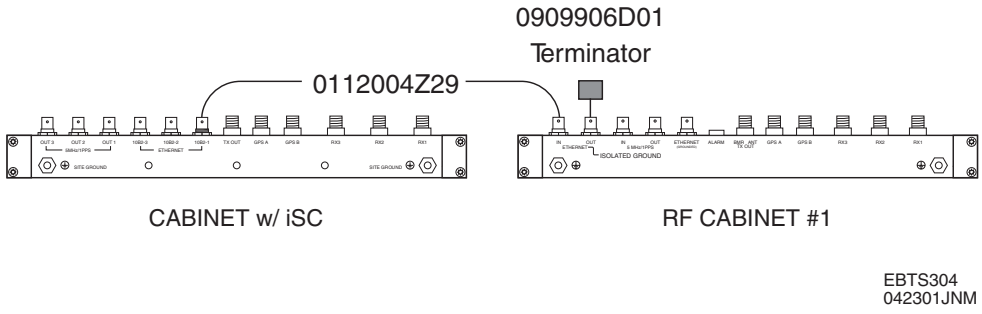


Figure 4-9 ***Ethernet Connections for Single RF Cabinet Omni Sites***

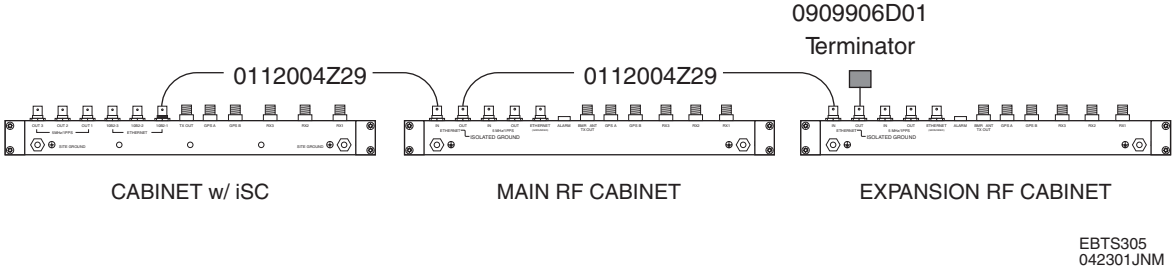


Figure 4-10 ***Ethernet Connections for 2 RF Cabinet Omni Expansion Sites***

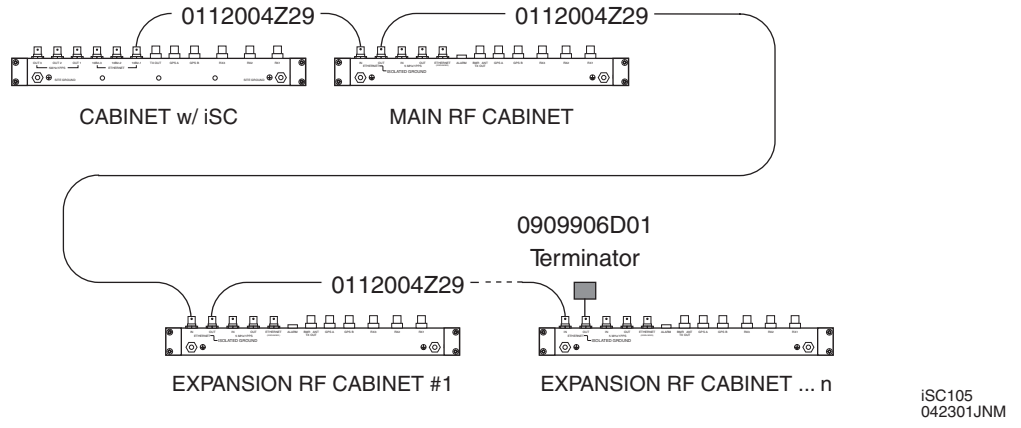


Figure 4-11 ***Ethernet Connections for Sites Using 3 or More RF Cabinets***

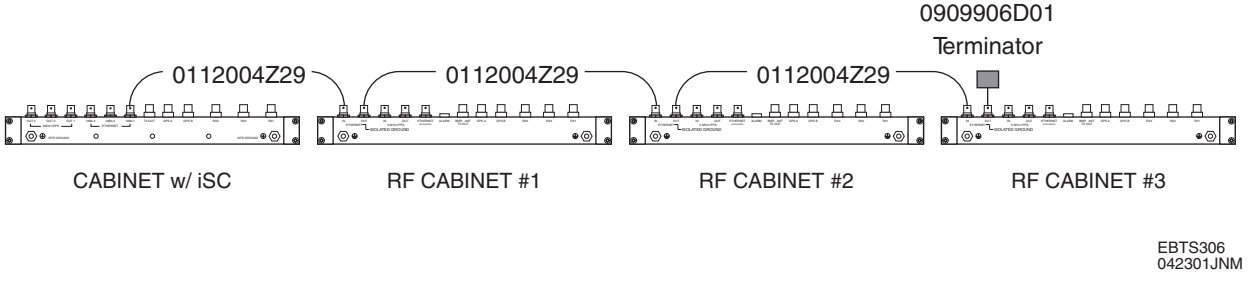


Figure 4-12 ***Ethernet Connections for Sectored Sites***

Alarm Intercabling

Cabinet equipment alarm connections are made between the RF Cabinets and the Environmental Alarm System (EAS/EAS2). The location of the alarm connection for the RF Cabinet depends on the type of RF Distribution System (RFDS) that is being used.

- **800 MHz Duplexed and Duplex Hybrid Expansion RFDS (0182020V06 and earlier)** — The alarm connection on the Main RF Cabinet is on the Main RF Cabinet junction panel and is labeled **ALARM**. The alarm connection on each Expansion RF Cabinet is located on the RFDS Power Supply tray.
- **800 MHz GEN 4 Duplexed RFDS and 900 MHz Duplexed RFDS** — The alarm connection on the Main RF Cabinet and expansion cabinet(s) is located on the Rx Multicoupler tray on each cabinet.
- **Cavity Combining RFDS** — The alarm connection is located on the RFDS Power Supply tray and is labeled **ALARM**.

Alarm Intercabling Procedure (General)

Perform alarm cabling from the EAS/EAS2 to RF cabinets (RFCs) as follows:

1. Make certain an adequate quantity of RJ45-to-RJ45 cables (P/N 3084225N42) is available. Each RF cabinet requires one cable.
2. Refer to Table 4-16. Noting the type of system being cabled, proceed as directed in Table 4-16.

Alarm Intercabling Procedure (For Systems Using More Than 3 RF Cabinets)

Alarm wiring for the Main RF Cabinet and Expansion RF Cabinets #1 and #2 terminate directly to the EAS/EAS2 rear panel as described above.

Alarm interface for Expansion RF Cabinet #3 is facilitated by Modular Adapter (PN 2882174W03), which breaks-out various signal pairs from EAS/EAS2 punch block 2 (**USER ALARM/CONTROL**) into six modular connectors.

Connect the alarm cable from Expansion RF Cabinet #3 to the modular connector designated as “EXPANSION RF CABINET #3”, as shown in Figure 4-17.

Alarm Intercabling for SRRC

For alarm intercabling information for the SRRC, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual*. *(on CD: 98P80800A17.)*

Alarm Intercabling for SRSC

For alarm intercabling information specific to the SRSC, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual*. *(on CD: 98P80800A17.)*

Table 4-16 ***Alarm intercabling***

System/Site Type	Intercabling Connections	Perform Cabling As Shown In:
800 MHz DUPLEXED RFDS (0182020V06 and earlier)		
1-5 Channel Omni	• EAS/EAS2 **RF#1** to Main RFC **ALARM** connector	Figure 4-13
5-8 Channel Duplex Hybrid Expansion	• EAS/EAS2 **RF#1** to Main RFC **ALARM** connector • EAS/EAS2 **RF#2** to Expansion RFC **ALARM** connector on Power Supply Tray	Figure 4-13
9-12 Channel Duplex Hybrid Expansion	• EAS/EAS2 **RF#1** to Main RFC **ALARM** connector • EAS/EAS2 **RF#2** to Expansion RFC #1 **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#3** to Expansion RF Cabinet #2 **ALARM** connector on Power Supply Tray	Figure 4-13
Sectored	• EAS/EAS2 **RF#1** to Main RFC #1 **ALARM** connector • EAS/EAS2 **RF#2** to Main RFC #2 **ALARM** connector • EAS/EAS2 **RF#3** to Main RFC #3 **ALARM** connector	Figure 4-13
800 MHz GEN 4 DUPLEXED RFDS		
1-6 Channel Omni	• EAS/EAS2 **RF#1** to Main RFC alarm connector on Rx Tray	Figure 4-14
7-12 Channel Omni Expansion	• EAS/EAS2 **RF#1** to Main RFC alarm connector on Rx Tray • EAS/EAS2 **RF#2** to Expansion RFC alarm connector on Rx Tray	Figure 4-14
13-18 Channel Omni Expansion	• EAS/EAS2 **RF#1** to Main RFC alarm connector on Rx Tray • EAS/EAS2 **RF#2** to Expansion RFC #1 alarm connector on Rx Tray • EAS/EAS2 **RF#3** to Expansion RFC #2 alarm connector on Rx Tray	Figure 4-14

Table 4-16 ***Alarm intercabling — continued***

System/Site Type	Intercabling Connections	Perform Cabling As Shown In:
19/20 Channel Omni Expansion	• EAS/EAS2 **RF#1** to Main RFC alarm connector on Rx Tray • EAS/EAS2 **RF#2** to Expansion RFC #1 alarm connector on Rx Tray • EAS/EAS2 **RF#3** to Expansion RFC #2 alarm connector on Rx Tray • EAS/EAS2 High-Capacity connections to Expansion RFC #3 alarm connector on Rx Tray	Figure 4-14 Figure 4-17

Table 4-16 ***Alarm intercabling — continued***

System/Site Type	Intercabling Connections	Perform Cabling As Shown In:
800 MHz CAVITY COMBINING RFDS		
1-5 Channel Omni	• EAS/EAS2 **RF#1** to Main RFC **ALARM** connector on Power Supply Tray	Figure 4-15
6-10 Channel Omni Expansion	• EAS/EAS2 **RF#1** to Main RFC **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#2** to Expansion RFC **ALARM** connector on Power Supply Tray	Figure 4-15
11-15 Channel Omni Expansion	• EAS/EAS2 **RF#1** to Main RFC **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#2** to Expansion RFC #1 **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#3** to Expansion RFC #2 **ALARM** connector on Power Supply Tray	Figure 4-15
16-20 Channel Omni Expansion	• EAS/EAS2 **RF#1** to Main RFC **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#2** to Expansion RFC #1 **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#3** to Expansion RFC #2 **ALARM** connector on Power Supply Tray • High-Capacity EAS/EAS2 connection to Expansion RFC #3 **ALARM** connector on Power Supply Tray	Figure 4-15 Figure 4-17
Sectored	• EAS/EAS2 **RF#1** to Main RFC #1 **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#2** to Main RFC #2 **ALARM** connector on Power Supply Tray • EAS/EAS2 **RF#3** to Main RFC #3 **ALARM** connector on Power Supply Tray	Figure 4-16
900 MHz DUPLEXED RFDS		
1-6 Channel Omni	• EAS/EAS2 **RF#1** to Main RFC alarm connector on Rx Tray	Figure 4-14
7-12 Channel Omni Expansion	• EAS/EAS2 **RF#1** to Main RFC alarm connector on Rx Tray • EAS/EAS2 **RF#2** to Expansion RFC alarm connector on Rx Tray	Figure 4-14

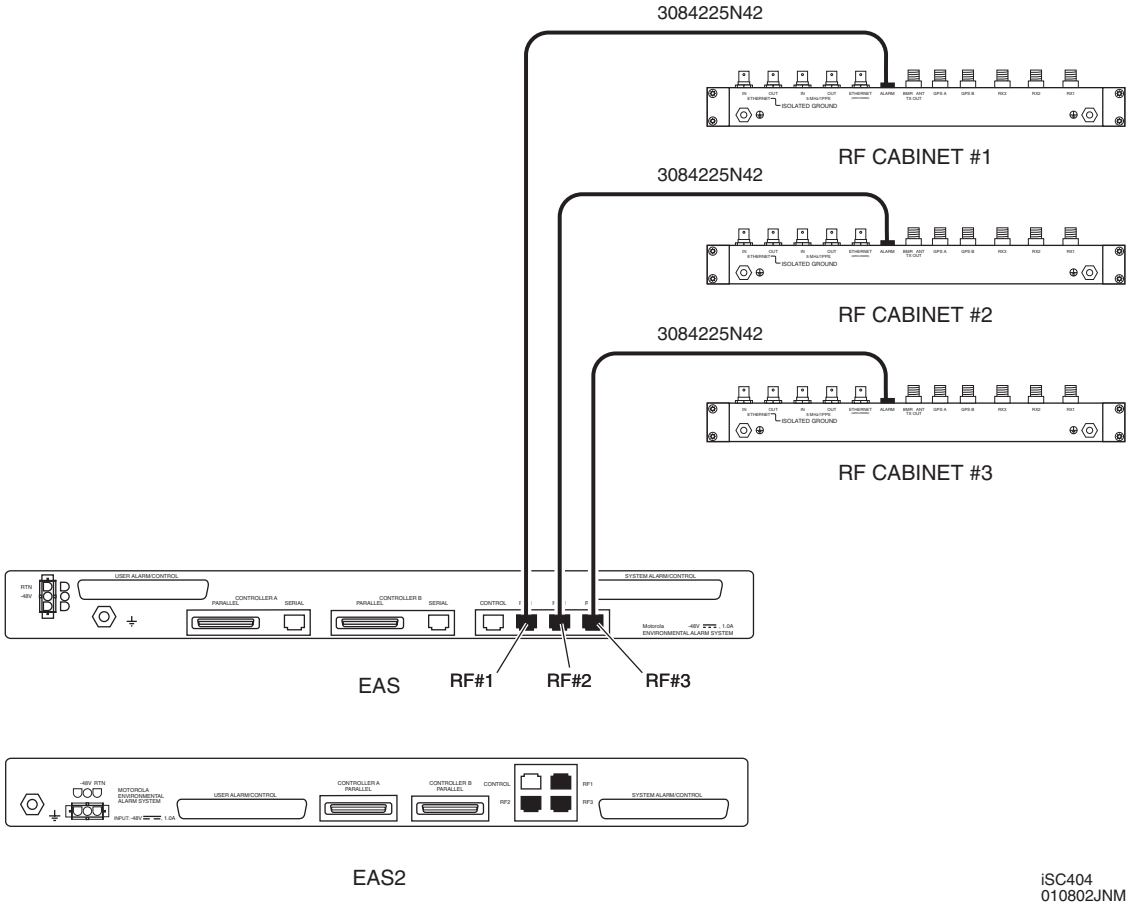
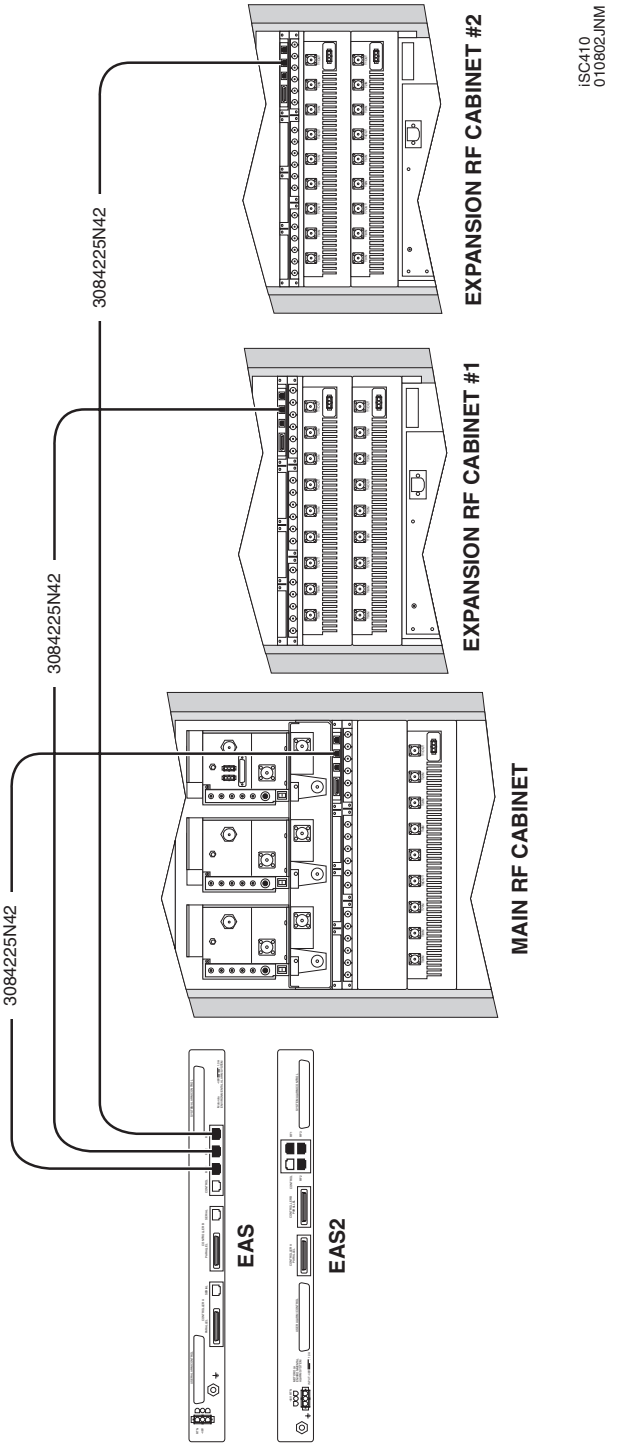
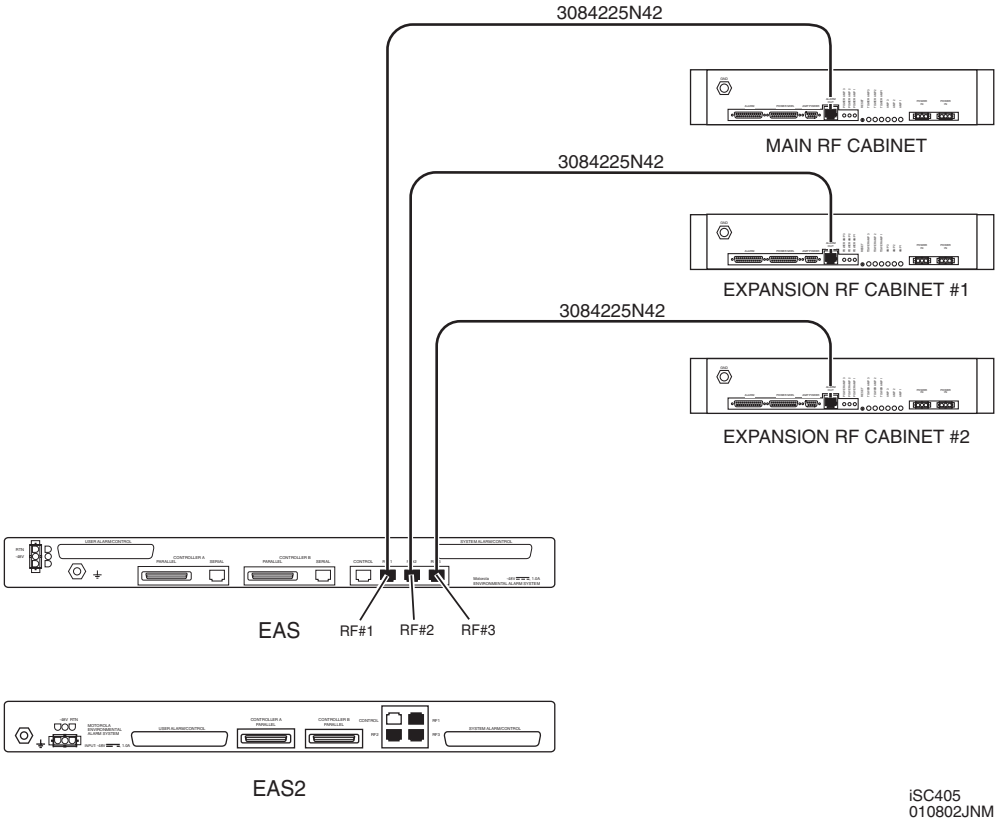


Figure 4-13 ***Alarm Connections for 800 MHz Duplexed RFDS (0182020V06 and earlier) Sectored Sites***



NOTE: For systems using more than 3 RFCs, additional EAS/EAS2 connections are as shown in Figure 4-17, Alarm Connections (Systems with 4-8 RF Racks).

Figure 4-14 ***Alarm Connections for GEN 4 RFDS / 900 MHz Duplexed RFDS Sites***



NOTE: 1-5 channel site uses Main RFC only.
6-10 channel site uses Main RFC and expansion RFC.
11-15 channel site uses Main RFC and two expansion RFCs.
16-20 channel site uses Main RFC and three expansion RFCs. For systems using more than 3 RFCs, additional EAS/EAS2 connections are as shown in Figure 4-17, Alarm Connections (Systems with 4-8 RF Racks).

Figure 4-15 ***Alarm Connections for Cavity Combining RFDS Omni Sites***

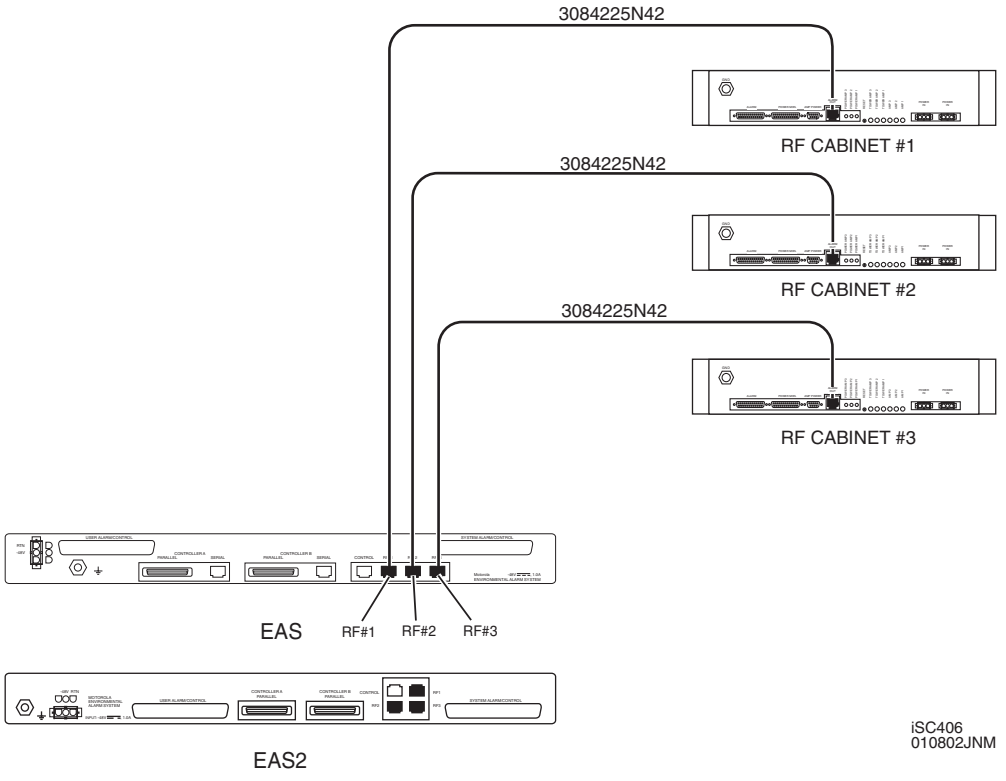


Figure 4-16 ***Alarm Connections for Cavity Combining RFDS Sectored Sites***

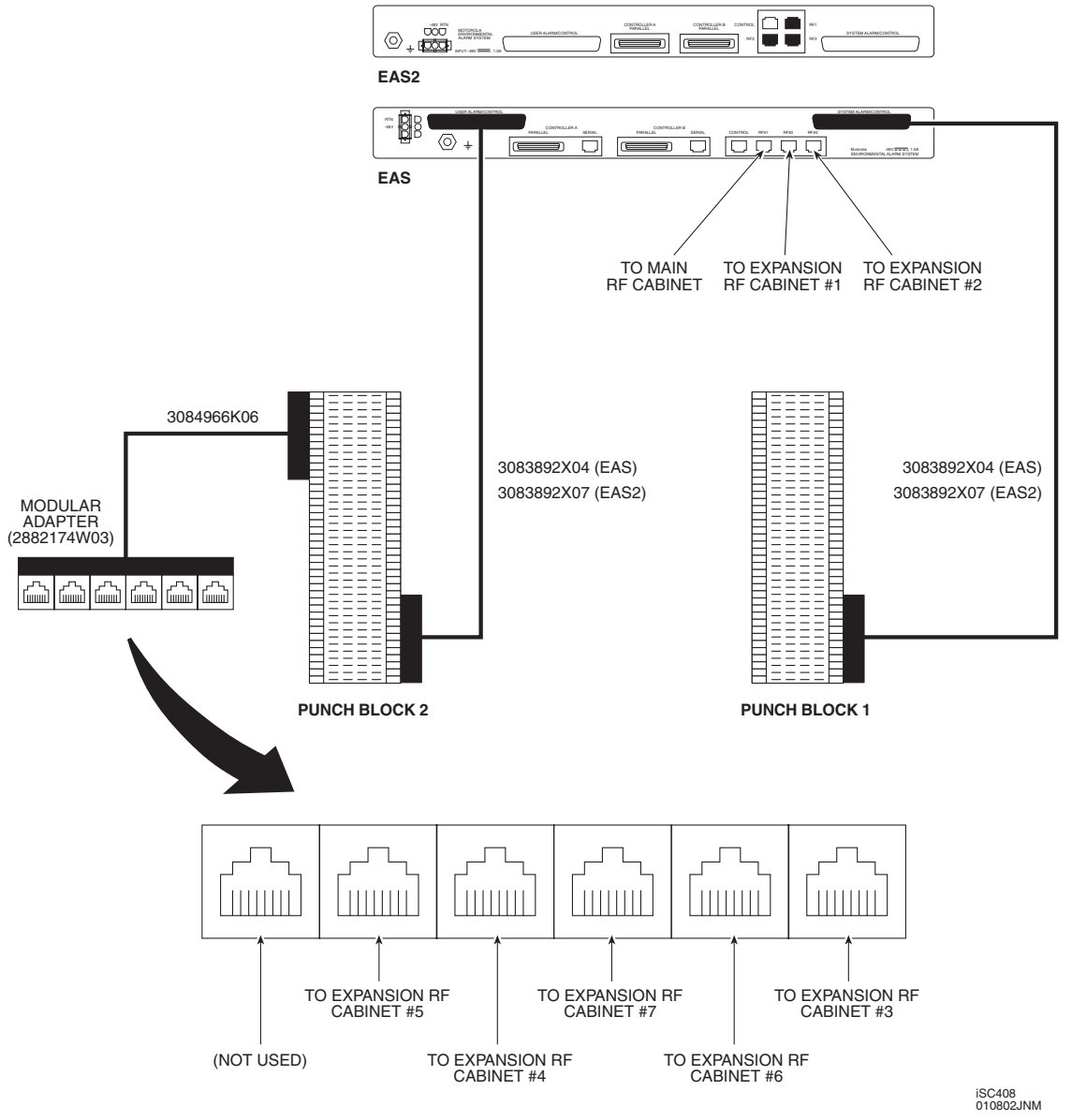


Figure 4-17 ***Alarm Connections (Systems with 4-8 RF Racks)***

Primary Control Channel Redundancy Intercabling

On a cavity combining RFDS, additional signaling connections must be made for Primary Control Channel (PCCH) redundancy. There is a PCCH redundancy control cable for each RF Cabinet used in the system.

The red wire is routed to RF Cabinet 1, the blue wire is routed to RF Cabinet 2, and the green wire is routed to RF Cabinet 3. RF Cabinets 2 and 3 are used only in sectored sites. All of the PCCH redundancy control wires (red, blue, and green) branch from the Control modular cable connection on the rear of the EAS/EAS2.

1. On the EAS/EAS2, locate the modular cable that is plugged into the Control connector.

   The end of this cable contains three separate branched wires that are colored red, blue, and green.

2. Locate the Mate-N-Lok connector at the end of a colored wire.

   This is a PCCH redundancy control connection for a specific RF Cabinet.

Note: Make sure that each wire is routed to the appropriate RF Cabinet. Red is for RF Cabinet 1, blue is for RF Cabinet 2, and green is for RF Cabinet 3.

3. Route each colored wire to the appropriate RF Cabinet.

4. In the RF Cabinet, locate the loose cable containing another Mate-N-Lok connector.

   This cable is connected to the antenna relay on the rear of the RF Cabinet and to the Auxiliary connector on the BR backplane.

5. Connect the two Mate-N-Lok connectors from the EAS/EAS2 and RF Cabinet together.

6. Repeat this procedure for additional RF Cabinets, if necessary.

GPS Antennas

The GPS receiver is part of the site controller. Each controller contains one GPS receiver. Redundancy is accomplished via a second Controller. A GPS antenna is connected to each GPS receiver.

1. Connect the GPS#1 antenna cable to the GPS A (or RX2 if not using site controller junction panel) N-type connector opening on the junction panel.

   Extension cables for the antenna feedlines are not provided and must be procured locally. Superflex™ 1/2" cable is the recommended extension cable.

2. If Controller B is installed, connect the GPS#2 antenna cable to the GPS B (or RX3 if not using site controller junction panel) N-type connector opening on the junction panel.

Alarm System Cabling

All site alarm wires enter from the top of the cabinet and connect to the rear of the EAS/EAS2.

Site alarm wiring should be complete before installation. This section gives instructions for connecting the site alarms to the EAS/EAS2. Figure 4-18 shows the rear view of the EAS/EAS2. Figure 4-19 shows the connections between the EAS/EAS2 and punch blocks 1 and 2. Punch block 1 contains system alarm/control signals while punch block 2 is typically defined as the "user" alarm/control interface.

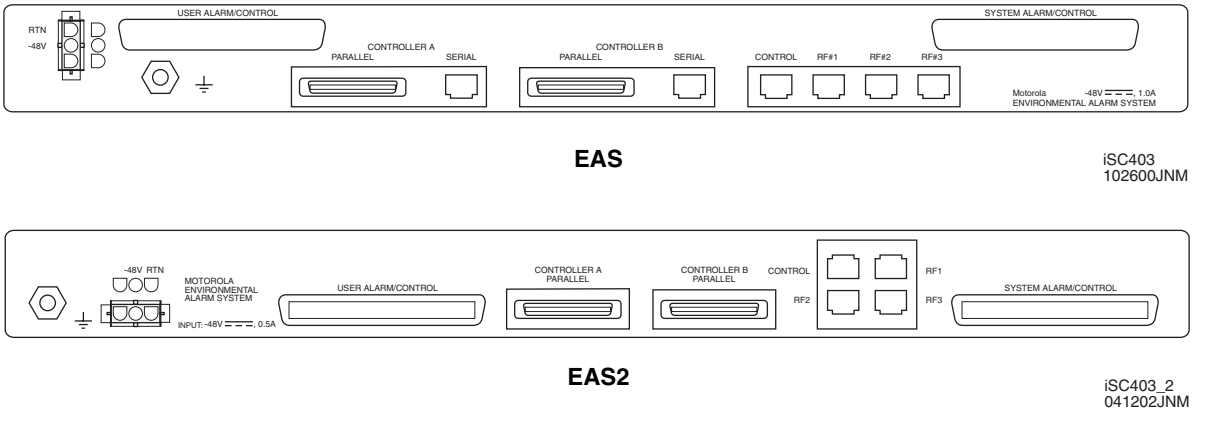


Figure 4-18 ***Alarm connections on the EAS/EAS2***

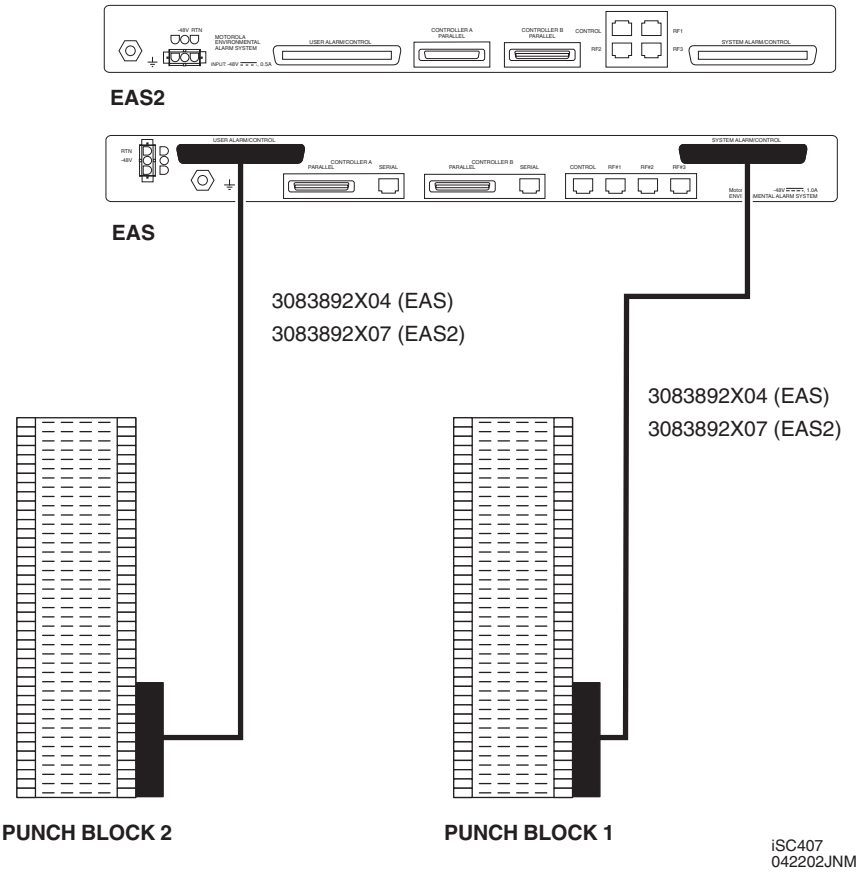


Figure 4-19 ***EAS/EAS2 to punch block 1 and punch block 2 connections***

1. Locate the 50-pin Champ cable connected to punch block 1.
2. Connect the free end of this cable to the System Alarm/Control connector on the rear of the EAS/EAS2.
3. Locate the 50-pin Champ cable connected to punch block 2.
4. Connect the free end of this cable to the User Alarm/Control connector on the rear of the EAS/EAS2.

Alarm System Cabling

The Environmental Alarm System (EAS/EAS2) handles alarms for the site. Site alarm wiring enters from the top of the equipment cabinet via the junction panel. Connector pinouts for the junction panel are the same as EAS/EAS2 connector pinouts.

EAS/EAS2 rear panel connectors appear in Figure 4-20. User and system alarm / control circuits connect to respective 50-pin connectors: Notice connectors P9 (USER ALARM CONTROL) and P10 (SYSTEM ALARM / CONTROL). Various system (internal) alarm circuits interface to the EAS/ EAS2 via connectors P5 through P8.

Five sets of changeover relay contacts allow control of external equipment. The relays are rated 50 Vdc at 250 mA. (If switching requirements exceed these ratings, use a relay contact to actuate a power relay.)

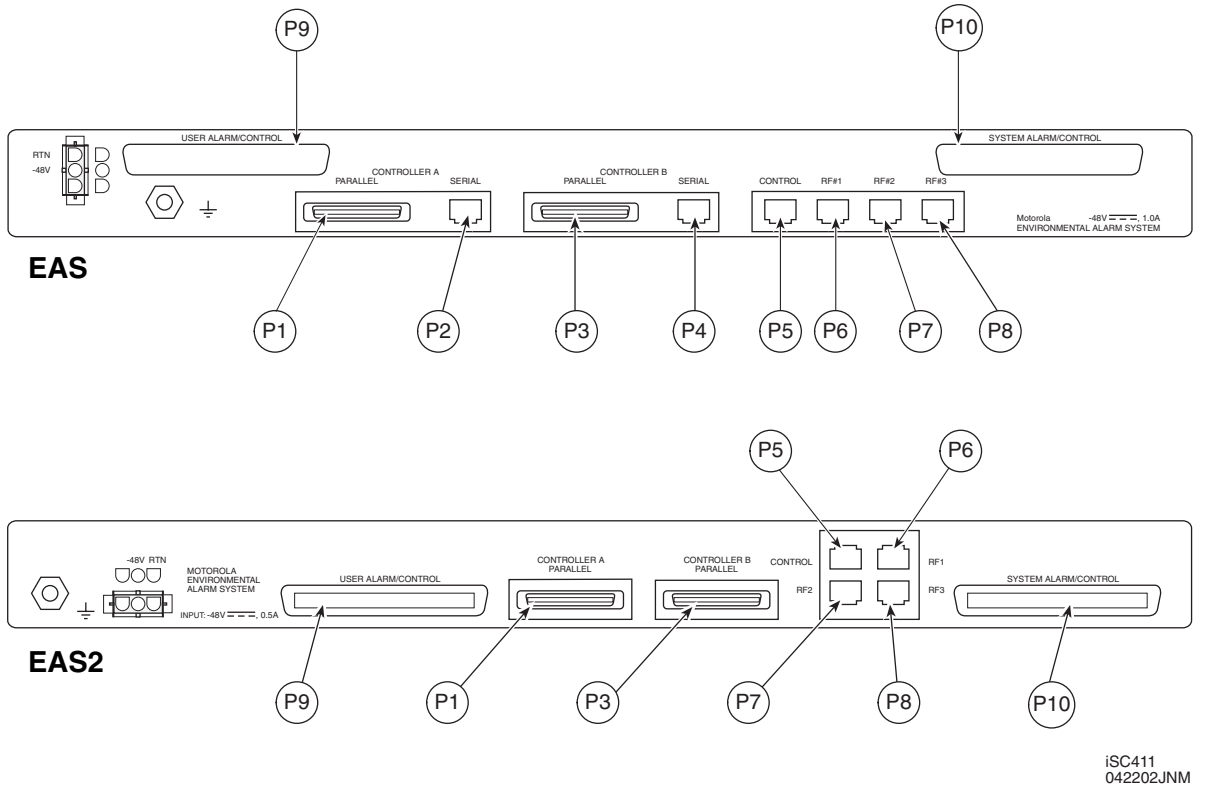


Figure 4-20 ***EAS/EAS2 rear panel connectors***

EAS/EAS2 Alarm / Control Connector Pinouts

Typically, USER ALARM / CONTROL and SYSTEM ALARM CONTROL connectors connect to the site alarm wiring using a punchblock. The tables that follow list EAS/EAS2 connector pinouts and functions:

- Tables 4-17 and 4-18 show P9 and P10 D-connector pinouts, respectively.
- Table 4-19 defines pin numbers on connectors P5 through P8.
- Tables 4-20 and 4-21 list user and system relay outputs on connectors P9 and P10.
- Table 4-22 lists internal relay outputs on connector P5.

Site alarm wiring should be complete before installation.

Table 4-17 ***User Alarm Inputs***

Alarm Code.	P9 (USER ALARM / CONTROL) Pin No.				Function
	EAS (D-SUB 50 CONN.)		EAS2 (CHAMP 50 CONN.)		
	RETURN	Signal (Live) Connection	RETURN	Signal (Live) Connection	
212	8	7	22	47	customer defined input
213	10	9	21	46	customer defined input
214	12	11	20	45	customer defined input
215	14	13	19	44	customer defined input
216	16	15	18	43	customer defined input
217	18	17	17	42	customer defined input
218	20	19	16	41	customer defined input
252	22	21	15	40	customer defined input
203	24	23	14	39	customer defined input
204	26	25	13	38	customer defined input
205	28	27	12	37	customer defined input
206	30	29	11	36	customer defined input
207	32	31	10	35	customer defined input
208	34	33	9	34	customer defined input
209	36	35	8	33	customer defined input
211	38	37	7	32	customer defined input
201	40	49	6	31	customer defined input
202	42	41	5	30	customer defined input

Table 4-18 ***System Alarm Inputs***

Alarm Code	P10 (SYSTEM ALARM / CONTROL) Pin No.				Function
	EAS (D-SUB 50 CONN.)		EAS2 (CHAMP 50 CONN.)		
	RETURN	Signal (Live) Connection	RETURN	Signal (Live) Connection	
210	6	5	23	48	reserved for system use
224	8	7	22	47	reserved for system use
241	10	9	21	46	reserved for system use
249	12	11	20	45	reserved for system use
250	14	13	19	44	reserved for system use
251	16	15	18	43	reserved for system use
247	18	17	17	42	major rectifier failure
246	20	19	16	41	minor rectifier module failure
245	22	21	15	40	breaker failure alarm
244	24	23	14	39	high DC voltage
243	26	25	13	38	low DC voltage
242	28	27	12	37	AC Power failure
223	30	29	11	36	predefined input, site AC surge protector
222	32	31	10	35	predefined input, site smoke detector
221	34	33	9	34	predefined input, site low ambient temperature
220	36	35	8	33	predefined input, site high ambient temperature
219	38	37	7	32	predefined input, site entry

Table 4-19 ***Internal Alarm Inputs***

Alarm Code	EAS/EAS2 Connector		Function
	Signal (Live) Connection	Ground Connection	
	P5 (CONTROL) Pin No.		
237	1	2	Control Cabinet circuit breaker
	P6 (RFI#1) Pin No.		
233	1	2	RF Cabinet 1 circuit breaker
234	3	4	RF Cabinet 1 combination/mc amplifier
235	5	6	RF Cabinet 1 combination/mc power supply
236	7	8	RF Cabinet 1 Tower Top Amplifier
	P7 (RF#2) Pin No.		
229	1	2	RF Cabinet 2 circuit breaker
230	3	4	RF Cabinet 2 combination/mc amplifier
231	5	6	RF Cabinet 2 combination/mc power supply
232	7	8	RF Cabinet 2 Tower Top Amplifier
	P8 (RF#3) Pin No.		
225	1	2	RF Cabinet 3 circuit breaker
226	3	4	RF Cabinet 3 combination/mc amplifier
227	5	6	RF Cabinet 3 combination/mc power supply
228	7	8	RF Cabinet 3 Tower Top Amplifier

Table 4-20 ***User Relay Outputs***

Alarm Code.	Contact	P9 (USER ALARM / CONTROL) Pin No.		Function
		EAS	EAS2	
256	COM	45	28	customer defined output
	NC	44	4	
	NO	46	3	
255	COM	49	26	customer defined output
	NC	48	2	
	NO	50	1	

NOTE: NC = Normnally Closed; NO = Normally Open.

Table 4-21 ***System Relay Outputs***

Alarm Code.	Contact	P10 (SYSTEM ALARM / CONTROL) Pin No.		Function
		EAS	EAS2	
248	COM	41	30	customer defined output. generator remote start
	NC	40	6	
	NO	42	5	
254	COM	45	28	reserved for system use
	NC	44	4	
	NO	46	3	
253	COM	49	26	reserved for system use
	NC	48	2	
	NO	50	1	

NOTE: NC = Normnally Closed; NO = Normally Open.

Table 4-22 ***Internal Relay Outputs***

Alarm Code	Contact	P5 (CONTROL) Pin No.	Function
238	NO	3	output, RF Relay Cabinet 1
	COM	4	
239	NO	5	output, RF Relay Cabinet 2
	COM	6	
240	NO	7	output, RF Relay Cabinet 3
	COM	8	

NOTE: NO = Normally Open.

EAS/EAS2 Connector Pinouts

EAS/EAS2 connectors and punch block information appear in Table 4-23. Only the alarm code number is passed to the OMC. The alarm code is the software message relating the punch block pins with the alarm.

Table 4-23 ***Punch block pinouts***

Alarm code	EAS/EAS2 connector	Punch block pairs	EAS/EAS2 standard alarm connection
201	User Alarm/Control	6, 31	customer defined input
202	User Alarm/Control	5, 30	customer defined input
203	User Alarm/Control	14, 39	customer defined input
204	User Alarm/Control	13, 38	customer defined input
205	User Alarm/Control	12, 37	customer defined input
206	User Alarm/Control	11, 36	customer defined input
207	User Alarm/Control	10, 35	customer defined input
208	User Alarm/Control	9, 34	customer defined input
209	User Alarm/Control	8, 33	customer defined input

Table 4-23 ***Punch block pinouts — continued***

Alarm code	EAS/EAS2 connector	Punch block pairs	EAS/EAS2 standard alarm connection
210	System/Alarm Control	23, 48	reserved for system use
211	User Alarm/Control	7, 32	customer defined input
212	User Alarm/Control	22, 47	customer defined input
213	User Alarm/Control	21, 46	customer defined input
214	User Alarm/Control	20, 45	customer defined input
215	User Alarm/Control	19, 44	customer defined input
216	User Alarm/Control	18, 43	customer defined input
217	User Alarm/Control	17, 42	customer defined input
218	User Alarm/Control	16, 41	customer defined input
219	System/Alarm Control	7, 32	predefined input, site entry
220	System/Alarm Control	8, 33	predefined input, site high ambient temperature
221	System/Alarm Control	9, 34	predefined input, site low ambient temperature
222	System/Alarm Control	10, 35	predefined input, site smoke detector
223	System/Alarm Control	11, 36	predefined input, site AC surge protector
224	System/Alarm Control	22, 47	reserved for system use
225	RF #3	1, 2	RF Cabinet 3 circuit breaker
226	RF #3	3, 6	RF Cabinet 3 combination/mc amplifier
227	RF #3	5, 8	RF Cabinet 3 combination/mc power supply
228	RF #3	7, 4	RF Cabinet 3 Tower Top Amplifier
229	RF #2	1, 2	RF Cabinet 2 circuit breaker
230	RF #2	3, 6	RF Cabinet 2 combination/mc amplifier

Table 4-23 ***Punch block pinouts — continued***

Alarm code	EAS/EAS2 connector	Punch block pairs	EAS/EAS2 standard alarm connection
231	RF #2	5, 8	RF Cabinet 2 combination/mc power supply
232	RF #2	7, 4	RF Cabinet 2 Tower Top Amplifier
233	RF #1	1, 2	RF Cabinet 1 circuit breaker
234	RF #1	3, 6	RF Cabinet 1 combination/mc amplifier
235	RF #1	5, 8	RF Cabinet 1 combination/mc power supply
236	RF #1	7, 4	RF Cabinet 1 Tower Top Amplifier
237	CONTROL	1, 2	Control Cabinet circuit breaker
238*	CONTROL	3, 4	output, RF Relay Cabinet 1
239*	CONTROL	5, 6	output, RF Relay Cabinet 2
240*	CONTROL	7, 8	output, RF Relay Cabinet 3
241	System/Alarm Control	21, 46	reserved for system use
242	System/Alarm Control	12, 37	AC Power failure
243	System/Alarm Control	13, 38	low DC voltage
244	System/Alarm Control	14, 39	high DC voltage
245	System/Alarm Control	15, 40	breaker failure alarm
246	System/Alarm Control	16, 41	minor rectifier module failure
247	System/Alarm Control	17, 42	major rectifier failure
248*	System/Alarm Control	30, 6, 5	customer defined output. generator remote start
249	System/Alarm Control	20, 45	reserved for system use
250	System/Alarm Control	19, 44	reserved for system use
251	System/Alarm Control	18, 43	reserved for system use
252	User/Alarm Control	15, 40	customer defined input

Table 4-23 ***Punch block pinouts — continued***

Alarm code	EAS/EAS2 connector	Punch block pairs	EAS/EAS2 standard alarm connection
253*	System/Alarm Control	26, 2, 1	reserved for system use
254*	System/Alarm Control	28, 4, 3	reserved for system use
255*	User/Alarm Control	26, 2, 1	customer defined output
256*	User/Alarm Control	28, 4, 3	customer defined output
* These alarms are outputs controlled by the EAS/EAS2 and/or OMC.			

Punch Block Signal Pair Definitions

Table 4-24 lists the system alarm/control signal connections available on punch block 1. Table 4-25 lists the user alarm/control signal connections available on punch block 2.

Note: Although punch block 2 is typically defined as the "user" alarm/control interface, punch block 2 also contains system connections reserved for RFCs 4 through 8. These connections are identified accordingly.

The punch block signal pairs consist of a signal and its respective return connection. In all cases, the lower-number of the pair is the signal function ("hot" connection) and the higher-number is its return.

In certain cases, jumpering from punch block 1 to punch block 2, or between the right and left sides of punch block 2 is required. In Tables 4-24 and 4-25, these are identified as entries containing four punch block numbers per alarm function. In these cases, a jumper is required from the pin indicated in the particular row to the pin indicated in the immediately adjacent column.

Figure 4-21 shows examples of punch block-to-punch block jumpering.

EAS/EAS2 Modular Alarm Connections

Table 4-26 lists the alarm connections at modular connectors RF#1 through RF#3 on the EAS/EAS2 rear panel.

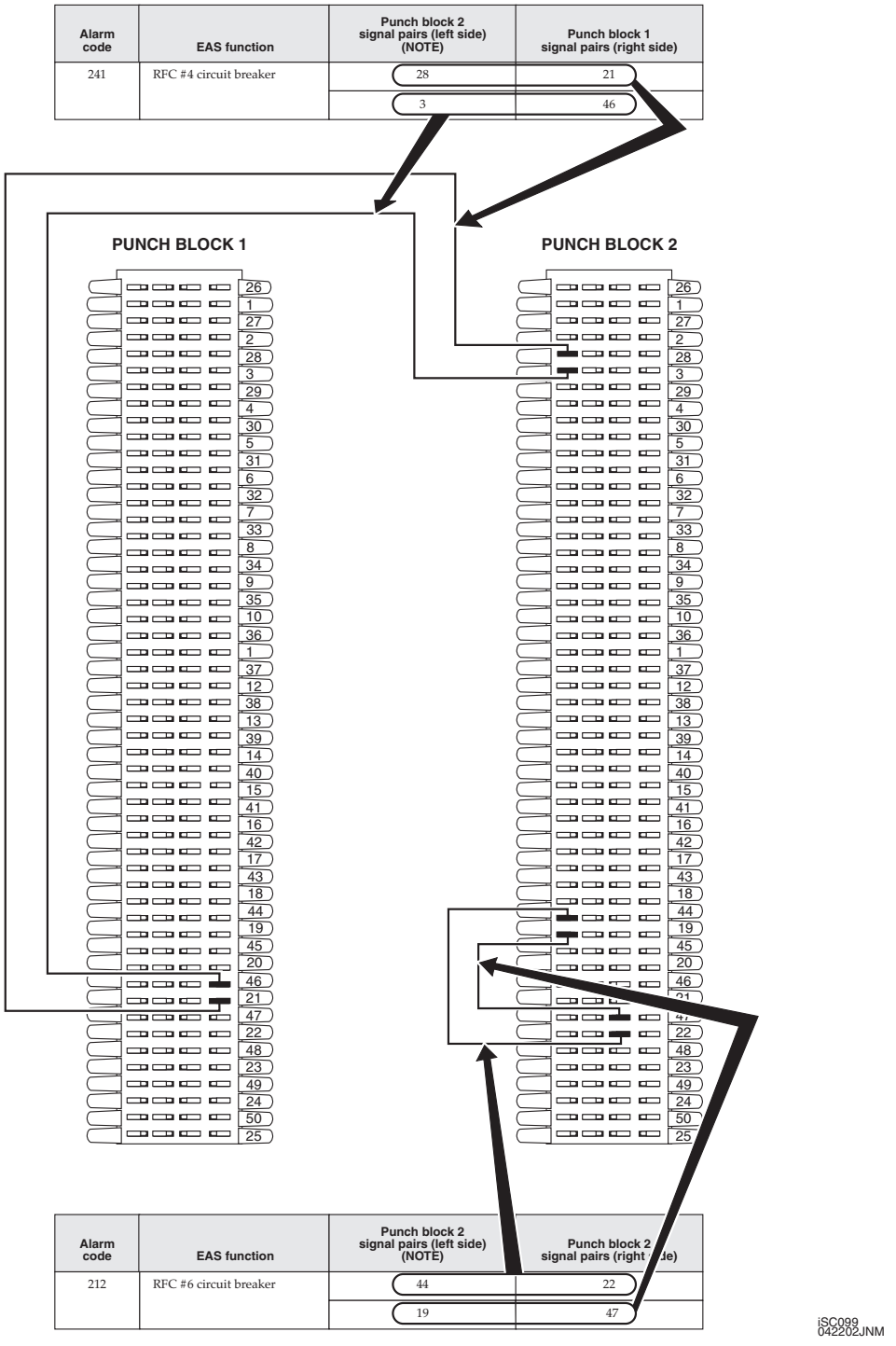


Figure 4-21 ***Punch block jumpering examples***

Table 4-24 ***Punch block 1 (system alarm) pinouts***

Alarm code	EAS/EAS2 function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 1 signal pairs (right side)
210	reserved for system use		23
			48
219	Site entry		7
			32
220	Site high ambient temperature		8
			33
221	Site low ambient temperature		9
			34
223	Site AC surge protector		11
			36
224	reserved for system use		22
			47
241	RFC #4 circuit breaker	28	21
		3	46
242	AC power failure		12
			37
243	LO DC voltage		13
			38
244	HI DC voltage		14
			39
245	Breaker alarm failure		15
			40
246	Minor rectifier module failure		16
			41

Table 4-24 ***Punch block 1 (system alarm) pinouts — continued***

Alarm code	EAS/EAS2 function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 1 signal pairs (right side)
247	Major rectifier failure		17
			42
248	Generator remote start		6
			5
			30
249	RFC #4 combiner/multicoupler amplifier	27	20
		2	45
250	RFC #4 combiner/multicoupler power supply	26	19
		4	44
251	RFC #4 tower top amplifier	29	18
		1	43
253	reserved for system use		26
			2
			1
254	reserved for system use		28
			4
			3

NOTE: Pinout connections in "Punch block 2" column indicate pins where jumpering between punch blocks 1 and 2 is required. Install jumper from pin specified in "punch block 1" column to the pin specified immediately to the right in "punch block 2" column. For example, on alarm code 249, jumper is to be installed from punch block 1, pin 20 to punch block 2, pin 27.

Table 4-25 ***Punch block 2 (user alarm) pinouts***

Alarm code	EAS/EAS2 function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 2 signal pairs (right side)
201	customer-defined input		6
			31
202	customer-defined input		5
			30
203	RFC #8 circuit breaker	36	14
		11	39
204	RFC #8 combiner/multicoupler amplifier	35	13
		10	38
205	RFC #8 combiner/multicoupler power supply	34	12
		12	37
206	RFC #8 tower top amplifier	37	11
		9	36
207	RFC #7 circuit breaker	32	10
		7	35
208	RFC #7 combiner/multicoupler amplifier	31	9
		6	34
209	RFC #7 combiner/multicoupler power supply	30	8
		8	33
211	RFC #7 tower top amplifier	33	7
		5	32
212	RFC #6 circuit breaker	44	22
		19	47

Table 4-25 ***Punch block 2 (user alarm) pinouts — continued***

Alarm code	EAS/EAS2 function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 2 signal pairs (right side)
213	RFC #6 combiner/multicoupler amplifier	43	21
		18	46
214	RFC #6 combiner/multicoupler power supply	42	20
		20	45
215	RFC #6 tower top amplifier	45	19
		17	44
216	RFC #5 circuit breaker	40	18
		15	43
217	RFC #5 combiner/multicoupler amplifier	39	17
		14	42
218	RFC #5 combiner/multicoupler power supply	38	16
		16	41
252	RFC #5 tower top amplifier	41	15
		13	40
255	customer-defined output		26
			2
			1
256	customer-defined output		28
			4
			3

NOTE: Pinout connections in "Punch block 2 (left side)" column indicate pins where jumpering between punch block 2 left and right sides is required. Install jumper from pin specified in "left side" column to the pin specified immediately to the right in "right side" column. For example, on alarm code 217, jumper is to be installed from punch block left-side, pin 39 to punch block right-side, pin 17.

Table 4-26 ***EAS/EAS2 modular alarm connection pinouts***

Alarm code	Connector	Pins	EAS/EAS2 function
225	RF #3	1, 2	RFC 3 circuit breaker
226	RF #3	3, 6	RFC 3 combiner/multicoupler amplifier
227	RF #3	5, 8	RFC 3 combiner/multicoupler power supply
228	RF #3	7, 4	RFC 3 tower top amplifier
229	RF #2	1, 2	RFC 2 circuit breaker
230	RF #2	3, 6	RFC 2 combiner/multicoupler amplifier
231	RF #2	5, 8	RFC 2 combiner/multicoupler power supply
232	RF #2	7, 4	RFC 2 tower top amplifier
233	RF #1	1, 2	RFC 1 circuit breaker
234	RF #1	3, 6	RFC 1 combiner/multicoupler amplifier
235	RF #1	5, 8	RFC 1 combiner/multicoupler power supply
236	RF #1	7, 4	RFC 1 tower top amplifier
237	CONTROL	1, 2	Control cabinet circuit breaker
238	CONTROL	3, 4	Output: RF relay Sector/Cell 1
239	CONTROL	5, 6	Output: RF relay Sector/Cell 2
240	CONTROL	7, 8	Output: RF relay Sector/Cell 3

Site Controller to Telephone Network T1/E1 Cabling

The local telephone company installs the T1/E1 line, which terminates in an 8-pin modular plug. This demarcation (demarc) point connects to the T1/E1 through a surge arrestor. Figure 4-22 shows the T1/E1 interface with the system.

The surge arrestor must be adequately grounded as outlined in the *Quality Standards Fixed Network Equipment - Installation Manual (R56)*. The surge arrestor usually mounts near the demarcation (demarc) point. The cable connecting the surge arrestor to the Telco SmartJack should be locally procured, or should be provided with the surge arrestor. The cable connecting the Controller to the surge arrestor is locally procured.

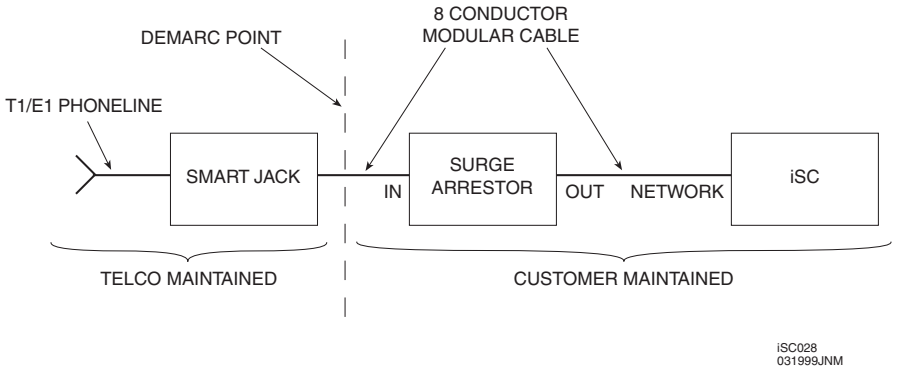


Figure 4-22 ***Telco (T1/E1) interface with the system***

The Telco interface should have been installed according to the Pre-installation chapter.

Note: The equipment can be installed and tested without the Telco T1/E1 present. The T1/E1 must be connected for proper operation of the site.

Note: Some modular cables have a ridge along one side of the cable for purposes of alignment with the connector.

Note: The SmartJack is capable of passing -48V Telco power through to the site controller. For operation, iDEN does not require this power. If -48V is present on the network connection to the site controller, the SmartJack is incorrectly configured. Contact the service provider immediately to correct this situation. The SmartJack switch should be set so that -48V power does not pass through to the site controller.

If this cable is locally manufactured, crimp the 8-pin connectors as shown in Figure 4-23. The wires should be routed straight through. Make sure that the conductor color is the same at both ends for each conductor of the cable.

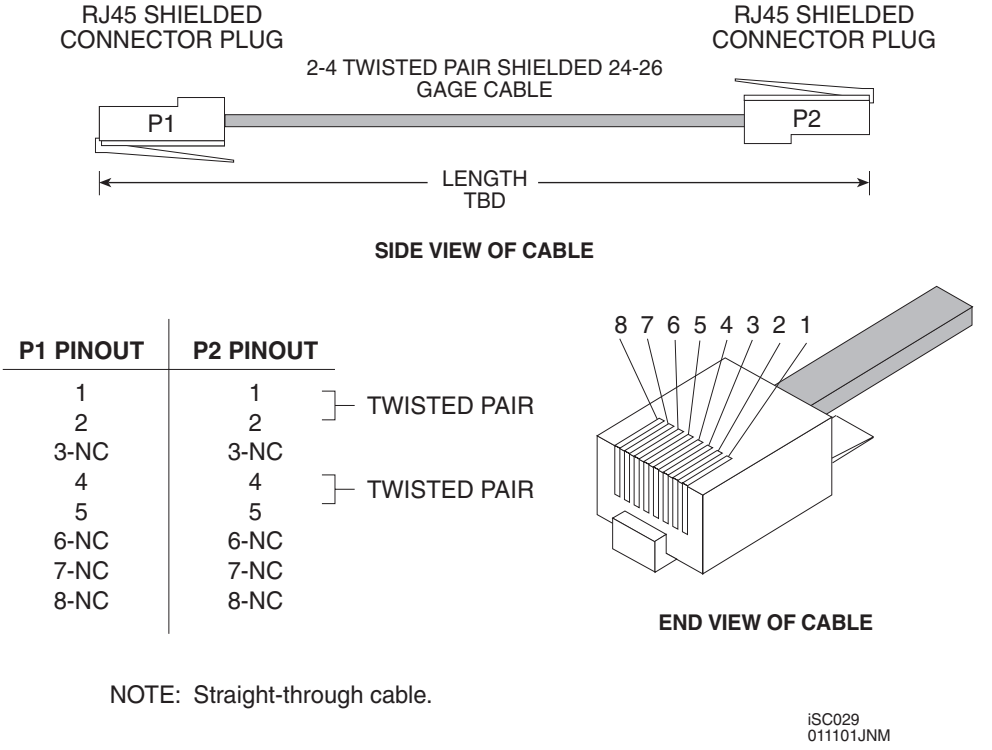


Figure 4-23 ***T1 interface cable configuration***

Site Controller and iDEN Smartjack Option Setting Requirements

For proper operation of the site controller and iDEN system, the Smartjack should be set up with the following options. The telco owns and maintains the Smartjack, and should be involved in switch setting changes.

- B8ZS Line Coding:

  iDEN requires B8ZS line coding, while many non-iDEN applications use AMI line coding. Improper selection results in “ones density” errors and prevents proper site controller operation. Operators have reported difficulties when the service provider provisions intermediate repeaters with an “auto” function. If problems occur on the span, the intermediate repeaters may automatically start switching between AMI and B8ZS, searching for a signal. Some Smartjacks have automatic capability as well.

- ESF Framing:

  iDEN requires ESF framing to operate. Intermediate network elements may be configured to automatically switch between SF and ESF framing. This process delays circuit restoration, and is difficult to detect without monitoring using appropriate test equipment. The Smartjack should be set up for ESF framing.

- Loop/Thru Powering

  By passing 48VDC power over the span, this Smartjack option allows the interface to provide (through) 48VDC to customer equipment. The option is set to “loop” if the customer equipment requires a dry contact that terminates the span line power in the Smartjack. Because iDEN does not support 48 VDC on the line, this option must be set to “loop.”

  The site controller automatically powers the network interface. 48VDC power need not come from the Smartjack.

⚠ CAUTION

THE SURGE ARRESTOR INSTALLED ON THE SITE CONTROLLER SIDE OF THE SMARTJACK WILL ATTEMPT TO CLAMP THE 48VDC TO APPROXIMATELY 8VDC, WHICH WILL DISRUPT SITE CONTROLLER OPERATION. IF THIS CONDITION CONTINUES, THE SURGE ARRESTOR MAY BE DAMAGED AND ISOLATED FROM THE REST OF THE CIRCUIT. THE SITE CONTROLLER MAY START OPERATING. PROPER OPERATION MAY BE OBSERVED, BUT THE SURGE ARRESTOR WILL NO LONGER PROVIDE SURGE PROTECTION. THIS CONDITION IS NOT IMMEDIATELY APPARENT BUT IS EASILY DETECTED WITH A VOLTMETER.

THE SITE CONTROLLER NETWORK CONTAINS A BUILT-IN SURGE ARRESTOR. IF 48VDC IS PRESENT, THE T1/E1 SIGNAL WILL BE DISRUPTED, PREVENTING PROPER OPERATION. IF APPLICATION OF 48VDC CONTINUES, THE SITE CONTROLLER'S POWER LINE CROSS PROTECTION CIRCUITRY ACTIVATES. AS LONG AS THE 48VDC IS PRESENT, THE CIRCUIT REMAINS OPEN. REMOVING THE 48VDC CAUSES THE CIRCUIT TO CLOSE. NORMAL OPERATION MAY RESUME AS LONG AS THE 48VDC IS NOT PRESENT.

- Loopback/All Ones

  Upon loss of the signal, some smartjacks have the option of going into loopback, instead of transmitting all ones. The site controller is provisioned to provide an ESF framed, all-ones keep-alive signal when not call processing.

  Many Smartjacks use pulse detection to indicate LOS. However, the site controller does not transmit anything when not powered, thus triggering the transmit LOS circuitry. To maintain the network connection when the EBTS is off-line, iDEN operators prefer an "all ones" Smartjack configuration.

- Code Enable/Disable

  To enable iDEN operators or telcos to activate ESF loopback of the Smartjack, the option Code Enable / Disable must be on/enabled in some Smartjacks. This option does not have any direct effect on the operation of iDEN equipment. Yet Code Enable/ Disable does affect the ability of the operator/service provider to diagnose network problems.

  The site controller responds to the loopback code designated for Channel Service Units, which is different than for the Smartjacks. The site controller responds to ESF loopback codes on the FDL message channel, or the in-band loopback code.

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MOTOROLA

5

Final Checkout

Chapter Overview

This chapter describes the final checkout procedures to be performed after installation of the EBTS equipment is complete. Refer to the *EBTS System Manual (on CD: 98P80800A17)* for the final checkout of non-site control equipment. The following table lists this chapter's topics.

Section	Page	This section . . .
Final Checkout Setup	5-2	describes the procedures for proper setup of the site control equipment
Powering the Site Controller Rack	5-3	describes the procedures for powering up the site control equipment
Circuit Breakers	5-4	describes the procedures for setting the circuit breakers

Final Checkout Setup

The following procedures should be performed after installation of the site controller is complete. This Final Checkout procedure ensures the proper operation of the site controller.

1. On the Cabinet, set all circuit breakers to OFF.

Figure 5-1 shows the Cabinet Breaker Panel.

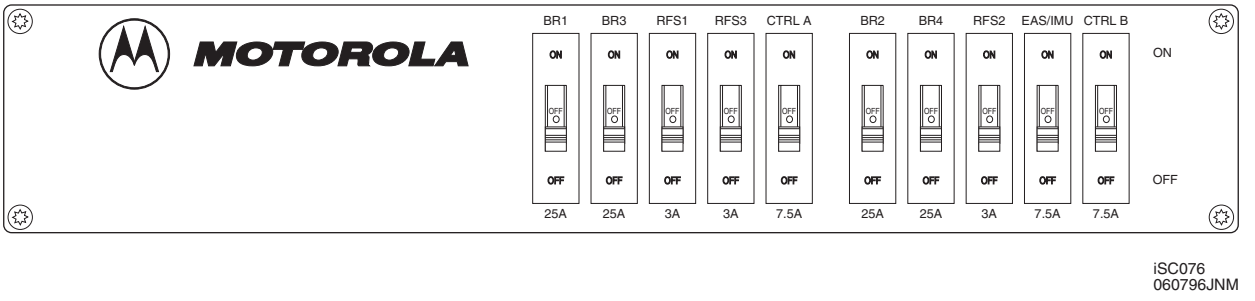


Figure 5-1 ***Cabinet Breaker Panel for standard site controller rack or SRRC (front view)***

For details of the AC/DC Power System for the SRSC, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual*. *(on CD: 98P80800A17)*

Powering the Site Controller Rack

1. On the Power Supply Rack Cabinet Breaker Panel, set breakers ACGA and ACGB to ON.

   This supplies power to the Controllers A and B. Refer to Figure 5-2.

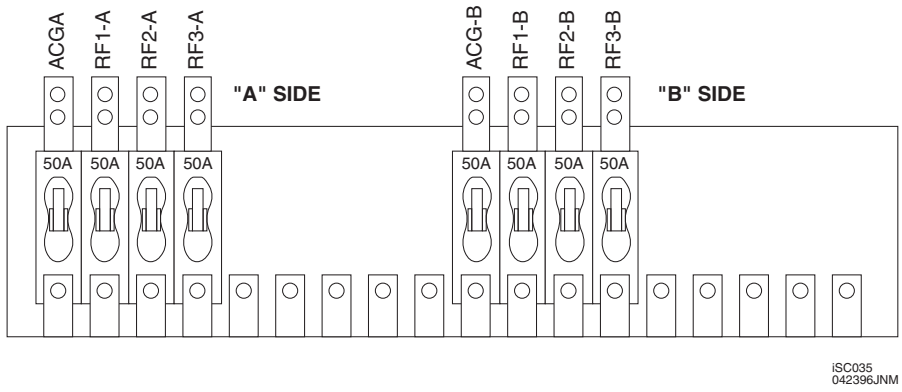


Figure 5-2 ***Power Supply Rack Breaker Panel (front view)***

2. Verify a voltage level between -41 Vdc and -60 Vdc at the -48 Vdc (hot) terminals on the Breaker Panel in the Cabinet.

3. Verify a voltage level of less than 1.0 V between the DC return and chassis ground of the Cabinet.

Circuit Breakers

Note: Breaker panels are always shipped fully configured whether the equipment each circuit breaker controls is installed or not. This procedure requires all breakers to be set to the ON position to prevent the triggering of the breaker alarm indication. All steps must be performed in this procedure to prevent unwanted alarm indications.

1. On the Cabinet breaker panel, set the EAS/EAS2/IMU breaker to ON. Refer to Figure 5-3.

   Verify that the Power LED on the EAS/EAS2 is lit.

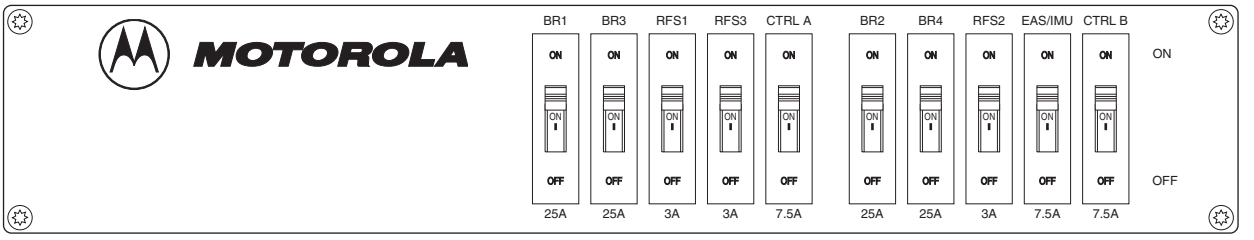


Figure 5-3 ***Cabinet Breaker Panel (front view)***

2. Set the CTRL A breaker to ON.

   Verify that the Power LED on Controller A is lit.

3. Set the CTRL B breaker to ON.

   Verify that the Power LED on Controller B is lit.

Note: The site reference requires 13 to 25 minutes to start up for the first time. During this delay, the GPS receiver locates and fixes on satellites. Also, the HSO requires 20 minutes for frequency stabilization.

MOTOROLA

6

System Testing

Chapter Overview

This chapter provides testing procedures for the site controller. The following table lists this chapter's topics.

Section	Page	This section . . .
Testing Overview	6-2	describes the requirements for MMI commands and testing procedures
Site Controller Verification	6-3	contains testing procedures for the site controller
RF Cabinet Verification	n/a	refer to the *EBTS System Manual (on CD: 98P80800A17)*

Testing Overview

The testing procedures covered in this chapter are intended to be used in conjunction with the information provided in the System Troubleshooting chapter. Together, the troubleshooting solutions and testing procedures provide the necessary information to isolate failures to a Field Replaceable Unit (FRU). This minimizes system downtime by quickly returning the site to normal operation.

Note: Ship faulty FRUs to a Motorola depot facility for servicing.

MMI commands

Service technicians can communicate with the system through Man-Machine Interface (MMI) commands and a service computer. MMI commands provide testing capabilities. They also enable access to alarm log files and various diagnostic tests. In addition, MMI commands provide a means to configure the site controller for various system tests.

The procedures in this chapter use a select number of MMI commands.

Test procedures

This chapter's test procedures check system functions and help isolate failures to the FRU level. If a failure cannot be isolated after performing these tests, refer to the tables within the System Troubleshooting chapter.

Site Controller Verification

The cabinet verification consists of:

Section	Page	This section . . .
Site Controller Verification	6-3	describes the Site Controller start up sequence and configuration
Loading the Base Radios	6-12	describes how to download the application code to each Base Radio
Standby Site Controller Status	6-14	describes how to check the status of the standby site controller system
Base Radio Registration	6-15	describes how to check the registration and status of each Base Radio within the system
T1 Connection Test	6-17	describes how to locally manufacture a T1 test cable; also how to set-up and perform a loop-back test on the T1 line
EAS/EAS2 Alarm Checkout	6-25	describes how to verify that EAS/ EAS2-monitored site alarms work properly
GPS Status	6-29	describes how to check the alarm, GPS, and on-line status of the GPS
Site Reference	6-31	provides a timing reference and a frequency reference to the base radios.

Site Controller Test Equipment

Table 6-1 lists the recommended test equipment for the site controller. This test equipment only applies to the site controller testing procedure.

Table 6-1 ***Test equipment for cabinet testing***

Equipment	Model/type	Supplier	Description
service computer *	80286 or better	IBM®, IBM compatible, or Macintosh	local service computer
T1/E1 test set	Fireberd	TTC	used to generate a Quasi Random Signal Sequence (QRSS) bit pattern and perform a loop-back test
T1/E1 test cable	n/a	locally procured	connects the T1 test set to the customer maintained T1 circuit
RS-232 cable	n/a	locally procured	straight through connecting cable with DB9 connector for site controller port
communication software	ProComm Plus (except version 2.0.1) (or equivalent)	DataStorm Technologies	host communication
* Either a DOS-based computer or Macintosh computer may be used for the service computer. Contact your iDEN System Manager for additional information.			

Service Computer Startup

This procedure assumes that power is applied to the system. If power is not applied, perform the procedures in the Final Checkout chapter.

Whenever the following procedures instruct you to enter software commands, this manual presents the commands in bold lettering. Enter all commands exactly as they appear. The command prompt precedes the command, as in the following example:

iSC> **whois isc**

1. Connect an RS-232 cable from the serial port on the service computer to “Service Access” connector on the front of Controller A.

2. Apply power to the service computer.

   After the service computer initializes, the first prompt on the screen identifies the hard drive name. This is most commonly the C:\ drive, but can vary depending on what type of computer is used and how it is configured.

   C:\>

Note: The service computer must contain serial port communications software (e.g. ProComm plus).

The following procedures are written for DOS-based service computers. For Macintosh service computers, alternate procedures are available from your iDEN System Manager .

3. Invoke the communications program by typing:

   C:\IDEN> **procomm**

4. Using the communications software, configure the service computer RS-232 port with the parameters listed in Table 6-2.

Table 6-2 ***RS-232 port configuration***

Description	Setting
Baud rate	19200
Parity bit	none
Data bits	8
Stop bits	1
COM port	COM1

Site Controller Startup Sequence

Note: This procedure may be halted and restarted at any time by powering down Controller B and pressing the CPU Reset pushbutton on Controller A.

Note: For ProComm users: The following versions are supported:

- ProComm Plus version 1.1b
- ProComm (all versions)
- ProComm Plus for Windows™ (all versions)

1. Start the service computer. For the appropriate startup procedure, refer to the Service Computer Startup section in this chapter.
2. Power up Controller A.
3. After the self-test is complete on Controller A, verify that the following messages appear on the service computer terminal:

```
Access Controller Gateway
Firmware Rev RXX.XX.XX (PowerPC)
Copyright (c) 2000
Motorola, Inc.

Unauthorized Access Prohibited

Current status:

Active/Standby Status:          UNKNOWN
MAC Address:                    XX:XX:XX:XX:XX:XX

To enter configuration mode, hit any key within 10 seconds:
```

4. Press any key within 10 seconds. When prompted, enter the proper password and press return.

Note: The display does not reflect the entry of the password.

The default password is **factory**.

The ACG# prompt is displayed on the service computer once the correct password has been entered.

5. At the ACG# prompt, type: **status**

   This command checks the current status of Controller A.

```
ACG# status
Active/Standby Status:          ACTIVE
MAC Address:                    XX:XX:XX:XX:XX:XX
Standby ACG MAC Address         (No Standby ACG)
```

E1/T1 Configuration

To configure the site controller for E1, enter “net e” at the ACG# prompt.

```
ACG# net e
Current NIC configuration is:
        Signalling: E1
```

To configure the site controller for T1, enter “net t” at the ACG# prompt.

```
ACG# net t
Current NIC configuration is:
        Signaling: T1
        T1 line build out:
            on port 0: 0
            on port 1: 0
            on port 2: 0
            on port 3: 0
```

To configure the T1 Line Build Out settings, enter “net b” at the ACG# prompt. For each port, enter:

net b Setting	LBO
0	0dB
1	-7.5dB
2	-15dB

The default line build out setting for each port is 0.

Example: Change line build out to -7.5dB

```
ACG# net b
Line build out for port 0 [0]: 1
Line build out for port 1 [0]: 1
Line build out for port 2 [0]: 1
Line build out for port 3 [0]: 1
Current NIC configuration is:
        Signaling: T1
        T1 line build out:
            on port 0: 1
            on port 1: 1
            on port 2: 1
            on port 3: 1
```

ACG# help

Available commands:

- config -Change configuration parameters
- date -Read/Set system clock
- dbg -Set/Clear/Show debug flags
- dir -Show file directory
- exit -Exit configuration mode
- go -Execute application code
- help -Print this info
- iso -Configure ISO timeout
- load -Load file into memory via ethernet
- loadall -Load all files into memory via ethernet
- makeroom -Make room after a file
- mcd -Enable/Disable memory corruption detection
- nvr -Dump NVRAM
- packdfs -Pack existing files in DFS memory
- passwd -Change operator password
- probe -Enter pROBE debugger
- put -Send file via tftp to another host
- reset -Reboot this processor
- rm -Delete file(s)
- savedfs -Save DFS
- status -Print configuration parameters
- sum -Compute CRC on memory range
- ver -Print firmware version
- install -Run ACG Install code
- net -Configure for T1/E1

Online help

To list available site controller commands, type **help**.

6. At the ACG# prompt, type: **install**

7. After it is initialized, the following message is displayed:

```
ACG# install

NVRAM is o.k. - calc = 1373883506, stored = 1373883506

Integrated Site Controller
Copyright Motorola Inc. 2000
Software Version:                    RXX.XX.XX-ACG_INSTALL
Active/Standby Status:               ACTIVE
GPS Status
   Site Reference ISA                                    available
   ROM checksum test performed                           unknown
   RAM checksum test performed                           unknown
   Correlation test for the channels performed           unknown
   Satellite tracking status                             unknown
   Frequency Lock status                                 unknown
   GPS Alarm status                                      alarm

Environmental Alarm Unit (EAS)                           not available

Ethernetnot available
   Internal Loopback Test                                fail

T1 initialization                    OK
Subrated E1 Network Interface 1:Available
Subrated E1 Network Interface 2:Available, but has LOSS OF SIGNAL
Subrated E1 Network Interface 3:Available, but has LOSS OF SIGNAL
Subrated E1 Network Interface 4:Available, but has LOSS OF SIGNAL
isc>
```

Site Controller Install Commands

At the iSC> prompt, type: **help**

This entry displays commands associated with the site controller.

```
iSC> help

help
ver
quit
display eas
display gps alarms
ping gps
status gps
display temp
ping standby
switch isc
whois isc
display nic
loop <line#>
deloop <line#>
ping br
customer output <activate | deactivate>
monitor <off | gps | external | 5mhz>
selftest
iSC>
```

Loading the Base Radios

The Base Radio (BR) software must be downloaded to each legacy BR. The software automatically transfers to each legacy BR connected to the site controller.

Note: This procedure refers to legacy BR only. Quad BR installation software is resident on the Base Radio and does not need to be downloaded from iSC. Quad BR must be switched to test mode, by performing diagnostic reset (press reset button located on the BR front panel and follow on screen instructions), in order to activate BR installation software. Refer to System Testing section in Volume 1 (System Installation and Testing) of EBTS manual for more information.

1. On the RF Cabinet breaker panel, set all BR breakers to OFF.
2. Apply power to a single BR via the breaker panel on the RF Cabinet and the power switch on the BR Power Supply.

   This begins the download of the application code from the Controller. During software download, the service computer displays a message similar to the following:

```
iSC>
downloading code to BR...
cabinet 1 position 3
.....
.....
.....
.....
.....
Complete Downloading code to BR...
```

Note: If an error occurs during the downloading process, reset the BR to start downloading again.

3. Verify that the BR receiving the download is in the proper cabinet and position.

   A failure in downloading to the proper BR cabinet and position indicates that the BR has been mis-programmed. Otherwise, a failed download might indicate that the cabinet is installed improperly. Continue downloading the remaining BRs, and then contact your iDEN System Manager for additional help.

4. Apply power to the next BR.

5. Repeat this procedure for each additional BR.

Standby Site Controller Status

To check the status of the standby Controller, use the following procedure.

At the iSC> prompt, type: **ping standby**

Verify the following message on the service computer:

```
iSC> ping standby
Standby iSC is                  available
Standby GPS is                  not available
```

Note: The standby GPS always has a response of NOT AVAILABLE. This is a normal indication and does not indicate a failure.

If the standby site controller is powered off, or if there is a communication problem, then a time-out occurs and the following is displayed:

```
iSC> ping standby
Ping standby isc is not successful.
```

Base Radio Registration

Checking Base Radio connectivity

1. At the iSC> prompt, type: **ping br**

   All Base Radios connected on the ethernet will be pinged.

Note: Quad BR must be switched to test mode, by performing diagnostic reset (press reset button located on the BR front panel and follow on screen instructions), in order to communicate with iSC. Refer to System Testing section in Volume 1 (System Installation and Testing) of EBTS manual for more information.

2. Verify the following messages on the service computer.

   Cab/pos number and ethernet address will be displayed for BRs that respond successfully:

iSC> **ping br**

Cab/Pos	Ethernet Address	Platform
11	08:00:3e:c0:1c:10	Legacy BR
12	08:00:3e:c0:1c:11	Legacy BR
13	08:00:3e:c0:1c:12	Legacy BR
14	08:00:3e:c0:1c:13	Legacy BR
21	08:00:3e:c0:1c:14	Quad BR
22	08:00:3e:c0:1c:15	Quad BR
31	08:00:3e:c0:1c:16	Quad BR
32	08:00:3e:c0:1c:17	Quad BR

The column Cab/Pos represents cabinet and position of the Base Radio. For example, 13 is the Base Radio in cabinet 1 position 3.

Note: BR position 1 (BR1) represents the BR mounting position within the cabinet which is closest to the floor. Position 5 represents the highest from the floor.

Cab/Pos number will not be displayed for Quad BRs with invalid cabinet/ position number and BRs that don't respond successfully.

```
iSC> ping br

Cab/Pos     Ethernet Address      Platform
---------   --------------------  -------------
            08:00:3e:c0:1c:18     Legacy BR
            08:00:3e:c0:1c:19     Quad BR
```

No information will be displayed for BRs that fail to respond at all.

The service computer displays the following messages if the site controller cannot communicate with any BR.

```
iSC> ping br
No BR responses received for 'ping br'
Ping br is not successful
```

Perform the following steps in case of unsuccessful response from one or more BRs:

1. Check the ethernet connection.
2. Check BR cabinet/position number.
3. Reset the BR.

T1 Connection Test

The T1 connection test requires an external test set capable of generating a Quasi Random Signal Sequence (QRSS) bit pattern. The test set must also have the ability to perform a loop-back test.

T1 Custom Test Cable

A custom interface cable is required to connect the test set to the circuit selected for testing. Use locally procured parts and the pin-out shown in Figure 6-1 to assemble this cable.

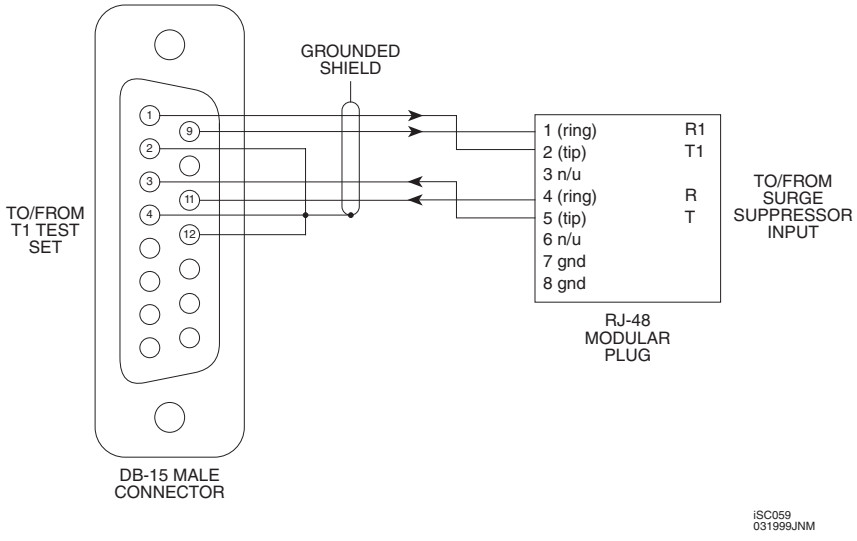


Figure 6-1 ***Pin-outs for the T1 test cable***

T1 Sest Setup

The following T1 test procedure uses the TTC Fireberd T1 test set.

1. Connect the 15-pin connector test cable to the T1 test set.

   Figure 6-2 shows this connection.

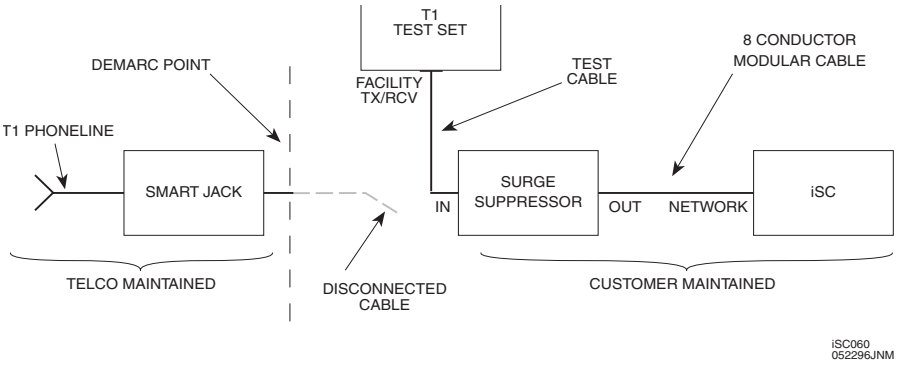


Figure 6-2 ***T1 test connections***

2. Disconnect the Telco SmartJack from the Telco surge arrestor.
3. Connect the T1 test set into the surge arrestor.

   If the Controller is not currently connected to the Telco demarcation point, the T1 test set can be plugged directly into the Controller.
4. Configure the T1 test set to the settings indicated in Table 6-3.

Table 6-3 ***Settings for the T1 test set***

Function	Setting
Receive input	Term
Transmit output	0dB(DSX)
Timing	Int
Test	Cont
Code	B8ZS
Print Event	Off
Mode	ESF
Pattern	T1-QRSS
Results I	Summary
Results II	Time

T1 test procedure

This test involves equipment looping using the **loop [line #]** and **deloop [line #]** MMI commands.

Note: Do not use the test set Loop Code switches. Pressing Loop Up or Loop Down affects the loop-back test.

1. At the prompt, type: **loop [line #]**

   This command displays the following message on the service computer:

```
iSC> loop 1
T1 interface in loopback mode
```

2. Press the RESTART button on the T1 test set to clear the display and start the test.

   Run the test uninterrupted for five minutes. No errors should be detected.

3. Use the Up and Down arrow keys on the test set keyboard to scroll through the results.

   These keys are located next to the Results I key.

4. At the iSC> prompt, type: **deloop [line #]**

   This command stops the site controller from looping the T1 line. The following message is displayed:

```
iSC> deloop 1
T1 interface returned to normal mode
```

Note: To put all T1/E1 spans in line loop-back use **loop 0** command.

Remotely Looping Back the T1 Site Controller for BER Testing

SR7.0 or later Boot ROM software provides T1 loop-back features not available in previous releases. System operators should be aware that previous system releases did not support loop-back when the site controller was operating from boot ROMs. With SR7.0 or later boot ROM flash loads, the site controller no longer resets after it has been put into loop-back . The system operator must send the appropriate loop-down commands to end the loop-back.

Loop-back capability has always existed for the site controller when it operates under software downloaded from the OMC. Performing a loop-back test breaks the data links between the MSO and the EBTS.

The site controller downloaded software includes a timer with a default value of one hour. When the links have been broken for one hour, this timer initiates a site controller reset and clears the loop-back. The value of this timer can be changed to run a longer loop-back test. This timer does not effect loop-backs when site controller is operating under Boot ROM software.

Two Types of T1 Loop-Back

Line Loop-Back

Line Loop-Back connects the received data from the network to the line driver. The data passes through the site controller unchanged. Framing errors, CRC errors, bipolar violations, and data errors pass back to the network as they were received.

Payload Loop-Back

Payload Loop-Back takes data received from the line and loops it back through the framer chip. This process loops back the data on the 24 DS0s, but generates new framing bits and CRC. The loop-back removes bipolar violations. A new data stream is created for the Facility Data Link.

Three Different Ways to Start and Stop a T1 Line Loop-Back on the Site Controller

Inband Line Loop-Back

A craftsperson inserts a T1 test set into the line going to the site controller. The test box then sends a loop-up code, consisting of a repeating `00001` pattern, across the entire T1 frame. All 24 DS0s have the data pattern across them. The site controller detects this pattern and enters loop-back mode.

When the craftsperson is done testing the T1 line, he sends the inband loop-down code to the site controller. This code is a repeating `001` pattern across the entire T1 frame. The site controller detects this pattern and quits looping the T1. Normal operation on the T1 line can now begin.

Front Panel Line Loop-Back Switch

The front panel of the site controller includes a Loop-Back Switch. Depressing the SEL/LOOP button for more than two seconds causes site controller to enter line loop-back mode. Depressing the SEL/LOOP button for two seconds again deactivates the line loop-back.

Line Loop-Back from a ANSI T1.403 Loop-Back Command on The Facility Data Link

A craftsperson uses a T1 test set and inserts it into the line going to the site controller. The test box then sends a T1.403, line loop-up, bit-oriented message on the FDL towards the site controller.

When the craftsperson is done testing the T1 line, he sends a T1.403, line loop-down, bit-oriented message on the FDL towards the site controller.

The T1.403, line loop-up and down commands transmit on the T1 Extended Super Frame Facility Data Link. The loop-up, bit-oriented message is `00001110 11111111,` with the rightmost bit transmitted first. The loop-down, bit-oriented message is `00111000 11111111,` with the rightmost bit transmitted first.

How Payload Loop-Back Works on the Site Controller

A craftsperson inserts a T1 test set into the line to the site controller. The test box then sends a T1.403, payload loop-up, bit-oriented message on the FDL towards the site controller.

When the craftsperson is done testing the T1 line, he sends a T1.403, payload loop-down, bit-oriented message on the FDL towards the site controller. Normal operation on the T1 line can now begin.

The T1.403, T1 payload loop-up and down commands transmit on the T1 Extended Super Frame Facility Data Link. The payload loop-up, bit-oriented message is `00010100 11111111,` with the right most bit transmitted first. The payload loop-down, bit-oriented message is `00110010 11111111,` with the right most bit transmitted first.

Starting and Stopping Loop-Backs

If someone starts a line loop-back using the in-band loop-up code, he will need to terminate loop-back using the in-band loop-down code. The site controller has two different loop-back decoders. One decoder is for in-band signaling. The other decoder is for facility data link signaling.

A T1.403, line loop-down, bit-oriented message on the FDL will not loop-down the site controller if it was looped-up with a in-band loop-up code. Likewise, a site controller that was looped-up with a T1.403, line loop-up, bit-oriented message on the FDL will not de-loop if an in-band loop-down code is sent.

Payload loop-back is a case by itself. The only way to start a payload loopback is with the T1.403, payload loop-up command. The only way to loop down is with the payload loop-down command.

Remotely Looping Back the E1 Site Controller for BER Testing

SR7.0 or later boot ROM software provides E1 loop-back features not available in previous releases of software. System operators should be aware that previous system releases did not support loop-back when the site controller was operating from boot ROMs. With the SR7.0 or later boot ROM flash load, the site controller no longer resets after it enters loop-back. The system operator must send a loop-down command to end the loopback.

Loop-back capability has always existed for the site controller when it operates under software downloaded from the OMC. Performing a loop-back test breaks the data links between the MSO and the EBTS.

The site controller downloaded software includes a timer. The default value of this timer is one hour. When the links have been broken for one hour, this timer initiates a site controller reset and clears the loop-back. The value of this timer can be changed to run a longer loop-back test. This timer does not effect loop-backs when site controller operates under boot ROM software.

Line loop-back connects the received data from the network to the line driver in the site controller. The data passes through the site controller unchanged. All framing errors, CRC errors, Bipolar Violations, and Data errors pass back to the network as they were received.

Two Different Ways to Start and Stop a E1 Line Loop-Back on the Site Controller

In-band Line Loop-Back

A craftsperson inserts a E1 test set into the line going to the site controller. The test box then sends a loop-up code consisting of a repeating `00001` pattern across the entire E1 frame. All 32 DS0s have the data pattern across them. The site controller detects this pattern and enters loop-back mode.

The site controller will not recognize the `00001` pattern if HDB3 (High-Density Bipolar of Order 3) encoding is used. HDB3 encoding replaces an occurrence of four zeros in a row with a bipolar violation substitution word. The loopback decoder in the site controller does not recognize this bipolar violation substitution word.

So that the site controller can recognize the `00001` code word, AMI line coding must be used. AMI encoding allows a string of four zeros to be transmitted. After the site controller enters loop-back mode, the BER test box may be changed back to HDB3 line encoding if desired. In normal operation, the site controller uses HDB3 line coding.

When the craftsperson is done testing the E1 line, he sends the inband loop-down code to the site controller. This code is a repeating `001` pattern across the entire E1 frame. The site controller detects this pattern and quits looping the E1. Normal operation on the E1 line can now begin. The loop-down code contains no more than four zeros in a row, so HDB3 or AMI line coding may be used to loop down the site controller.

Front Panel Line Loop-Back Switch

The front panel of the site controller includes a Loop-Back Switch. Depressing the SEL/LOOP button for more than two seconds causes site controller to enter line loop-back mode. Depressing the SEL/LOOP button for two seconds again deactivates the line loop-back.

EAS/EAS2 Alarm Checkout

The following procedure verifies correct wiring of alarms monitored by the EAS/EAS2.

1. At the iSC> prompt, type: **display eas**

   The service computer displays information similar to the following:

iSC>**display eas**

CODE	DESCRIPTION	
237	Control cabinet circuit breaker	o.k.
233	RF cabinet 1 circuit breaker	o.k.
234	RF cabinet 1 combiner /multicoupler Amplifier	o.k.
235	RF cabinet 1 combiner/multicoupler power supply	o.k.
228	RF cabinet 3 tower top amplifier	o.k.
238	RF cabinet 1 PCCH Redundancy Control Output	inactive
229	RF cabinet 2 circuit breaker	o.k.
230	RF cabinet 2 combiner /multicoupler Amplifier	o.k.
231	RF cabinet 2 combiner/multicoupler power supply	o.k.
236	RF cabinet 1 tower top amplifier	o.k.
239	RF cabinet 2 PCCH Redundancy Control Output	inactive
225	RF cabinet 3 circuit breaker	o.k.
226	RF cabinet 3 combiner /multicoupler Amplifier	o.k.
227	RF cabinet 3 combiner/multicoupler power supply	o.k.
232	RF cabinet 2 tower top amplifier	o.k.
240	RF cabinet 3 PCCH Redundancy Control Output	inactive
245	Power system breaker fail	o.k.
246	Rectifier Module Fail (minor)	o.k.
247	Rectifier Module Fail (major)	o.k.
243	Low Voltage	o.k.
244	High Voltage	o.k.
242	AC Power Failure	o.k.
219	Site Entry	o.k.
220	Site High Ambient Temperature	o.k.
221	Site Low Ambient Temperature	o.k.
222	Site Smoke Detector	o.k.
223	Site AC Surge Protector	o.k.
224	System use	o.k.
207	Customer input	o.k.
208	Customer input	o.k.
211	Customer input	o.k.
212	Customer input	o.k.
213	Customer input	o.k.
214	Customer input	o.k.
215	Customer input	o.k.
216	Customer input	o.k.
217	Customer input	o.k.
218	Customer input	o.k.
248	Generator remote start	inactive

Note: The tower top amplifier response (codes 228, 232, and 236) to the **display eas** command is only returned on systems containing a cavity combining RF Distribution System.

2. To verify a particular alarm, perform the proper action to trigger it.

   For example, the following describes this verification.

   2.1 Open the site entry door.

   2.2 Type: **display eas**

   The status of the Site Entry alarm (code 219) changes to the alarm state.

   2.3 Close the site door.

   2.4 Type: **display eas**

   The Site Entry alarm (code 219) returns the O.K. condition.

3. Verify other alarms for proper wiring by triggering them as described above.

Some actions trigger more than one alarm. For instance, switching off the main breaker to the Controller. Other alarms are site-specific, and may or may not be wired. Site-specific alarms are generally more difficult to trigger manually.

The alarm actions listed below do not remove power from the controller. Removing controller power disrupts the testing procedure.

A list of alarms and actions required to trigger each are given in Table 6-4.

Table 6-4 ***Alarm action and alarm responses***

If you do this . . .	Then this alarm triggers . . .
Open site entry door	Site entry
Set off smoke alarm	Site smoke detector
Trip thermostat high point	Site high ambient temperature
Trip thermostat low point	Site low ambient temperature
Switch off the EAS breaker	Control equipment cabinet circuit breaker alarm
Switch off the RFS1 breaker of RFC1	RFC 1 circuit breaker and combiner/ multicoupler power supply

Table 6-4 ***Alarm action and alarm responses — continued***

If you do this . . .	Then this alarm triggers . . .
Switch off the RFS1 breaker of RFC2	RFC 2 circuit breaker and combiner/ multicoupler power supply
Switch off the RFS1 breaker of RFC3	RFC 3 circuit breaker and combiner/ multicoupler power supply
Switch off both RFS1&2 breakers of RFC1	RFC 1 combiner/multicoupler amplifier RFC 1 combiner/power supply RFC 1 circuit breaker RFC 1 tower top amplifier *
Switch off both RFS1&2 breakers of RFC2	RFC 2 combiner/multicoupler amplifier RFC 2 combiner/power supply RFC 2 circuit breaker RFC 2 tower top amplifier *
Switch off both RFS1&2 breakers of RFC3	RFC 3 combiner/multicoupler amplifier RFC 3 combiner/power supply RFC 3 circuit breaker RFC 3 tower top amplifier *
Switch off the AC circuit breaker for rectifier 1 at the site power panel	AC power failure Minor rectifier alarm
Switch off any breaker in the Power Supply rack **	Power system breaker fail
If possible, turn off the AC power for rectifiers 1 and 2 in the Power Supply rack	Major rectifier alarm
Switch off any RF Cabinet 1 breaker	RFC 1 circuit breaker
Switch off any RF Cabinet 2 breaker	RFC 2 circuit breaker
Switch off any RF Cabinet 3 breaker	RFC 3 circuit breaker
* Only present on RF Cabinets containing cavity combining RF Distribution Systems. ** Breaker alarms may take time to appear.	

GPS Status

Use these procedures to verify the Global Positioning Satellite (GPS) status.

1. At the iSC> prompt, type: **ping gps** or **display gps alarms**
2. Verify the following information is displayed on the service computer:

iSC> **ping gps**	
GPS	on line
Satellite Tracking Status	site sync down
Frequency Lock Status	not locked
Alarm status	OK

iSC>**display gps alarms**	
GPS Alarm StatusOK	
Self-test	OK
GPS Software version	OK
GPS Communications	OK
Online Fault	OK
Idle-mode fault	OK
GPS IPPS	OK
HSO 1PPS	OK
HSO locked to GPS	UNKNOWN
Time/frequency output #1	OK
Time/frequency output #2	OK
Oscillator aging	UNKNOWN
Total number of alarms	0

The controller is on line when the green ACTIVE LED on the controller is lit.

If the standby or active controller lists the Satellite tracking as NOT ADEQUATE, make sure:

- the GPS receiver has been allowed enough time (25 minutes max.) to locate the satellites
- the GPS antenna cable is properly connected. If it is, the GPS antenna is possibly faulty

⚠ CAUTION

DO NOT ATTEMPT TO MAKE A RESISTANCE CHECK OF THE GPS ANTENNA. DAMAGE TO THE ACTIVE DEVICES WITHIN THE ANTENNA ELEMENT MAY RESULT.

3. At the iSC> prompt, type: **status gps**

This command displays details of the GPS receiver

iSC>**status gps**
0 satellites tracked (4 are required)

ID	Mode	S/N
9	0	0
30	0	0
19	0	0
2	0	0
22	0	0
20	0	0
25	0	0
27	0	0

Latitude N	0 deg 0 min 0.000 sec
Longitude E	0 deg 0 min 0.000 sec
Altitude	59.0 feet below sea level
Date/Time	01/01/1999 12:26:03 GMT

Site Reference

The site reference outputs provide a timing reference and a frequency reference to the base radios. The timing reference is one pulse per second (1PPS) derived from the GPS receiver. The frequency reference is a 5 MHz signal from a high stability oscillator. In addition, the high stability oscillator is trained to GPS to eliminate aging and temperature effects.

The site reference signal is a combined 1PPS/5MHz signal. It is combined by altering the duty cycle of the 5MHz frequency reference such that the change from a 25% to 75% duty cycle represents the 1PPS timing mark. In order for the base radios to properly decode the 1PPS/5MHz signal, it must meet the mask shown below in Figure 6-3 at the input of each base radio.

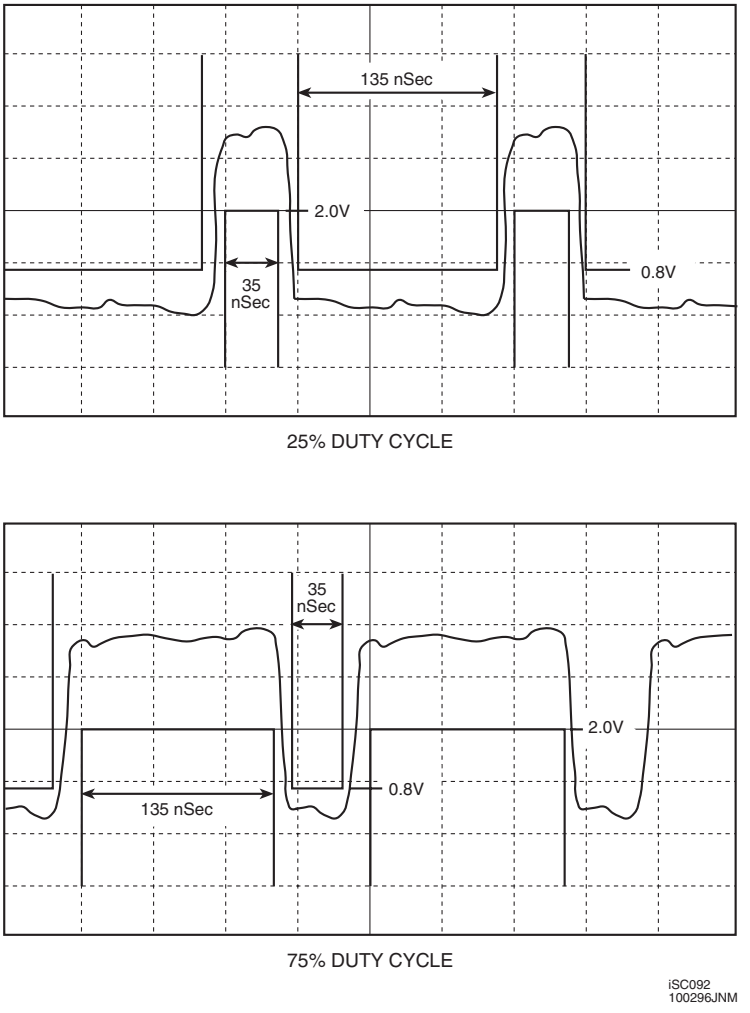


Figure 6-3 ***Site Reference - 25% and 75% duty cycle pulse mask***

MOTOROLA

7

System Troubleshooting

Chapter Overview

This chapter provides troubleshooting procedures for the system.

The following table lists this chapter's topics

Section	Page	This section . . .
Controller	7-3	defines the possible failures and corrective actions for failure symptoms of the Controller
EAS/EAS2 Unit	7-6	defines the possible failures and corrective actions for failure symptoms of the EAS/EAS2 unit.

Troubleshooting

The fault indications identified in this chapter provide a guide for isolating failures to a Field Replaceable Unit (FRU). The service technician should perform troubleshooting whenever a failure occurs during normal operation that cannot be resolved by the Operations and Maintenance Center (OMC).

Some indications list several possible failures along with corresponding corrective actions. If a failure is isolated to the FRU level, the suspected module should be replaced with a new one. This restores the system to normal operation as quickly as possible.

Suspected FRUs should be shipped to a Motorola repair depot for repair.

Controller

Table 7-1 ***Controller Troubleshooting***

Indication	Possible failure	Corrective action
status gps MMI command response: Satellite tracking mode on all channels is less than 8.	Antenna, cables, surge arrestors, RFI	• Check antenna, cables, and surge arrestors before replacing the Controller.
		• If antenna installation is OK, suspect intermodulation desensitizing.
status gps MMI command response: S/N numbers of mode 8 satellites are less than 25.	Antenna, cables, surge arrestors, RFI	• Check antenna, cables, and surge arrestor before replacing the Controller.
		• If antenna installation is OK, suspect intermodulation desensitizing.
ping gps MMI command indicates no satellites tracked.	Open or damaged GPS antenna, lead-in, or surge arrestor	• Verify GPS antenna, lead-in, and surge arrestor.
Slow handovers.	Open or damaged GPS antenna, lead-in, or surge arrestor	• Verify GPS antenna, lead-in, and surge arrestor.
	Open 5 MHz cable or missing termination of 5 MHz cable	• Check for open 5 MHz cable and missing termination of 5 MHz cable.
Power LED is not lit	No power to Controller	• Check power source
	Cabling	• Check power cabling to Controller. If necessary, replace cabling.
	Controller failure	• Replace the Controller.
Controller can't communicate over ethernet	Ethernet cabling or terminations	• Check cabling. Verify that each end of the cable has a 50-ohm termination.
	Controller failure	• Replace the Controller.
LOS/OOF LED is lit (Loss of Signal / Loss of Frame)	T1 / E1 cabling	• Check cabling to Controller. If necessary, replace cabling.
	Controller failure	• Replace the Controller.

Table 7-1 ***Controller Troubleshooting***

Indication	Possible failure	Corrective action
Yellow Alarm LED is lit	Controller is receiving an alarm from the far end.	• Check for proper operation of external site equipment.
		• Notify far end.
AIS LED is lit (Alarm Indication Signal)	Far end equipment failure	• NOTE: The AIS LED is lit when the All Ones Keep Alive signal is received.
		• Check for proper operation of external site equipment.
		• Notify far end.
FE/CRC LED is lit (Framing Error/CRC Error)	T1 is not configured for ESF.	• Configure T1 correctly.
	Bit errors	• Check T1 / E1 cabling.
		• Check T1 / E1 levels
		• Check for T1 / E1 noise or crosstalk.
	Controller failure	• Replace the Controller.
BPV/PD LED is lit (Bipolar Violation/Pulse Density Violation)	T1 is not configured for B8ZS	• Configure T1 correctly.
	Bit errors	• Check T1 / E1 cabling.
		• Check T1 / E1 levels
		• Check for T1 / E1 noise or crosstalk.
	Controller failure	• Replace the Controller.
Net LED is lit (Network Loopback)	The Controller has received an in-band or out-of-band loopback code, and is in loopback mode.	• Notify far end.
Local LED is lit (Local Loopback)	Front panel switch has put the Controller into loopback mode.	• Push and hold the Sel / Loop switch for 2 seconds. This action takes the unit out of loopback mode.

Table 7-1 ***Controller Troubleshooting***

Indication	Possible failure	Corrective action
display gps alarms response	Self-test ALARM	Replace the Controller.
	GPS Software Version ALARM	Replace the Controller.
	GPS Communications ALARM	Replace the Controller.
	Online fault ALARM	Replace the Controller.
	Idle-mode fault ALARM	Replace the Controller.
	GPS 1PPS ALARM	Replace the Controller.
	HSO 1PPS ALARM	Replace the Controller.
	HSO locked to GPS ALARM	Replace the Controller.
	Time / frequency output #0, #1 or #2 ALARM	Replace the Controller.
	Oscillator aging ALARM	Replace the Controller.

EAS/EAS2 Unit

Table 7-2 ***EAS/EAS2 troubleshooting***

Indication	Possible failure	Corrective action
EAS/IMU breaker on Cabinet breaker is on, but POWER LED (green) on EAS/EAS2 is not lit.	No power connected to EAS/ EAS2.	• Check power source.
	cabling	• Check power cabling to EAS/EAS2; replace cable if necessary.
Wrong EAS/EAS2 response	miswired modular cable	• Check EAS/EAS2 modular cabling.
AC fail alarm	AC input, or an open or disconnected alarm lead	• Verify AC input, check for open or disconnected alarm leads.
High temperature alarm	AC input to air conditioner	• Verify AC input.
	site air conditioner	• Call for service on air conditioner.
	Alarm sensor improperly set or wires shorted.	• Check and adjust alarm sensor.
	Alarm sensor located in a hot spot.	• Check and adjust alarm sensor.
Low temperature alarm	Air conditioner does not shut off.	• Repair HVAC.
	Thermostat is set too low.	• Set thermostat to 78˚ F.
	Cold air blowing on alarm sensor.	• Shield or relocate sensor.

MOTOROLA

8

Software Commands

Chapter Overview

This chapter provides definitions for the Man-Machine Interface (MMI) commands. MMI commands are used to test and configure the system equipment via a service computer.

The following table lists this chapter's topics.

MMI Commands	8-2	describes the MMI commands, including access levels, and conventions
Site Controller Commands	8-4	defines the site controller command set which is used to configure and test the site controller

MMI Commands

MMI commands are input from a service computer to the system RS-232 serial port (19200 bps, 8 data bits, 1 stop bit, no parity). The RS-232 port is accessed from the site controller Service Access connector.

The service technician enters the MMI commands to communicate with the site controller at the system level. The system response is returned to the service computer via RS-232.

The appropriate test procedures use these commands to test and configure the system. The test procedure for the site controller appears in the System Testing chapter of this manual and the test procedure for the BR appears in the *EBTS System Manual (on CD: 98P80800A17) Base Radio* chapter.

Access Level

Site controller commands are available through the use of the password **factory**. This password allows the service technician access to a subset of the MMI command set. This subset is used for field service and does not allow permanent configuration of the site controller.

Note: The **factory** password is a default password that is programmed during manufacturing. The password may be changed by the Operations and Maintenance Center (OMC).

Conventions

The syntax for each command is presented as follows:

- **bold** text shows the actual text to be typed at the iSC> prompt to invoke a command or action
- *italic* text shows the syntax used for a command
- text enclosed in brackets [ ] indicates an optional value that may be entered.
- Where items are separated by vertical bars | , the items are the applicable choices that may be entered
- *italic* text enclosed in braces < > indicates a corresponding selection or parameter that **must** be entered for the command to execute

The syntax for site controller commands is case sensitive. Each example is shown in the format that should be entered by the operator.

Some commands require the use of parameters. If input parameters are not entered, a response is returned identifying the proper syntax for the command.

A definition describes in detail each command's purpose and function. The definition is followed by an example of the commands response. Typical values have been used whenever possible.

Some commands return varying responses (such as available, not available, unknown, o.k., and alarm). Only one of the possible responses is listed in each example.

Site Controller Commands

HELP

Syntax:

help

The 'help' command prints a list of commands and their functions.

Example:

```
iSC> help

help
ver
quit
display eas
display gps alarms
ping gps
status gps
display temp
ping standby
switch isc
whois isc
display nic
loop <line#>
deloop <line#>
ping br
customer output <activate | deactivate>
monitor <off | gps | external | 5mhz>
selftest
iSC>
```

VER

Syntax:

ver

The 'ver' command prints the Install/Test application software version.

Example:

iSC> **ver**
iSC3 Factory Install R09.02.02-ACG-INSTALL

QUIT

Syntax:

quit

The 'quit' command resets the site controller to exit the Install/Test application.

Example:

iSC> **quit**
Do you really want to quit? [n]
Answer 'y' at the prompt to reset the board.

DISPLAY EAS

Syntax:

display eas

The 'display eas' command lists the status of all the EAS/EAS2 contacts. A sample of the output is shown.

Example:

```
iSC> display eas
CODE        DESCRIPTION                          
201         50 Pin Telco B: pin 11               alarm
202         50 Pin Telco B: pin 9                alarm
203         50 Pin Telco B: pin 27               alarm
204         50 Pin Telco B: pin 25               alarm
```

DISPLAY GPS ALARMS

Syntax:

display gps alarms

The 'display gps alarms' command lists alarm conditions preset in the CPS Receiver.

Example:

```
iSC>display gps alarms
GPS Alarm StatusOK
    Self-test                   OK
    GPS Software version        OK
    GPS Communications          OK
    Online Fault                OK
    Idle-mode fault             OK
    GPS 1PPS                    OK
    HSO 1PPS                    OK
    HSO locked to GPS           UNKNOWN
    Time/frequency output #1    OK
    Time/frequency output #2    OK
    Oscillator aging            UNKNOWN
Total number of alarms          0
```

PING GPS

Syntax:

ping gps

The 'ping gps' command lists the operation status of the CPS.

Example:

```
iSC> ping gps
GPS                          on line
Satellite Tracking Status    site sync down
Frequency Lock Status        notlocked.
Alarm status                 OK
```

STATUS GPS

Syntax:

status gps

The 'status gps' command lists the tracking status of any CPS satellites that the site controller is tracking.

Example:

```
iSC>status gps
0 satellites tracked (4 are required)
    ID      Mode      S/N
     9         0        0
    30         0        0
    19         0        0
     2         0        0
    22         0        0
    20         0        0
    25         0        0
    27         0        0
Latitude N                  0 deg 0 min 0.000 sec
Longitude E                 0 deg 0 min 0.000 sec
Altitude                    59.0 feet below sea level
Date/Time                   01/01/1999 12:26:03 GMT
```

DISPLAY TEMP

Syntax:

display temp

The command 'display temp' displays the temperature of the site controller in degrees Centigrade.

Example:

iSC> **display temp**
GPS Temperature OK at 34 deg C

PING STANDBY

Syntax:

ping standby

The 'ping standby' command sends a ping message to the standby site controller. If the standby site controller is alive, it returns a ping response. This response contains information about its availability.

Example:

iSC> **ping standby**

Standby iSC is	available
Standby GPS is	not available

SWITCH ISC

Syntax:

switch isc

The 'switch isc' command forces the standby site controller to become the active site controller, and the active site controller to become the standby site controller. This command cannot be executed on the standby site controller. The standby site controller must be up and running the site controller Install/Test application.

Example:

```
iSC> switch isc
switch iSC accomplished, please switch your service terminal to the newly
activated iSC to continue with your diagnostics.
```

WHOIS ISC

Syntax:

whois isc

The 'whois isc' command displays the MAC addresses of the active and standby site controller, and reports which site controller the user is connected to.

Example:

```
iSC> whois isc
iSC active ethernet address          44:44:44:44:44:33
iSC standby ethernet address         00:00:00:00:00:00
You are connected to active iSC.
```

LOOP

Syntax:

loop <line #>

The 'loop' command puts any TI /E1 line into a remote loopback mode. The <line #> argument can be any Tl/El line 1 - 4. To put all TI/El lines into loopback mode, enter 0 for the <line #> argument.

Example:

```
iSC>loop 1
```

DELOOP

Syntax:

deloop <line #>

The 'deloop' command takes any Tl /E1 line out of a Remote Loopback mode. The line # argument can be any Tl/El line 1 - 4. To deloop all TI/El lines, enter 0 for the line # argument.

Example:

iSC>**deloop 1**

PING BR

Syntax:

ping br

The purpose of this command is to check ethernet connectivity. This command sends a ping message to all Base Radios connected to ethernet and displays the cabinet and position number and the ethernet address for BRs that respond successfully.

Cab/pos number and ethernet address will be displayed for BRs that respond successfully:

Note: Quad BR must be switched to test mode, by performing diagnostic reset (press reset button located on the BR front panel and follow on screen instructions), in order to communicate with iSC. Refer to System Testing section in Volume 1 (System Installation and Testing) of EBTS manual for more information.

```
iSC> ping br

Cab/Pos    Ethernet Address      Platform
---------- --------------------- -------------
   11      08:00:3e:c0:1c:10     Legacy BR
   12      08:00:3e:c0:1c:11     Legacy BR
   13      08:00:3e:c0:1c:12     Legacy BR
   14      08:00:3e:c0:1c:13     Legacy BR
   21      08:00:3e:c0:1c:14     Quad BR
   22      08:00:3e:c0:1c:15     Quad BR
   31      08:00:3e:c0:1c:16     Quad BR
   32      08:00:3e:c0:1c:17     Quad BR
```

The column Cab/Pos represents cabinet and position of the Base Radio. For example, 13 is the Base Radio in cabinet 1 position 3.

Cab/Pos number will not be displayed for Quad BRs with invalid cabinet/ position number and BRs that don't respond successfully.

```
iSC> ping br

Cab/Pos    Ethernet Address      Platform
---------- --------------------- -------------
           08:00:3e:c0:1c:18     Legacy BR
           08:00:3e:c0:1c:19     Quad BR
```

No information will be displayed for BRs that fail to respond at all.

In case of no responses received from Base Radios, the time-out occurs and the following error messages are displayed.

```
iSC> ping br
No BR responses received for 'ping br'
Ping br is not successful
```

Note: Quad BR must be switched to the test mode, by pressing the diagnostic reset button located on the BR front panel, in order to communicate with iSC. Refer to System Testing section in Volume 1 (System Installation and Testing) of EBTS manual for more information.

CUSTOMER OUTPUT

Syntax:

customer output <activate/deactivate>

The 'customer output' command activates or deactivates the customer output.

Example:

iSC> **customer output activate**

MONITOR

Syntax:

monitor <off | gps | external | 5mhz>

The 'monitor' command selects the input source of the front panel monitor port.

The user can monitor the following:

iSC> monitor off -- no signal (default)

iSC> monitor gps --GPS 1pps

iSC> monitor external -- External 1pps

iSC> monitor 5mhz -- 5MHz clock

SELFTEST

The 'selftest' command executes a series of hardware tests and reports results to the user.

Controller

Chapter Overview

This chapter provides technical information for the Controller.

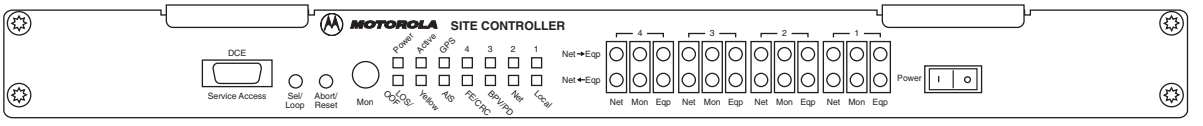
The following table lists this chapter's topics

Section	Page	This section . . .
Controller	9-2	provides a description
Indicators	9-3	describes the indicators
Switches	9-4	describes the switches
Connectors	9-5	describes the connectors
Performance Specifications	9-7	defines the performance specifications

Controller

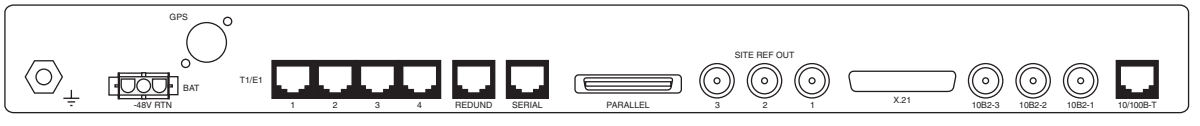
The Site Controller supports the following I/O:

- One 10 / 100BaseT Ethernet port
- Three 10Base2 Ethernet ports
- Four T1 / E1 connections
- One X.21 connection
- One IEEE 1284 parallel port (for connecting to the EAS/EAS2)
- One front panel RS232 MMI
- Three time / frequency reference outputs
- GPS
- RJ45 Serial
- RJ45 Redundancy



iSC401
042202JNM

Figure 9-1 ***Controller (front view)***



iSC400
102600JNM

Figure 9-2 ***Controller (rear view)***

Indicators

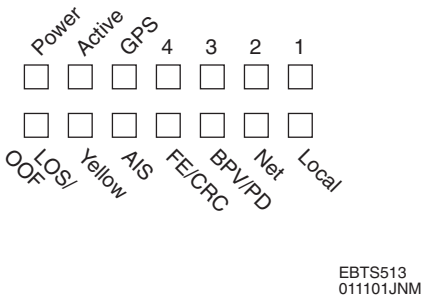


Figure 9-3 ***Front Panel LEDs***

Table 9-1 ***Front Panel LED's***

LED Name	LED Color	Function
	Top Row	
Power	Green	ON: Power Supplies are operating and CPU is not in reset mode. OFF: Power supplies are not within tolerance, or the CPU is in reset mode.
Active	Green	ON: T1 / E1 and Site Reference relays are energized. OFF: T1 / E1 and Site Reference relays are open.
GPS	Green	ON: Satellites tracked; high stability oscillator locked to GPS; no alarms detected. FLASHING: Free running, or tracking satellites but not ready to key BR's. OFF: Alarm condition detected.
4	Green	Reserved for future use. Span 4 selected. (Bottom row of LED's refers to Span 4.)
3	Green	Reserved for future use. Span 3 selected. (Bottom row of LED's refers to Span 3.)
2	Green	Reserved for future use. Span 2 selected. (Bottom row of LED's refers to Span 2.)
1	Green	Span 1 selected. (Bottom row of LED's refers to Span 1.)

Table 9-1 ***Front Panel LED's***

LED Name	LED Color	Function
	Bottom Row	
LOS / OOF	Red	ON: Detected T1 / E1 Loss Of Signal or Out -Of-Frame condition. OFF: Normal operation.
Yellow	Yellow	ON: Detected T1 / E1 yellow alarm. OFF: Normal operation.
AIS	Yellow	ON: Detected Alarm Indication Signal. OFF: Normal operation.
FE / CRC	Red	ON: Detected Framing Error or CRC error. OFF: Normal operation.
BPV / PD	Red	ON: Detected Bipolar Violation or Pulse Density violation. OFF: Normal operation.
Net	Red	ON: T1 / E1 Network loopback. OFF: Normal operation.
Local	Yellow	ON: T1 / E1 Local loopback. OFF: Normal operation.

Switches

The Controller contains three switches on the front panel:

- **Power** – a toggle switch that applies (position 1) and removes (position 0) power to the Controller
- **Abort/Reset** – a pushbutton switch that aborts or resets the Controller CPU when pressed
- **Sel/Loop** – a pushbutton that selects a span or initiates network loopbacks when pressed

Table 9-2 ***Front Panel Switches***

Switch Name	Switch Function
Sel / Loop	Push to select T1 / E1 span. Push and hold (> 2 seconds) to loop / deloop selected span.
Abort / Reset	Push for abort. Push and hold (>2 seconds) for reset
Power	Power On / Off switch

Connectors

The following connectors are located on the front panel:

- **Network Access bantam jacks** – bantam jacks provide access for servicing the T1/E1 network
- **Monitor SMB port** – provides access for monitoring the time and frequency reference signals
- **Service Access DB9 connection** – provides MMI serial port access

.

Table 9-3 ***Front Panel Connectors***

Connector	Function
Service Access	Serial RS232 MMI (Man Machine Interface)
Mon	5MHz / 1PPS monitor
T1 / E1 Net Mon /Eqp	Net -> Eqp / Net: Break into T1 / E1 from network (receive T1 / E1) Net -> Eqp / Mon: Monitor T1 / E1 from network (receive T1 / E1) Net -> Eqp / Eqp: Break into T1 / E1 to equipment (receive T1 / E1) Net <- Eqp / Net: Break into T1 / E1 to network (transmit T1 / E1) Net <- Eqp / Mon: Monitor T1 / E1 to network (transmit T1 / E1) Net <- Eqp / Eqp: Break into T1 / E1 from equipment (transmit T1 / E1)

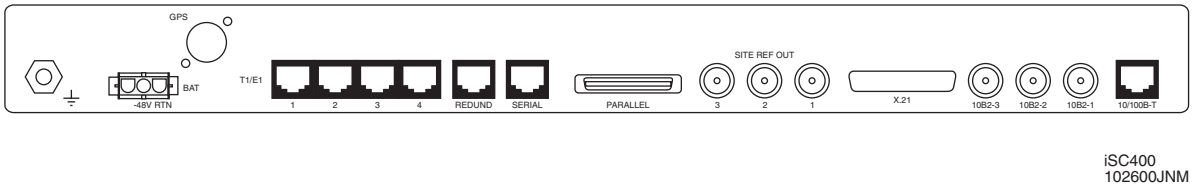


Figure 9-4 ***Controller rear connectors***

Table 9-4 ***Rear Connectors***

Connector Name	Connector Type	Connects to...
Battery	MATE-N-LOK	Center pin to -48V battery; right pin to battery return
GPS	N	GPS antenna
T1 / E1	RJ48C	Port 1 to T1/E1 span; port 2 is cabled but reserved for future use; ports 3 and 4 are reserved for future use. Receive: Pins 1 & 2 Transmit: Pins 4 & 5
Redundancy	RJ45	Redundant site controller
Serial	RJ45	No connection
Parallel	IEEE1284C	EAS/EAS2 parallel port
Site Reference Output	BNC	BR reference inputs
X.21	DB15	No connection
10Base2 Ethernet	BNC	Redundant site controller and the BR's 10Base2 ports; each 10Base2 port is terminated with two 50-ohm loads. Refer to Chapter 4 for cabinet to cabinet cabling details.
10 / 100BaseT Ethernet	RJ45	Redundant site controller

Performance Specifications

Table 9-5 lists the specifications.

Table 9-5 ***Controller performance specifications***

Specifications	Value or range
Input supply voltage range	-40 to 60 VDC
Power Consumption	30W typical; 40W maximum
Operating temperature	-30˚ to 60˚ C
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	75% R.H. at 55˚ C (Max.)

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MOTOROLA

10

Environmental Alarm System

Chapter Overview

This chapter describes the Environmental Alarm System (EAS). The following table lists this chapter's topics.

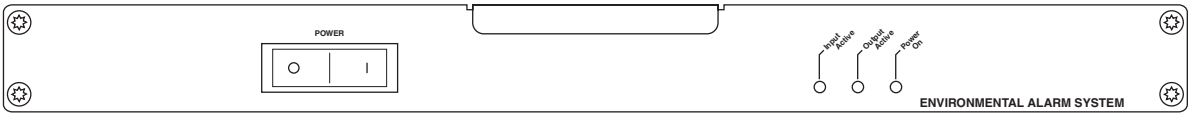
Section	Page	This section...
EAS Functional Description	10-2	describes the EAS and its function in the EBTS
Indicators	10-2	describes EAS indicator functions
Performance Specifications	10-3	defines EAS performance specifications
Theory of Operation	10-3	provides the EAS theory of operation
Connectors	10-5	describes EAS connector functions

EAS Functional Description

The EAS provides a central location for site alarm signal processing. The EAS monitors environmental conditions of the site, including AC power, smoke alarms, intrusion alarms, antenna tower lights, etc.

Alarm wiring from the EBTS equipment and power supply equipment connects directly to the EAS. The EAS sends alarm flags to the Site Controller, which stores the alarms in memory.

Figure 10-1 shows the EAS front view and Figure 10-3 shows the EAS rear view.



iSC402
102600JNM

Figure 10-1 ***Environmental Alarm System (front view)***

Indicators

Table 10-1 lists and describes EAS status indicators.

Table 10-1 ***EAS Indicators***

Indicator	Color	Function
Input Active	red	Indicates an active input.
Output Active	yellow	Indicates an active output.
Power On	green	Indicates the unit is on and powered-up.

Performance Specifications

Table 10-2 lists the EAS specifications.

Table 10-2 ***EAS Performance Specifications***

Specification	Value or Range
Input supply voltage range	-40 to 60 Vdc
Power consumption	Typical: 40W Maximum: 50W
Operating temperature range	0º to 50º C (32º to 122º F)
Storage temperature range	-40º to 85º C (-40º to 185º F)
Physical dimensions: Height Width	 1 Rack Unit (RU) 482.6 mm (19")
Humidity	5% to 95% (non-condensing, non-operating) 0 to 90% (non-condensing, operating)
Maximum loop length	24 or 32 gauge wire => 610 m (2000')
Alarm input "ON" current	5.0 mA min.
Alarm input "OFF" current	0.1 mA max.

Theory of Operation

The EAS provides a direct interface between the Site Controller and various site alarms. Figure 10-2 shows a functional block diagram of the EAS.

The EAS is configured for 48 dry contact input sensors and 8 relay closure outputs. Each I/0 provides 4000V of isolation between field wiring and sensitive control circuitry.

The Site Controller and EAS interact in a master/slave relationship. The Site Controller sends commands to the EAS to determine the status of alarm inputs or set the state of control outputs. The EAS, in turn, sends alarm status responses to the Site Controller.

The EAS continuously scans the status of the alarm inputs, ensuring that all alarms are consistently monitored.

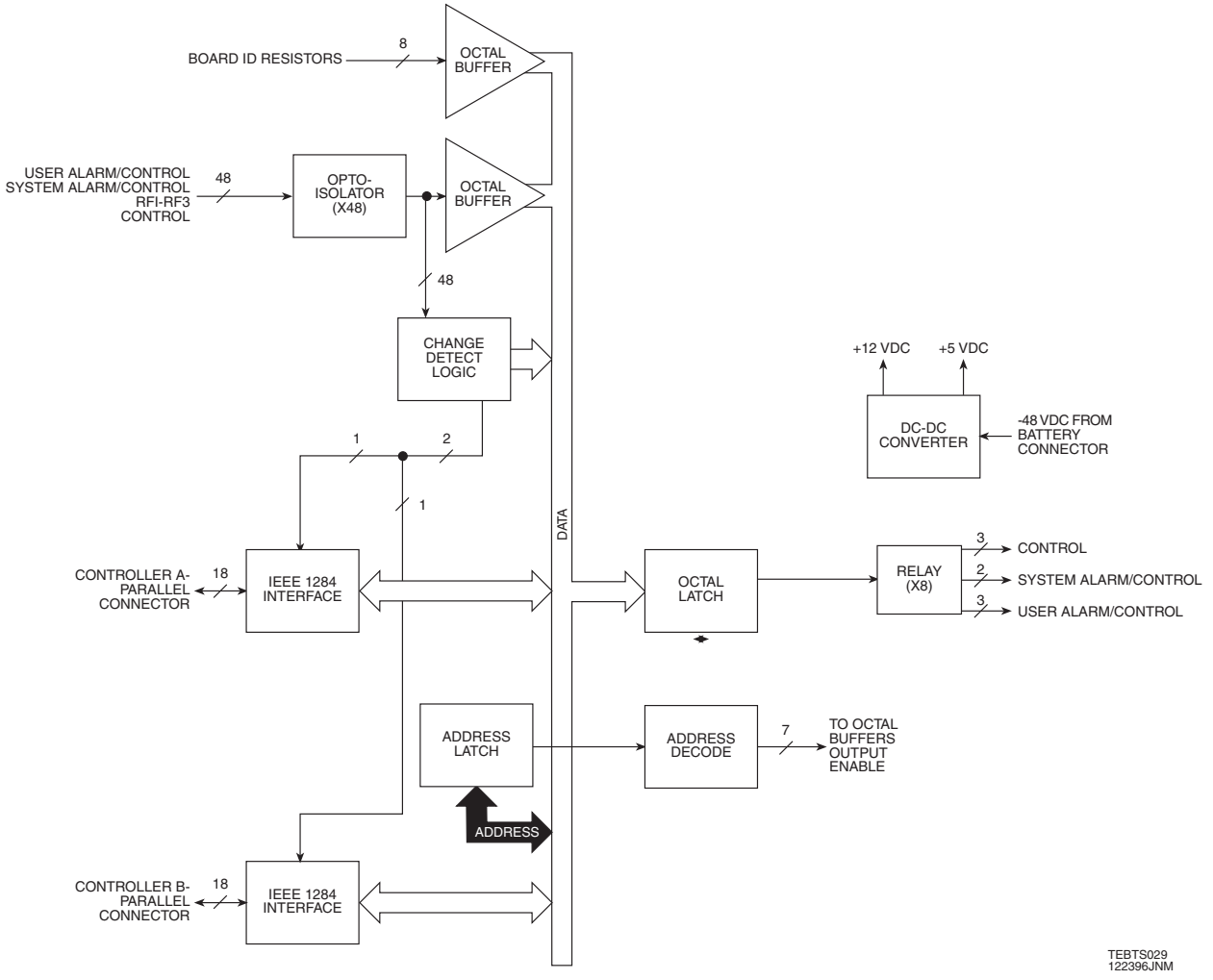


Figure 10-2 ***EAS Block Diagram***

Connectors

Figure 10-3 shows the rear view of the EAS. Table 10-3 lists and describes the EAS connectors.

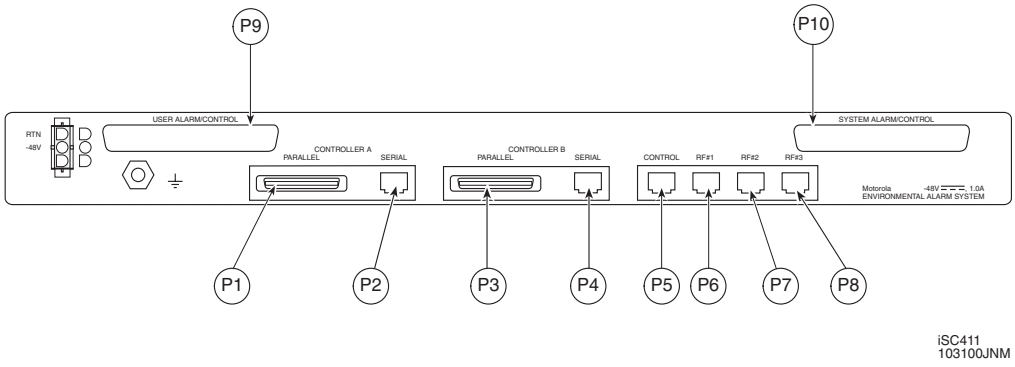


Figure 10-3 ***EAS (rear view)***

Table 10-3 ***EAS Connectors***

Connector	Type	Description
Battery	Mate-N-Lok	Provides -48Vdc input power and ground connector from Equipment Cabinet Circuit Breaker Panel.
GND	Ground stud	Provides a connection for the chassis ground.
User Alarm/ Control	50-pin subminiature-D	Provides a connection for the site alarms through a submini-D cable. Refer to Chapter 4 - Installation for pinout details. ***NOTE:*** All customer provisioned connections are inputs, except for pins 1, 2, 26 and 3, 4, 28 which are outputs.
System Alarm/ Control	50-pin subminiature-D	Provides a connection for the site alarms through a submini-D cable. Refer to Chapter 4 - Installation for pinout details. 1, 2, 26; 3, 4, 28; & 5, 6, 30 are outputs.
Controller A - Parallel	36-pin IEEE 1284	Provides a parallel link for alarm commands and responses to Site Controller A. ***NOTE:*** Alarm commands and responses pass through an IEEE 1284 cable.
Controller A - Serial	RJ48	Not used
Controller B - Parallel	36-pin IEEE 1284	Provides a parallel link for alarm commands and responses to Site Controller B. ***NOTE:*** Alarm commands and responses pass through an IEEE 1284 cable.

Table 10-3 ***EAS Connectors***

Connector	Type	Description
Controller B - Serial	RJ48	Not used
Control	RJ48	Alarm connection for the Equipment Cabinet Circuit Breaker Panel. The alarm activates when any breaker trips or is set to the OFF position.
RF#l	modular	Alarm connection for Receiver Multicouplers (RMCs). The alarm activates if an RMC power supply or low noise amplifier fails.
RF#2	modular	Alarm connection for Receiver Multicouplers (RMCs). The alarm activates if an RMC power supply or low noise amplifier fails.
RF#3	modular	Alarm connection for Receiver Multicouplers (RMCs). The alarm activates if an RMC power supply or low noise amplifier fails.

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Gen 2 Environmental Alarm System

Chapter Overview

This chapter describes the Gen 2 Environmental Alarm System (EAS2). The following table lists this chapter's topics.

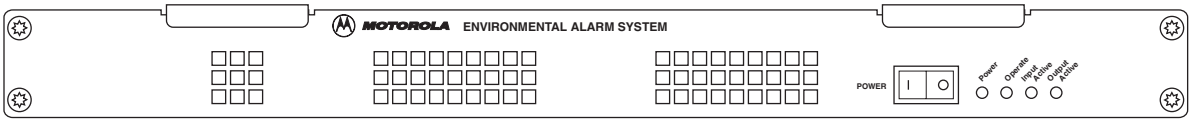
Section	Page	This section...
EAS2 Functional Description	11-2	describes the EAS2 and its function in the EBTS
Indicators	11-2	describes EAS2 indicator functions
Performance Specifications	11-3	defines EAS2 performance specifications
Theory of Operation	11-3	provides the EAS2 theory of operation
Connectors	11-5	describes EAS2 connector functions

EAS2 Functional Description

The EAS2 provides a central location for site alarm signal processing. The EAS2 monitors environmental conditions of the site, including AC power, smoke alarms, intrusion alarms, antenna tower lights, etc.

Alarm wiring from the EBTS equipment and power supply equipment connects directly to the EAS2. The EAS2 sends alarm flags to the Site Controller, which stores the alarms in memory.

Figure 11-1 shows the EAS2 front view and Figure 11-3 shows the EAS2 rear view.



iSC402_2
010802JNM

Figure 11-1 ***Gen2 Environmental Alarm System (front view)***

Indicators

Table 11-1 lists and describes EAS2 status indicators.

Table 11-1 ***EAS2 Indicators***

Indicator	Color	Function
Input Active	red	Indicates an active input.
Output Active	amber	Indicates an active output.
Power On	green	Indicates the unit is on and powered-up.
Operate	green	Indicates I/O board is operational

Performance Specifications

Table 11-2 lists the EAS2 specifications.

Table 11-2 ***EAS2 Performance Specifications***

Specification	Value or Range
Input supply voltage range	-41 to -60 Vdc
Power consumption	Typical: 22W Maximum: 50W
Operating temperature range	-30° to 60° C (-22° to 140° F)
Storage temperature range	-40° to 85° C (-40° to 185° F)
Physical dimensions: Height Width	 1 Rack Unit (RU) 482.6 mm (19")
Humidity	75% R.H. at 55°C (Max.)
Maximum loop length	24 or 32 gauge wire => 610 m (2000')
Alarm input "ON" current	5.0 mA min.
Alarm input "OFF" current	0.1 mA max.

Theory of Operation

The EAS2 provides a direct interface between the Site Controller and various site alarms. Figure 11-2 shows a functional block diagram of the EAS2.

The EAS2 is configured for 48 dry contact input sensors and 8 relay closure outputs. Each I/0 provides 4000V of isolation between field wiring and sensitive control circuitry.

The Site Controller and EAS2 interact in a master/slave relationship. The Site Controller sends commands to the EAS2 to determine the status of alarm inputs or set the state of control outputs. The EAS2, in turn, sends alarm status responses to the Site Controller.

The EAS2 continuously scans the status of the alarm inputs, ensuring that all alarms are consistently monitored.

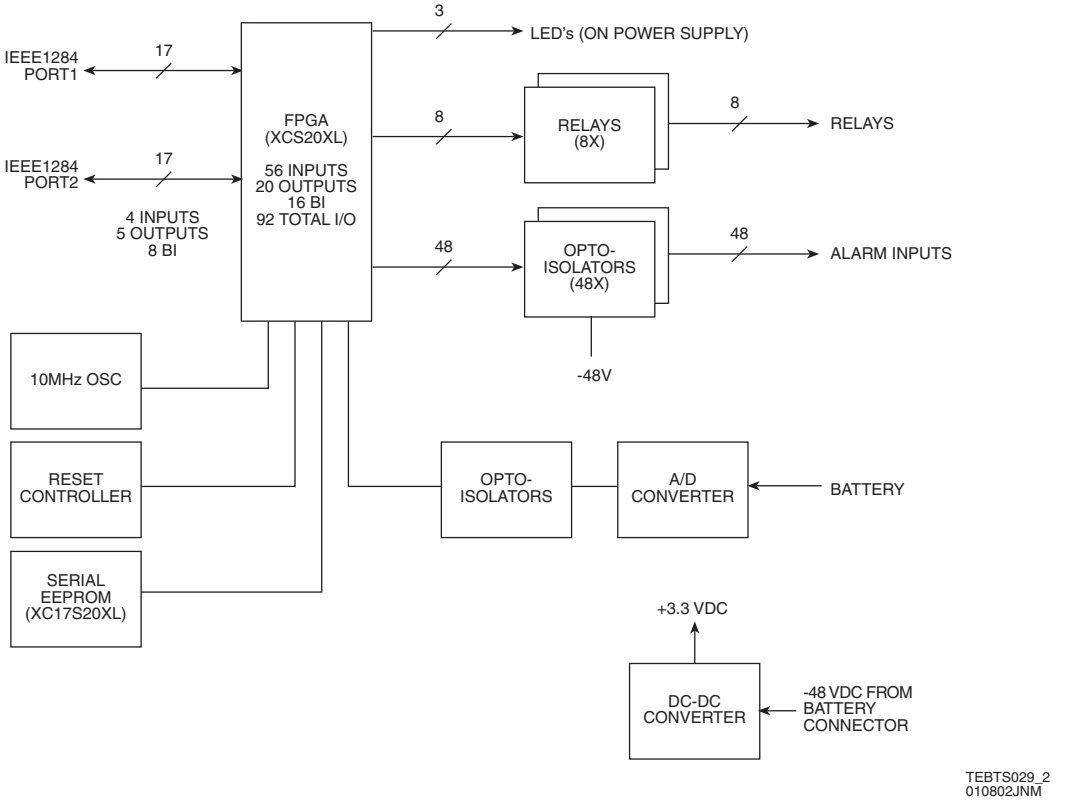


Figure 11-2 ***EAS2 Block Diagram***

Connectors

Figure 11-3 shows the rear view of the EAS2. Table 11-3 lists and describes the EAS2 connectors.

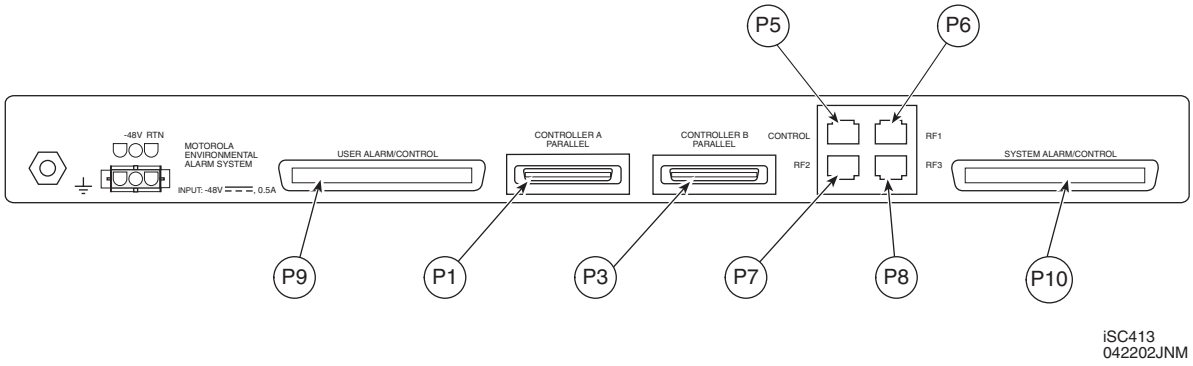


Figure 11-3 ***EAS2 (rear view)***

Table 11-3 ***EAS2 Connectors***

Connector	Type	Description
Battery	Mate-N-Lok	Provides -48Vdc input power and ground connector from Equipment Cabinet Circuit Breaker Panel.
GND	Ground stud	Provides a connection for the chassis ground.
User Alarm/ Control	50-pin champ	Provides a connection for the site alarms through a champ cable. Refer to Chapter 4 - Installation for pinout details. ***NOTE:*** All customer provisioned connections are inputs, except for pins 1, 2, 26 and 3, 4, 28 which are outputs.
System Alarm/ Control	50-pin champ	Provides a connection for the site alarms through a champ cable. Refer to Chapter 4 - Installation for pinout details. 1, 2, 26; 3, 4, 28; & 5, 6, 30 are outputs.
Controller A - Parallel	36-pin IEEE 1284	Provides a parallel link for alarm commands and responses to Site Controller A. ***NOTE:*** Alarm commands and responses pass through an IEEE 1284 cable.

Table 11-3 ***EAS2 Connectors***

Connector	Type	Description
Controller B - Parallel	36-pin IEEE 1284	Provides a parallel link for alarm commands and responses to Site Controller B. ***NOTE:*** Alarm commands and responses pass through an IEEE 1284 cable.
Control	RJ48	Alarm connection for the Equipment Cabinet Circuit Breaker Panel. The alarm activates when any breaker trips or is set to the OFF position.
RF#l	modular	Alarm connection for Receiver Multicouplers (RMCs). The alarm activates if an RMC power supply or low noise amplifier fails.
RF#2	modular	Alarm connection for Receiver Multicouplers (RMCs). The alarm activates if an RMC power supply or low noise amplifier fails.
RF#3	modular	Alarm connection for Receiver Multicouplers (RMCs). The alarm activates if an RMC power supply or low noise amplifier fails.

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MOTOROLA

12

FRU Replacement Procedures

Chapter Overview

Chapter 12 summarizes replacement procedures for the environmental alarm system (EAS/EAS2) and site controller.

The following table lists this chapter's topics.

Section	Page	This section...
Environmental Alarm System Replacement	12-2	describes procedures for EAS/EAS2 removal and installation
Site Controller Replacement	12-3	describes procedures for site controller removal and installation
Gen 3 Site Controller Retrofit	12-5	describes procedures for retrofitting a Gen 2 Site Controller cabinet with Gen 3 Site Controllers

Environmental Alarm System Replacement

Perform Environmental Alarm System (EAS/EAS2) replacement as described in the following paragraphs.

Removal

Remove EAS/EAS2 as follows:

1. Remove power from the EAS/EAS2 by setting the Power Supply ON/ OFF switch to the OFF position.
2. Set the appropriate breaker switch on the Breaker Panel to OFF.
3. Tag and disconnect the cabling from the EAS/EAS2 rear panel connectors.
4. Remove the four M6 TORX screws which secure the EAS/EAS2 front panel to the Equipment Cabinet mounting rails.
5. While supporting the EAS/EAS2, remove the EAS/EAS2 from the Equipment Cabinet by sliding the EAS/EAS2 from the front of cabinet.

Installation

Install EAS/EAS2 in Equipment Cabinet as follows:

1. While supporting the EAS/EAS2, slide the EAS/EAS2 in the Equipment Cabinet mounting position.
2. Secure the EAS/EAS2 to the Equipment Cabinet mounting rails using the four M6 TORX screws. Tighten the screws to 4.5 Nm (40 in-lb).
3. Connect the green/yellow ground conductor between the secondary ground bar and the grounding lug on the rear of the housing, and ensure the connection is tight.
4. Connect the cabling to the EAS/EAS2 rear panel connectors as tagged during the EAS/EAS2 removal. If replacing an EAS with an EAS2, connect the 3083892X06 adapters to ‘USER Alarm/Control and ‘SYSTEM Alarm/Control’ ports.
5. Set the EAS/EAS2 power switch to ON.

Site Controller Replacement

Perform Site Controller replacement as described in the following paragraphs.

Removal

Remove the Site Controller from the Equipment Cabinet as follows:

1. Remove power from the Site Controller by setting the Power Supply ON/ OFF switch to OFF.
2. Set CTRL A and CTRL B breaker switches (as applicable) to OFF.
3. Tag and disconnect the cabling from the Site Controller rear panel connectors.
4. Remove the four M6 TORX screws which secure the Site Controller front panel to the Equipment Cabinet mounting rails.
5. While supporting the Site Controller, remove the Site Controller from the Equipment Cabinet by sliding the Site Controller from front of the cabinet.

Installation

Install Site Controller in Equipment Cabinet as follows:

1. If adding a Site Controller, install side rails in the appropriate Site Controller mounting position in the rack.
2. While supporting the Site Controller, slide the Site Controller in the Equipment Cabinet mounting position.
3. Secure the Site Controller to the Equipment Cabinet mounting rails using the four M6 TORX screws. Tighten the screws to 4.5 N-m (40 in-lb).
4. Connect the green/yellow ground conductor between the secondary ground bar and the grounding lug on the rear of the housing, and ensure the connection is tight.
5. Connect cabling to the Site Controller rear panel connectors as tagged during the Site Controller removal. If adding a Site Controller, perform required cabling in accordance with Appendix C - Cabling Diagrams.
6. Perform the Site Controller verification in accordance with the "Site Controller Setup/ Verification" section of Chapter 6 - System Download/ Testing.

Gen 3 Site Controller Retrofit

Existing Site Control cabinets containing Gen2 iSCs and an iMU may be retrofitted to have Gen 3 Site Controllers and an EAS/EAS2 installed. The following paragraphs detail the procedures to be used to retrofit Stand Alone Site Control racks.

Stand Alone Control Rack

1. Remove the existing iSCs and the iMU per the FRU removal instructions in the appropriate section of the manual that came with the rack.
2. Verify that all power to the rack has been removed by turning off the appropriate breaker(s) on the power rack.
3. Label and disconnect all cables into the rack including those at the junction panel. DISCONNECT THE GROUND CABLE LAST.
4. Remove the junction panel and the cabling between the junction panel and the old iSCs and iMU.
5. Remove the existing slide rails that supported the iSCs and iMU.
6. Install the new blank front panels and move the 1RU blank front panel in the rack per Figure 2-3 of this manual. Additional cage nuts and screws are provided for use as needed.
7. Install the new slide rails provided so that the Gen 3 SCs and the EAS/EAS2 will be positioned in the appropriate place in the rack per Figure 2-3 of this manual.
8. Install the new junction panel into the rack utilizing the existing grounding cage nuts and screws. Replace the cage nuts and screws if evidence of damage exists.
9. Connect the green rack ground cable to one of the M10 ground studs labeled SITE GROUND on the junction panel. Ensure the connection is tight.
10. Install the new Gen 3 SCs and the EAS/EAS2 into the rack onto their appropriate slide rails. Secure each unit into the rack utilizing (4) M6 screws which are provided.

11. Connect the yellow/green ground cables supplied to the M6 ground stud on each Gen 3 SC and the EAS/EAS2. Ensure the connection is tight. Connect the free end of each ground cable to one of the (3) ground cage nuts present in the rack which the previous modules had utilized. The ground cage nuts may need to be repositioned if the cable will not reach. Multiple lugs may not be installed onto a single nut.

12. Install the remaining cabling per Appendix C of the manual. In addition, new alarm cables have been provided to route from the punch blocks to the EAS/EAS2.

13. Reconnect any cabling coming into the rack at the junctional panel.

14. Reconnect the power to the rack by turning all applicable breakers on.

NOTICE:

Motorola recommends special attention to the following procedures for successful and safe installation of retrofit Gen 3 Site Controllers.

Note: The complete instructions and wiring diagrams for the retrofit are contained within this manual.

- **New Rails:** The 6 new slide support rails (P/N 0783103X05) are narrower and allow easier access to the Gen 3 SC connections. The existing rails should be removed and replaced with these new rails.
- **Do this first**: The new ground cables supplied should be connected prior to connecting power or any connections.
- **Common error:** Ensure that the redundancy cable (P/N 3084225N24) used, is a redundancy cable. As a simple visual aid, the supplied redundancy cable has yellow bands near each end.
- **New Connection:** Be sure to connect the 10/100 Base - T cable (P/N 3082505Y12). It is located at the far right of the rear panels and runs between the two Gen 3 SCs. This high-speed interface is reserved for future use.

Appendix A

Acronyms

Acronym	Definition
A/D	Analog-to-Digital
A	Amperes
AC	Alternating Current
ACG	Access Controller Gateway
ACT	Active
ADA	American Disabilities Act
AIC	Ampere Interrupting Capacity
AIS	Alarm Indication Signal (Keep Alive)
AMI	Alternate Mark Inversion
ANSI	American National Standards Institute
ASCII	American National Standard Code for Information Interchange
ASIC	Application Specific Integrated Circuit
Aux	Auxiliary
avg	average
AWG	American Wire Gauge
bd	baud
BERT	Bit Error Rate Test
BMR	Base Monitor Radio
BNC	Bayonet “N” Connector
BPV	Bipolar Violation
BR	Base Radio

Acronym	Definition
BRC	Base Radio Controller
BSC	Base Site Controller
BTU	British Thermal Unit
B8ZS	Bipolar with 8-Zero Substitution
CC	Control Cabinet
CD	Carrier Detect
cd	change directory
CLK	Clock
CLT	Controller
cm	centimeter
CMOS	Complementary Metal Oxide Semiconductor
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CSMA/CD	Carrier Sense Multiple Access with Collision Detect
CSU	Channel Service Unit
CTS	Clear to Send
D/A	Digital-to-Analog
DAP	Dispatch Application Processor
DB-15	15-pin D-subminiature
DB-9	9-pin D-subminiature
DC	Direct Current

Acronym	Definition
DCE	Data Circuit-Terminating Equipment
DCSPLY	DC Supply
deg	degree
DIP	Dual In-line Package
div	division
DMA	Direct Memory Access
DOP	Dilution of Precision
DRAM	Dynamic Random Access Memory
DS0	64Kb Data Channel
DS1	1.544Mb Data Channel
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
DVM	Digital Volt Meter
E1	2.048 Mb telephone line
E-NET	Ethernet
EAS	Environmental Alarm System
EAS2	Gen 2 Environmental Alarm System
EBTS	Enhanced Base Transceiver System
EIA	Electronics Industry Association
ELP	Ethernet LAN PCI card
EMI	Electro-Magnetic Interference
EPROM	Erasable Programmable Read Only Memory
EEPROM	Electronically Erasable Programmable Read Only Memory
ESF	Extended Superframe
ESI	Ethernet Serial Interface
ESMR	Enhanced Special Mobile Radio

Acronym	Definition
FCC	Federal Communications Commission
FDL	Facility Data Link
FIFO	First-In, First-Out
FNE	Fixed Network Equipment
freq	frequency
FRU	Field Replaceable Unit
GND	Ground
GPS	Global Positioning System
GPSR	Global Positioning System Receiver
HDB3	High-Density Bipolar of Order 3
HDLC	High-level Data Link
HSO	High Stability Oscillator
HVAC	Heating Ventilation Air Conditioning
Hz	Hertz
I/O	Input/Output
IC	Integrated Circuit
iDEN	integrated Dispatch Enhanced Network
IEEE	Institute of Electrical and Electronic Engineers
in	inches
ISA	Industry Standard Architecture
iSC	integrated Site Controller
kg	kilogram
kHz	kiloHertz
LAN	Local Area Network
LAPD	Link Access Procedure D-Channel

Acronym	Definition
lbs	pounds
LED	Light Emitting Diode
LIU	Line Interface Unit
LLC	Link Layer Controller
LNA	Low Noise Amplifier
LOS	Loss of Signal
max	maximum
MGN	Multi-Grounded Neutral
MHz	MegaHertz
min	minimum
min	minute
mm	millimeter
MMI	Man-Machine-Interface
MPS	Metro Packet Switch
MS	Mobile Station
MSO	Mobile Switching Office
ms	millisecond
MSC	Mobile Switching Center
N.C.	Normally Closed
N.O.	Normally Open
NEC	National Electric Code
no.	number
NTWK	Network
OEM	Original Equipment Manufacturer
OMC	Operations and Maintenance Center
OSHA	Occupational Safety and Health Act
P/N	Part Number

Acronym	Definition
PA	Power Amplifier
PAL	Programmable Array Logic
PC	Personal Computer
PCI	Peripheral Component Interconnect
PCCH	Primary Control Channel
PDOP	Position Dilution of Precision
PLL	Phase Locked Loop
PPM	Parts Per Million
PPS	Pulse Per Second
PS	Power Supply
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
PVC	Polyvinyl Chloride
pwr	power
QRSS	Quasi Random Signal Sequence
Qty	Quantity
R1	Receiver #1
R2	Receiver #2
R3	Receiver #3
RAM	Random Access Memory
RCV	Receiver
Ref	Reference
RF	Radio Frequency
RFC	Radio Frequency Cabinet
RFDS	RF Distribution System
RFS	RF System
ROM	Read Only Memory

Acronym	Definition
RPM	Revolutions Per Minute
RU	Rack Unit
Rx	Receive
S/W	Software
sec	second
SF	Superframe
SNMP	Simple Network Manangement Protocol
SQE	Signal Quality Error
SRAM	Static Random Access Memory
SRI	Site Reference ISA card
SRRC	Single Rack Redundant Controller
SRSC	Single Rack Single Controller
SS	Surge Suppressor
STAT	Status
Std	Standard
STP	Subrated T1 PCI card
T1	1.544 Mb telephone line
TDM	Time Division Multiplex
TDMA	Time Division Multiple Access
Telco	Telephone Company
Tx	Transmit
TXD	Transmit Data
typ	Typical
UL	Underwriters Laboratories
V	Voltage
Vac	Voltage - alternating current

Acronym	Definition
Vdc	Voltage - direct current
Vp-p	Voltage peak-to-peak
WDT	Watchdog Timer
WP	Write Protect

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Appendix B

Parts & Suppliers

Overview

This appendix contains recommended part numbers and manufacturers for various hardware, tools, and equipment used during installation of the system.

Also contained in this appendix is other installation-related information, such as determining types of wire lugs, lengths and sizes of various wires and cables, custom cabling information, and fuses.

Note: All suppliers and model numbers listed are recommended due to their proven performance record in previous installations. Motorola cannot guarantee the effectiveness of the installation or performance of the system when using other supplier parts. Addresses, phone numbers, fax numbers, and other information is presented for each of the recommended suppliers, when possible. This information is subject to change without notice.

The following table describes the contents of this appendix.

Section	Page
Surge arrestors	B-2
RF attenuators	B-3
Emergency generator	B-4
Portable generator connection	C-5
GPS evaluation kit	C-5
GPS antenna amplifier	C-6
Site alarms	C-7
Site alarm wiring	C-9

Section	Page
Cabinet mounting hardware	C-9
Cable connections	C-10
Battery system connections	C-11
Intercabinet cabling	C-14
Equipment cabinet power connections	C-16
Other recommended suppliers	C-17
Ordering spare parts	C-18

Surge arrestors

Two types of surge arrestors should be used in the system site, including:

- AC power and Telco
- Antenna surge arrestors

AC power and Telco surge arrestors

The recommended AC Power and Telco surge arrestors are manufactured by Northern Technologies. The recommended model numbers (or equivalent) are:

- AC power - *LAP-B* for 120/240 single-phase
  LAP-C for 208 Vac three-phase
- Telco - *TCS T1DS*

Northern Technologies

P.O. Box 610
Liberty Lake, WA 99019
Phone: 800-727-9119
Fax: 509-927-0435
Internet: www.northern-tech.com

Antenna surge arrestors

The recommended antenna surge arrestors are manufactured by Polyphaser Inc. The following models (or equivalent) are recommended:

- Base Radio antenna (800 MHz tower top amplifier only) - *094-0801T-A*

- Base Radio antenna (800 MHz cavity combined, transmit only; up to 5 channels) - *IS-CT50HN-MA*
- Base Radio antennas (800 MHz duplexed) - *IS-CT50HN-MA*
- Base Radio antennas (900 MHz duplexed) - 097-0311G-A.2
- GPS antennas - *092-082-0T-A*
- lightning arrestor bracket kit - *Contact your local Motorola sales representative to order this kit*
- receive tower top amplifier - *094-0801T-A*
- tower top test port cable - *IS-50NX-C2*

Polyphaser Corp.

P.O. Box 9000
Minden, NV 89423-9000
Phone: 800-325-7170
702-782-2511
Fax: 702-782-4476
Internet: www.polyphaser.com

Motorola has set up several kits that contain the necessary arrestors with proper mounting hardware for the various antenna configurations. Contact your local Motorola representative for these OEM kits.

RF attenuators

Several RF attenuators are needed at a site to ensure proper receive adjustments. The attenuators are used at the LNA sites to offset the excess gain from the Tower Top amplifiers, to balance the receive path, and to attenuate the BMR signal path. Use the following specifications when choosing vendors:

- 1 dB increments
- 0.5 dB accuracy or better
- female N connector / male N connector
- Specified frequency range
  - **800 MHz systems** – requires attenuator specification to include 806-821 MHz range
  - **900 MHz systems** – requires attenuator specification to include 896-901 MHz range

Alan Industries, Inc.

745 Green Way Drive
P.O. Box 1203
Columbus, IN 47201
Phone: 800-423-5190
812-372-5909
Fax: 812-372-5909
Internet: www.alanindustries.com

Huber + Suhner, Inc.

19 Thompson Drive
Essex, VT 05452
Phone: 802-878-0555
Fax: 802-878-9880
Internet: www.hubersuhnerinc.com

JFW Industries, Inc.

5134 Commerce Square Drive
Indianapolis, IN 46237
Phone: 317-887-1340
Fax: 317-881-6790
Internet: www.jfwindustries.com

Pasternack Enterprises

P.O. Box 16759
Irvine, CA 92623
Phone: 949-261-1920
Fax: 949-261-7451
Internet: www.pasternack.com

Emergency generator

Several different generator sizes are available. Determine the loading requirements of the site prior to ordering a generator. A recommended manufacturer of the emergency backup generator power system is:

Generac Power Systems, Inc.

P.O. Box 8
Waukesha, WI 53187
Phone: 414-544-4811
Fax: 414-544-0770
Internet: www.generac.com

Portable generator connection

The recommended (or equivalent) portable generator connection is the *AJA200-34200RS*, manufactured by Appleton Electric. Figure B-1 is a view of a connector located on the building. An adapter may be required if local electrical standards conflict with the wiring configuration.

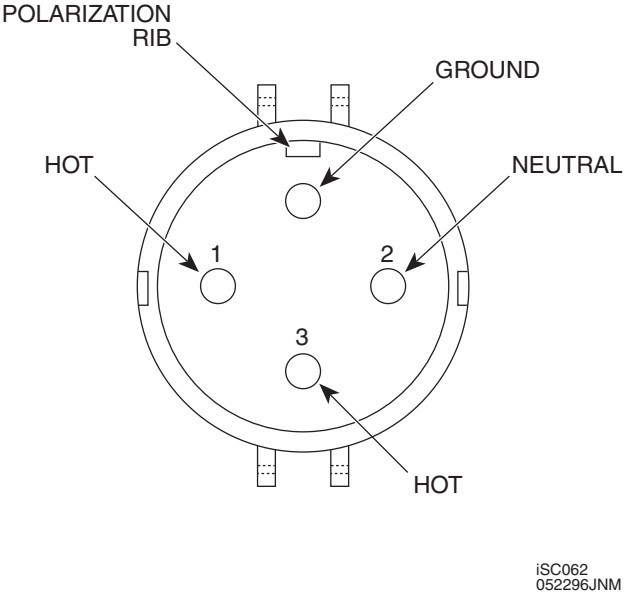

Figure B-1 ***Portable generator connector***

An alternate supplier of the portable generator connection is the *ARKTITE Heavy Duty Receptacle Model 80, Style 2, 200 Amps*, manufactured by Crouse-Hinds.

Crouse-Hinds, Inc.

P.O. Box 4999
Syracuse, NY 13221
Phone: 315 477-7000
Fax: 315 477-5717

GPS evaluation kit

The GPS evaluation kit (part number VPEVL0002) is available from Motorola Position and Navigation System Business.

Motorola Position and Navigation System Business

4000 Commercial Avenue
Northbrook, IL 60062
Phone: 847 714-7329
Fax: 847 714-7325

GPS antenna amplifier

There are two recommended manufacturers of the GPS antenna amplifiers.

GPS Networking

710A West 4th St.
Pueblo, CO 81003
Phone: 800-463-3063
719-595-9880
Fax: 719-595-9890
Internet: www.gpsnetworking.com

Starlink Inc.

6400 Highway 290 East
Suite 202
Austin, TX 78723
Phone: 512 454-5511
800 460-2167
Fax: 512 454-5570
Internet: www.starlinkdgps.com

Site alarms

Three types of alarms should be used at a site, including:

- Intrusion alarm
- Smoke alarm
- Temperature alarm

Intrusion alarm

The recommended intrusion alarm is the *Sonitrol 29A* or equivalent.

Sonitrol

211 N. Union St. Suite 350
Alexandria, VA 22314
Phone: 800 326-7475
Fax: 703 684-6612

Smoke alarm

A recommended smoke alarm is the *Sentrol 320CC* or equivalent. This smoke alarm provides a relay closure for the EAS alarm. These smoke detectors are available from many electrical wholesale distributors. For the location nearest you, call Sentrol between 6 a.m. and 5 p.m. Pacific Standard Time and ask Sales for the location of the nearest EW (Electric Wholesale) distributor.

Sentrol, Inc.

12345 SW Leveton Drive
Tualatin, OR 97062
Phone: 800 547-2556
Internet: www.sentrol.com

Temperature alarm

The recommended temperature alarm is the *Grainger #2E206* or equivalent thermostat. This alarm is manufactured by Dayton Electronics and distributed by W.W. Grainger:

W.W. Grainger

Locations Nationwide
Phone: 800 323-0620
Fax: 800 722-3291
Internet: www.grainger.com

Site alarm wiring

The following table identifies recommended Motorola part numbers for prewiring the site alarms.

Part number	Description	Quantity
0183652P01	punch block	2
3083892X04	alarm cable for EAS	2
3083892X07	alarm cable for EAS2	2

Cabinet mounting hardware

The cabinet mounting hardware is site dependent and must be procured locally.

Equipment cabinets

The mounting hardware used to secure the equipment cabinets containing control and/or RF hardware must be able to provide 1545 pounds of retention force.

- If the cabinets are to be secured to a concrete floor, 1/2” grade 8 bolts with anchors are recommended.
- If the cabinets are to be secured to another type of floor, determine the appropriate mounting hardware.

Power Supply Rack

The Motorola offered Power Supply Rack from Power Conversion Products is available in a standard and an earthquake rack.

Power Conversion Products, Inc.

42 East Street
P.O. Box 380
Crystal Lake, IL 60014
Phone: 815 459-9100
Phone: 800 435-4872 (customer service)
Fax: 815 459-9118

If the earthquake rack is used, it must be bolted to the floor using the *02100-13 High Performance Anchor Kit*, consisting of:

- anchors (qty. 4)
- load sharing plates (qty. 2)
- large square washers (qty. 8)

Hendry Telephone Products

P.O.Box 998
Goleta, CA 93116
Phone: 805 968-5511
Fax: 805 968-9561

Cable connections

The recommended manufacturer for all wire lugs used during site installation is Thomas & Betts.

Thomas & Betts

1555 Lynnfield Road
Memphis, TN 38119
Phone: 800 248-7774 (sales/technical support)
Phone: 901 682-7766 (general information)

Note: Double hole wire lugs are preferred, but single hole wire lugs can be used where mounting requirements dictate their use.

Selecting master ground bar lugs

Table B-1 identifies recommended part numbers for wire lugs used to connect chassis ground wiring to the master ground bar from each cabinet.

Table B-1 ***Recommended master ground bar lugs***

Wire size	Wire type	Lug color	Description	P/N †
#2 AWG	stranded	brown	single 1/4” diameter hole	54107
#2 AWG	stranded	brown	double 1/4” diameter hole, 5/8” center	54207
#6 AWG	stranded	blue	single 1/4” diameter hole	54105
#6 AWG	stranded	blue	double 1/4” diameter hole, 5/8” center	54205

NOTE: These lugs require the use of the TBM5-S crimping tool.

† All part numbers are Thomas & Betts.

Selecting cabinet ground lugs

Table B-2 identifies recommended part numbers for wire lugs used to connect chassis ground wiring to the grounding point of each cabinet.

Table B-2 ***Recommended Junction Panel ground lugs***

Wire size	Wire type	Lug color	Description	P/N †
#2 AWG	stranded	brown	single 1/2” diameter hole	54145
#6 AWG	stranded	blue	single 3/8” diameter hole	E6-12

NOTE: These lugs require the use of the TBM5-S crimping tool.

† All part numbers are Thomas & Betts.

Battery system connections

The cable loop length refers to the total length of wire within a given circuit. For example, the combined length of the -48 Vdc (hot) lead and the DC return lead equals the cable loop length. This means that a cabinet that needs 16 feet of wire between the batteries and Power Supply Rack has a total loop length of 32 feet.

Determining battery system wire size

The wire size for the connection between the batteries and the Power Supply Rack is determined by the required wire length and the maximum allowable voltage drop. The voltage drop in the loop must be kept to below 200 mV. The wire selected should be UL-approved and contain a high number of strands for flexibility.

For a standard configuration, the Power Supply Rack is located directly adjacent to the batteries with a cable loop length of 20 feet or less, which requires the use of a 4/0 wire. Table B-3 shows recommended wire sizes for various loop lengths. Larger wire sizes may be used if the recommended sizes are not available. The recommended wire sizes are large enough to allow site expansion to a fully loaded site.

Table B-3 ***Battery system wire size***

Loop length	Wire size
20 feet	4/0 (or 250 MCM)
30 feet	350 MCM
45 feet	500 MCM

Selecting battery system lugs

Depending on the wire size used and the manufacturer of the batteries, different wire lugs are crimped onto the power cable ends. After the wire size has been determined from Table B-3, verify the manufacturer of the Batteries (*Dynasty or Absolyte*).

Two different battery systems are offered with the system. The *Dynasty* system is a low to medium capacity, field expandable system supplied for smaller sites or sites with minimal backup hour requirements. This system is custom designed to Motorola specifications. The *Dynasty* system is manufactured by Johnson Controls:

Johnson Controls

Specialty Battery Division
900 East Keefe Avenue
P.O. Box 591
Milwaukee, WI 53212
Phone: 414 967-6500

The *Absolyte IIP* battery system is a heavy duty, high capacity battery system. The *Absolyte IIP* battery system is manufactured by GNB Technologies:

GNB Technologies

829 Parkview Boulevard
Lombard, IL 60148
Phone: 708 629-5200
Phone: 800 872-0471
Fax: 708 629-2635

Refer to Table B-4 to determine the proper wire lug for the connection of that wire to the Power Supply Rack.

Table B-4 ***Power Supply Rack connection lugs***

Wire size	Cabinet lug	Crimp tool	Lug P/N †
4/0	double 3/8” hole, 1” center	TBM5-S	54212
250 MCM	double 3/8” hole, 1” center	TBM8-S	54213
350 MCM	double 3/8” hole, 1” center	TBM8-S	54215
500 MCM	double 3/8” hole, 1” center	TBM8-S	54218
† All part numbers are Thomas & Betts.			

Refer to Table B-5 to determine the proper wire lug for the connection to the batteries, based on the wire size and battery manufacturer. One column lists the selection for *Dynasty* and the other lists the selection for *Absolyte IIP*.

Table B-5 ***Battery connection lugs***

Wire size	Lug color	Dynasty		Absolyte IIP	
		Description	P/N	Description	P/N
4/0	purple	double 3/8” hole, 1” center	54212	single 1/2” hole	54170
250 MCM	yellow	double 3/8” hole, 1” center	54215	single 1/2” hole	54113
350 MCM	red	double 3/8” hole, 1” center	54218	single 1/2” hole	54115
500 MCM	brown	double 3/8” hole, 1” center	54220	single 5/8” hole	54118

Anti-oxidant greases

Any one of the following anti-oxidant greases are recommended for connections to the positive (+) and negative (-) terminals of the batteries:

- No-Ox
- OxGuard
- Penetrox

Intercabinet cabling

Ethernet and alarm cables connecting to the Junction Panels of each cabinet are supplied with the system. These cables may not be suitable for every site. It may be necessary to locally fabricate cables for a custom fit. Information is provided for both supplied cables and custom cables.

Supplied cables

The cables listed in Table B-6 are supplied with the system. The length of these cables should be sufficient if the considerations outlined in the Pre-Installation chapter were followed.

Table B-6 ***Supplied intercabinet cabling***

Description	Qty.	P/N
120" long, N-type male to N-type male cable	3	0112004B24
108" long, BNC male-to-BNC Male, RG400 cable	2*	0112004Z29
210" long, 8-pin modular plug cable	1*	3084225N42
186" long, PCCH redundancy control cable	1**	3082070X01
phasing harness	1	0182004W04

NOTE: All part numbers are Motorola.

* Per RF Cabinet.

** Per Control Cabinet.

Making custom cables

If custom Ethernet or 5 MHz cables must be locally manufactured, use the part numbers listed in Table B-7 for ordering the required materials.

Table B-7 ***Parts for Ethernet and 5 MHz cables***

Description	Qty.	P/N
connector, BNC male	as required	2884967D01
cable, RG400	as required	3084173E01
NOTE: All part numbers are Motorola.		

Table B-8 lists the part numbers for custom alarm cables.

Table B-8 ***Parts for alarm cables***

Description	Qty.	P/N
connector, 8-pin modular	as required	2882349V01
cable, 8-wire	as required	locally procured
NOTE: All part numbers are Motorola.		

Table B-9 lists the part numbers for custom PCCH cables.

Table B-9 ***Parts for extending PCCH redundancy control cables***

Description	Qty.	P/N
186” long, PCCH redundancy control cable	1 per Cabinet	3082070X01
8-pin male Telco to 8-pin male Telco extension cable, length: as needed	as required	locally procured
modular, 8-pin female-to-female adaptor	as required	locally procured
NOTE: Motorola does not guarantee proper operation of system if longer PCCH cable is used. All part numbers are Motorola.		

Equipment cabinet power connections

Selecting power connection lugs

Table B-10 identifies recommended part numbers for lugs used for power connections between the Power Supply Rack and the Control and RF Cabinets. The maximum wire size accepted by the Control and RF Cabinets is 2/0. The Control and RF Cabinets use screw type compression connectors and do not require lugs.

Table B-10 ***Recommended power connection lugs for Power Supply Rack***

Size	Lug color	Description	P/N †
2/0	black	double 3/8” hole, 1” center	54210
#2 AWG	brown	double 1/4” hole, 5/8” center	54207
#4 AWG	gray	double 1/4” hole, 5/8” center	54206
#6 AWG	blue	double 1/4” hole, 5/8” center	54205
† All part numbers are Thomas & Betts.			

Determining power connection wire size

The cable loop length refers to the total length of wire within a given circuit. For example, the combined length of the -48 Vdc (hot) lead and the DC return lead equals the cable loop length. This means that a cabinet which needs 16 feet of wire between the Power Supply Rack and equipment cabinets has a total loop length of 32 feet.

The wire size for the connection between the Power Supply Rack and the equipment cabinets is determined by the required wire length and the maximum allowable voltage drop. The voltage drop in the loop must be kept to below 500 mV. The wire selected should be UL-approved and contain a high number of strands for flexibility. Table B-11 shows the recommended wire sizes for various loop lengths of the RF Cabinet. Table B-12 shows the recommended wire sizes for loop lengths of the Control Cabinet

For a standard configuration, the equipment cabinets are located adjacent to the Power Supply Rack with a cable loop length less than 35’.

Table B-11 ***Power connection wire size***

Loop length	Wire size
25 feet or less	#6 AWG
25 to 40 feet	#4 AWG
40 to 60 feet	#2 AWG
60 to 130 feet	1/0 AWG
NOTE: The wire sizes listed are large enough to allow expansion of an RF Cabinet to five Base Radios.	

Table B-12 ***Power connection wire size for Cabinets***

Loop length	Wire size
150 feet or less	#6 AWG

Each equipment cabinet has a total of four Power Supply Rack connections: two -48 Vdc (hot) and two DC returns. Each equipment cabinet contains two separate power distribution systems. A single hot wire and a single return wire are used for each side of the bus. Two return leads provide redundancy and allow a uniform wire size to be used for all 48 Vdc power distribution system connections.

Other recommended suppliers

The following are the addresses of various suppliers for equipment used during system installation.

Test Equipment

- Fluke 77 Digital Multimeter

Fluke Corporation

P.O. Box 9090
Everett, WA 98206-9090
Phone: 425-347-6100
Internet: www.fluke.com

Service computer

A PC or Macintosh can be used for optimization and field service. The following are the minimum requirements:

- 19,200 bps serial port
- one floppy drive
- communication software, such as Smartcomm II or Procomm Plus

Software

- PKZIP software

  PKWare Inc.

  9025 N. Deerwood Drive
  Brown Deer, WI 53223
  Phone: 414 354-8699
  Fax: 414-354-8559
  Internet: www.pkware.com

- ProComm software

  Quarterdeck Select Corporation

  P.O. Box 18049
  Clearwater, FL 34622-9969
  Phone: 800-683-6696
  Fax: 813-532-4222
  Internet: www.Qdeck.com

Ordering spare parts

Motorola Inc.

America's Part Division
Attn: Order Processing

1313 E. Algonquin Road
Schaumburg, IL 60196
Phone: 800-422-4210 (sales/technical support)
Fax: 847-538-8198

Newark Electronics

Call for a local phone number in your area to order parts
Phone: 800-463-9275 (catalog sales)
773-784-5100
Fax: 847-310-0275
Internet: www.newark.com

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Appendix C

Cabling Diagrams

Overview

This appendix provides cabling information for the site controller using the site controller Junction and Circuit Breaker Panels.

For SRRC cabling diagrams, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual*. *(on CD: 98P80800A17.)* For SRSC cabling diagrams, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual*. *(on CD: 98P80800A17.)*

Site Controller Cabling

Site controller cabling refers to the cable connections between the Circuit Breaker Panel, Junction Panel, EAS/EAS2, Controller A, and Controller B.

Table C-1 identifies and Figure C-1 and Figure C-2 show standard T1 site controller cabling.

Table C-1 ***T1 Site Controller cabling***

Index number	Part number	From	To	Notes
1	3083609X01	**CTL A EAS** connector on Circuit Breaker Panel	**Bat** connector on Controller A **Battery** connector on EAS/EAS2	Y-cable that supplies power to Controller A and the EAS/EAS2
2	3082082X02	**CTL B** connector on Circuit Breaker Panel	**Bat** connector on Controller B	supplies power to Controller B
3	3082004X02	**ETHERNET 10B2-1** connector on Junction Panel	Y-connector tap on Controller A, **10B2-1** Connector	
4	3082004X02	**ETHERNET 10B2-2** connector on Junction Panel	Y-connector tap on Controller A, **10B2-2** Connector	
5	3082004X02	**ETHERNET 10B2-3** connector on Junction Panel	Y-connector tap on Controller A, **10B2-3** Connector	
6	5882669Y01	**10B2-1** connector on Controller A	-	BNC Y-connector
7	5882669Y01	**10B2-2** connector on Controller A	-	BNC Y-connector
8	5882669Y01	**10B2-3** connector on Controller A	–	BNC Y-connector
9	5882669Y01	**10B2-1** connector on Controller B	-	BNC Y-connector
10	5882669Y01	**10B2-2** connector on Controller B	-	BNC Y-connector

Table C-1 ***T1 Site Controller cabling — continued***

Index number	Part number	From	To	Notes
11	5882669Y01	**10B2-3** connector on Controller B	-	BNC Y-connector
12	3013943N19	Y-Connector on Controller A **10B2-1** connector	Y-Connector on Controller B **10B2-1** connector	
13	3013943N19	Y-Connector on Controller A **10B2-2** connector	Y-Connector on Controller B **10B2-2** connector	
14	3013943N19	Y-Connector on Controller A **10B2-3** connector	Y-Connector on Controller B **10B2-3** connector	
15	0909906D01	-	Y-Connector on Controller B **10B2-1** connector	termination for Controller B **10B2-1**
16	0909906D01	-	Y-Connector on Controller B **10B2-2** connector	termination for Controller B **10B2-2**
17	0909906D01	-	Y-Connector on Controller B **10B2-3** connector	termination for Controller B **10B2-3**
18	3082004X02	**5 MHz/1 PPS Out 1** connector on Junction Panel	Y-connector on Controller A **Site Ref Out - 1** Connector	
19	3082004X02	**5 MHz/1 PPS Out 2** connector on Junction Panel	Y-connector on Controller A **Site Ref Out - 2** Connector	
20	3082004X02	**5 MHz/1 PPS Out 3** connector on Junction Panel	Y-connector on Controller A **Site Ref Out - 3** Connector	
21	3013943N05	Y-connector on Controller A **Site Ref Out - 1** connector	**Site Ref Out - 1** Connector on Controller B	
22	3013943N05	Y-connector on Controller A **Site Ref Out - 2** connector	**Site Ref Out - 2** Connector on Controller B	

Table C-1 ***T1 Site Controller cabling — continued***

Index number	Part number	From	To	Notes
23	3013943N05	**Site Ref Out - 3** Y-connector on Controller A	**Site Ref Out - 3** Connector on Controller B	
24	5882669Y01	**Site Ref Out-1** connector on Controller A	-	BNC Y-connector
25	5882669Y01	**Site Ref Out-2** connector on Controller A	-	BNC Y-connector
26	5882669Y01	**Site Ref Out-3** connector on Controller A	-	BNC Y-connector
27	3012028P31	**GPS A** connector on Junction Panel	**GPS** connector on Controller A	
28	3012028P31	**GPS B** connector on Junction Panel	**GPS** connector on Controller B	
29	3083499X01	**Controller A - Parallel** connector on EAS/EAS2	**Parallel** connector on Controller A	
30	3083499X01	**Controller B - Parallel** connector on EAS/EAS2	**Parallel** connector on Controller B	
31	5882449V01	-	**T1/E1 - 1** connector on Controller A	modular T-adapter
32	5882449V01	-	**T1/E1 - 2** connector on Controller A	modular T-adapter
33	3084225N48	modular T-adapter (5882449V01) on Controller A **T1/E1 - 1**	**T1/E1 - 1** connector on Controller B	
34	3084225N48	modular T-adapter (5882449V01) on Controller A **T1/E1 - 2**	**T1/E1 - 2** connector on Controller B	
35	3084225N24	**Redund** connector on Controller A	**Redund** connector on Controller B	
36	3082070X01	**CONTROL** connector on EAS/EAS2	**STATUS** connector on Circuit Breaker Panel	
37	3082505Y12	**10/100B-T** connector on Controller A	**10/100B-T** connector on Controller B	

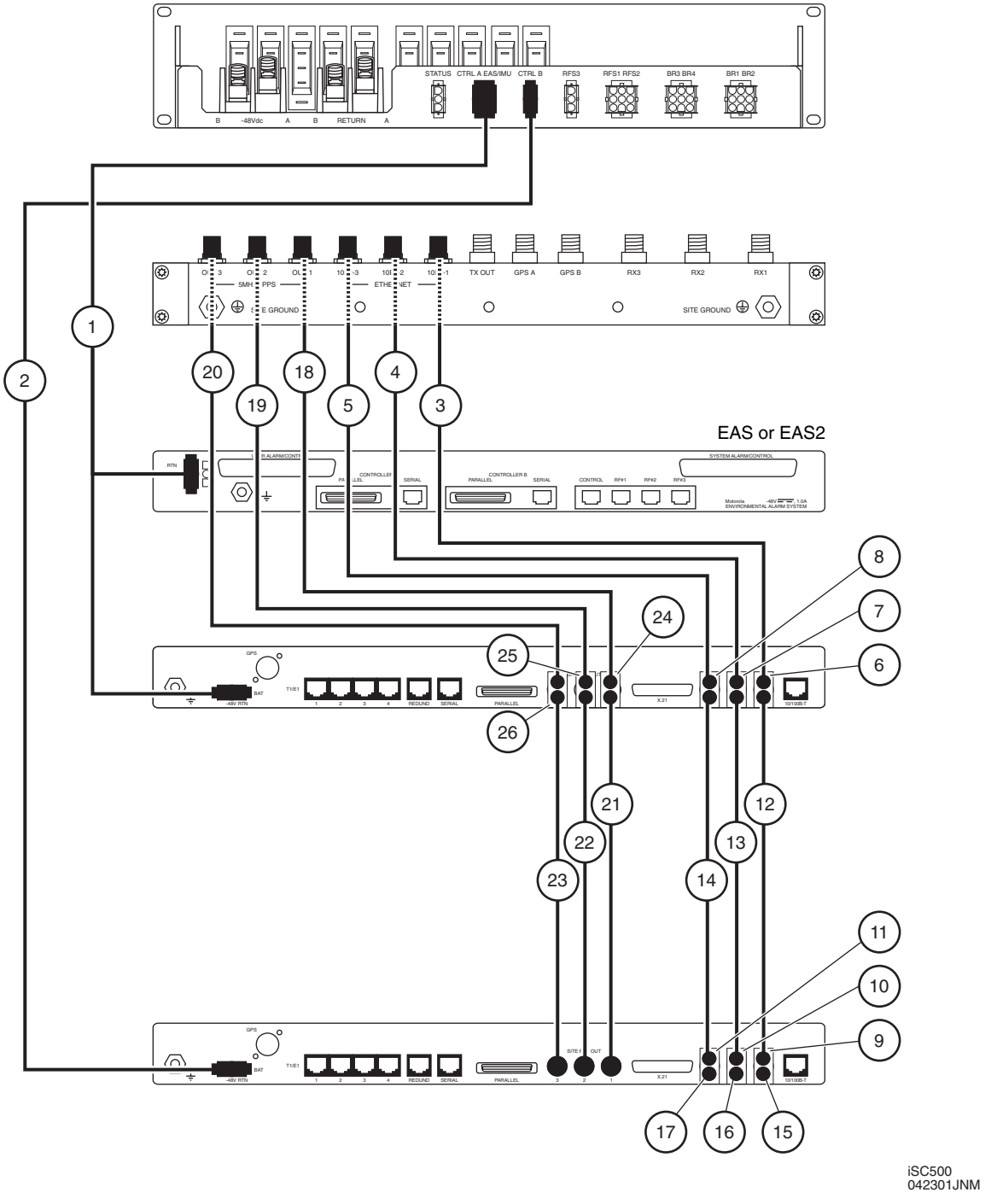


Figure C-1 ***Power, Ethernet, and Site Reference Cabling Diagram***

Site Controller Cabling

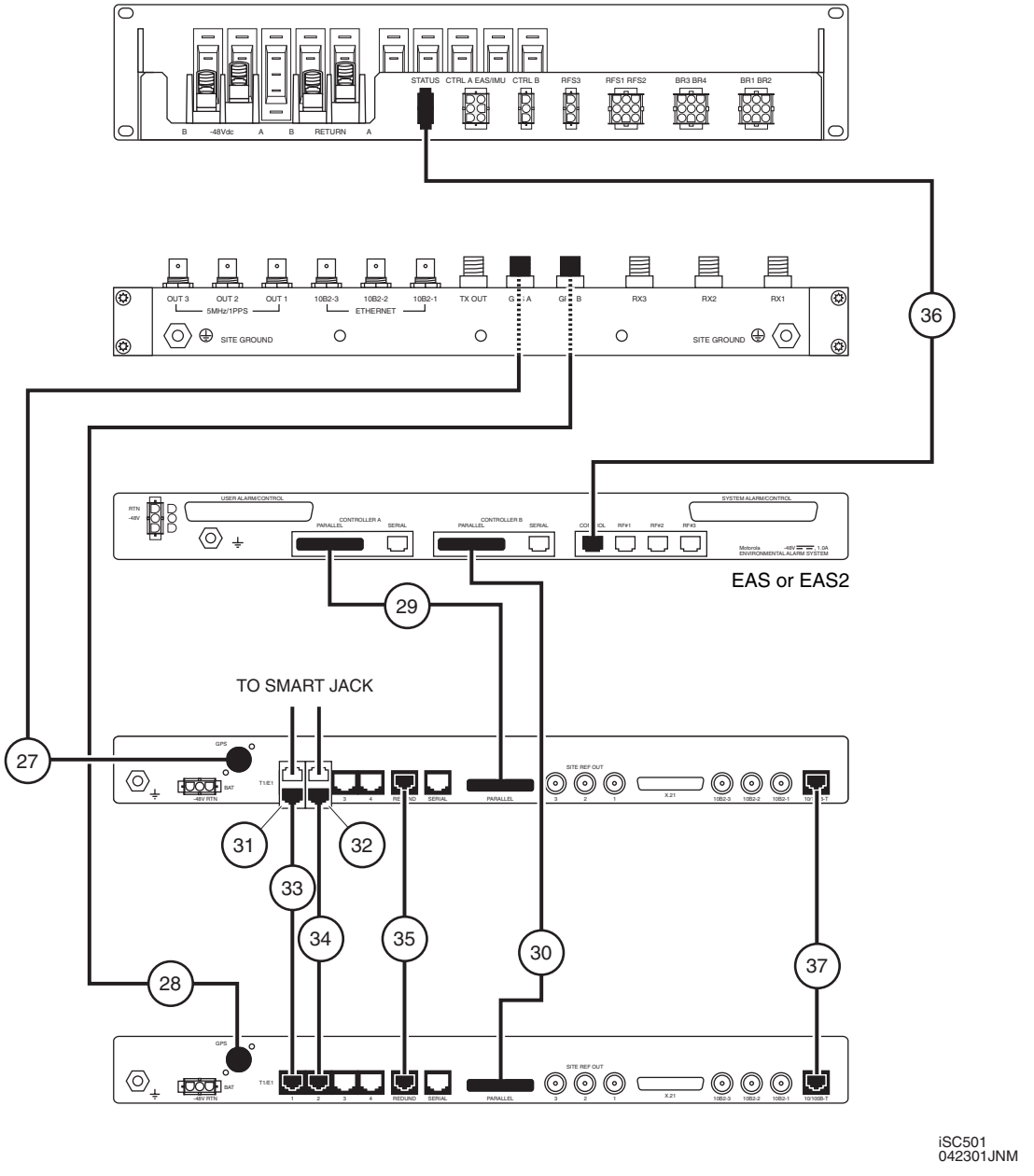


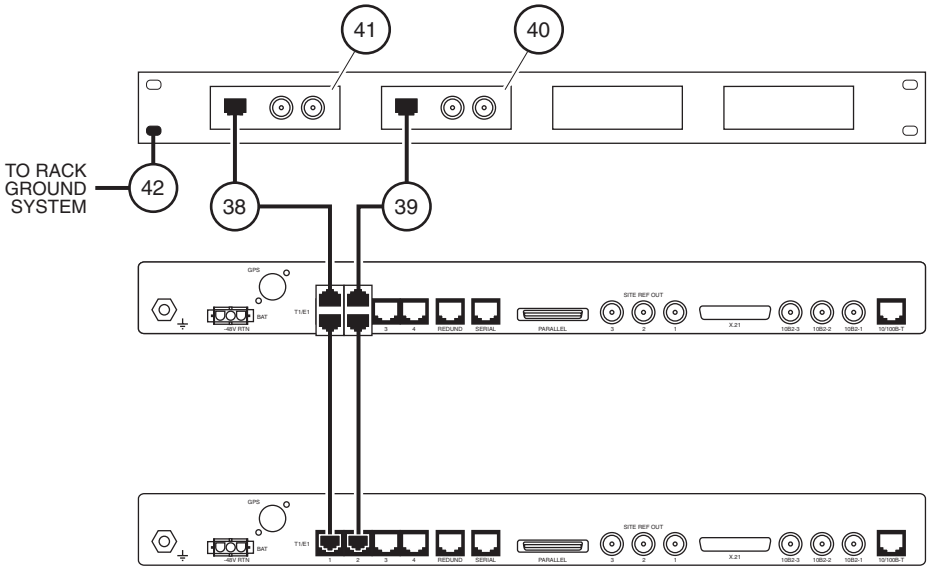
Figure C-2 ***EAS or EAS2/iSC Interconnect Cabling Diagram***

Table C-2 identifies and Figure C-3 shows site controller E1 75Ω (2.048 Mb) cabling.

Note: All cabling for E1 75Ω Control Racks is the same as that shown in Table C-1. In addition, the following cables shown in Table C-2 are necessary for E1 75Ω communication.

Table C-2 ***Site Controller E1 75 Ω (2.048 Mb) cabling***

Index number	Part number	From	To	Notes
38	3084225N48	Modular T-Adapter on Controller A, **T1/E1-1** Connector	**E1-1** 75Ω Balun transformer	
39	3084225N48	Modular T-Adapter on Controller A, **T1/E1-2** Connector	**E1-2** 75Ω Balun transformer	
40	0182694Y01	-	-	75Ω Balun transformer
41	0182694Y01	-	-	75Ω Balun transformer
42	3082000X12	Mounting screw on Balun panel	Rack Ground system	



iSC502
032801JNM

Figure C-3 ***75Ω E1 (2.048 Mb) Cabling***

Table C-3 identifies and Figure C-4 shows site controller E1 120Ω (2.048 Mb) cabling.

Note: All cabling for E1 120Ω Control Racks is the same as that shown in Table C-1 (Site Controller T-1 Cabling) . In addition, the following cables shown in Table C-3 and Figure C-4 are also included for E1 120Ω communication.

Table C-3 ***Site Controller E1 120 Ω (2.048 Mb) cabling***

Index number	Part number	From	To	Notes
43	3082468Y03	Modular T-Adapter on Controller A, **T1/E1-1** Connector	Network	
44	3082468Y03	Modular T-Adapter on Controller A, **T1/E1-1** Connector	Network	

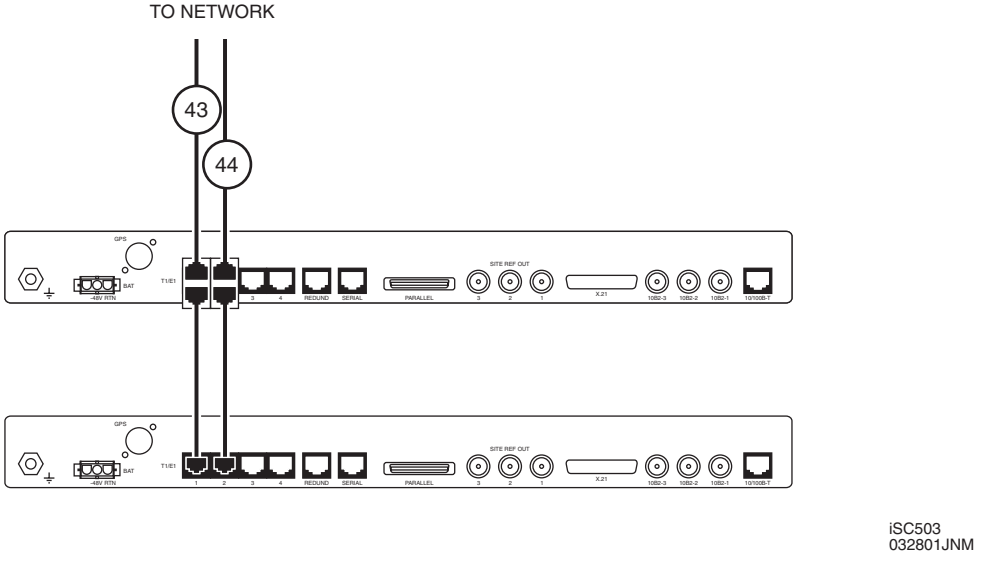


Figure C-4 ***120 Ω (2.048 Mb) E1 Cabling***

A

Alarm
EAS/EAS2 checkout 6-25
intercabinet cable ordering information B-13
intrusion alarm ordering information B-7
ordering information for different types B-6
required system equipment 3-24
site alarm wiring part numbers B-8
smoke alarm ordering information B-7
temperature alarm ordering information B-7
wiring 3-22

Antenna
GPS amplifier ordering information B-6
GPS antenna identification 3-21
GPS antenna planning 3-19
GPS antenna requirements 3-20
GPS surge arrestor ordering information B-3
surge arrestor location 3-19
surge arrestor ordering information B-2

B

Base Monitor Radio
rf attenuator ordering information B-3

Base Radio
loading software 6-12
registration and status procedures 6-15

C

Cabling
for 5 MHz/1 PPS 4-18
for alarm system 4-40
for alarms 4-29
for ethernet 4-24
for GPS antennas 4-40
for PCCH 4-39
iSC C-2
iSC to telephone network T1 4-56
ordering information for wire lugs B-9
power connection ordering information B-15
sectored site cables 4-12
T1 interface 4-58

Commands
MMI 6-2
MMI commands 8-2

Controller
command responses 7-3
description 9-2
dimensions 3-4
front panel connectors 9-5
front panel CPU reset switch 9-4
front panel view 2-7
front view 9-2
GPS antenna connection 4-40
performance specifications 9-7
rear view 9-2, 9-6
troubleshooting the Subrated T1 PCI (STP) card 7-3

D

Description
cell site 4-2
Controller 9-2
sector site 4-2

E

Enhanced Base Transcoder System
site description 2-2

Environmental Alarm System
alarm checkout 6-25
alarm connections 4-40
connector pinouts 4-43
dimensions 3-4
front panel view 2-7
rear view 2-8

troubleshooting 7-6
Ethernet
intercabinet cabling ordering information B-13

F

Final Checkout
Powering the iSC rack 5-3
Final checkout
Circuit breakers 5-4
setup 5-2

G

Global Positioning System
antenna amplifier ordering information B-6
antenna identification 3-21
antenna planning 3-19
antenna requirements 3-20
antenna surge arrestor ordering information B-3
evaluation kit description 3-20
evaluation kit ordering information B-5
tracking criteria 3-19

I

Installation
alarm wiring 3-22
antenna 3-19
cabinet requirements 3-14
Controller dimensions 3-4
EAS/EAS2 dimensions 3-4
electrical requirements 3-12
environmental considerations 3-10
grounding requirements 3-15
site planning 3-3
special considerations 3-8
surge arrestors 3-10, 3-13
integrated Site Controller
cabling C-2
final checkout setup 5-2
list of MMI commands 8-4
powering the rack 5-3
standby status procedures 6-14
test equipment - serial 6-4
to telephone network T1 cabling 4-56
verification procedures 6-3

J

Junction Panel
for existing cabinets 4-8
for iSC cabinets 4-8

M

Man-Machine Interface
commands 8-2
Motorola Telephone Numbers
Literature Distribution Center 1-4
Technical Support 1-5

P

Performance specifications
Controller 9-7
Punch Block
alarm connections for punch block 1 3-26
alarm connections for punch block 2 3-28
for EAS/EAS2 pinouts 3-25, 3-27

Q

Quality Standards - FNE Installation Manual
1-4

R

Removal/Installation
Environmental Alarm System 12-2
Site Controller 12-3
Repair
Static Sensitive Precautions 1-7
Technical Support 1-5

S

Service Information LOT-iii
Site Reference ISA card
status procedures 6-29
Software commands
MMI commands 8-2
Subrated E1 PCI card
description 10-2, 11-2
Indicators 10-3, 11-3

Performance specifications 10-5, 11-5

Surge arrestors

AC power and Telco ordering information B-2
description 3-13
ordering information B-2

System Testing 6-1

iSC verification 6-3

System testing

Base radio registration & status 6-15
EAS/EAS2 alarm checkout 6-25
iSC post-download commands 6-11
iSC startup sequence 6-5
Loading base radios 6-12
MMI commands 6-2
Service computer start-up 6-4
SRI status 6-29
Standby iSC status 6-14
T1 connection test 6-17
test procedures 6-2

T

T1 connection test procedures 6-17

Technical Support 1-5

Telco

backboard 3-10
service entrance 3-10
surge arrestors 3-10

Test equipment

iSC 6-4
T1 custom test table 6-17

Tools, Equipment, and Parts

list of parts for installation 3-35
list of test equipment for installation 3-33
list of tools for installation 3-29

Troubleshooting

Controller command responses 7-3
description 7-2
EAS/EAS2 7-6
philosophy 7-2

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