SIEMENS

INSTALLATION

BASE STATION COMMUNICATIONS PACKAGE II (BCP II) 53410

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DOCUMENT NO. COM-00-97-20
VERSION C.1

Siemens Industry, Inc. Rail Automation
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DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	11-98		Initial Release
B	3-7-01	ALL	B Revision Released Switch from BCM to BCM II
C	3-29-13	ALL	Change from MTR2000 to MTR3000 and XCMMAINT software update.
C.1	5-8-2014	ALL	Convert to Siemens Format

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NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are frequently used to direct the reader's attention to specific information. Use of the three terms is defined as follows:

WARNING

INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY. WARNINGS ALWAYS TAKE PRECEDENCE OVER NOTES, CAUTIONS, AND ALL OTHER INFORMATION.

CAUTION

REFERS TO PROPER PROCEDURES OR PRACTICES WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN A POTENTIALLY HAZARDOUS SITUATION AND/OR POSSIBLE DAMAGE TO EQUIPMENT. CAUTIONS TAKE PRECEDENCE OVER NOTES AND ALL OTHER INFORMATION, EXCEPT WARNINGS.

NOTE

Generally used to highlight certain information relating to the topic under discussion.

If there are any questions, contact Siemens Industry, Inc. Application Engineering.

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- Ground yourself before touching card cages, assemblies, modules, or components.
- Remove power from card cages and assemblies before removing or installing modules.
- Remove circuit boards (modules) from card cages by the ejector lever only. If an ejector lever is not provided, grasp the edge of the circuit board but avoid touching circuit traces or components.
- Handle circuit boards by the edges only.
- Never physically touch circuit board or connector contact fingers or allow these fingers to come in contact with an insulator (e.g., plastic, rubber, etc.).
- When not in use, place circuit boards in approved static-shielding bags, contact fingers first. Remove circuit boards from static-shielding bags by grasping the ejector lever or the edge of the board only. Each bag should include a caution label on the outside indicating static-sensitive contents.
- Cover workbench surfaces used for repair of electronic equipment with static dissipative workbench matting.
- Use integrated circuit extractor/inserter tools designed to remove and install electrostatic-sensitive integrated circuit devices such as PROM's (OK Industries, Inc., Model EX-2 Extractor and Model MOS-40 Inserter (or equivalent) are highly recommended).
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

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SECTION 1
INTRODUCTION

1.0 INTRODUCTION

1.1 SCOPE

This manual is the installation guide for the Siemens Base Communications Package II (BCP II) Radio System. The BCP II includes the 53444 Base Control Module II (BCM II), the Motorola Base Station (MTR3000™), and the RF Duplexer (see Figure 1-1).

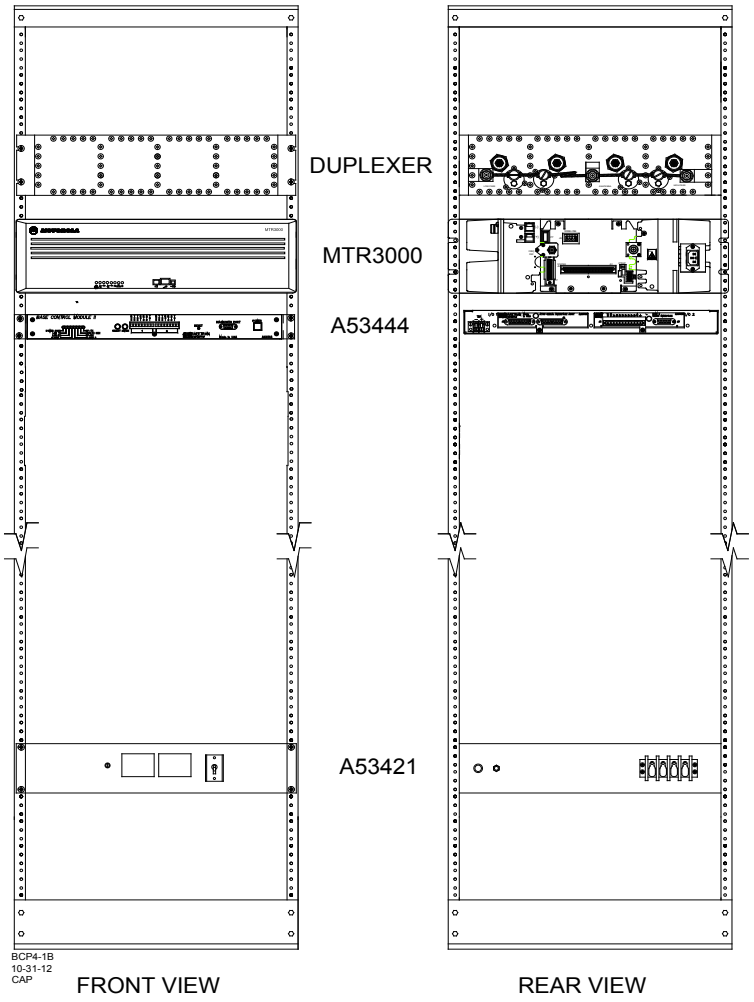


Figure 1-1 Equipment Rack Configuration

The BCP II is periodically upgraded with additional features; therefore, prospective users are encouraged to contact Siemens for the latest technical information, or to request customization

1.2 APPLICABLE DOCUMENTS

Refer to the following documentation for individual information on the BCP II components:

1. Base Control Module II (BCM II) 53444 Installation Manual (Siemens Document No. COM-00-01-02)
2. MTR3000™ 800 and 900 MHz Base Station, Repeater for Analog Conventional, and Trunking Systems (Motorola Installation and User Manual No.68007024098)
3. MTR3000™ 800 and 900 MHz Base Station, Repeater (Detailed Service Manual No. 68007024097)
4. Installation and Tuning Instructions for Q-Circuit Res-Lock Duplexers (Sinclair Document No. CM-1009)

1.3 SYSTEM OVERVIEW

- Separate modules simplify system maintenance issues and provide for more flexible installation options.
- RS-232 / RS422 connection option on two BCM II client ports
- 16-character front-panel BCM II display provides clear diagnostic messages
- BCM II Front-panel push-button configuration – no laptop needed during routine maintenance
- Inbound RSSI reading provides additional system information of signal strength at BCM II location
- Optional BCM II on-board ladder-logic processing for code system applications
- BCM II protocol emulation and conversion of many industry standard code-line protocols
- Full non-volatile BCM II event log built in with hardware real-time clock
- Full duplexer operation at 4800 baud using GMSK direct FM signaling with extensive error detection and correction (software upgradable to 9600 baud)
- MTR3000™ 900 MHz transmitter RF Power Output (adjustable between 8 and 100 watts)

1.4 SPECIFICATIONS

1.4.1 BCM II

Input Voltage:	9V to 36VDC
Input Isolation:	2000V rms
Power Consumption:	200mA @ 13.5V
Dimensions:	17.5 inches (44.45 centimeters)wide 1.75 inches (4.45 centimeters) high 8 inches (20.32 centimeters) deep
Weight:	7.5 pounds (3.375 kilograms) (approximately)
Operating Temperature Range:	-22°F to +140°F (-30°C to +60°C)

1.4.2 Duplexer

Dimensions:	16.5 inches (41.91 centimeters) wide 4.28 inches (10.87 centimeters) high 5.5 inches (13.97 centimeters) deep
Weight:	15 pounds (6.75 kilograms) (approximately)

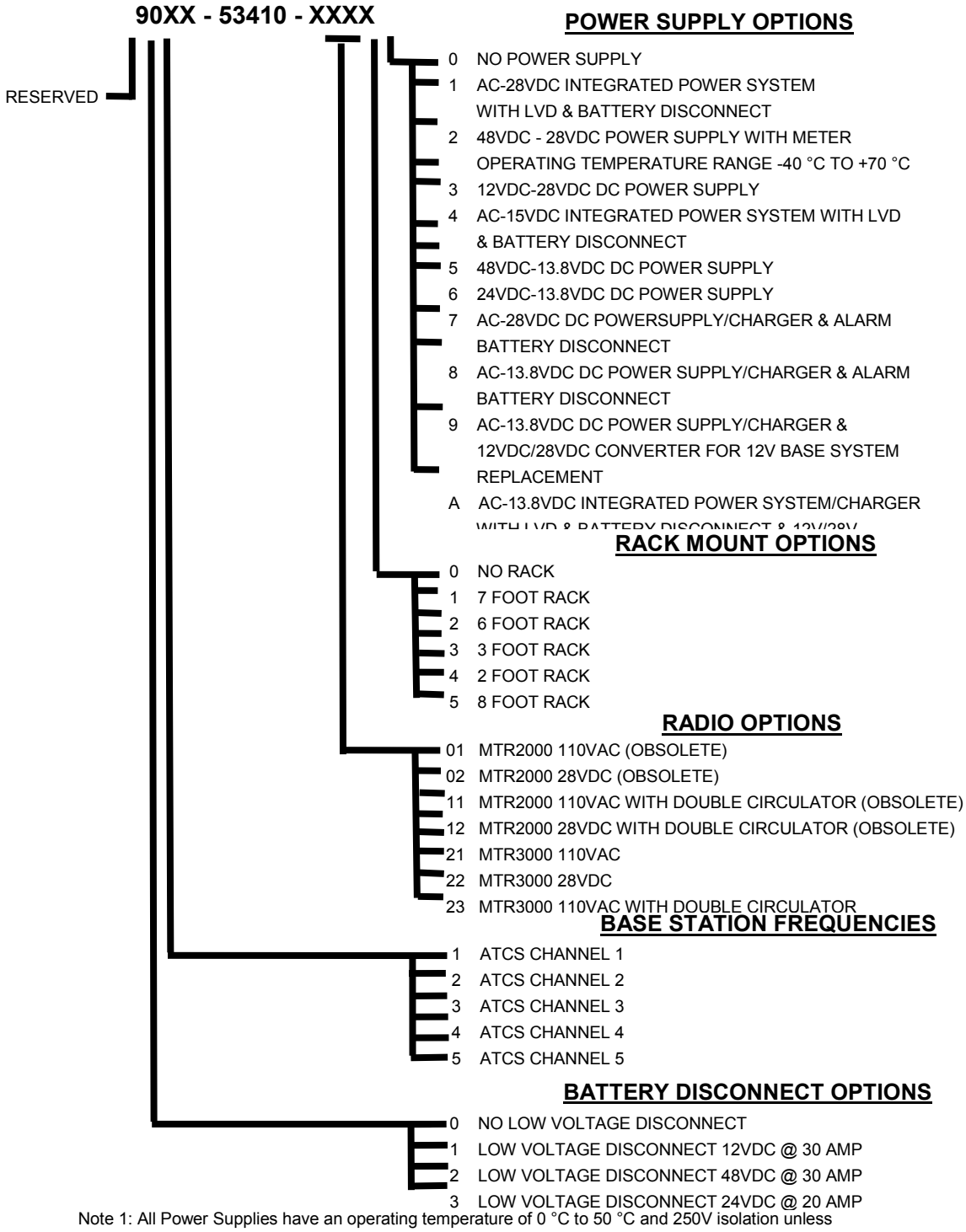
1.4.3 Base Communications Package

Dimensions:	19 inches (48.26 centimeters) wide (standard rack mount) 14.75 inches (37.47 centimeters) high (approximately) 16.5 inches (41.9 centimeters) deep
Rack Weight:	34 pounds (15.3 kilograms)
Package Weight:	113 pounds (50.85 kilograms)
System Operating Temperature Range:	-22°F to +140°F (-30°C to +60°C)

1.5 ORDERING INFORMATION

1.5.1 BCP II Configuration Options

The various configuration options available for the BCP II are provided in the BCP II Configuration Chart, Figure 1-2. To order, specify the basic BCP II part number (9000-53410) plus the applicable dash numbers.



Note 1: All Power Supplies have an operating temperature of 0 °C to 50 °C and 250V isolation unless otherwise specified

Note 2: Integrated Power Systems incorporate the following:

1. Power Supply/Battery Charger
2. Battery Backup Transfer for 300 AmpHours of Battery
3. Status Indicators & Meters
4. Alarms (Form "C" Contact) for AC input and DC output failure
5. Low Voltage Disconnect (LVD) to protect battery from excessive low voltage discharge

Note 3: Power Supply/Charger with meters and Form "C" contacts for output power failure

Figure 1-2 BCP II Configuration Chart

1.5.2 BCP II Interconnection Cables

The interconnection cables for the BCP II are listed in Table 1-1. See also paragraph 4.4.

Table 1-1 BCM II Interconnection Cables and Accessories

Description	Quantity Included	Order Number
Male N to male N RF cable	1 ea.	Z706-02008-0005
96-pin DIN (Eurocard) to 25-pin D and two 18 AWG leads with spade lug termination	1 ea.	9000-26762-00001
AMP Power Lock connector	1 ea.	53884-3 (AMP part number)
AMP Power Lock connector	1 ea.	53884-4 (AMP part number)
AMP 10/12 AWG insulated ring lug	1 ea.	54330-1 (AMP part number)
110-volt AC line cord	1 ea.	Z706-02010-0008
12-pin I/O connector plug	1 ea.	Z715-09158-0000
Eurostyle® terminal block to spade lug	1 ea.	Z715-09111-0000
Male 8-pin RJ45 to male 8-pin RJ45	1 ea.	Z927-01111-0000
RJ45 to DB25 male adapter	1 ea.	Z715-09060-0008

1.5.3 RF Cable Options

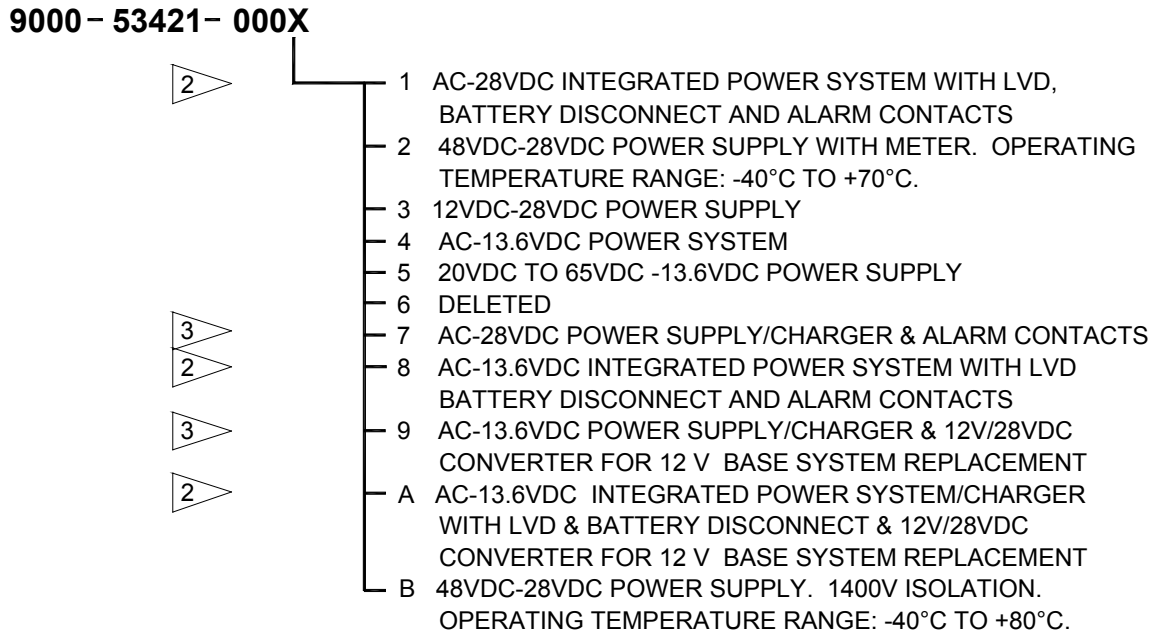
The RF cable options available for the BCP II are listed in Table 1-2. See also paragraph 5.1.

Table 1-2 RF Cable and Adapter Options

Description	Quantity Included	Order Number
Low loss 5ft. 0.5in. Superflex Cable Type N male to type N male	1 ea.	Z801-08475-0005
Low loss 5ft. 0.5in. Superflex Cable Type N male to type N male right angle	1 ea.	Z706-02008-0005

1.5.4 DC Power Options

Power supply options are determined by the input power available to the BCP II. Power options available for the BCP II are provided in the BCP II Power Options Chart, Figure 1-2. To order, specify the basic BCP II power supply part number (9000-53421-000) plus the applicable option number from Figure 1-2. See also paragraph 5.2.



BCP1-2
2-16-01

Note 1: All Power Supplies have an operating temperature of 0°C to 50°C and 250V isolation unless otherwise specified.

Note 2: Integrated Power Systems Incorporate the following:
1. Power Supply/Battery Charger
2. Battery Backup Transfer for 300 AmpHours of Battery
3. Status Indicators & Meter
4. Alarms (Form "C" Contact) for AC input and DC output failure
5. Lov Voltage Disconnect (LVD) to protect battery from excessive low voltage discharge.

Note 3: Power Supply/Charger with meters and (Form C contacts for output power failure)

Figure 1-2 BCP II Power Options Chart

1.5.5 Battery Charger Option

The battery charger option available for the BCP II is listed in Table 1-3. See also paragraph 5.2.1.

Table 1-3 Battery Charger Option

Description	Quantity Included	Siemens Order Number
24V – 30VDC, 10 ampere	1 ea.	Z931-01135-0030

1.5.6 Surge Panel Options

The surge panel options available for the BCP II are listed in Table 1-4. See also paragraph 5.2.2.

Table 1-4 Surge /Low Voltage Disconnect Panel Options

Description	Quantity Included	Siemens Order Number
18VDC - Single DC voltage surge panel	1 ea.	5000-43012-0023
32VDC - Single DC voltage surge panel	1 ea.	5000-43012-0013
110VAC & 32VDC - Dual voltage surge panel	1 ea.	5000-43012-0021
110VAC & 18VDC - Dual voltage surge panel	1 ea.	5000-43012-0022

1.5.7 Power Strip Option

The power strip option available for the BCP II is listed in Table 1-5. See also paragraph 5.2.1.

Table 1-5 Power Strip Option

Description	Quantity Included	Siemens Order Number
AC power strip with 20 ampere circuit breaker and surge protector	1 ea.	Z927-04841-0000

1.5.8 Double Circulator Options

The double circulator options available for the BCP II are listed in Table 1-6. See also paragraph 5.3.1.2.

Table 1-6 Double Circulator Options

Description	Quantity Included	Siemens Order Number
Shelf for CLF1290	1 ea.	Z927-04827-0000
*Double circulator shelf to MTR3000 backplane interface cable	1 ea.	30-85431-U03 (Motorola part number)
Thermistor cable assembly	1 ea.	Z706-02010-0000

1.5.9 Field Replacement Parts

The field replacement parts available for the BCP II is listed in Table 1-7.

Table 1-7 Field Replacement Parts

Description	Quantity Included	Siemens Order Number
DC fuse: SMT 0.5 AMP fast-acting for MTR3000 (P/N R451005)	2 ea.	Z843-00007-0005

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SECTION 2
FUNCTIONAL DESCRIPTION

2.0 FUNCTIONAL DESCRIPTION

2.1 BASE COMMUNICATIONS PACKAGE OVERVIEW

The BCP II is used in an Advanced Train Control System (ATCS) data network (See Appendix A) to perform the following general functions:

- Provide the interface between Cluster Controller (CC) and "upstream" office equipment
- Deliver ATCS messages to and receive messages from field equipment via an RF link.

2.2 BCP II FUNCTIONAL DESCRIPTION

The main functional components of the BCP II are shown in Figure 2-1. The MTR3000™ is a full duplex base station capable of simultaneously receiving and transmitting messages over the RF link.

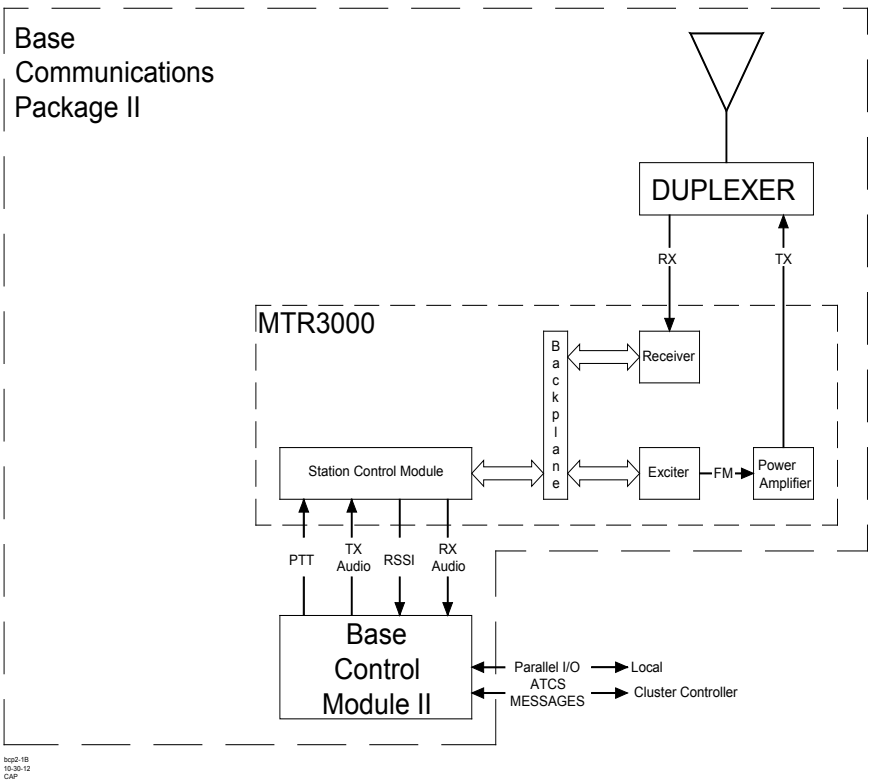

Figure 2-1 BCP II Simplified Block Diagram

ATCS messages received from the field are processed by the BCP II as follows:

1. The RF signal is routed from the antenna, through the duplexer, to the front-end of the base station Receiver, where it is demodulated to a wideband audio signal.
2. The amplitude of the wideband audio signal is detected by the Station Control Module (SCM), producing a proportional DC voltage, the Received Signal Strength Indication (RSSI) signal.
3. The SCM routes the RSSI and the wideband audio (RX Audio) signals to the BCM II.
4. Within the BCM II, the ATCS data is extracted from the RX Audio signal and compiled with the RSSI signal into an ATCS datagram.

NOTE

NOTE

RSSI information is encoded into the datagram to allow "upstream" CCs to determine the BCP IIs best able to access (communicate with) other RF devices of the network, such as WCPs.

5. The BCM II transmits the ATCS message (datagram) via modem to the CC.

ATCS messages received from the CC via modem are processed by the BCP II as follows:

1. The BCP II reads the datagram's destination ATCS address.
2. If the address is that of the BCP II, the BCP II responds to the message as appropriate.
3. If the destination address of the ATCS message is that of a field device, the message within the datagram is converted to a sinusoidal (wideband audio) format and routed to the Base Station's SCM as the TX Audio signal. At the same time, the BCM II initiates a Push-To-Talk (PTT) request signal to the SCM.
4. In response to PTT, the SCM transfers the audio signal to the Exciter circuit, where it is converted to a FM modulated carrier (FM) signal.
5. The FM signal is amplified by the Power Amplifier and applied to the duplexer as the TX signal. This signal passes through the duplexer to the antenna.
6. The TX signal is transmitted over the RF channel.

The BCP II initiates ATCS messages to field devices via the RF link or to the CC. BCP II message origination is determined by the BCP II codeplug configuration (see Appendix C). For example, the BCP II may be configured to originate messages when alarm inputs are energized and/or to originate BCP II status messages to the CC.

BCP II intelligence is provided by the BCM II. Control of the MTR3000™ is exercised by means of cable A26762 between BCM II connector J3 and MTR3000™ backplane System connector J5.

SECTION 3
BCP II CONNECTORS

3.0 BCP II CONNECTORS

3.1 GENERAL

This section describes the connectors involved in BCP II equipment installation.

3.2 BCM II EXTERNAL CONNECTORS

The BCM II is equipped with six connectors (see Figure 3-1) which include two 25-pin D-type client port connectors, a 15-pin D-type radio connector, a 9-pin D-type diagnostic connector, a 12-pin I/O connector and a 2-terminal power connector. The pin assignments for each of these connectors are described in the following paragraphs.

3.2.1 25-Pin D-Type Client Port Connectors (Female)

The female, 25-pin, D-type connectors (J1 and J2) located on the 23388 ATCS Serial Interface Assembly panel at the back of the BCM II enclosure provide serial client ports that can be configured for RS-232 or RS-422 operation. Similarly, for synchronous protocols, the direction of the transmit clock for each port is software configurable to work either as a DCE or DTE device. Table 3-1 25-Pin Female D-Type Connector Pin Assignments lists the pin assignments for the 25-pin connectors. See paragraph 3.2.1.1 for client port interface cable requirements.

Table 3-1 25-Pin Female D-Type Connector Pin Assignments

Pin	RS-232	RS-422
2	Tx Data out	Tx data (-) out
3	Rx Data in	Rx data (-) in
4	RTS out	RTS (-) out
5	CTS in	CTS (-) in
7	Common	Common
9		Rx Clock (+) in
12		Tx Clock (+) in
13		CTS (+) in
14		Tx data (+) out
15	Tx clock in	Tx clock (-) in
16		Rx data (+) in
17	Rx clock in	Rx clock (-) in
18		Tx clock (+) out
19		RTS (+) out
24	Tx clock out	Tx clock (-) out

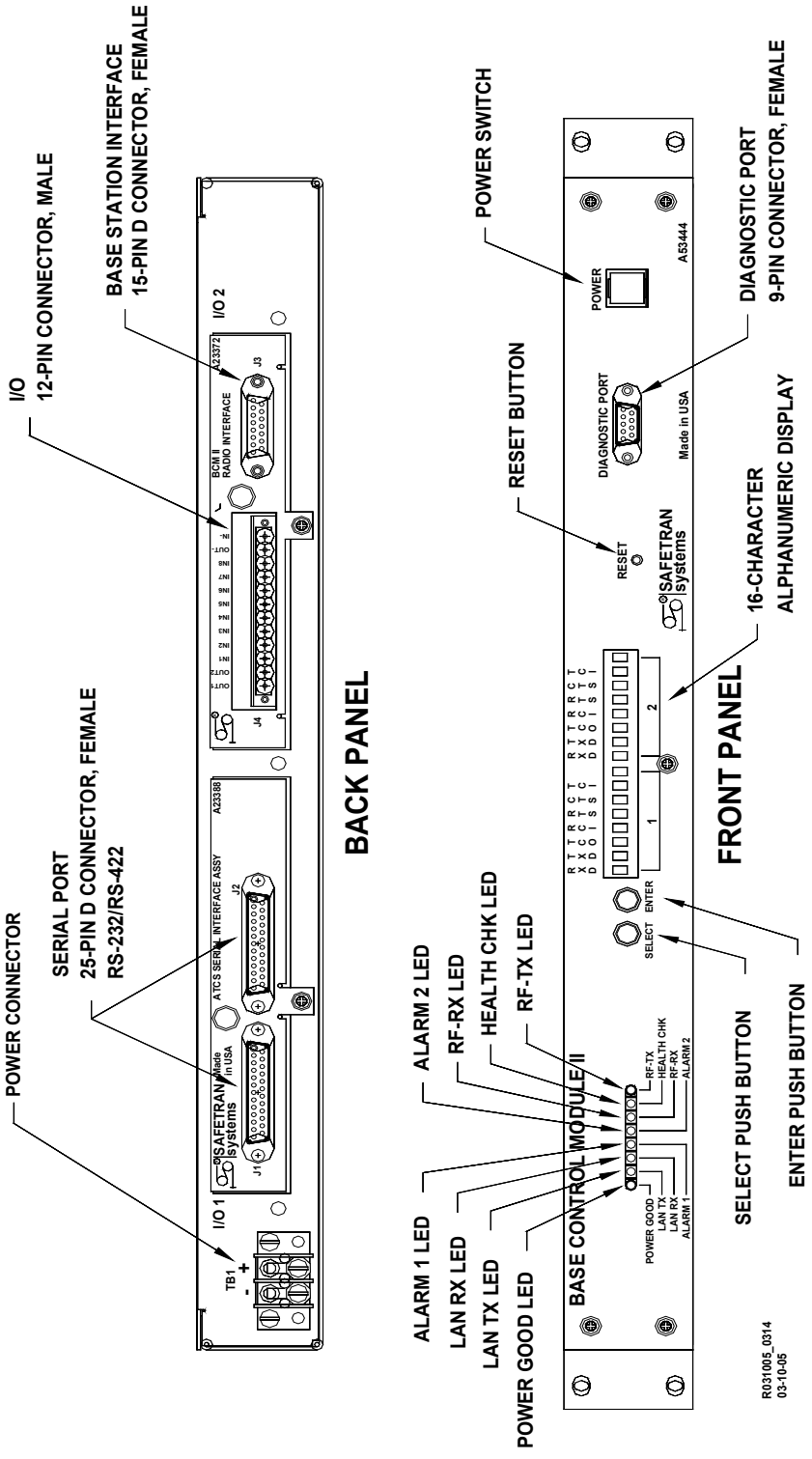

Figure 3-1 BCM II External Connectors

3.2.1.1 Client Port Interface Cable Requirements

The client port interface cable used to connect 25-pin connector J1 or J2, located on the back panel of the BCM II, to a modem, consists of 8-conductor RJ45 cable and two RJ45-to-DB25 male adapters. This is a straight-through cable with the following pin connections on the adapters:

RJ-45 Pin	Description	DB-25 Pin	Description
1	TX Data Out	2	TX Data Out
2	TX Clock Out	3	RX Data In
3	RTS Out	4	RTS Out
4	RX Data In	5	CTS In
5	RX Clock In	7	Ground (Common)
6	CTS In	15	TX Clock In
7	TX Clock In	17	RX Clock In
8	Ground (Common)	24	TX Clock Out

NOTE

NOTE

Do not use a standard RS-232 or other 25-pin cable for this connection when interfacing to a modem. Use only the cable specified by Siemens. Failure to do so could result in improper operation of the BCM II.

3.2.2 9-Pin D-Type Diagnostic Connector (Female)

The female, 9-pin, D-type connector (Diagnostics) located on the front panel provides access to the BCM II diagnostic and configuration data during maintenance operations. Table 3-2 9-Pin Female D-Type Connector Pin Assignments lists the pin assignments for this connector. Use a straight-through cable to connect to the diagnostic computer.

Table 3-2 9-Pin Female D-Type Connector Pin Assignments

Pin	Function
2	Tx data out
3	Rx data in
5	Common
7	RTS out
8	CTS in

3.2.3 Terminal Power Connector (TB1)

The two-terminal power connector is a standard terminal strip with screw terminals. Polarity is clearly marked on the BCM II rear panel directly above the terminal strip. The left terminal is negative (–) and the right terminal is positive (+)

3.2.4 15-Pin D-Type Radio Connector (Female)

The female, 15-pin, D-type connector (J3) located on the 23372 BCM II Radio Interface panel at the back of the BCM II enclosure provides interface to the BCP II radio. Table 3-3 15-Pin Female D-Type Connector Pin Assignments lists the pin assignments for the 15-pin connector.

Table 3-3 15-Pin Female D-Type Connector Pin Assignments

Pin	Function
1	Channel Active (MCS2000 applications only)
2	Radio Push to Talk out (PTT)
3	TX Audio
4	Analog Ground
5	RX Audio
6	Carrier Operated Relay (COR)
7	Reset (MCS2000 applications only)
8	Digital Ground
9	SB9600 bus (+) (MCS2000 applications only)
10	SB9600 bus (-) (MCS2000 applications only)
11	Analog Ground
12	RSSI
13	SB9600 bus busy (MCS2000 applications only)
14	Status (MCS2000 applications only)
15	Digital ground

3.2.5 12-Pin I/O Connector (Male)

The male, 12-pin, I/O connector (J4) located on the 23372 BCM II Radio Interface panel at the back of the BCM II enclosure provides 8 opto-isolated input connections and 2 opto-isolated output connections. Table 3-4 12-Pin Male I/O Connector Pin Assignments lists the pin assignments for the 12-pin connector.

Table 3-4 12-Pin Male I/O Connector Pin Assignments

Pin	Function
1	Output 1
2	Output 2
3	Input 1
4	Input 2
5	Input 3
6	Input 4
7	Input 5
8	Input 6
9	Input 7
10	Input 8
11	Output common negative (–)
12	Input common negative (–)

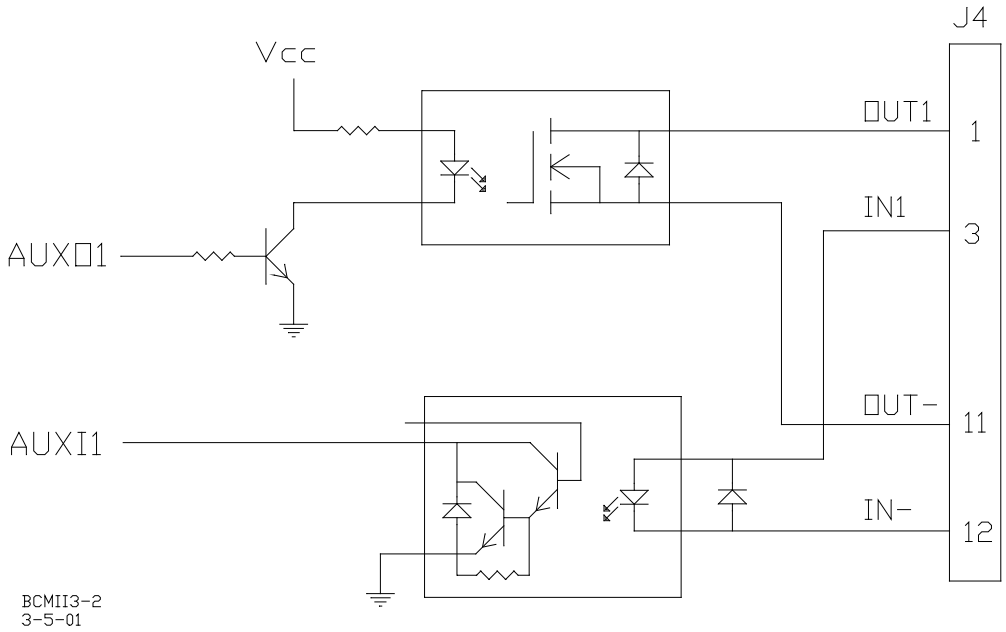

Figure 3-2 Typ. Internal Circuit of Aux DC I/O Ports (23372 Conn J4)

3.2.6 LED Indicators

There are eight LEDs on the front panel of the BCM II. Table 3-5 describes the functions of the LED indicators.

Table 3-5 BCM II LED Indicator Descriptions

Descriptor	Description	Color
POWER GOOD	On solid when power is connected	Green
LAN TX	Not used	Red
LAN RX	Not used	Red
ALARM 1	Not used	Red
ALARM 2	Not used	Red
RF-RX	On when receiving RF	Red
HEALTH CHK	Blinks when executive software is running	Red
RF-TX	On when transmitting RF	Red

Figure 3-3 shows the LED indicator configuration on the BCM II front panel.

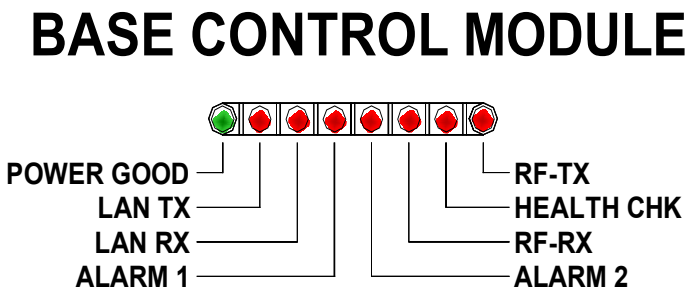

Figure 3-3 BCM II LED Indicators

3.3 MTR3000™ EXTERNAL CONNECTORS

The MTR3000™ has five external connectors that are utilized during BCP II installation (see Figure 3-4). These connectors include an N-type transmit RF connector, an N-type receive RF connector, a DB-25 Female TX/RX Audio Signal connector, a three-pin AC power connector and a two-pin DC power connector, and a 96-pin Eurocard DIN-type system connector. The pin assignments for the 96-pin connector are described in the following paragraph.

3.3.1 96-Pin Eurocard DIN-Type System Connector (Female)

The female, 96-pin, Eurocard DIN-type connector (J5 System) is located at the back of the MTR3000™ on the Backplane Interconnect Board. This connector, along with the 25-pin D-Type on J7 system provides package connection with the BCM II. Table 3-7 lists the applicable pin assignments for this connector. For BCP II's configured for 115 VAC power, this connector also provides DC power (14.2 VDC) to the BCM II and for BCP II's configured for 28.6VDC power. Table 3-6 lists the applicable pin assignments for this connector.

Table 3-6 96-Pin Eurocard Connector Pin Assignments

Pin	Row	Function
11	C	RSSI
20	A	+ 5VDC
27	A	Ground
27	B	Ground
27	C	Ground
18	C	+ 14.2 VDC
18	B	+ 14.2 VDC
18	A	+ 14.2 VDC
31	C	Ground
31	B	Ground
31	A	Ground

Table 3-7 25-Pin D-Type Connector Pin Assignments

Pin	Function
1	TX Audio (Input)
2	PTT
7	RX Audio (Output)
9	Ground

3.4 MTR3000™ INTERNAL CONNECTORS

The MTR3000™ has four external connectors that are used during BCP II installation (see Figure 3-5). These connectors include a four-pin RJ22-type service speaker connector, an eight-pin RJ-type RSS connector, and an eight-pin RJ-type service microphone connector.

3.5 Q4220E DUPLEXER EXTERNAL CONNECTORS

The Q4220E is equipped with three N-type RF connectors (see Figure 3-6): a low pass (receive), connector, a high pass (transmit) connector, and an antenna connector.

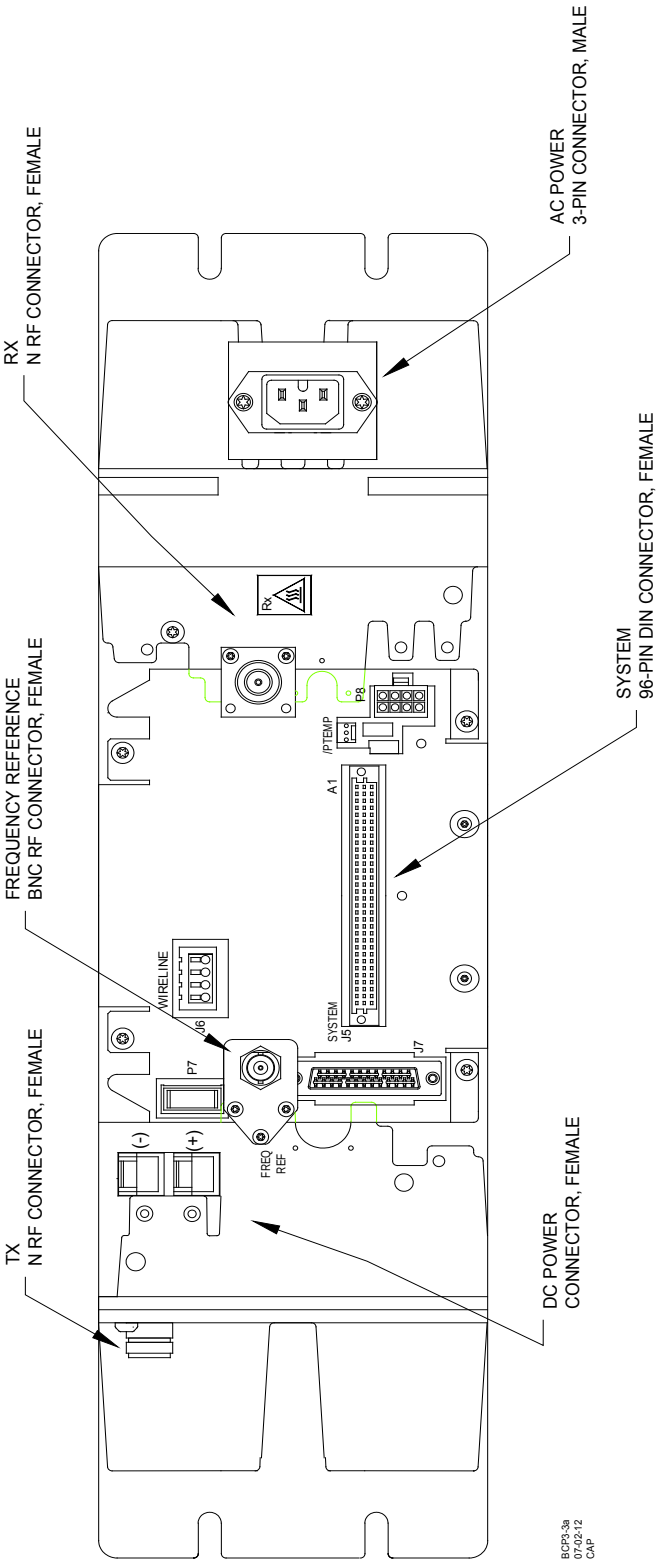

Figure 3-4 MTR3000™ - Model T3000A External Connectors

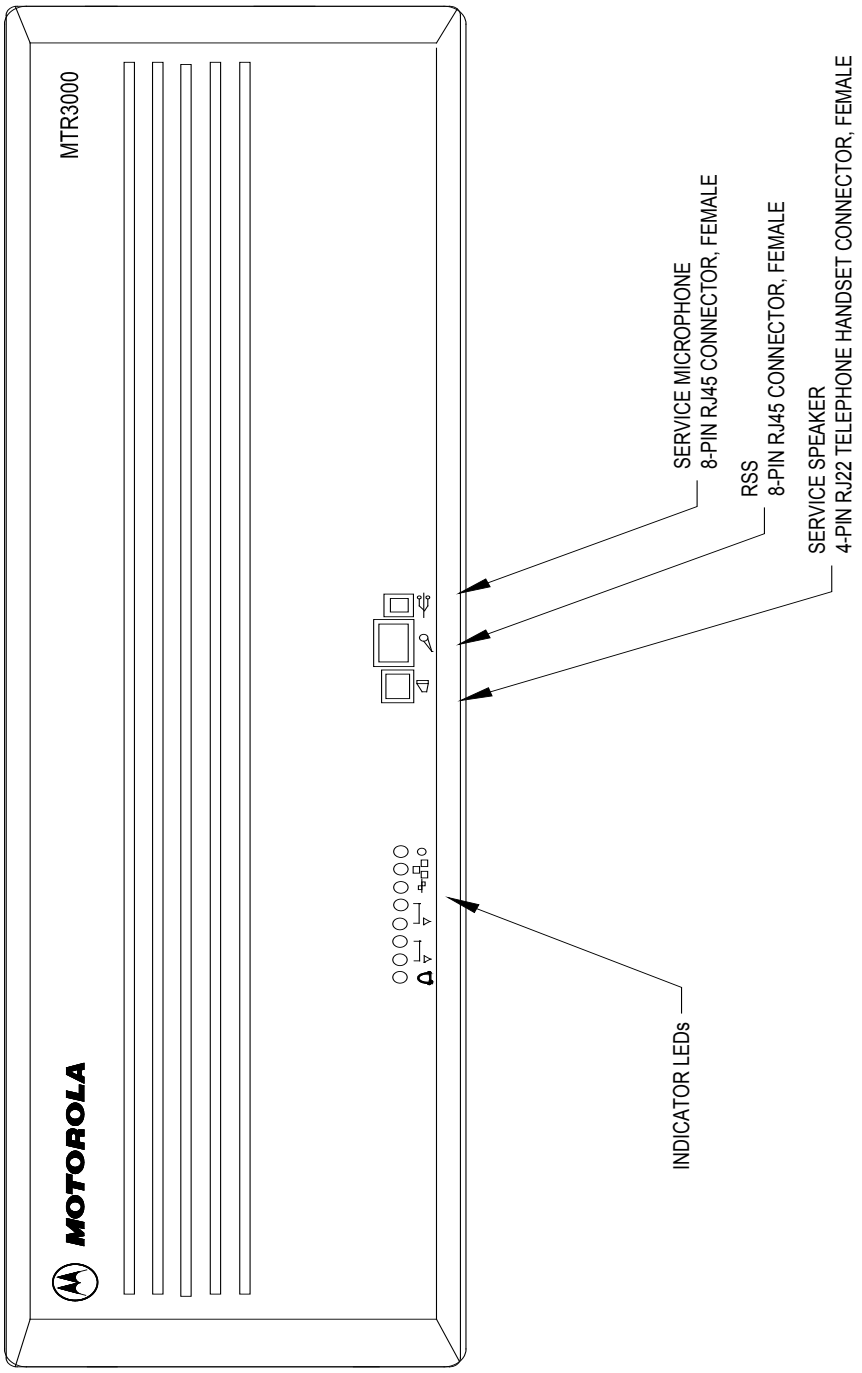

Figure 3-5 MTR3000™ Station Control Module Indicators and I/O

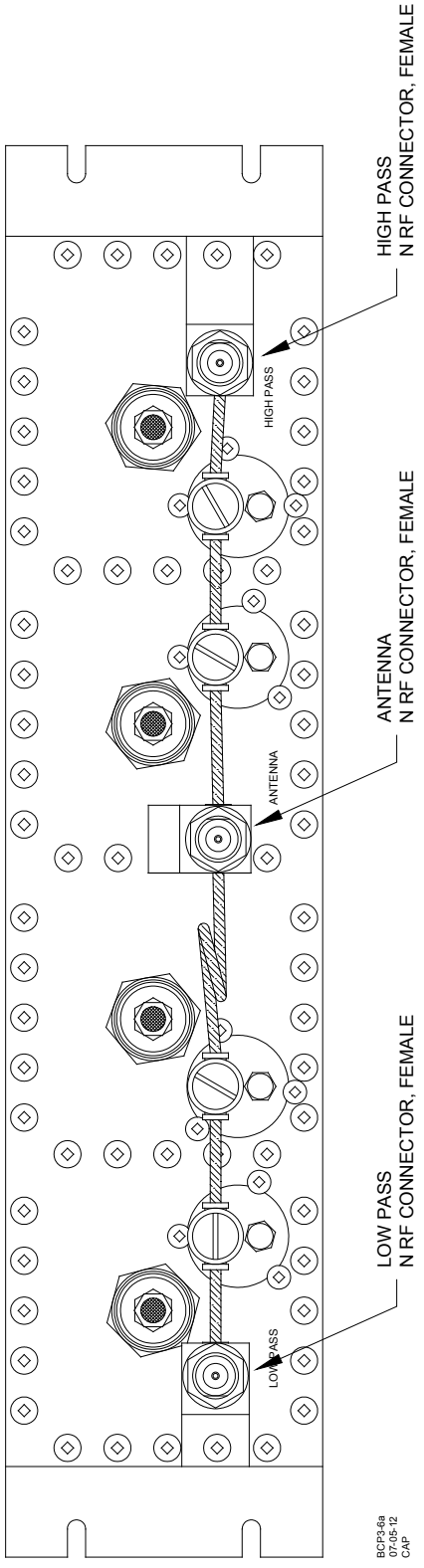

Figure 3-6 Q4220E Duplexer I/O Connectors

SECTION 4
INSTALLATION

4.0 INSTALLATION

The components of the BCP II are designed for standard 19-inch rack mounting. A typical rack-mount configuration is shown in Figure 4-1.

4.1 VENTILATION REQUIREMENTS

The MTR3000™ is equipped with cooling fans that are used to provide forced convection cooling. The remaining components of the BCP II do not require forced ventilation and are rated for industrial temperatures.

⚠ CAUTION

CAUTION

MAXIMUM AMBIENT TEMPERATURE FOR THE MTR3000 SHOULD NOT EXCEED +60 °C (+140 °F) POOR PERFORMANCE AND/OR COMPONENT DAMAGE MAY OCCUR.

4.2 POWER

The BCP II may be configured for either DC or AC operation. DC power may be provided by customer-supplied battery power, or by one of several power-supply options. Refer to Section V for a complete listing of BCP II power options.

4.3 GROUNDING AND SURGE SUPRESSION

Grounding and surge protection recommendations for the BCP II are provided in Appendix D.

4.4 BCP II INTERCONNECT CABLING

A typical BCP II installation is shown in Figure 4-1. The MTR3000™ will operate on AC, DC, or AC with DC Backup. The interconnect diagram shows both AC and DC power connections. The Siemens Rail A53421 48 VDC to 28.6 VDC DC-to-DC Converter is shown in the diagram. All necessary information is provided on the diagram and in Table 4-1. The cable numbers listed in the left column of Table 4-1 correspond to the cable numbers (e.g. #4) appearing on Figure 4-2.

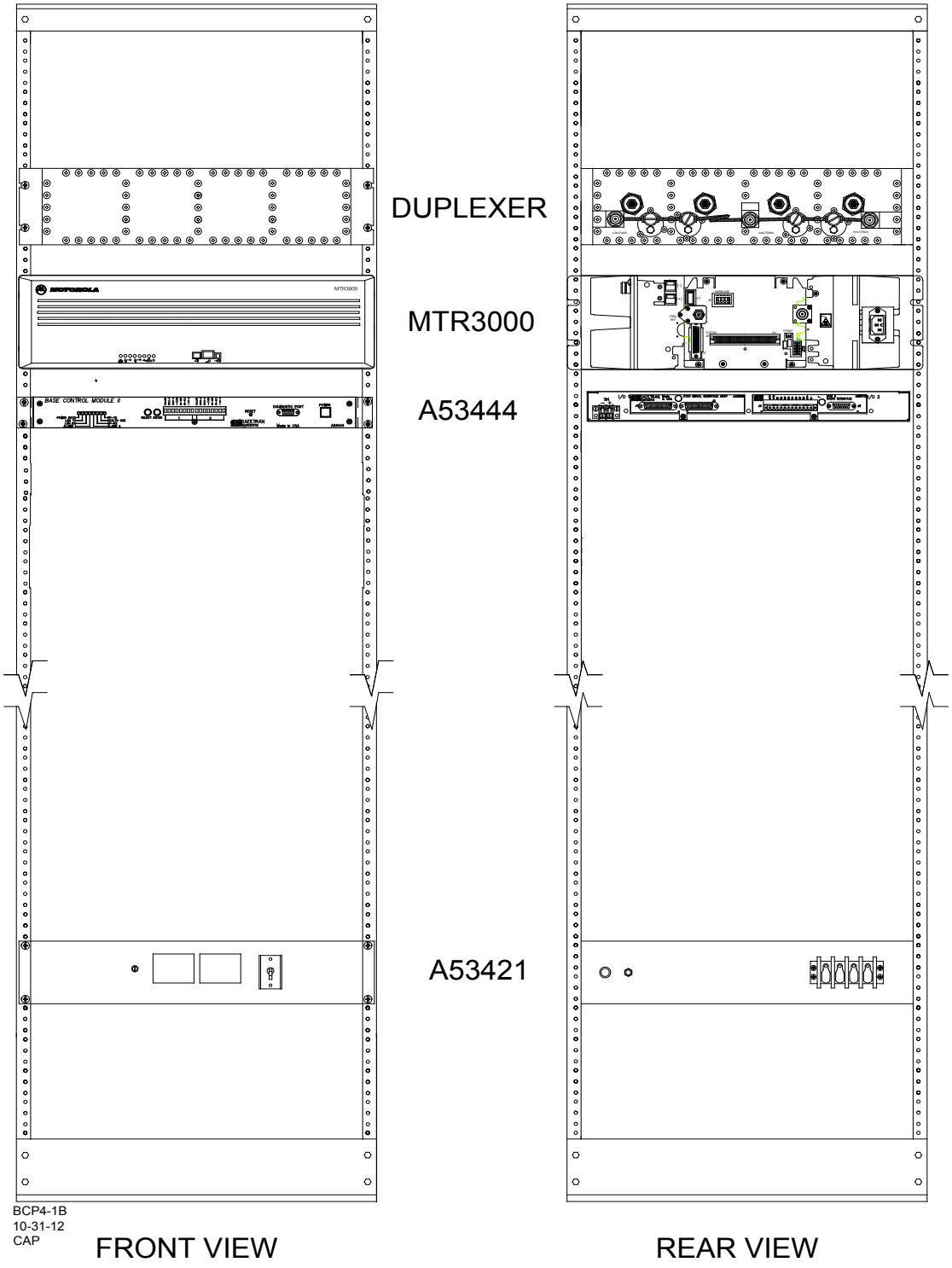

Figure 4-1 Typical BCP II AC/DC Installation With DC-DC Converter

Table 4-1 BCM II Interconnect Wiring Description

Cable #	Part Number	Where Used	Termination
1	See Appendix E	Duplexer to antenna	Male N to male N
2	Z706-02008-0005	Duplexer to MTR3000	Male N to male N
3		Not Used	
4	9000-26762-0001	MTR3000 to 53444	96-pin DIN (Eurocard) to 15-pin D, 25-pin D, and two 18 AWG leads with spade lug termination
5	Z706-02010-0008	MTR3000	Female 3-pin to male 3-pin
6	Z714-09041-0000 & Z714-09040-0000	53421 to MTR3000	Red AMP Power Lock connector to 10/12 AWG insulated ring lug
7	Z715-09158-0000	53444	12-pin I/O Connector Plug
8, 9		Not Used	
10	Z927-01111-0000 & Z715-09060-0008	53444 to modem or CC	Male 8-pin RJ45 to male 8-pin RJ45 with two RJ45 to DB25 male adapters
11	Customer supplied	53421 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
12	Customer supplied	53421 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
13	Customer terminated	MTR3000 and 53421 to earth ground	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug

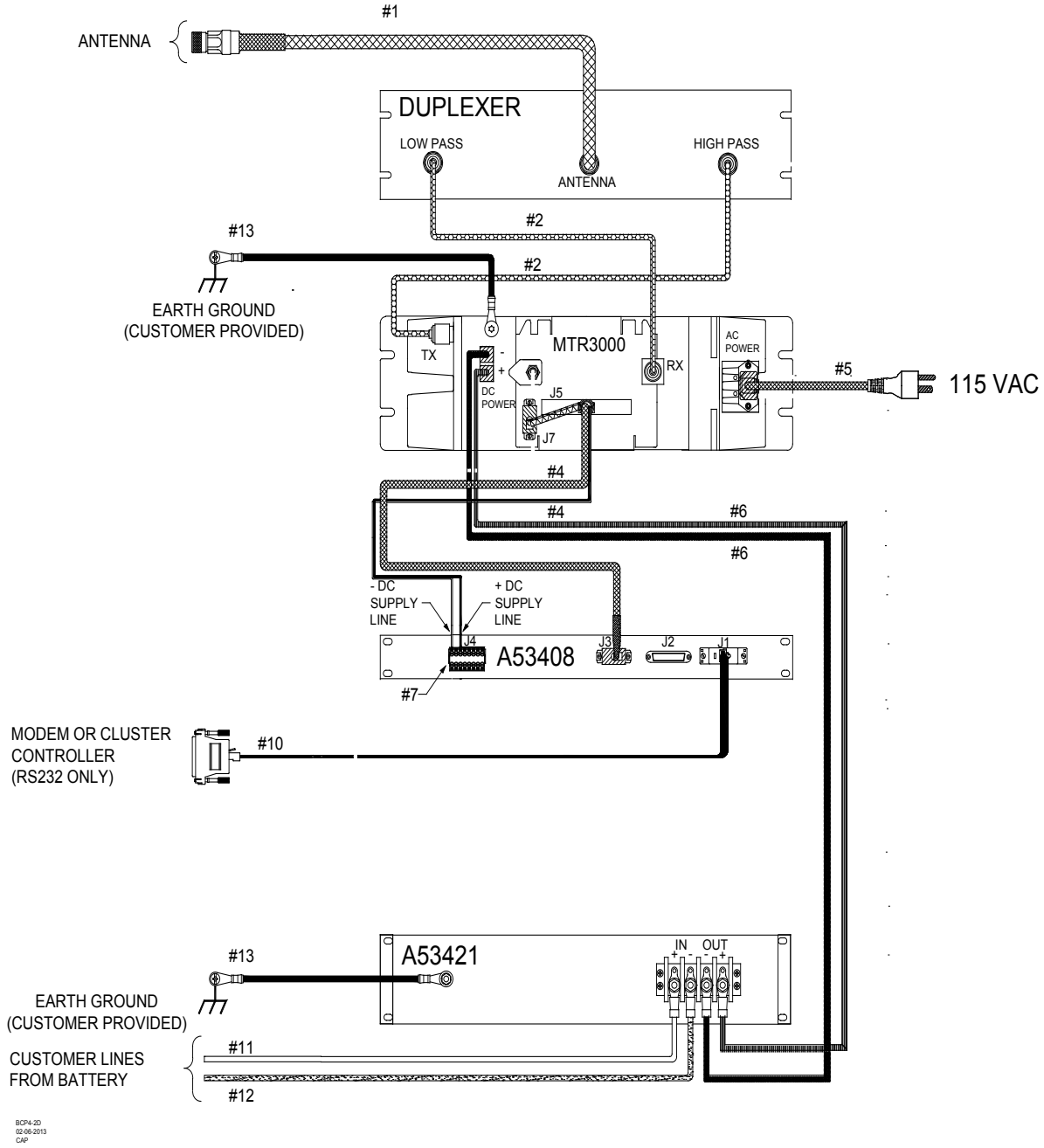

Figure 4-2 BCP II Typical AC and DC Interconnect Diagram

4.5 REMOVING THE FRONT BEZEL

The front bezel of the MTR3000™ is removed by grasping the notches on the sides of the bezel and firmly pulling back to disengage the locking clips.

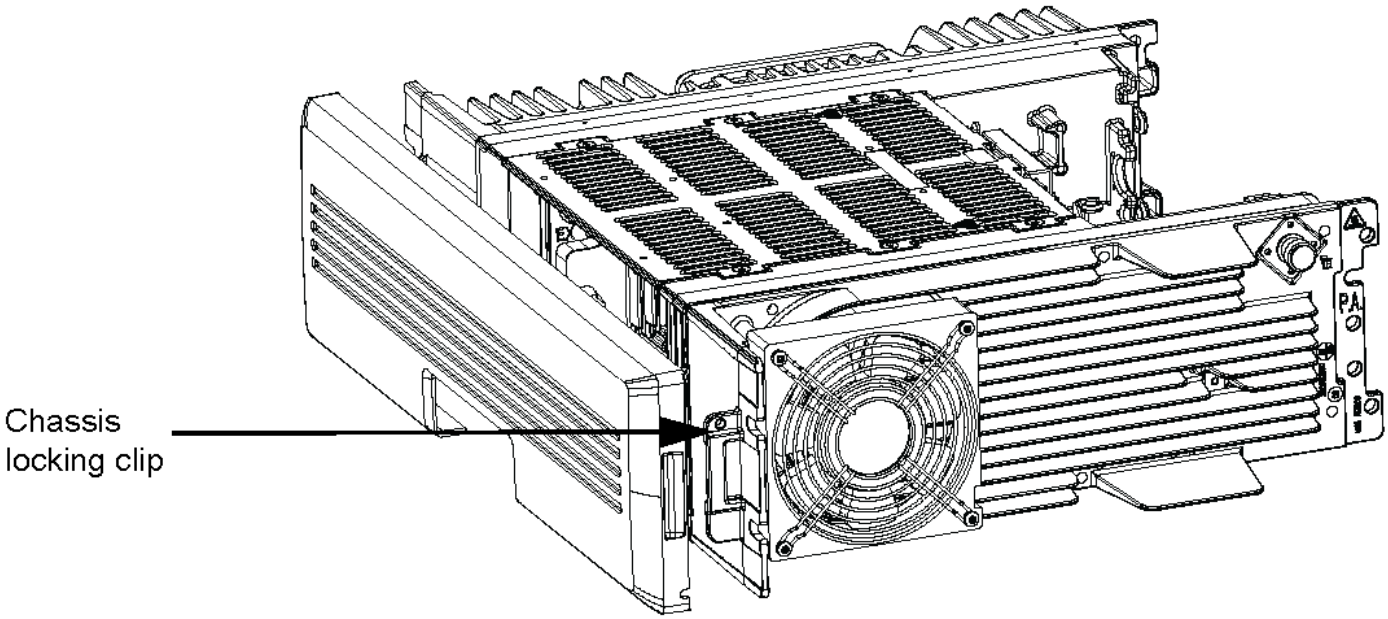

Figure 4-3 MTR3000™ Front Bezel Removal

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SECTION 5
BCP II OPTIONS/ACCESSORIES

5.0 BCP II OPTIONS/ACCESSORIES

5.1 GENERAL

This section lists the options available for BCP II installations. For further information, contact Siemens Rail Automation Technical Support.

5.2 RF CABLE OPTIONS

The RF cable options available for the BCP II are listed in Table 5-1.

Table 5-1 RF Cable and Adapter Options

Part Number	Order Number	Where Used	Description
F4A-NMNM-5	Z801-08475-0005	Duplexer	* Low loss 5ft. 0.5in. Superflex Cable Type N male to type N male
SP400U-60NM/N9	Z706-02008-0005	Duplexer	* Low loss 5ft. 0.5in. Superflex Cable Type N male to type N male right angle
* Both Cables Required			

5.3 DC POWER OPTIONS

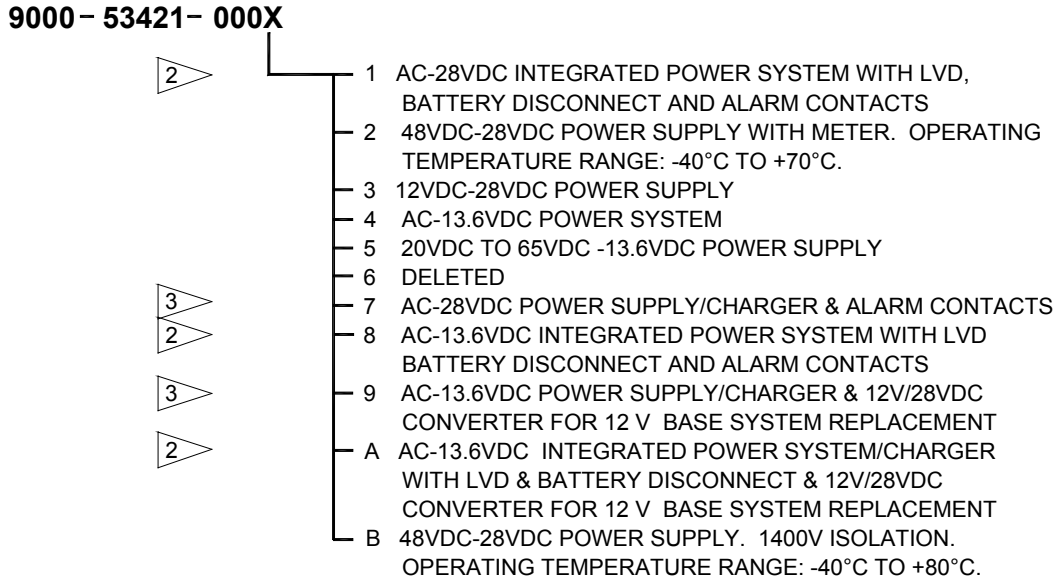
Power supply options are determined by the input power available to the BCP II. Power options available for the BCP II are provided in the BCP II Power Options Chart, Figure 5-1. To order, specify the basic BCP II power supply part number (9000-53421-000) plus the applicable option number from Figure 5-1.

5.3.1 Battery Charger Option

The battery charger option available for the BCP II is listed in Table 5-2.

Table 5-2 Battery Charger Option

Part Number	Order Number	Description
L1884	Z931-01135-0030	24V – 30VDC, 10 ampere



Note 1: All Power Supplies have an operating temperature of 0°C to 50°C and 250V isolation unless otherwise specified.

Note 2: Integrated Power Systems Incorporate the following:

1. Power Supply/Battery Charger
2. Battery Backup Transfer for 300 AmpHours of Battery
3. Status Indicators & Meter
4. Alarms (Form "C" Contact) for AC input and DC output failure
5. Lov Voltage Disconnect (LVD) to protect battery from excessive low voltage discharge.

Note 3: Power Supply/Charger with meters and (Form C contacts for output power failure)

Figure 5-1 BCP II Power Options Chart

5.3.2 Surge Panel Options

The surge panel options available for the BCP II are listed in Table 5-3.

Table 5-3 Surge/Low Voltage Disconnect Panel Options

Part Number	Order Number	Description
43012-23	5000-43012-0023	18VDC - Single DC voltage surge panel
43012-13	5000-43012-0013	32VDC - Single DC voltage surge panel
43012-21	5000-43012-0021	115VAC & 32VDC - Dual voltage surge panel
43012-22	5000-43012-0022	115VAC & 18VDC - Dual voltage surge panel
53426-01	9000-53426-0001	*24VDC low voltage disconnect panel
53426-02	9000-53426-0002	*48VDC low voltage disconnect panel
53426-03	9000-53426-0003	*12VDC low voltage disconnect panel
*Provides battery discharge protection		

5.3.3 Power Strip Option

The power strip option available for the BCP II is listed in Table 5-4.

Table 5-4 Power Strip Option

Part Number	Order Number	Description
IBAR12/20 ULTRA	Z927-04841-0000	AC power strip with 20 ampere circuit breaker and surge protector.

5.4 CONFIGURATION OPTIONS

The various configuration options available for the BCP II are provided in the BCP II Configuration Chart, Table 5-2. To order, specify the basic BCP II part number (9000-53410) plus the applicable dash numbers.

5.4.1 CLF 1290 Double Circulator

The CLF1290 is used to eliminate intermodulation products from a desired signal before it is transmitted. This option is typically used in high density radio sites applications where other transmitters are operating at frequencies close to that of the base station.

5.4.1.1 CLF 1290 Connectors

The CLF1290, Figure 5-3, is equipped with an external N-type RF connector and two internal attached cables: an N-type RF cable and an inline temperature sensor cable.

5.4.1.2 Double Circulator Options

The options available for the CLF1290 Double Circulator are listed in Table 5-5 **Double Circulator Options**.

Table 5-5 Double Circulator Options

Part Number	Order Number	Description
A04827	Z927-04827-0000	Shelf for CLF1290
TKN9132	30-85431-U03	*Double circulator shelf to MTR3000 backplane interface cable
*Order from Motorola		

5.4.1.3 Double Circulator Option Installation

A typical rack-mount configuration using the CLF1290 double circulator option is shown in Figure 5-3. The equipment cabling for a typical installation employing a double circulator is shown in Table 5-6. All necessary information is provided on the diagram and in Table 5-6. The cable numbers listed in the left column of Table 5-6 correspond to the cable numbers (e.g. #4) appearing on Figure 5-4.

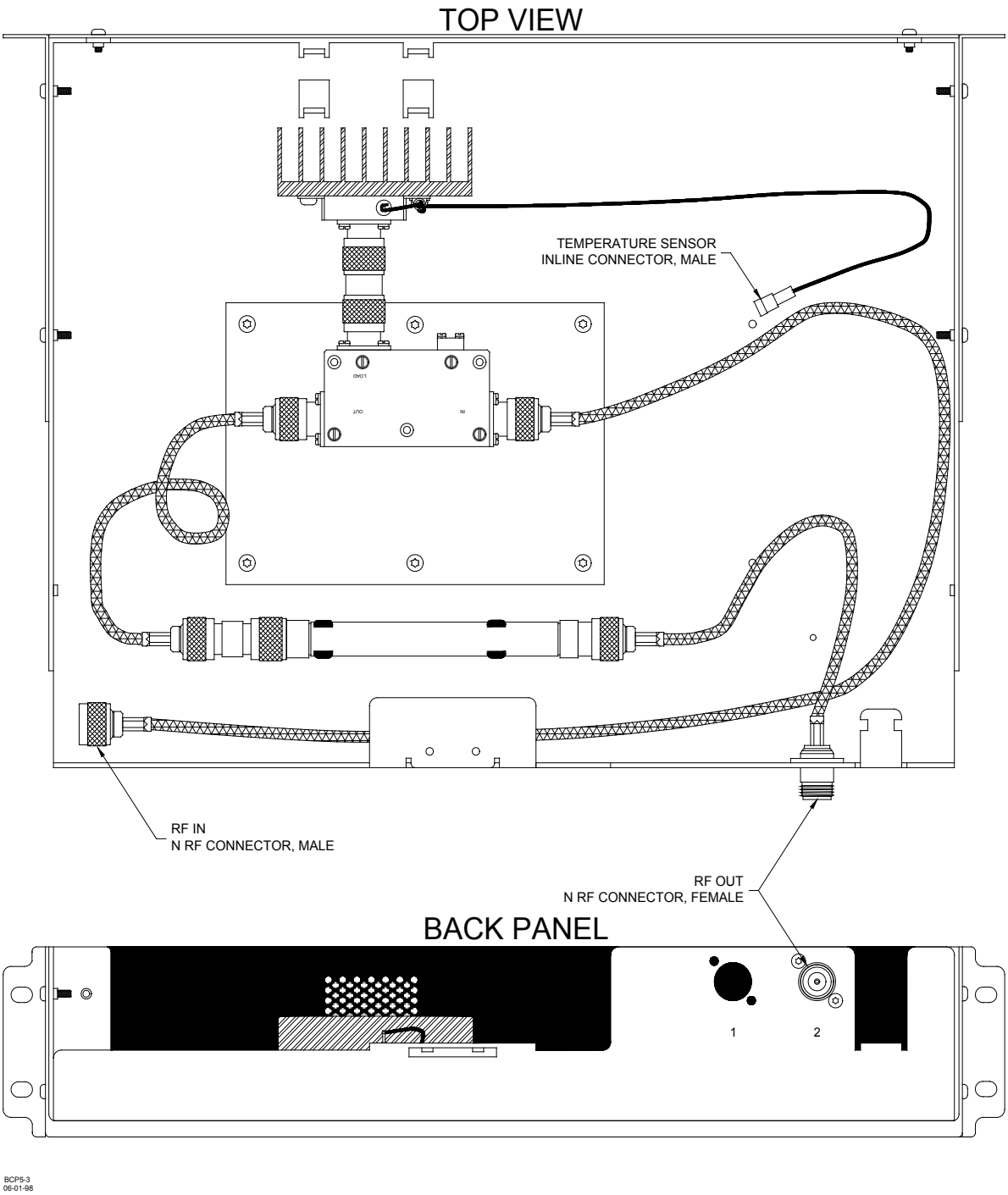


Figure 5-2 Double Circulator Option

Table 5-6 BCM II Interconnect Cable Description w/Dbl Circulator Option

Cable #	Part Number	Where Used	Termination
1	See Appendix E	Duplexer to antenna	Male N to male N
2	Z706-02008-0003	Duplexer to MTR3000, Duplexer to CLF1290, MTR3000 to CLF1290	Male N to male N
3		Not Used	
4	9000-26762-0001	MTR3000 to 53444	96-pin DIN (Eurocard) to 15-pin D, 25-pin, and two 18 AWG leads with spade lug termination
5	Mot 30-85431-U30	CLF1290 to MTR3000	Female inline to 3-pin female header connector.
6	Z714-09042-0000 & Z714-09040-0000	53421 to MTR3000	Black AMP Power Lock connector to 10/12 AWG insulated ring lug
7	Z714-09041-0000 & Z714-09040-0000	53421 to MTR3000	Red AMP Power Lock connector to 10/12 AWG insulated ring lug
8,9		Not Used	
10	Z715-09111-0000	53444 to Modem or CC	Male 8 pin RJ45 to male 8 pin RJ45 with two RJ45 to DB25 male adapters
11		Not Used	
12	Customer supplied	53421 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
13	Customer supplied	53421 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
14	Customer terminated	MTR3000 and 53421 to earth ground	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
15	Customer terminated	MTR3000 to AC Power outlet	3-Prong L-15P Power Cord

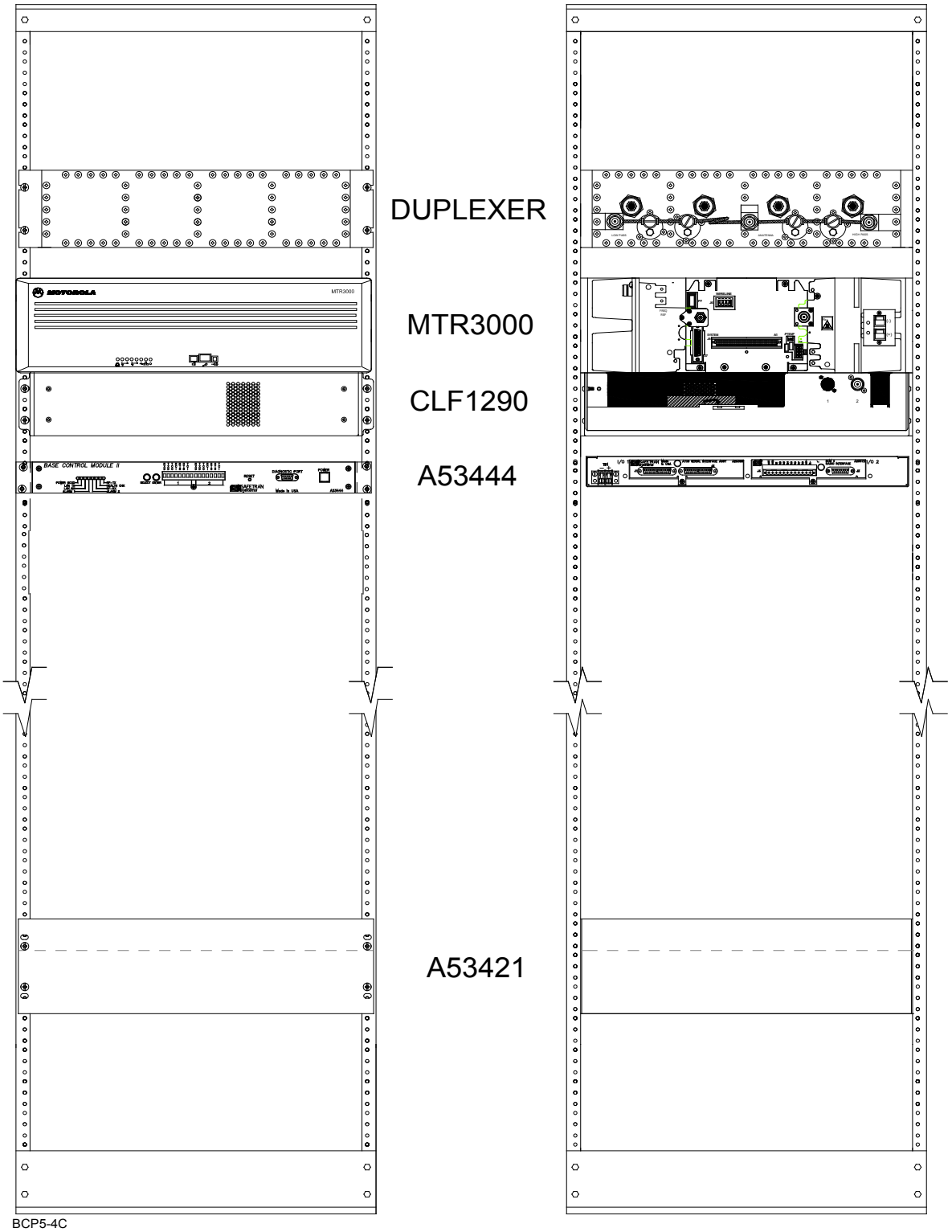


Figure 5-3 BCP II Installation with Double Circulator Option

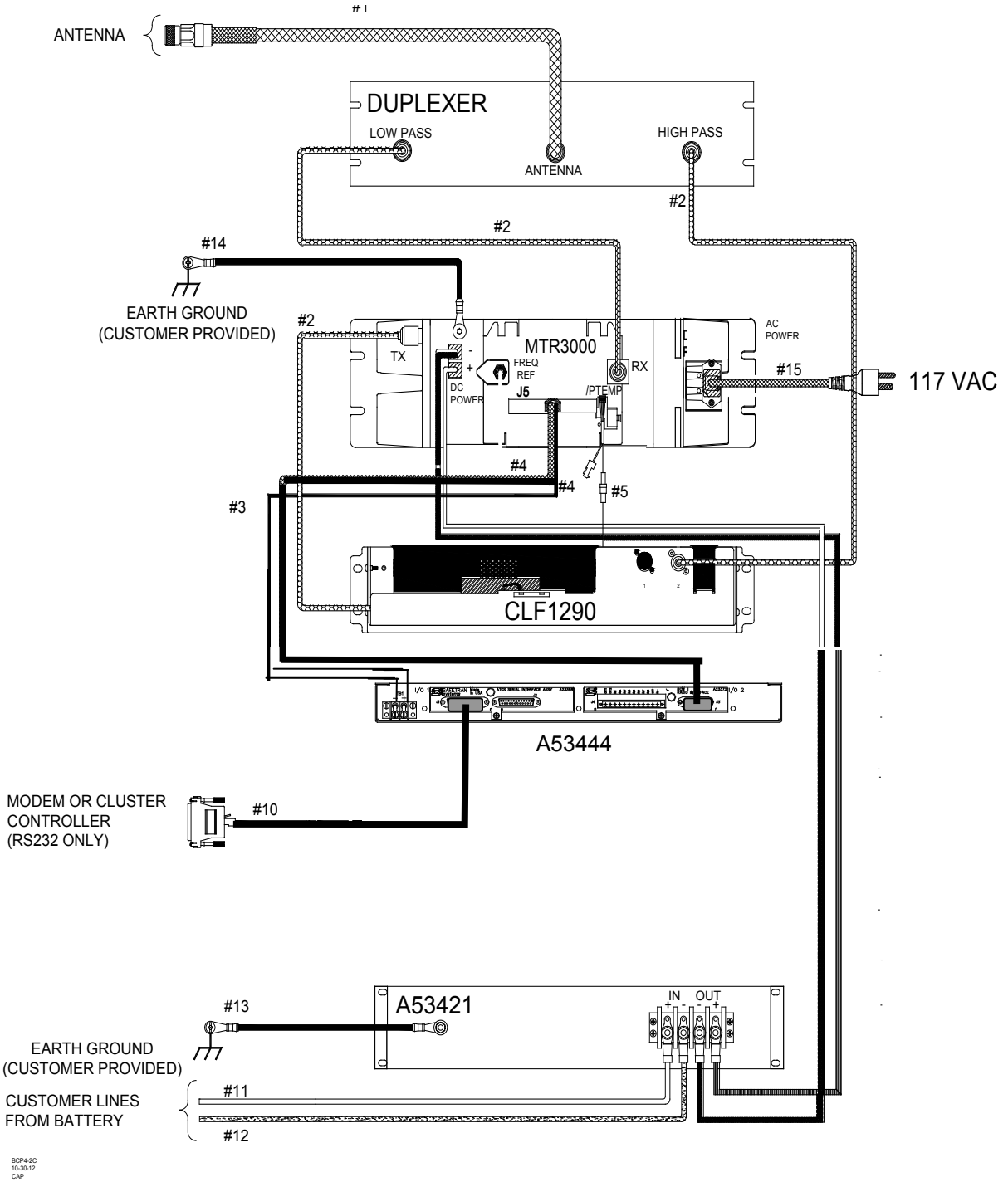


Figure 5-4 BCP II Double Circulator Option

5.5 MODEM OPTIONS

The modem options available for the BCP II are listed in Table 5-7.

Table 5-7 Modem Options

Part Number	Order Number	Description
62095200030	Z927-00152-0000	Point-to-point V.32 data modem for 120VAC power
620952801	Z927-00153-0000	Point-to-point V.32 data modem for 12-60VDC power
*Model 3340	20430	Multipoint V.29, V.32, V.32 *bis*, V.33 data modem for 120VAC power
**Model 3345	20481/10005	Multipoint V.29, V.32, V.32 *bis*, V.33 data modem for 120VAC power
11294-719	Z925-00122-0000	Modem Shelf
* U.S.A. line standard ** Canadian line standard		

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SECTION 6
CONFIGURATION AND ALIGNMENT

6.0 CONFIGURATION AND ALIGNMENT

6.1 INTRODUCTION

BCP II configuration data identifies the BCP II with a specific location and establishes its communications, I/O, and ancillary function parameters. BCP II alignment sets the operational parameters of the MTR3000 base station.

6.2 CONFIGURATION

Ordinarily, initial setup and routine maintenance tasks consist of making changes to the site configuration (code plug) and storing the data permanently in the BCM II.

- While most of the parameters are factory set and do not require user alteration, site-specific data such as local ATCS address, remote FEPCC address, client port assignments, system timers, hardware configuration, and etc. may be programmed onsite by field maintenance personnel.

- This is accomplished in one of three ways:

1. Manually, by means of the front panel push buttons and display.

2. Using the configuration editor in XCMMAINT.EXE and uploading the complete modified code plug information. This is the recommended method.

3. Patching the code plug data one byte at a time in the online terminal mode of XCMMAINT.EXE. This method is more likely to be used by experienced maintenance personnel for updating or making small changes at an in-service site.

The advantage of the front-panel method is that no diagnostic equipment (typically a laptop computer) is necessary to check configuration data or to perform routine maintenance.

When using the Siemens XCMMaint configuration/online utility, all code plug data (as well as other site data) may be stored in a PC data file.

- The MS-DOS file extension for this type of file is ".XCM" and is used to refer to code plug files for the BCM II.

- This allows code plug files for each BCP II to be saved with a unique file name. In addition, one or more 'default' code plug files may be generated and saved to disk.

- The advantage to this method is that commonly-used configurations may be conveniently stored and later used by the XCMMAINT utility to configure new units as they are installed.

A complete list of all code plug parameters is provided in Appendix C.

NOTE

NOTE

BCM II files are compatible with BCM files of the same extension (e.g., filename.XCM).

6.3 FRONT PANEL CONFIGURATION

Each time power is applied, the BCM II performs a series of tests to evaluate its operational status.

- The tests performed and their results are presented on the alphanumeric display (Figure 6-1).
- At the completion of these tests, a **TESTS COMPLETE** message is displayed.
- This message is automatically turned off approximately 5 minutes after test completion.

NOTE

NOTE

Pressing the **SELECT** push button while the **Reset** function is displayed, turns off the display and returns the BCM II to normal operation. (If the **ENTER** push button is pressed, the unit will reset.)

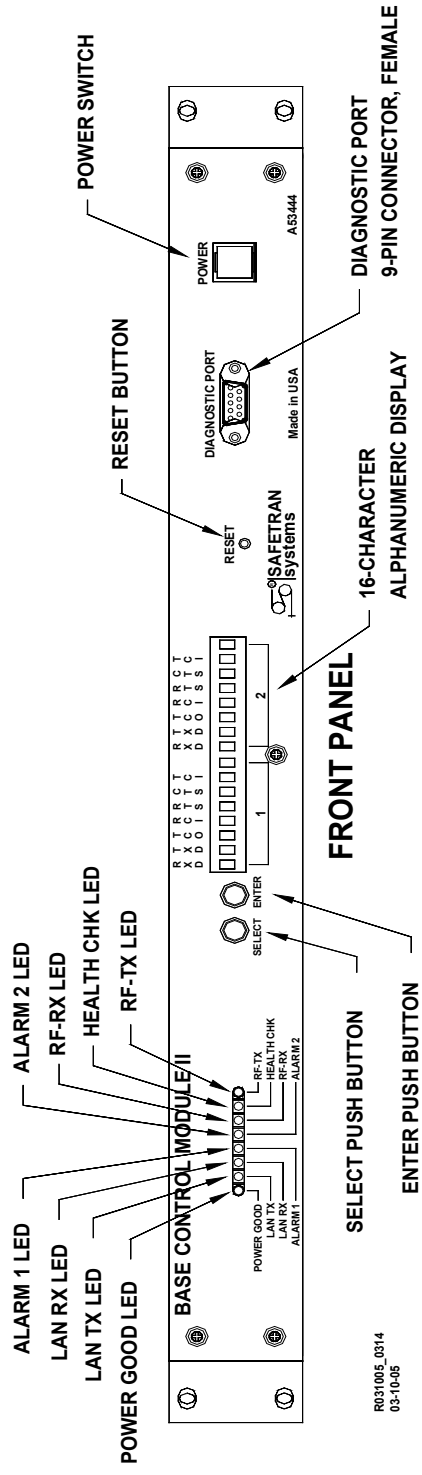


Figure 6-1 Base Control Module II Front Panel

The display is reactivated by the **SELECT** push button.

- When this push button is pressed, **Site Edit**, the first of eight functions, is displayed.
- Subsequently, each time the **SELECT** push button is pressed, the display advances to a new function (see Figure 6-1).

These functions may be sequentially accessed as follows:

- Site Edit
- RF Edit
- Port J1
- Port J2
- Port DC
- Diagnostics
- Date/Time
- Reset

NOTE

NOTE

Pressing the **SELECT** push button while the **Reset** function is selected clears the display.

Most of the display functions listed above contains subfunctions that allow the user to change and/or monitor Codeplug data.

- The subfunctions accessible from each function are identified in the following paragraphs.

Subfunctions are selected as follows:

1. Press and release the **SELECT** push button until the desired function is displayed.
2. Press the **ENTER** push button.
   The first subfunction listing is displayed.
3. Press and release the **SELECT** push button until the desired subfunction is displayed.
4. Press the **ENTER** push button.
   An "*" appears at the right of the subfunction display.
5. Press and release the **SELECT** push button until the desired value or item is displayed.
6. Press the **ENTER** push button.
   - **Confirm (Enter)** is displayed.
7. Press the **ENTER** push button to confirm the selected value or item.
8. Press and release the **SELECT** push button until the function of step 1 is again displayed.
9. Repeat steps 1 through 8 as required.

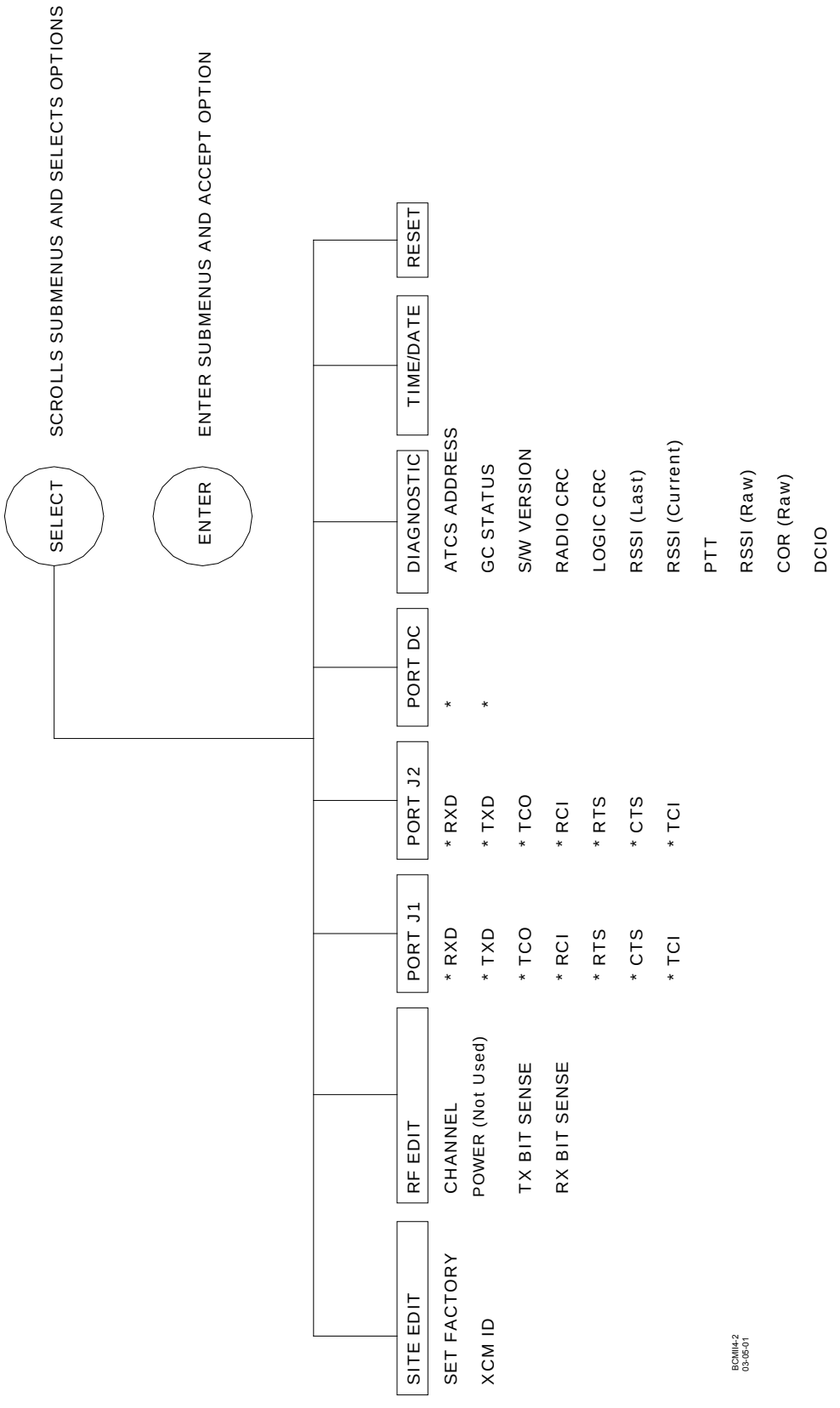
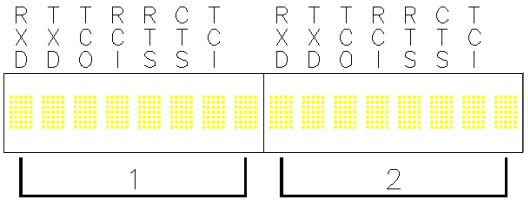


Figure 6-2 BCM II Function Menus

6.3.1 Alphanumeric Display

The Alphanumeric Display is divided into two sections as shown below. The seven most significant bits of each section are identified by an acronym as shown below:



The acronyms above section 1 have no relevance at this time.

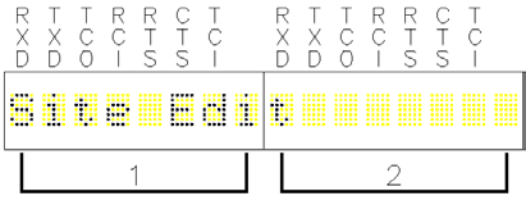
- The acronyms above section 2 correspond to and identify the relevant serial bits of BCM II ports J1 and J2 and the local, opto-isolated I/O of 12-pin connector J4.
- The definitions for these acronyms are listed in Table 6-1.

Table 6-1 Alphanumeric Display Acronyms

Acronym	Definition
RXD	Receive Data
TXD	Transmit Data
TCO	Transmit Clock Out
RCI	Receive Clock In
RTS	Ready To Send
CTS	Clear To Send
TCI	Transmit Clock In

6.3.2 Site Edit

The **Site Edit** function display is shown below:



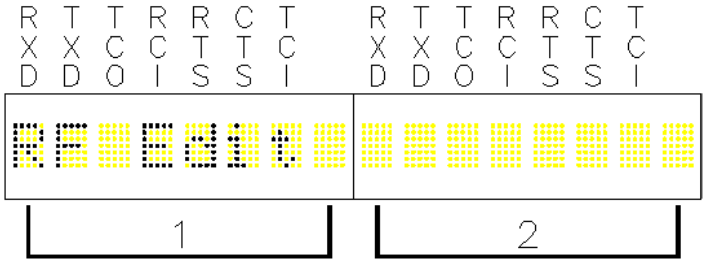
The sub functions listed in Table 6-2 may be accessed from this function.

Table 6-2 Site Edit Sub Functions

Subfunction Display	Item/Value Range	Description
Set	**Factory**	Factory code set
XCM id:	**Enable**	Local address enable
	Disable	Local address disable

6.3.3 RF Edit

The **RF Edit** function display is shown below:



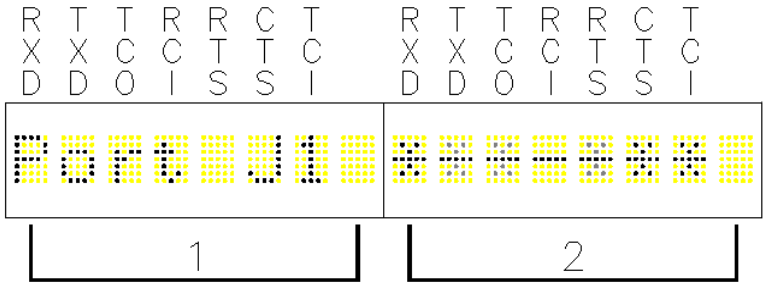
The sub functions listed in Table 6-3 may be accessed from this function.

Table 6-3 RF Edit Sub Functions

Subfunction Display	Item/Value Range	Description
Chan	**1…6**	Not Used
Power:	**Auto**	Sets radio RF output power level
	Low	
	High	
TX	**Normal**	Normal bit-sense transmission
	Invert	Invert the bit-sense of transmitted data
RX	**Normal**	Normal bit-sense reception
	Invert	Inverts the bit-sense of receive data

6.3.4 Port J1

The **Port J1** function display is shown below:



For Port J1 data activity display above a zero (0) is represented by a dash (-) and a one (1) is represented by an asterisk (*). The serial bits are described in Table 6-1 Alphanumeric Display Acronyms. The sub functions listed in Table 6-4 Port J1 Sub Functions may be accessed from this function.

Table 6-4 Port J1 Sub Functions

Subfunction Display	Item/Value Range	Description
See Note.	**Wayside**	Selects wayside equipment - MCM II
	Mobile	Selects mobile equipment - BCM II
See Note.	**HDLC ADM**	Selects serial port communications protocol.
	HDLC ABM	
	HDLC POL	
	HDLC UI	
	HDLC NUL	
	GENI (0)	
	ECP	
	BCP GENI	
	MCS 1	
	ASYNC	
	SSR	
	SCS128	
	GENI (F)	
	CN2000A	
	CN2000B	
	CN DHP	
	SLIP	
	CENTRA	
	FRM RLY	
	BGENI (O)	
	PPP	
	PPPMCast	
	GPRS (bu)	
	GPRScont	
	ARES	
Baud: ### See Note.	**300**	Selects serial port communications baud rate.
	600	
	1200	
	2400	
	4800	
	9600	
	19.2 (K)	
See Note.	**RS422** **RS232**	Serial port configuration.
See Note.	**SYNC** **ASYNC**	Clock sync mode.
Poll = # See Note.	**0 – 127**	Module polling address
Max Poll	**0 – 127**	Sets polling range

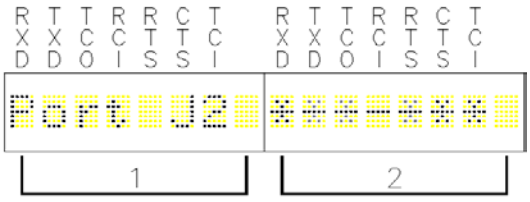
NOTE

NOTE

Sub function default display is dependent on current Codeplug parameters.

6.3.5 Port J2

The **Port J2** function display is shown below:

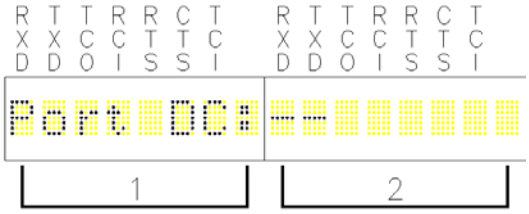


Sub functions corresponding to those listed in Table 6-4 Port J1 Sub Functions may be accessed from this function.

- This function also monitors the serial bit activity of connector J2.
- The serial bits are described in Table 6-1 Alphanumeric Display Acronyms.
- A zero (0) is represented by a dash (**–**) and a one (1) is represented by an asterisk (*****).

6.3.6 Port DC

The **Port DC** function display is shown below:

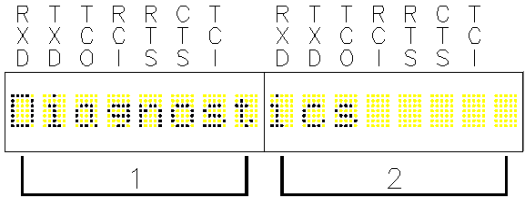


This function monitors the I/O bit activity of connector J4.

- The I/O bits are displayed at the RXD and TXD positions of section 2.
- Zero (0) bits are represented by a dash (**–**) and one (1) bits are represented by an asterisk (*****).
- No sub functions are available from this function.

6.3.7 Diagnostics

The **Diagnostics** function display is shown below:



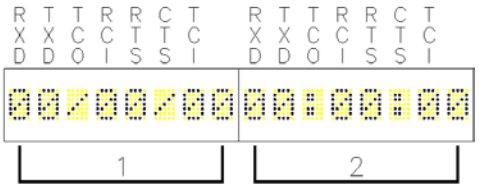
The sub functions listed in Table 6-5 may be accessed from this function. Typical values for each sub function display are shown.

Table 6-5 Diagnostic Sub Function

Subfunction Display	Item/Value	Description
X:	**355AA12AA10000**	Local ATCS address display. Varies per site.
GC:	**None**	None
XCM Ver.	**BCM-II V01.08.00**	Displays version of installed software
Conf. CRC:	**D757**	CRC of site configuration file
TEST	**FFFF**	Name and CRC of installed logic file
RSSI(L)	**-70dB**	RSSI of last data packet
RSSI(C)	**-120dB**	Current signal strength of received carrier
PTT	**off**	Toggles push-to-talk line to radio
	on	
COR raw	**000**	Carrier Operated Relay **(Not Used)**
RSSI raw	**000**	Current RSSI value as read from analog input.
DCIO_IN	**HHHHHHHH LLLLLLLLL**	State of 8 alarm inputs where H is for high and L is for low. Starting from left-to-right, leftmost is alarm1 and rightmost is alarm 8

6.3.8 Date and Time

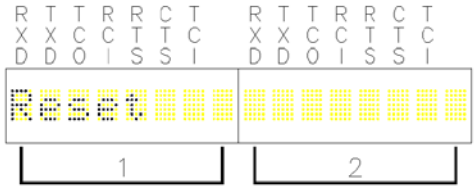
The **Date and Time** function display is shown below:



This is a display of the date and time obtained from the Central Office. No sub functions are available from this function.

6.3.9 Reset

The **Reset** function display is shown below:



When this function is activated, it first resets the BCM II and then conducts a series of tests to determine BCM II operational status.

- Table 6-6 BCM II Self Tests list the tests performed.

Table 6-6 BCM II Self Tests

Subfunction Display	Test Results Displayed	Test Description
ROM RAM *******	OK /FAILED	Performs CRC of Executive Firmware in ROM and performs memory test on RAM
CODEPLUG *****	OK /FAILED	Verifies CRC of configuration data in codeplug
MODULATOR ****	OK /FAILED	Verifies the modulator & demodulator via an internal loopback test of the TX and RX audio data paths
RADIO *********	OK /FAILED	Resets Motorola radios equipped with an SB9600 bus; has no effect on MTR2000 or MTR3000 radios
HDLC PORT 0 **	OK /FAILED	Verifies the client ports via an internal loopback test of the TX and RX data paths
HDLC PORT 1 **	OK /FAILED	Verifies the client ports via an internal loopback test of the TX and RX data paths

NOTE

NOTE

Alphanumeric display is automatically turned off approximately 12 minutes after the **SELECT** or **ENTER** push buttons are last activated.

6.4 BCM II CONFIGURATION PROGRAM

The BCM Configuration program (XCMMAINT.EXE or similar name) and associated files are distributed on a CD ROM.

- The XCMMAINT.EXE program or similar name must be installed on an MS-DOS compatible computer with a serial port. For computers without a serial port, use a USB-to-Serial adapter. Not all adapters will work for all computers. A suggested adapter is the Cables Unlimited USB-2920, USB 2.0 to Serial DB-9 Adapter.

6.4.1 Installation

To install the BCM Configuration program proceed as follows:

1. Insert the installation CD to the CD Drive.
2. Make a folder on the drive where CD Files will reside. (Titles limited to 8 characters).
3. Copy the files from CD to the folder.
4. Create a shortcut to the XCMMaint's executable file onto the computer desktop.

6.4.2 Using the BCM Configuration Program

Connect the serial port of the PC to the Diagnostic Port on the front of the BCM II as shown in the figure below.

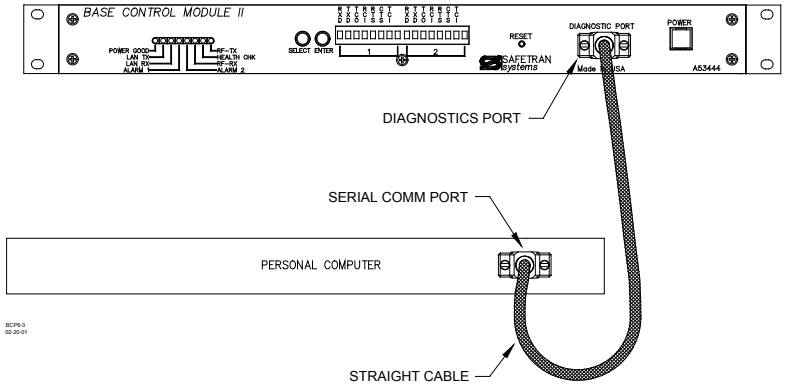


Figure 6-3 BCM II to Personal Computer Interconnection Diagram

Start the XCMMAINT configuration Editor by opening the XCMMAINT.EXE file. The name of this executable file will change per the installation CD.

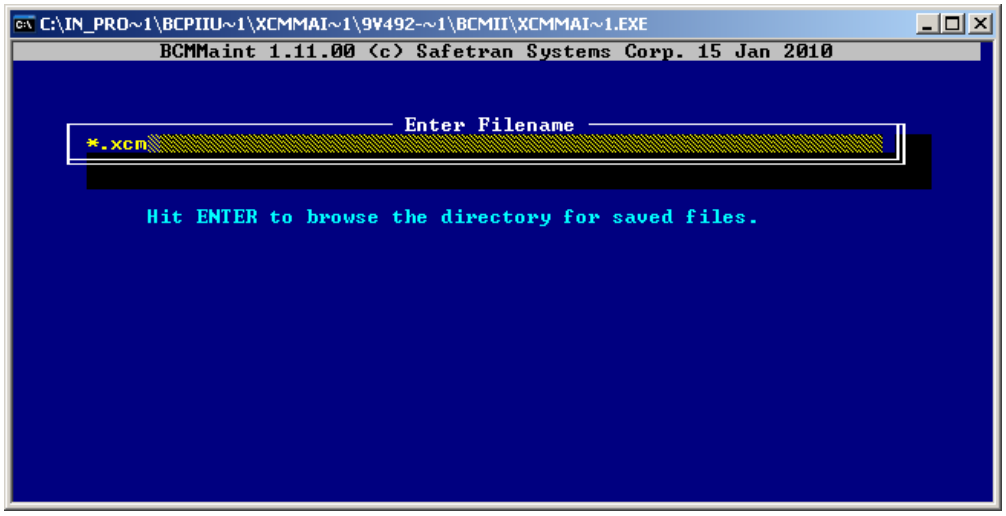


Figure 6-4 Configuration Editor Startup Screen

6.4.2.1 Accessing A Saved Codeplug File

To access a saved configuration code-plug file from the Configuration Editor Startup Screen:

1. Press the **ENTER** key.
   - A list of Codeplug files (*.xcm), Figure 6-5, displays within the Startup Screen.

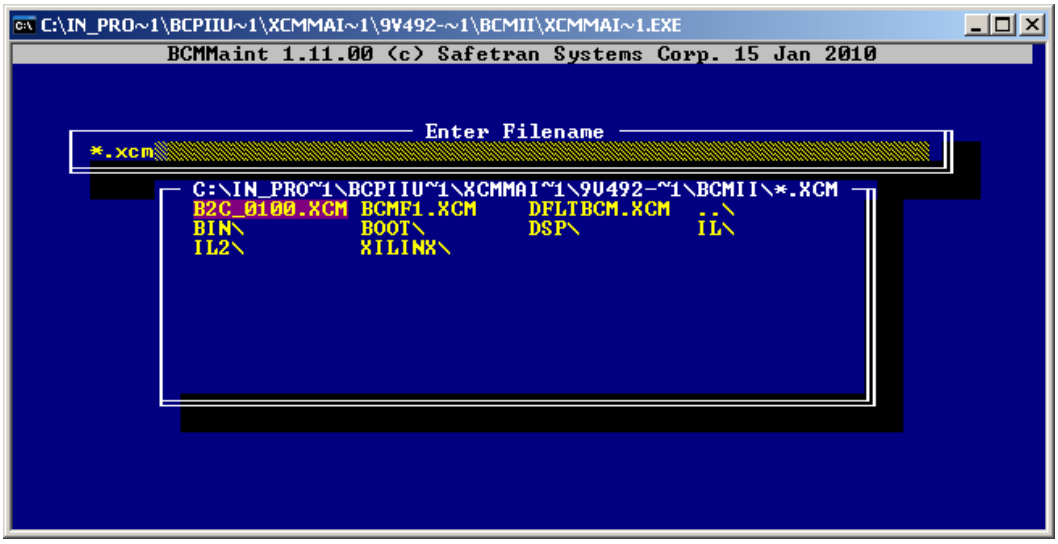


Figure 6-5 Codeplug File List

2. Place the cursor on the desired codeplug file name within the list using the arrow keys.
3. Press the **ENTER** key.
   - The selected codeplug file is displayed within the Main Editor Screen, Figure 6-6.

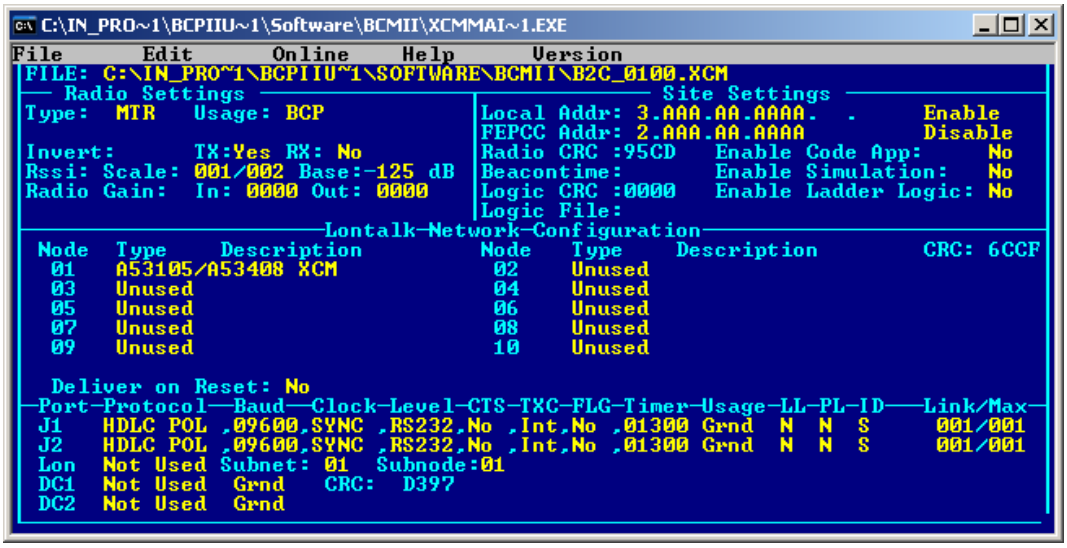


Figure 6-6 Typical Main Editor Screen

6.4.2.2 Read BCM II Codeplug

To read the codeplug currently stored in BCM II unit for display on editor screen:

- Enter **Alt-O** and use down arrow key to select '**Read Codeplug from Unit**'. Press **Enter** key.

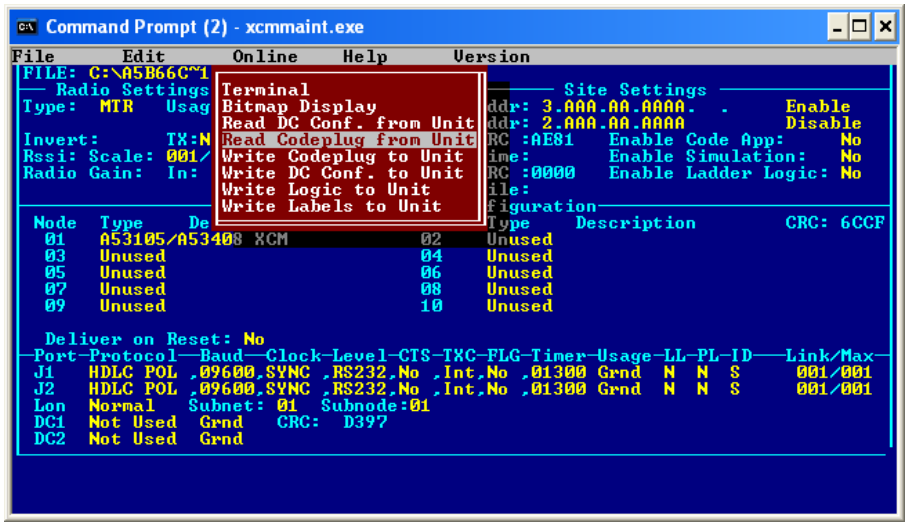


Figure 6-7 Read BCM II Codeplug File

- The codeplug file is read from the BCM II and displayed as shown in Figure 6-8

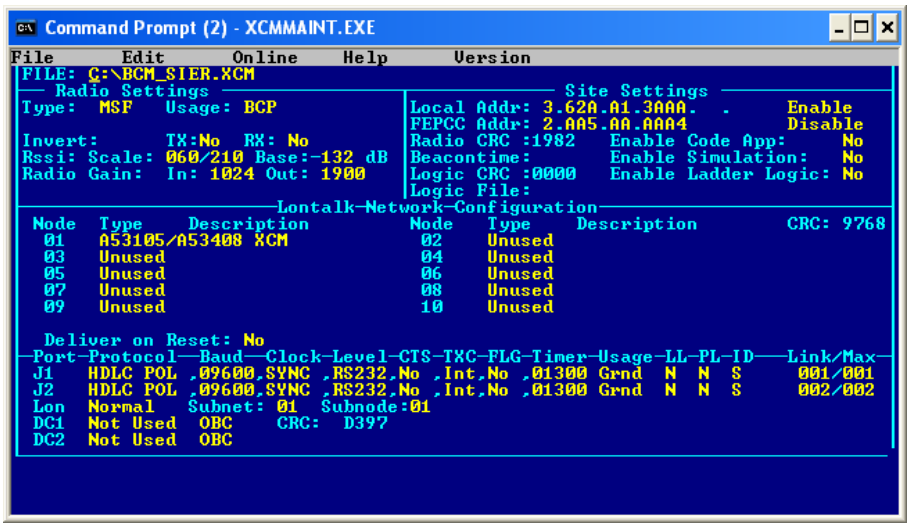


Figure 6-8 Read Codeplug from BCM II

6.4.3 Main Editor Screen

Codeplug configuration is performed from the Main Editor Screen. This screen is divided into four functional sections:

- RF Settings
- Site Settings
- LonTalk® Network Configuration
- Port Selection

6.4.3.1 Using the Main Editor Screen

The name and path for the selected file is identified at the upper left corner of the display as shown in Figure 6-9.

- At the top of the display is the Menu Bar.
- ♦ The Menu Bar contains the names of five drop-down menus or functions that are accessible from the Main Editor Screen.
- ♦ To display a drop-down menu or access the indicated function, simultaneously press the **ALT** key and the letter key corresponding to the first letter of the menu name (e.g., **ALT-F** for the **File** menu).
- ♦ Items are highlighted within each drop-down menu by using the arrow keys or mouse. Pressing **Enter** selects the highlighted item.

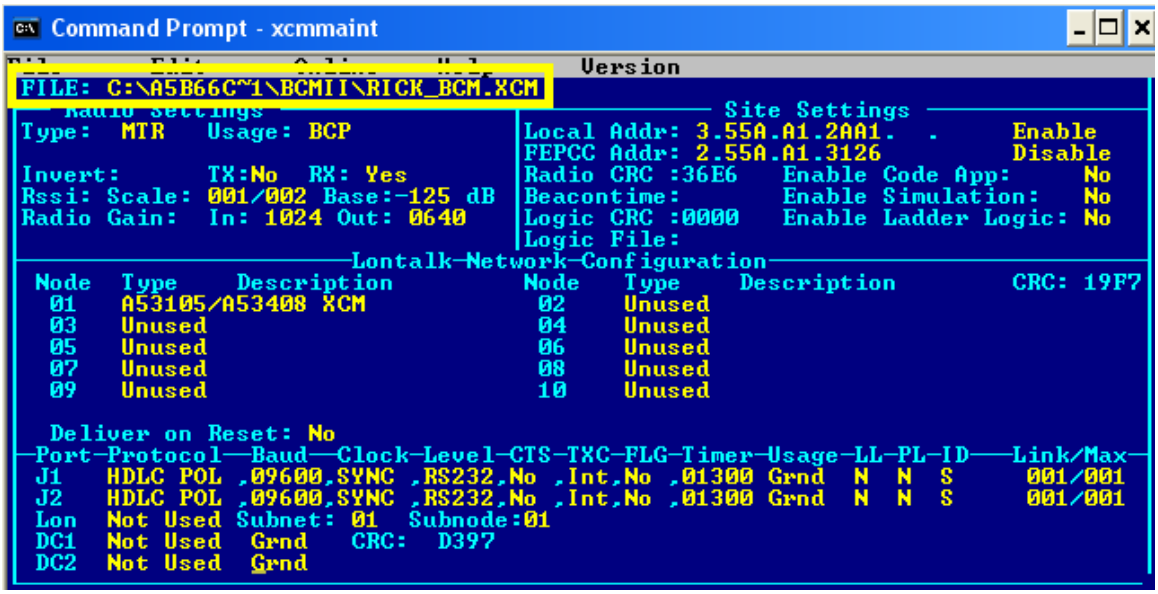


Figure 6-9 XCM File Name and Path

- **File Menu**

The **File** (**Alt-F**) drop-down menu contains the following five entries:

- **Load**

The **Load** entry allows another codeplug file (.XCM extension) to be loaded in place of the one currently displayed.

To select the **Load** entry:

1. Highlight the **Load** entry using the arrow keys.

2. Press the **Enter** key.
   - The following prompt is displayed:

3. Enter a file name by performing one of the following actions:
   - Type the file name (maximum of eight characters plus the .XCM extension) at the **Enter Filename** prompt.
   - Press the **Enter** key to bring up the Codeplug File List and make a file selection from the presented list using the arrow keys.

4. Press the **Enter** key.

- **Save**

Selecting this entry saves the currently displayed code-plug configuration data to the file listed in the upper left corner of the Main Editor Screen.

- After the file is saved, the code-plug configuration data remains displayed within the Screen.

- **Save As**

This entry permits the currently displayed code-plug configuration data to be saved to a file other than the one named in the upper left corner of the Main Editor Screen.

The **Save As** entry is selected as follows:

1. Highlight the **Save As** entry using the arrow keys.

2. Press the **Enter** key.
   - The following prompt is displayed:

3. Enter a file name by performing one of the following actions:

- Type the file name (maximum of eight characters plus the **.XCM** extension) at the **Enter Filename** prompt.
- Press the **Enter** key to bring up the Codeplug File List, Figure 6-5, and then make a file selection from the presented list using the arrow keys.

4. Press the **Enter** key.

NOTE

NOTE

When a file name is selected from the Codeplug File List, the currently displayed codeplug configuration data overwrites any data in the selected file.

- **Save + ABS**

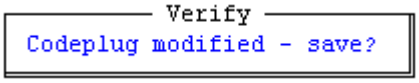
This entry permits the currently displayed code-plug configuration data to be saved in the modified binary s-record format (ABS).

- **Exit**

Select this entry to quit the Configuration program and return to the DOS prompt or Desktop.

The **Exit** entry is selected as follows:

1. Highlight the **Exit** entry using the arrow keys.
2. Press the **Enter** key.
   - If the codeplug has been changed without being saved, the **Verify** prompt is displayed (see right).



3. Type **Y** (yes) to save the changes to the configuration or **N** (no) to discard the changes to the configuration.
3. Press the **Enter** key.
   - The Main Editor Screen closes and the DOS prompt is displayed.

6.4.3.2 Edit Function

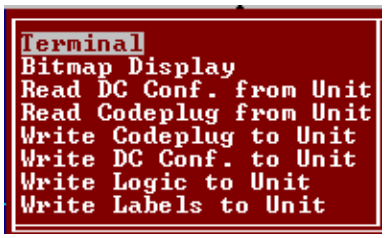
The Edit Function is not used.

6.4.3.3 Online Menu

The **Online** (**Alt-O**) drop-down menu contains the following eight entries:

- **Terminal**

This entry provides access to a number of diagnostic tools and access to the event log.



- When **Terminal** is selected a blank screen appears displaying only the Menu bar containing the name of the three available drop down menus: **File, Online,** and **Upload.**

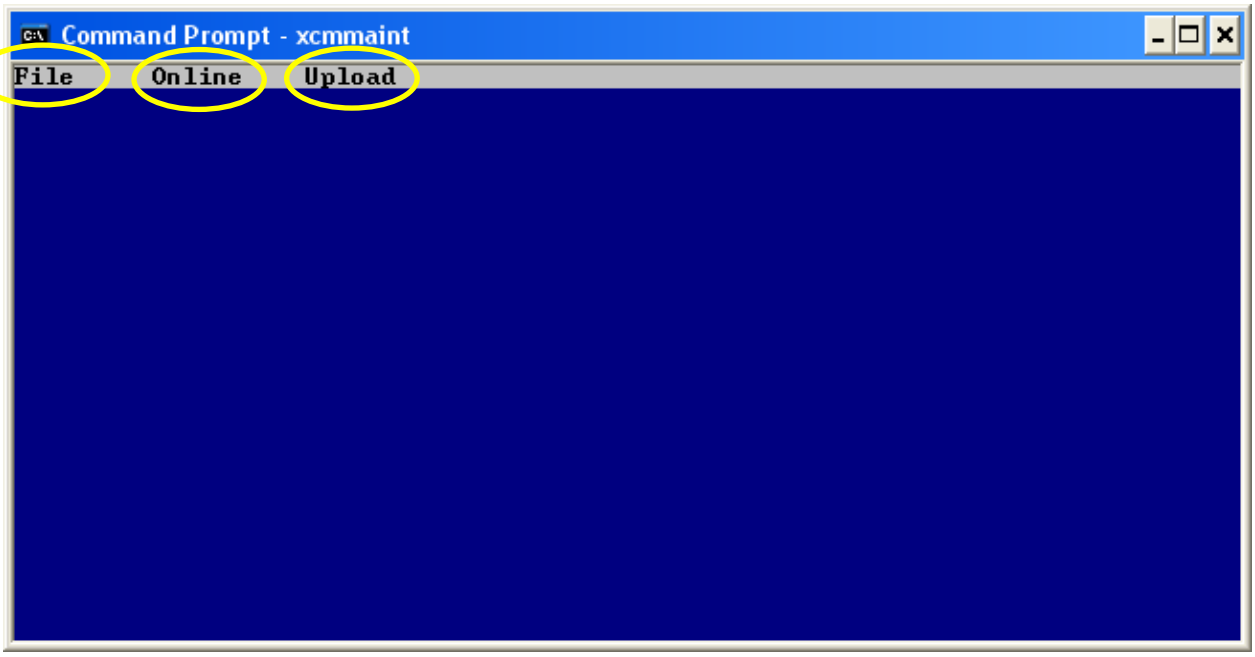


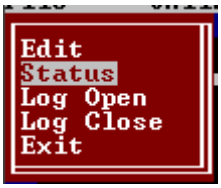
Figure 6-10 Terminal Sub Menus

- **File Menu**

The **File** menu contains five entries that function as follows:

a. Selecting **Edit** closes the Online Terminal Screen and returns to the Main Editor Screen display.

1. The **Status** entry screen is identical in display and function to the **Terminal** entry described above.



b. Selecting **Log Open** brings up the following prompt:

Type a log file name to be created (the **.log** extension will be appended) and press **Enter**.

All subsequent BCM II log entries will be written to this file until it is closed or until the XCMMAINT.EXE utility is exited.

NOTE

NOTE

Only one log capture file may be opened at one time. If a log capture file is already open, the prompt to enter a log file name will not display.

c. Selecting **Log Close** will close the currently open log file, if any, without prompting.

d. Selecting **Exit** terminates the program.

- **Online Menu**

The **Online** drop-down menu of this screen is the same as the Main Editor **Online** drop-down menu.

- A number of diagnostic, status, and troubleshooting commands may be initiated from the Online Terminal Screen.
  - ♦ Pressing the **ENTER** key causes an "*" prompt to display.
  - ♦ Typing **HELP** after the on screen "*" and pressing the **ENTER** key causes the Command List to be displayed within the Online Terminal Screen as shown in Figure 6-11.

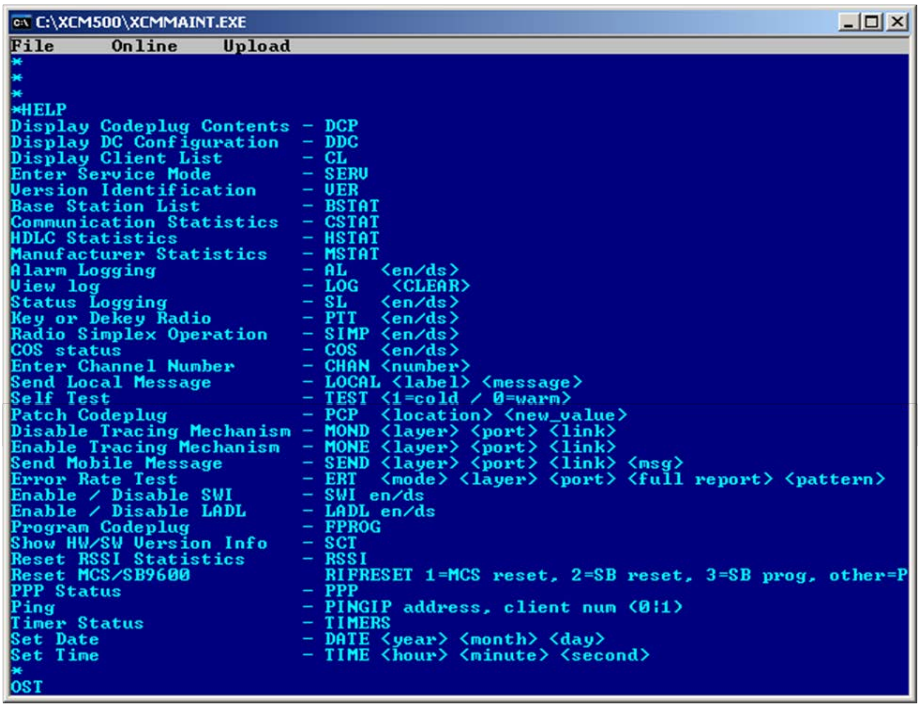


Figure 6-11 Online Terminal Screen Command List

NOTE

NOTE

<**Page Up**> may be used to view lines that have scrolled off the screen

The Online Terminal Screen Commands may be initiated from the Online Terminal Screen by:

1. Pressing the **Enter** key.
   - An * is displayed at the top left of the Screen, verifying that the program is communicating with the BCM II.

2. Typing the command followed by a space and the desired parameter designation.

- Examples:
  - ♦ Status Log enable command is entered as: **SL**<space>**en**.
    - o Commands requiring multiple parameters are entered with a space between each parameter.
    - o Send Local Message command is entered as: **LOCAL** <space> **<label>** <space> **<message>**.

3. Pressing the **Enter** key.

1. The command executes and the results are displayed on the Screen as shown in Figure 6-12.

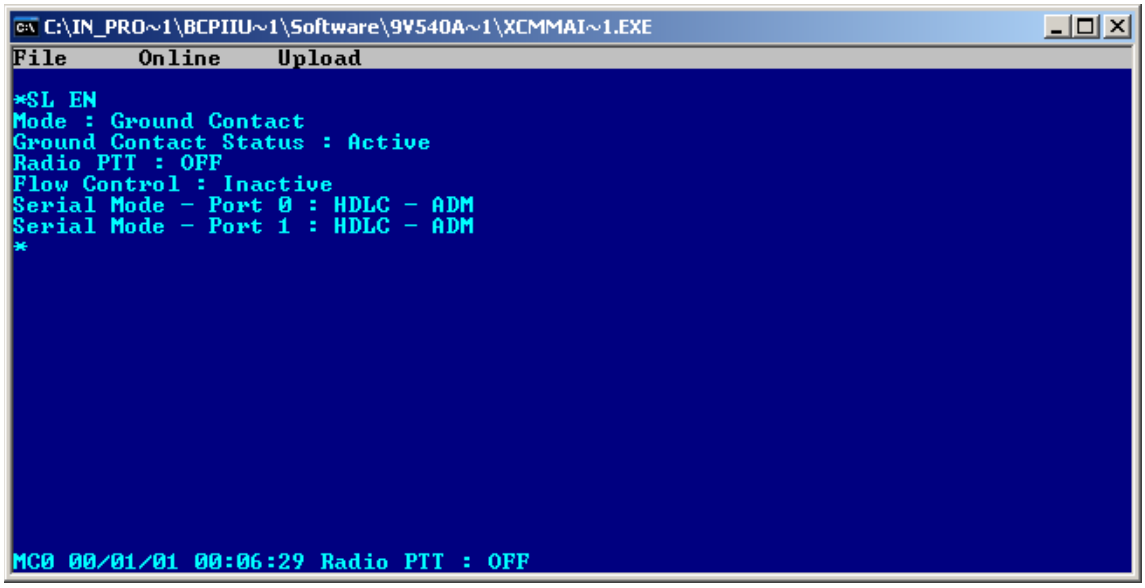


Figure 6-12 Status Log Enable Command

- **Viewing and/or logging the WCP CPU II Event Log**

1. Press the **ENTER** key.

   A "*****" prompt is displayed.

2. To create a new event log for logging WCP CPU II events, select **Log Open** from the **Terminal's** drop-down **File** menu.

   a. Type a log file name to be created (the **.log** extension will be appended) and press **Enter**.

3. Type **LOG** at the "*****" prompt.

4. Press the **Enter** key.

The event log of the WCP CPU II is displayed on the Screen as shown in Figure 6-13. As each new event occurs, it is added to the end of the event log file.

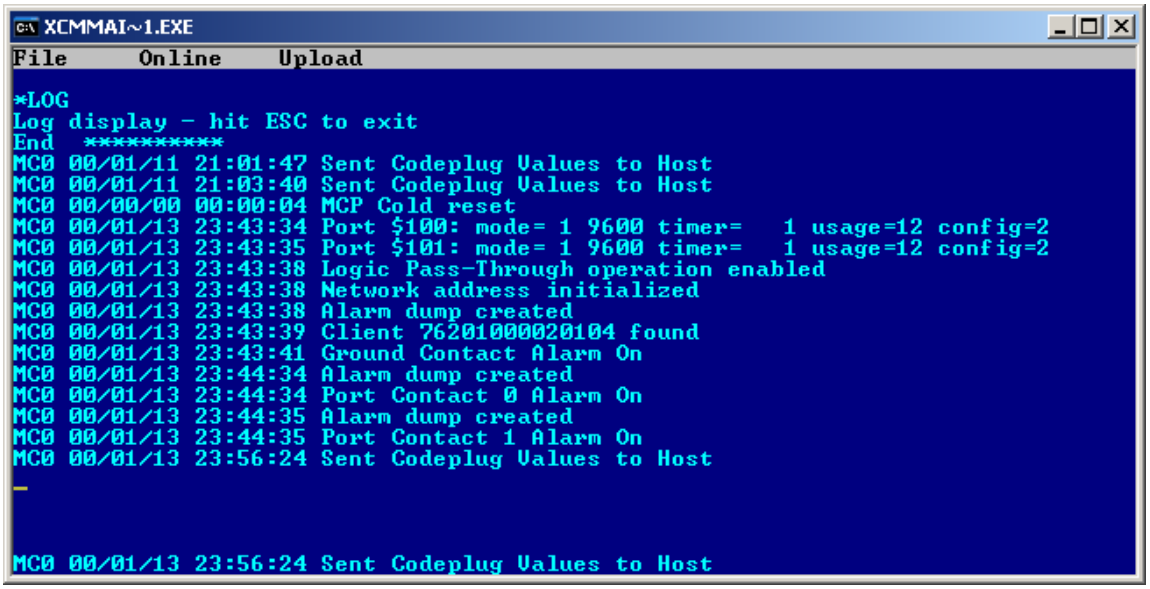


Figure 6-13 View Log

NOTE

NOTE

Each new event also displays at the bottom of the screen as it occurs.

While viewing the event log, the following commands may be executed:

- Typing **B** moves the previous sixteen entries to the bottom of the display.
- Typing **F** moves the display down (forward) sixteen entries.
- Typing **S** moves the display to the start of the log.
- Typing **E** moves the display to the end of the log.
- Typing **P** pauses the log updates.
- Typing **W** erases all events in the log.
- Pressing the Esc key interrupts the log display and disables log command execution.

5. At the completion of event log viewing and logging, perform the following:

    1. If a log file is open, select **Log Close** from the **Terminal's** drop-down **File** menu.

    2. To return to main edit screen, select **Edit** from the drop-down **File** menu.

The Online Terminal Screen closes and the Main Editor Screen displays.

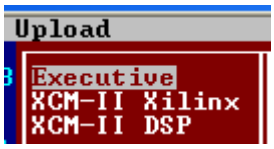
- **Upload Menu**

Upload (Alt-U) performs firmware upgrading and has the following three drop-down selections:

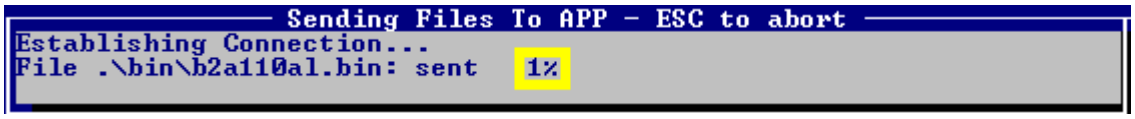
The files associated with each of three drop-down selections are stored on the installation CD. File 'xcmmaint.ini' specifies the path to each of these files.

1. **Executive** – The executive firmware consists of BCM II's operating system software and system application software. As BCM II's firmware is changed and updated by Siemens Rail, select this command to flash an updated executive into BCM II. Upon selecting this command, BCM II configuration program will automatically establish a session with the BCM II unit and write new executive to BCM II's flash memory. The entire operation takes about 6 minutes.

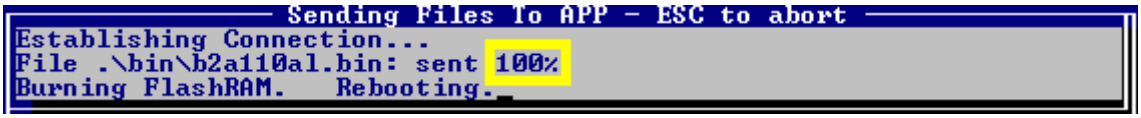
To begin this operation, enter **Alt-U** and use up/down arrow keys to highlight **Executive** selection. Then press **ENTER** key.



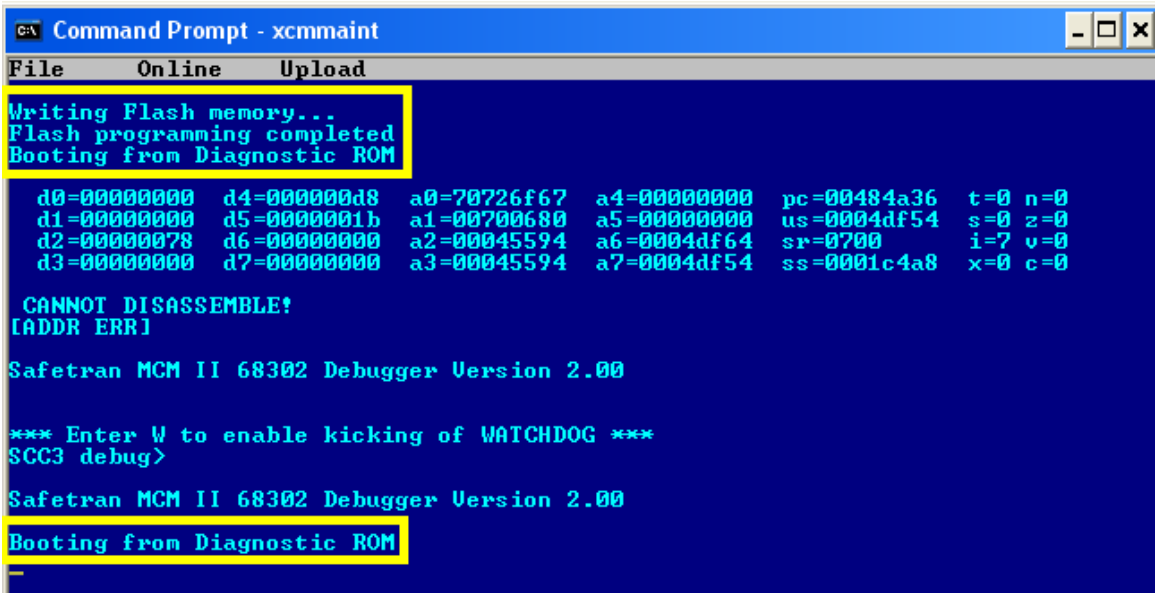
The following sequence of screens show the steps automatically performed by BCM II configuration program to accomplish re-flashing of new executive firmware:



New executive firmware is being serially sent to BCM II with percentage of completion shown.



Percentage complete is now 100%, new executive firmware has completely been serially sent to BCM II. New executive firmware is written to flash memory. Upon completion of flash operation, BCM II will automatically reboot.

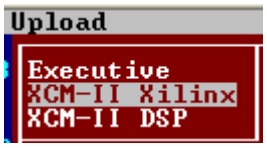


BCM II is rebooting. Old executive has been overwritten with new executive firmware.

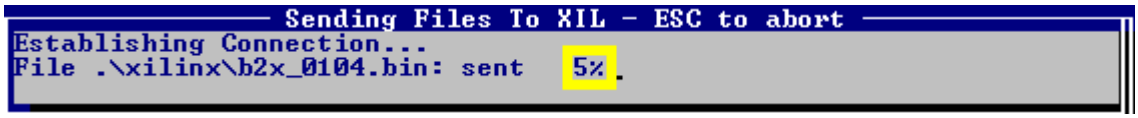
2. **XCM-II Xilinx** – Xilinx firmware handles the FPGA logic functionality.

As BCM II's Xilinx logic is changed and updated by Siemens Rail, select this command to flash updated Xilinx firmware into BCM II. Upon selecting this command, BCM II configuration program will automatically establish a session with BCM II unit and write new Xilinx firmware to BCM II's flash memory. The entire operation takes about 100 seconds.

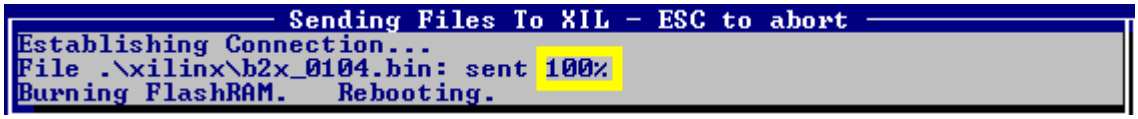
To begin this operation, enter **Alt-U** and use up/down arrow keys to highlight **XCM-II Xilinx** selection. Then press **ENTER** key.



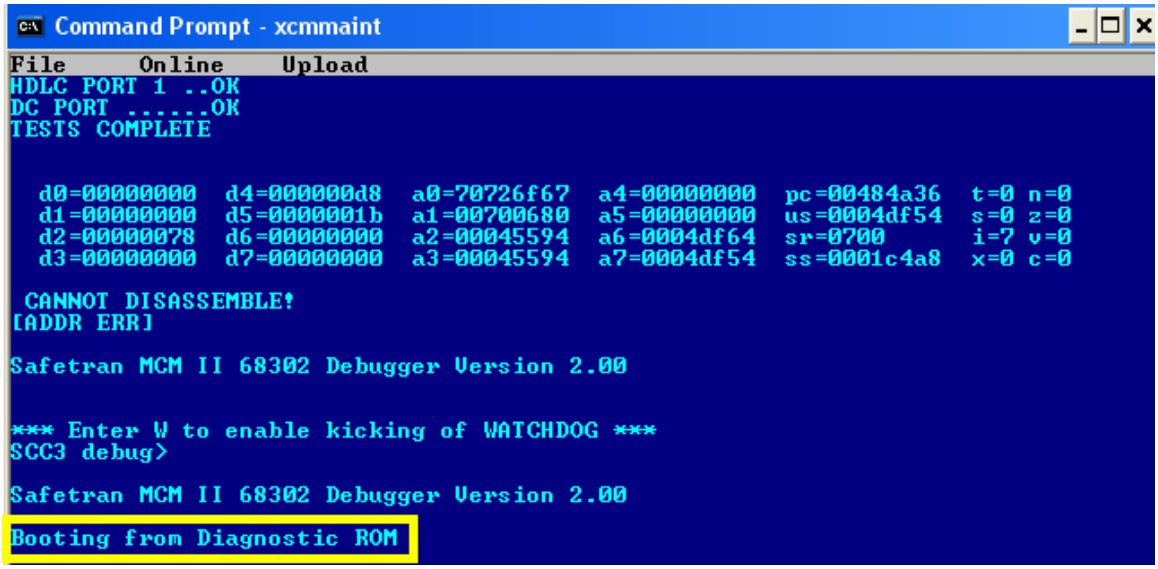
The following sequence of screens show the steps automatically performed by BCM II configuration program to accomplish re-flashing of Xilinx firmware:



New Xilinx firmware is being serially sent to BCM II with percentage of completion shown.



Percentage complete is now 100%, new Xilinx firmware has completely been serially sent to BCM II. New Xilinx firmware is written to flash memory. Upon completion of flash operation, BCM II will automatically reboot.



BCM II is rebooting. Old Xilinx firmware has been overwritten with new Xilinx firmware.

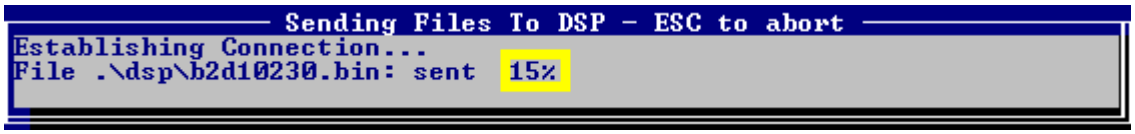
3. **XCM-II DSP** - DSP firmware handles the RF processing functionality.

As BCM II's DSP firmware is changed and updated by Siemens Rail, select this command to flash updated DSP firmware into BCM II. Upon selecting this command, BCM II configuration program will automatically establish a session with BCM II unit and write new DSP firmware to BCM II's flash memory. The entire operation takes about 60 seconds.

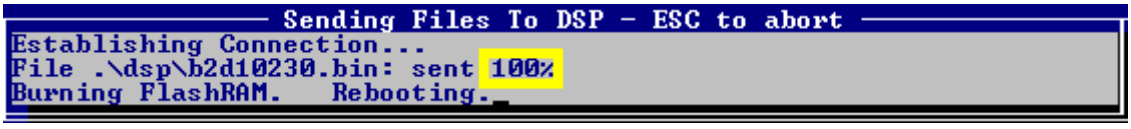
To start the DSP firmware update operation:

Enter **Alt-U** and use up/down arrow keys to highlight **XCM-II DSP** selection. Then press **ENTER** key.

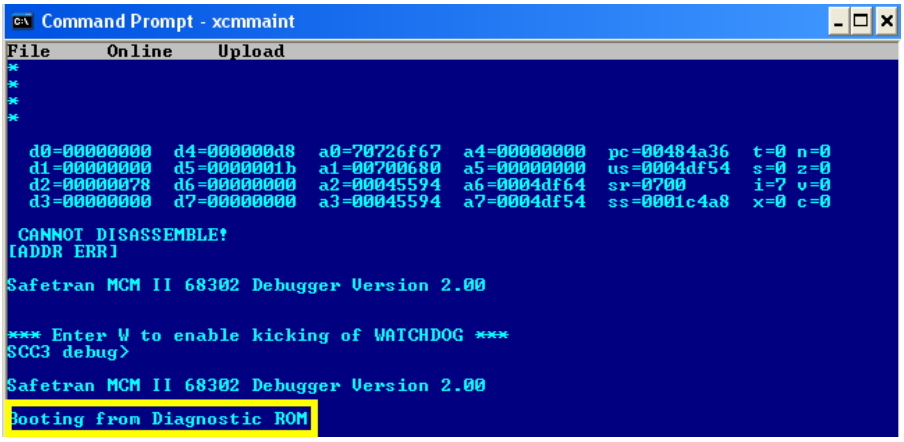
The following sequence of screens show the steps automatically performed by BCM II configuration program to accomplish re-flashing of DSP firmware:



New DSP firmware is being serially sent to BCM II with percentage of completion shown.



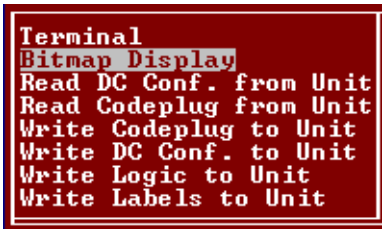
Percentage complete is now 100%, new DSP firmware has completely been serially sent to BCM II. New DSP firmware is written to flash memory. Upon completion of flash operation, BCM II will automatically reboot.



BCM II is rebooting. Old DSP firmware has been overwritten with new DSP firmware.

- **Bitmap Display**

This function is not used in BCM II.



Selecting the **Bitmap Display** entry causes the Bitmap screen, Figure 6-14, to display.

- The Bitmap screen is an online dynamic display of the logic state of any physical inputs or outputs associated with the BCM II via ladder logic.
- The logic states of all internal bitfields are displayed as well.
- When properly configured I/O modules are installed on the local Echelon® LAN, the current state of their inputs and outputs can be viewed in real time using this screen.

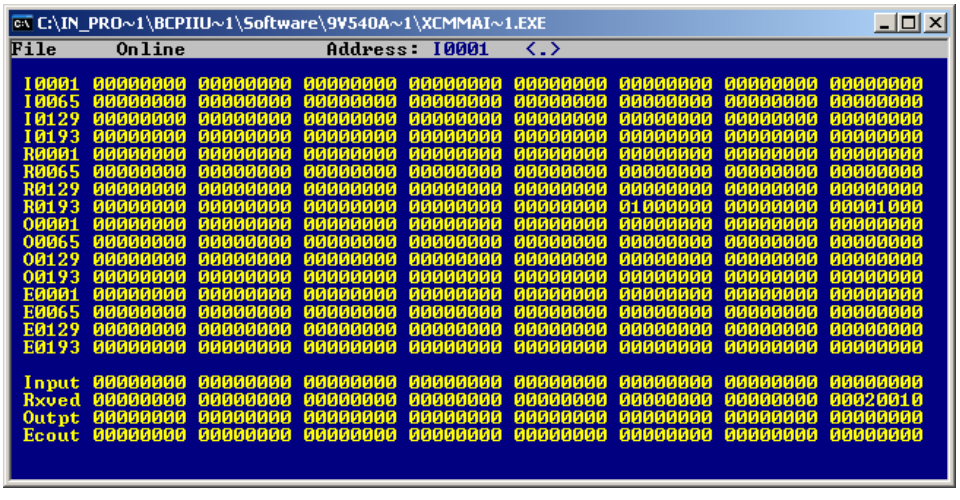
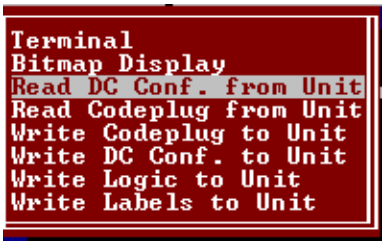


Figure 6-14 Bitmap Display Screen

- **Read DC Conf. From Unit**

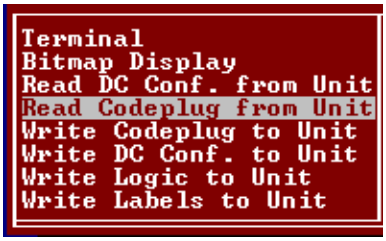
Selecting this function and pressing **ENTER**, causes the configuration of the DC port of the BCM II (associated with connector J4) to be read.



- The **Receiving data** popup box displays briefly as the data is read.
- The main edit screen is updated to reflect the configuration data that is read.

- **Read Codeplug From Unit**

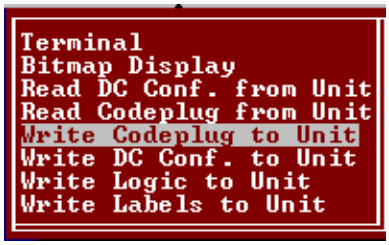
Selecting this function and pressing **ENTER**, causes the Codeplug portion of the BCM II configuration data to be read.



- This is a 512-byte data array that stores all the user-modifiable BCM II configuration information.
- The **Receiving data** popup box (see above) displays briefly as the data is read.
- The main edit screen is updated to reflect the codeplug data that is read.
- See Appendix C for code plug parameter details.

- **Write Codeplug to Unit**

Selecting this function and pressing **ENTER**, causes all the configuration data appearing on the main edit screen to be written to the BCM II's non-volatile memory.



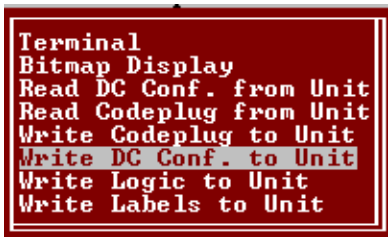
- The **sending data** popup box displays briefly as codeplug data is written.

⚠ CAUTION

CAUTION

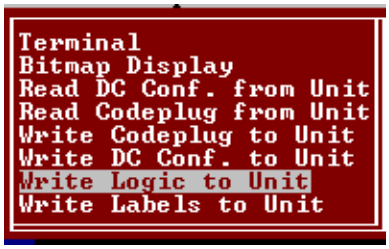
WHEN THE UPLOAD CODEPLUG FUNCTION IS SELECTED, THE EXISTING CODEPLUG DATA IN THE BCM II IS OVERWRITTEN AND IRRETRIEVABLY LOST.

- **Write DC Conf. To Unit**



This function is used to write the DC Configuration to the BCM II.

- **Write Logic To Unit Logic**



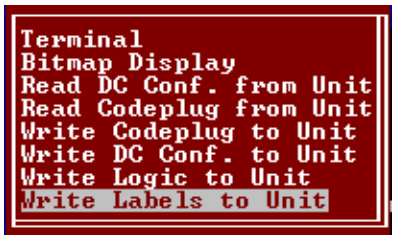
This function uploads compiled ladder logic to the BCM II if the following conditions are met:

- Appropriate ladder logic has been compiled
- The name of the logic file generated has been entered on the main edit screen (in the Site Settings section).
  - ♦ The file extension is omitted.

After the upload sequence is complete, the BCM II calculates a CRC value for the ladder logic.

- If this CRC value does not match the CRC embedded in the logic file, the process aborts with the BCM II unchanged.

- **Write Labels To Units Labels**



Selecting this function and pressing **ENTER** causes the tokenized label file associated with the ladder logic to be uploaded to the BCM II. This function is not used in BCM II.

- The conditions for uploading are the same as for the logic upload described above.
- The label file and the logic file are generated by the logic compiler and have the same base filename (with different extensions).
  - ♦ It is only necessary to specify the base filename in the **Logic File** field on the main edit screen.

6.4.3.4 Help Window

The **Help** window, Figure 6-15, provides general help instructions.

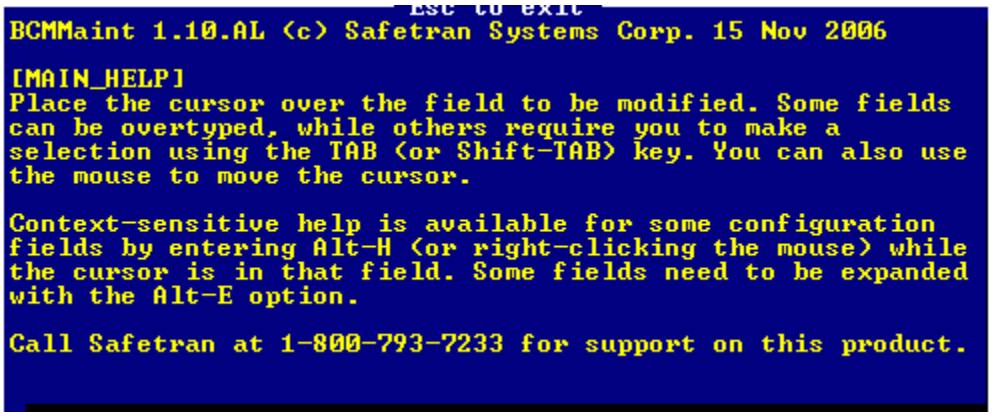


Figure 6-15 Help Window

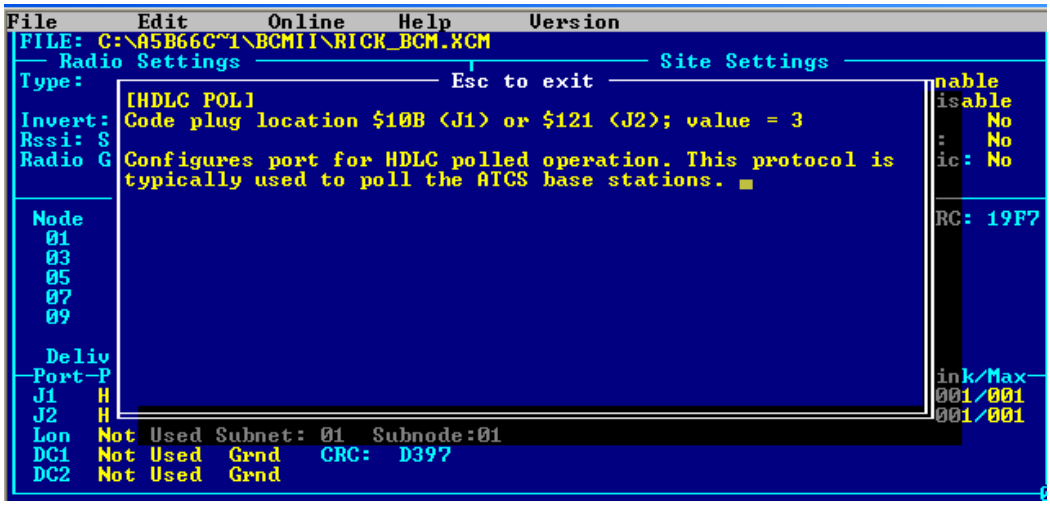
- **Help For Each Configuration Parameter**

Help text is available for each configuration parameter by one of two methods:

1. Use arrow keys to move cursor to a configuration parameter and press **Alt-H**.

2. Use mouse to move cursor to a configuration parameter and **right-click** the mouse.

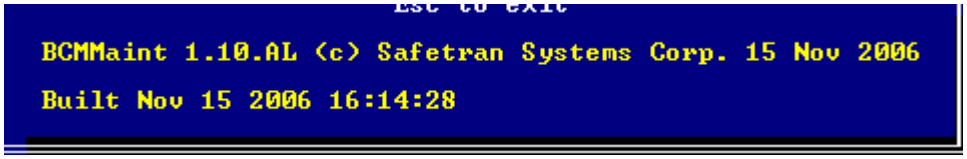
For example the figure below shows the help text for ‘protocol’ parameter in port configuration section of configuration screen:



To return back to main configuration screen press **ESC** key.

6.4.3.5 Version Window (Alt-V)

The Version (**Alt-V**) window shown below displays the executive software version running in the BCM II.



To return back to main configuration screen press **ESC** key.

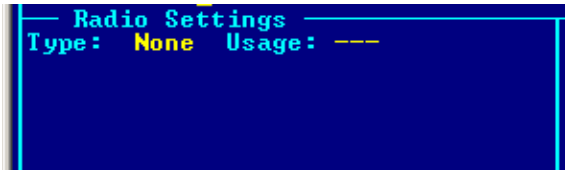
6.4.4 Radio Settings Displays

The **Radio Settings** section configuration is determined by the **Type** field setting.

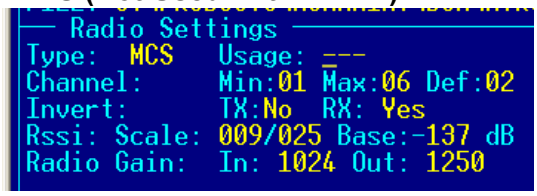
6.4.4.1 Type and Usage Fields

- The **Type:** field selection range and the default field configuration for each selected radio are as follows

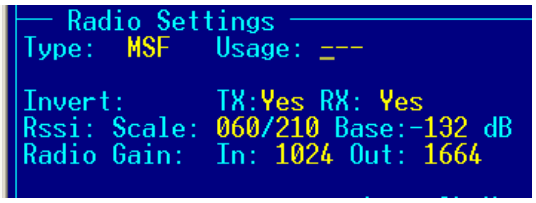
  - **None**



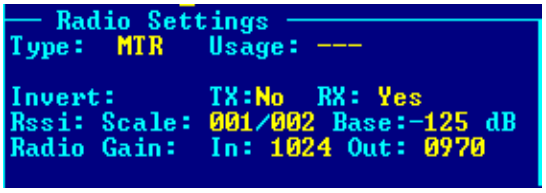
  - **MCS (Not Used With BCP II)**



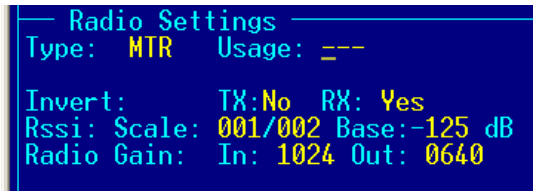
  - **MSF**



- **MTR**

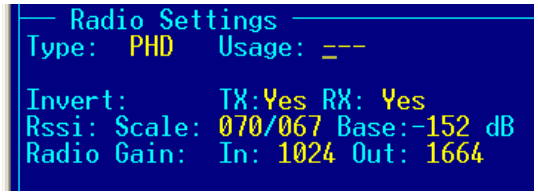


MTR3000 - Gain Out = 0970

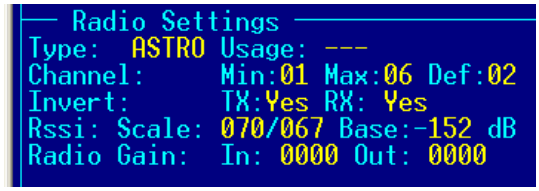


MTR2000 (Discontinued) - Gain Out = 0640

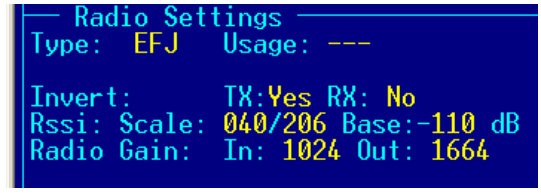
- **PHD**



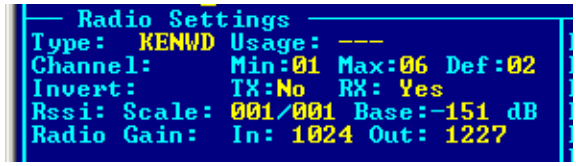
- **ASTRO (Not Used With BCP II)**



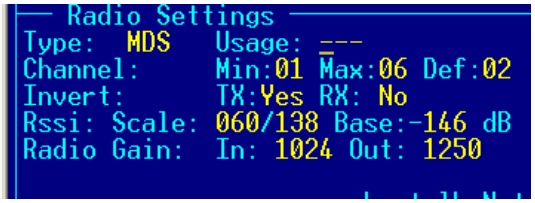
- **EFJ (Not Used With BCP II)**



- **KENWD (Not Used With BCP II)**



- **MDS (Not Used With BCP II)**



- The **Usage:** field selection range is as follows:
- **BCP**
- **MCP**

NOTE

NOTE

1. As shown above, not all of the **Radio Settings** fields are displayed for each radio.
   - The fields displayed are dependent on the radio selected.
2. For current BCP applications, set **Usage:** to **BCP** and select either **MTR** (MTR-3000), **MSF** (earlier Motorola MSF-5000), or MDS for the **Radio:** field.

6.4.4.2 Channel Field

In a BCP II configuration, the **Channel:** field, is not used. The ATCS channel assigned to the BCP II radio is set using Motorola CPS (Customer Programming Software) and associated test hardware.

6.4.4.3 Invert Field

The **Invert:** fields are used to invert the bit-sense of the transmitted data to or the received data from the WCP. This function is intended for cross-functionality with foreign equipment.

- The **Invert TX** and **Invert RX** field selection ranges are as follows:
  - **No**
  - **Yes**

6.4.4.4 RSSI Scale and Base Fields

RSSI (Received Signal Strength Indicator) scaling and base values are included on the configuration screen only for compatibility with foreign equipment.

- The default values result in proper RSSI reporting for current Siemens Rail BCP equipment.

6.4.4.5 Radio Gain

Radio Gain is used to control the sensitivity of the RX audio detector (**In**), or to adjust the radio deviation (**Out**).

- Radio input gain is normally not changed from the default values.
- The **Radio Gain** fields default values for are:
  - **MTR2000**
    - **In: 1024**
    - **Out: 0640**
  - **MTR3000**
    - **In: 1024**
    - **Out: 0970**

6.4.4.6 Default Value Setup

When the cursor is in the **Radio Settings Type** field, pressing <**Alt-E**> will cause XCMMaint to load the default values for the radio type selected.

- This will overwrite all radio parameters except channel (when applicable).

6.4.5 Site Settings Display

6.4.5.1 Local Addr Field

When the **Enable** function is selected this field sets the ATCS address for the BCP II as shown in Figure 6-16.

- Field selection range: **0.000.00.0000** to **9.999.99.9999**

NOTE

NOTE

The default value of **A.AAA.AA.AAAA** corresponds to a setting of **0.000.00.0000**.

This represents the local ATCS address assigned to BCM II. This should always be enabled. Since BCM II is a base station, ATCS address format is 3.RRR.NN.DDD where:

3 = Wire line address type
RRR = Railroad number(see Appendix B)
NN = Node number(railroad defined)
DDD = Base device number(railroad defined)

The ATCS specification recommends that the node number (NN) be the same as the node number of the cluster controller to which it is connected.

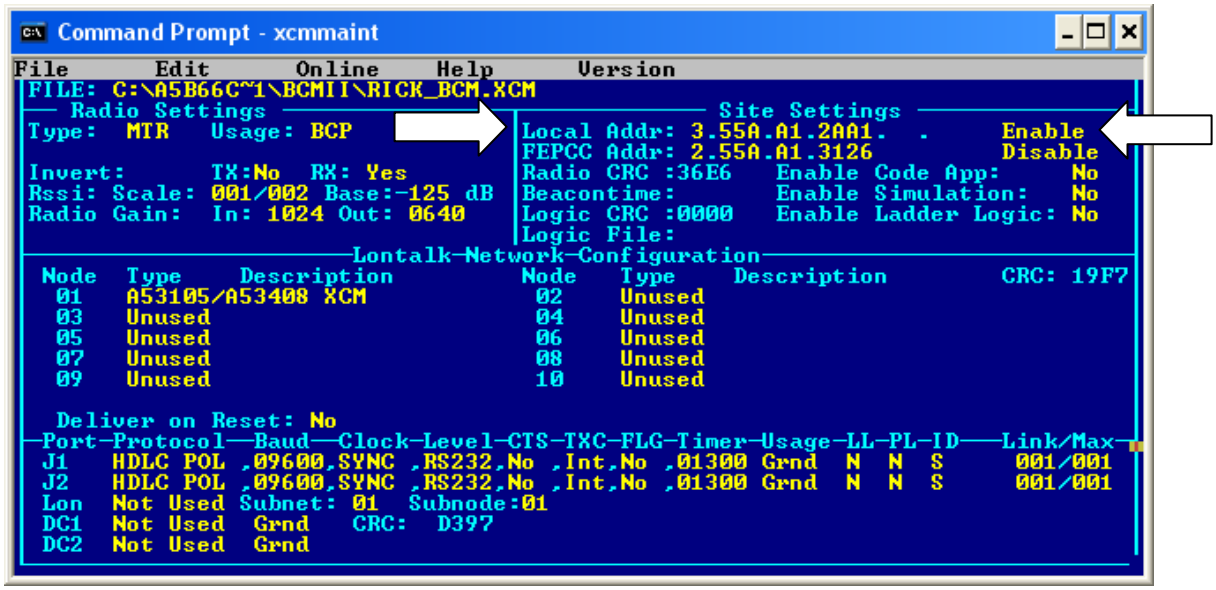


Figure 6-16 MainEditor Screen - Site Local Address Selection

6.4.5.2 FEPCC Addr Field

When the **Enable** function is selected (see Figure 6-17) this field sets the FEP/CC address for the initial inbound transmissions.

- Field selection range: **0.000.00.0000** to **9.999.99.9999**

NOTE

NOTE

The default value of **A.AAA.AA.AAAA** corresponds to a setting of **0.000.00.0000**.

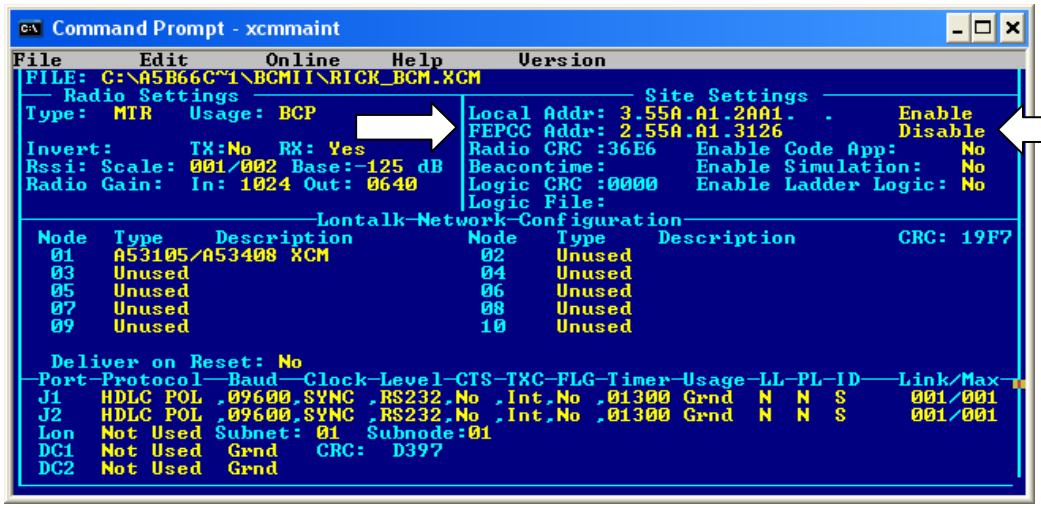


Figure 6-17 Main Editor Screen - Site FEPCC Address Selection

- This field is required for systems where the BCP equipment does not support packets with a zero destination length.
- When the **Disable** function is selected, the address set into the **FEPCC Addr:** field is ignored.

6.4.5.3 Enable Code App Field (Not Used With BCP II)

The **Enable Code App** field (see Figure 6-18) enables the internal MCM code system application when used with Siemens Rail Automation I/O modules.

- Field selection option:
  - **No** = If not using R/Link I/O modules
  - **Yes** = If using R/Link I/O modules (defined on XCMMAINT screen's LonTalk® Network Configuration

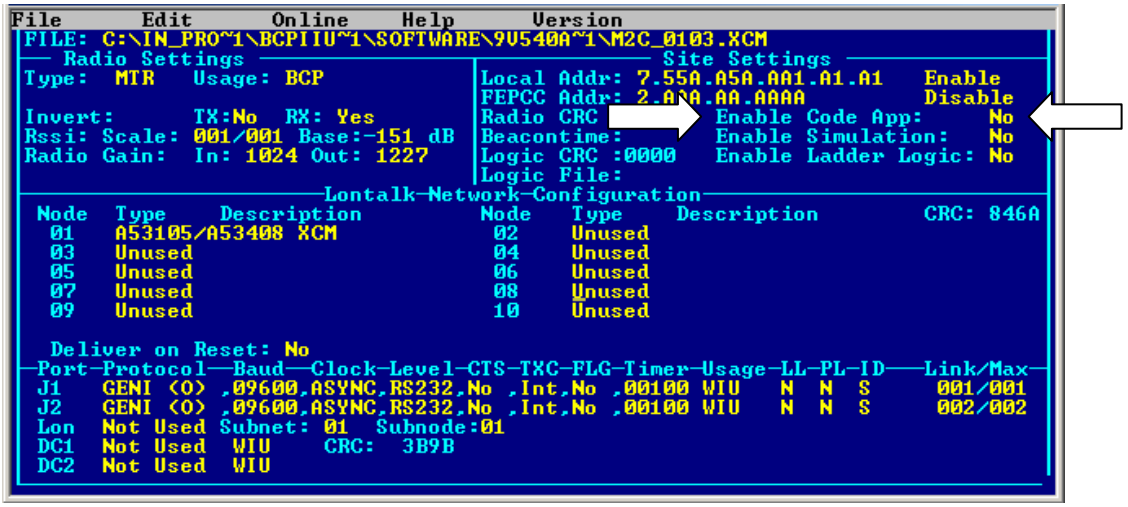


Figure 6-18 Main Editor Screen - Site Enable Code Application Selection

6.4.5.4 Enable Simulation Field (Not Used With BCP II)

The **Enable Simulation** field (see Figure 6-19) enables simulation, allowing inputs from the diagnostic program to toggle bits in the ladder logic application.

- Field selection option:
  - **No** = Disables manipulation of bits from diagnostic terminal
  - **Yes** = Enables manipulation of bits from diagnostic terminal

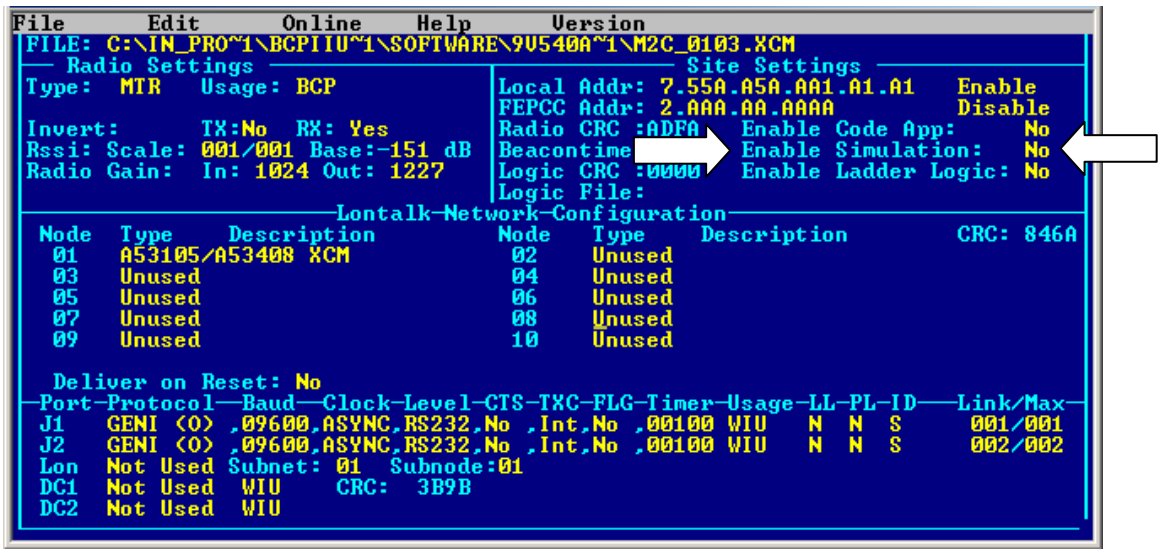


Figure 6-19 Main Editor Screen - Site Enable Simulation Selection

6.4.5.5 Enable Ladder Logic Field (Not Used With BCP II)

The **Enable Ladder Logic** field (see Figure 6-20) enables the internal ladder (PLC) logic.

- Field selection option:
  - **No** = Don't use Ladder Logic
  - **Yes** = Use Ladder Logic
- If disabled, indications from the I/O modules are passed straight through to the office, and office controls are passed straight through to the I/O module outputs.

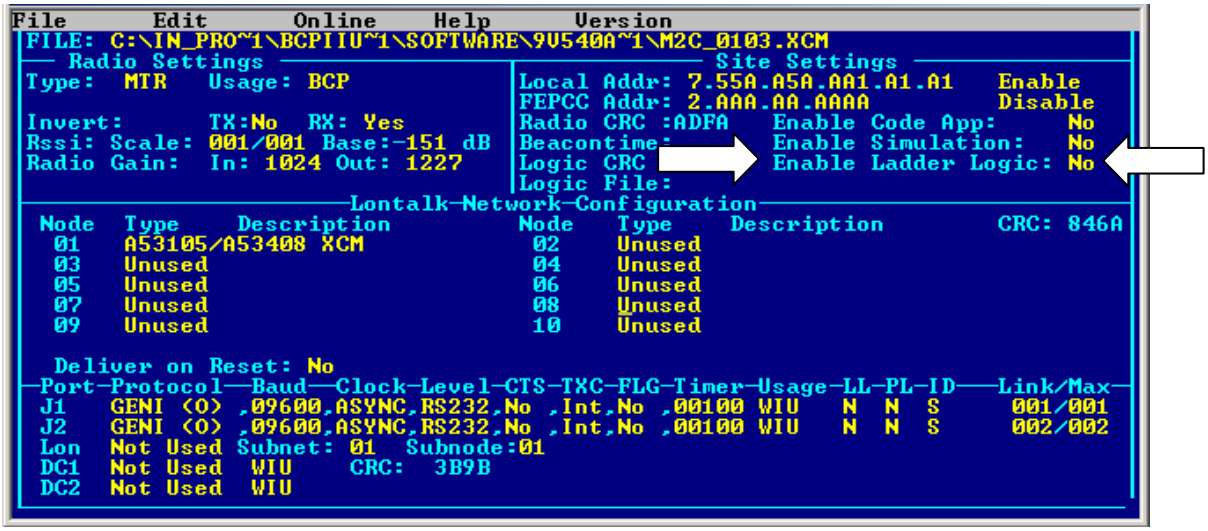


Figure 6-20 Main Editor Screen - Site Enable Ladder Logic Selection

- When the **Logic File: *** field is highlighted (see Figure 6-21) and **Enter** is pressed, the following prompt is displayed:

- Field selection option:
  - **Blank** with **Enable Ladder Logic** set to **No.**
  - ***** with **Enable Ladder Logic** set to **Yes.**
- To enter a ladder logic file name, perform one of the following:
  - Type the file name (maximum of eight characters plus the .LLW extension) at the **Enter Filename** prompt.

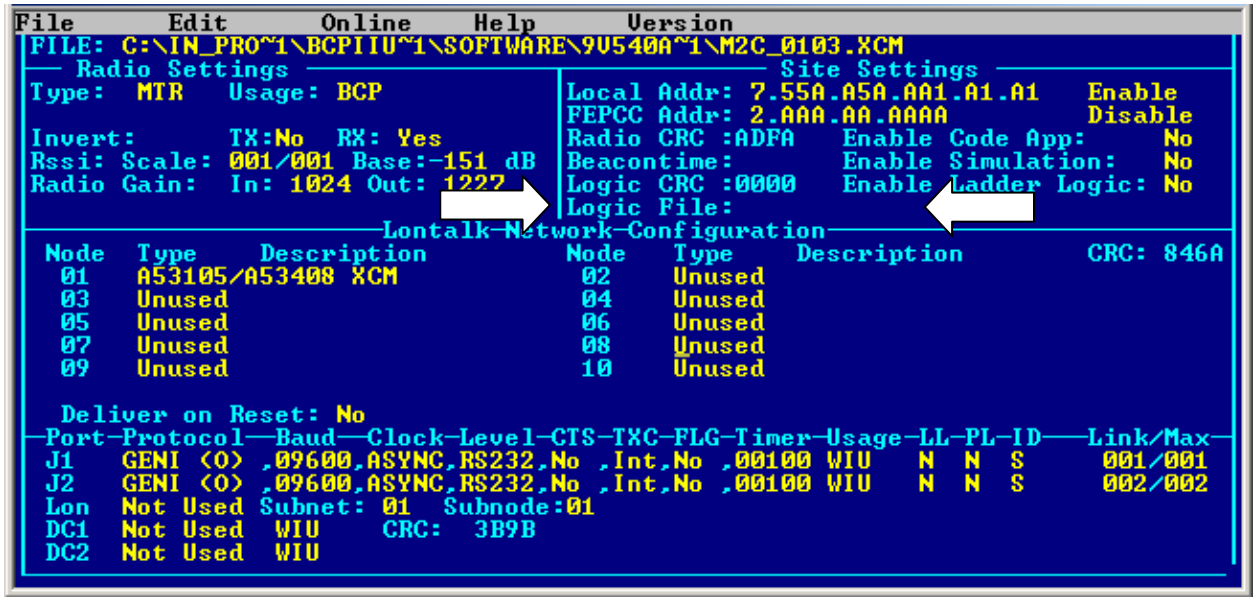
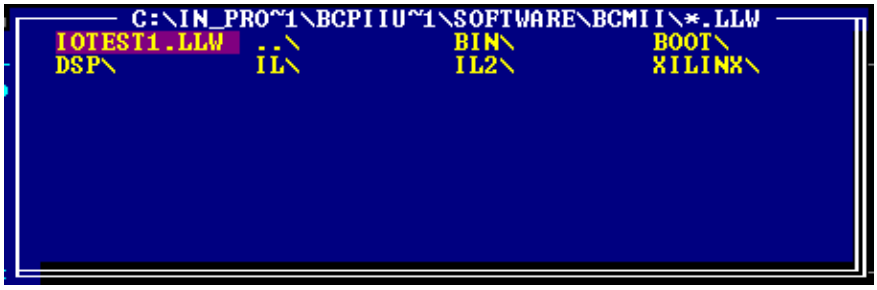


Figure 6-21 Main Editor Screen - Site Logic File Designation

- Press the **Enter** key to bring up the Ladder Logic File List (see below) and make a file selection from the presented list using the arrow keys.



6.4.6 LonTalk® Network Configuration

The LonTalk® Network is not used with the BCP II. No configuration settings are required. Any settings (other than default) will be ignored by the BCP II equipment.

6.4.7 BCM Port Configuration

See Figure 6-22.

6.4.7.1 Serial Client Ports J1 and J2

The **J1** and **J2 Port** field selection range descriptions are presented in Table 6-7 Client Port Field Descriptions.

Table 6-7 Client Port Field Descriptions

Field Name	Range	Description
Protocol	See Table 6-8	Serial protocol used by client. See Table 6-8
Baud	00300 to 19200 in 300 baud increments	Baud rate for specified port
Clock	SYNC and ASYNC	Specifies synchronous or asynchronous clocking
Level	RS232 and RS422	Selects RS-232 or RS-422 interface
CTS	No and Yes	Handshaking flag. If YES, the serial port uses RTS-CTS flow control.
TXC	Int and Ext	Synchronous clock only: Int sets the BCM client port as clock source
FLG	No and Yes	Synchronous only: YES causes BCM to send HDLC idle flags to serial port
Timer	00000 to 99999	Code line protocol poll timer in 10ms tics; can be left at 160 (1.6 sec) for most applications
Usage	Ground, OBC, and WIU	Denotes type of equipment connected to port: Ground network(BCM II application). Onboard(OBC) Controller(mobile application), and Wayside Interface Unit(WCP application).
LL	Y and N	Enables ladder logic operations
PL	Y and N	Enables polling operations
ID	L and S	Selects (L)ong or (S)hort RX idle character delays.
Link	000 to 999	Sets the poll address or start of poll range for some emulations
Max	000 to 231	Sets the end of poll range for some emulations

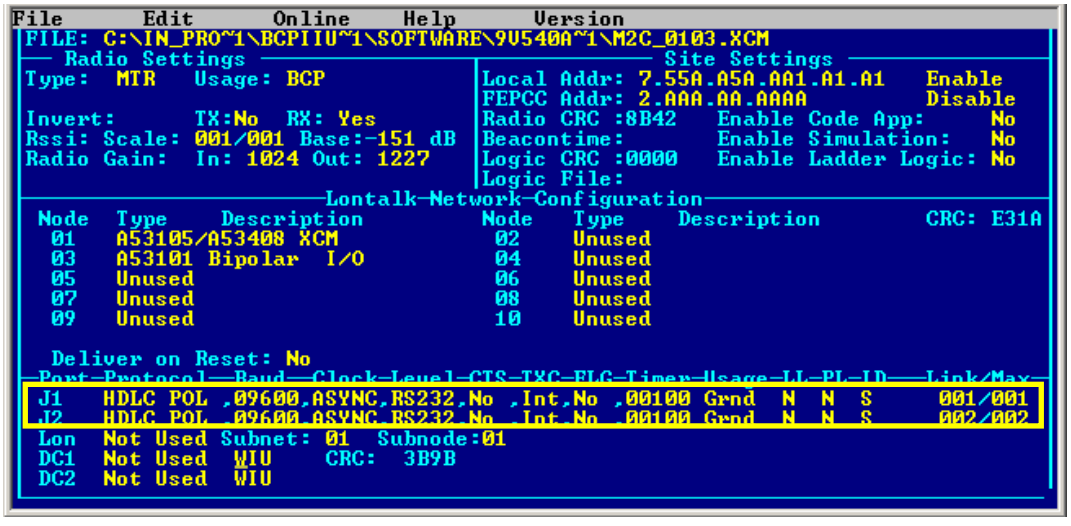


Figure 6-22 Serial Port Protocol Select

Table 6-8 Client Port Protocol Descriptions

Protocol	Description
NOT USED	No Protocol Selected - Not Used
HDLC ADM	HDLC Asynchronous Disconnect Mode
HDLC ABM	HDLC Asynchronous Balanced Mode
HDLC POL	HDLC polled operation: Will answer to poll ID set in LINK field
HDLC UI	HDLC Unnumbered Information mode
HDLC NULL	HDLC Null (connectionless) mode
GENI (O)	Emulates US&S Genisys office. Polling range set by Link/Max fields
ECP	Interface to Safetran Emergency Control Panel
BCP GENI	Emulates Genisys field for sending and receiving Genisys ATCS packets. Link field defines Genisys station address.
MCS 1	Emulates Harmon MCS-1 office. Polling range set by Link/Max fields
ASYNC	Standard ASYNC port: inbound data converted to ATCS packets and outbound packets are stripped of ATCS headers
SSR	Interfaces to Safetran Spread Spectrum Radio linear network
SCS128	Safetran SCS128 office emulation. Polling range set by Link/Max fields
GENI (F)	Emulates US&S Genisys field. Used for dial backup operation
CN2000A	Canadian National proprietary (new) asynchronous field station protocol
CN2000B	Canadian National proprietary (old) asynchronous field station protocol
CN DHP	DHP2000 Series equipment
SLIP	Single Line IP Protocol
CENTRA	Centra-Code protocol
FRM RLY	Frame Relay Protocol
BGENI (O)	Genisys ATCS BCP Office interface
PPP	Point-Point Protocol
PPPMCast	Point-Point Protocol with Multicast capability
GPRS(bu)	GPRS Backup protocol
GPRSCont	GPRS Continuous protocol
ARES	ARES Protocol

6.4.7.2 IP Addressing

Six protocol assignments require IP addressing.

- These are:
  - **SLIP**
  - **FRM RLY**
  - **PPP**
  - **PPPMCast**
  - **GPRS(bu)**
  - **GPRScont**
- The **IP Address Assignments** screen, Figure 6-23, displays when the cursor is placed on one of the above protocol fields and <**Alt-E**> is pressed.
- The fields in this screen are:
  - **Local IP:**
    - IP address of the BCP
  - **Remote Host IP**:
    - IP address of the packet switch or office equipment
  - **Base Route ID:**
    - Base routing number (ATCS)
  - **Port J1 Routing Priority Tag**
  - **Port J2 Routing Priority Tag**
  - **RF Port Routing Priority Tag**
    - One of two separate ATCS Routing Priority Tag values may be assigned to each port.
  - **$85** designates that a port is used as a secondary connection to the office
  - **$45** designates that a port is used as a primary connection to the office.

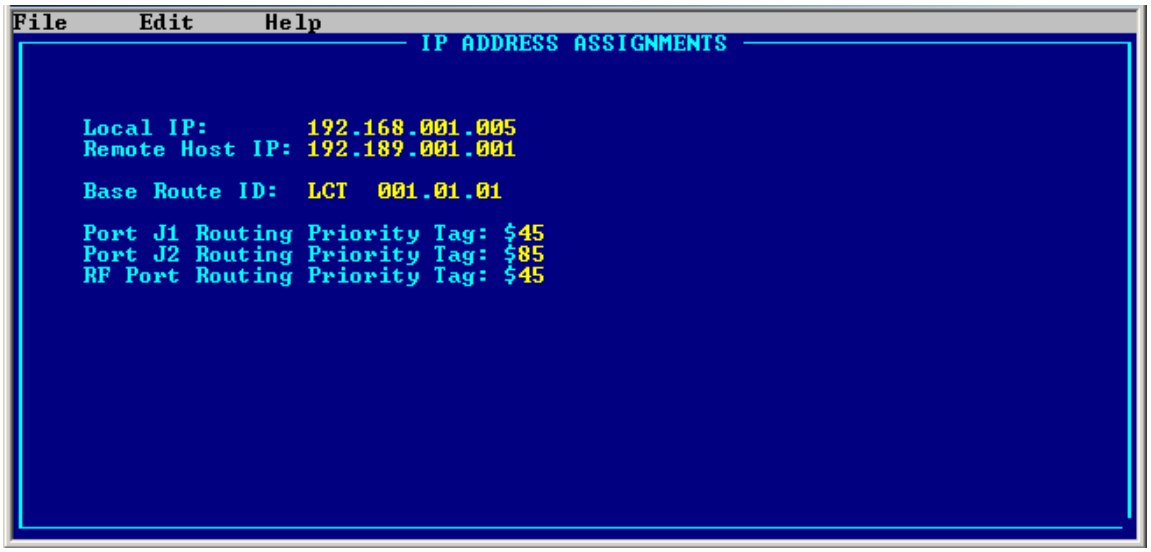


Figure 6-23 IP Address Assignments Screen

6.4.7.3 LON Port

The **Lon Port** is **NOT USED**. The BCM component does not support Echelon® LonTalk®.

- **Not Used**
- **Normal**

NOTE

NOTE

BCP II **DOES NOT USE** Echelon® Lon Talk®, therefore this setting is **Not Used**.

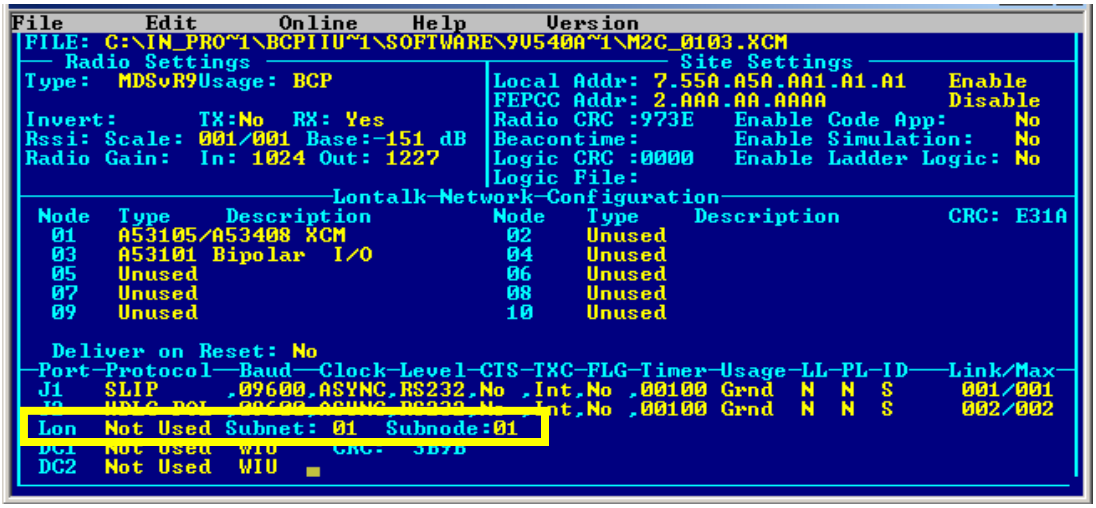


Figure 6-24 LON Enable Select

6.4.7.4 DC1 and DC2 Ports

These auxiliary I/O ports can be individually configured to drive a DC code line or to report a change of inputs to the office as alarms.

- The field port protocol selection ranges for each port are as follows:

Protocol	Description	Usage
NOT USED	The DC ports are unused.	WIU
506 CODE	Emulates DC 506 office protocol. Use ALT-E to access configuration screen.	WIU
514 Code	Emulates DC 514 office protocol. Use ALT-E to access configuration screen.	WIU
J Code	Not Supported	WIU
K Code	Not Supported	WIU
Alarms	J4 inputs reports as alarms report to office: IN1, IN2, IN3, IN4, IN5, IN6, IN7, IN8	WIU
Control	Enables J4 OUT1, OUT2 to be controlled by J4 inputs, or internal alarm conditions. Enter Alt-E to access configuration screen.	WIU

- The **DC1 and DC2 Port Baud** field selection ranges:

Usage	Description
Ground	Ground network
OBC	mobile application
WIU	WCP application

- The **CRC** value displayed changes with each new protocol selection.

The **TIMECODE CONFIGURATION** edit screen, Figure 6-25., may be accessed when either the **506 Code** or **514 Code** field port protocols are selected.

- Accessed by entering **Alt – E**.

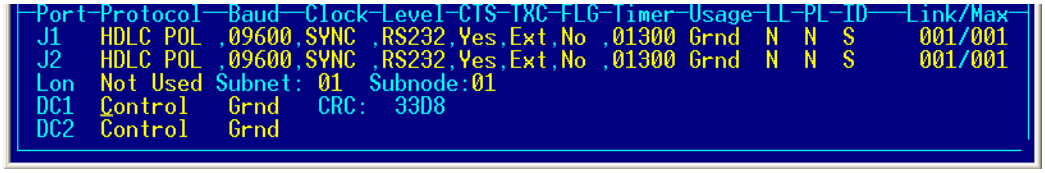


Figure 6-25 DC Control

The DC Alarm Control configuration screen appears by pressing Alt-E. The screen will appear as shown in Figure 6-26..

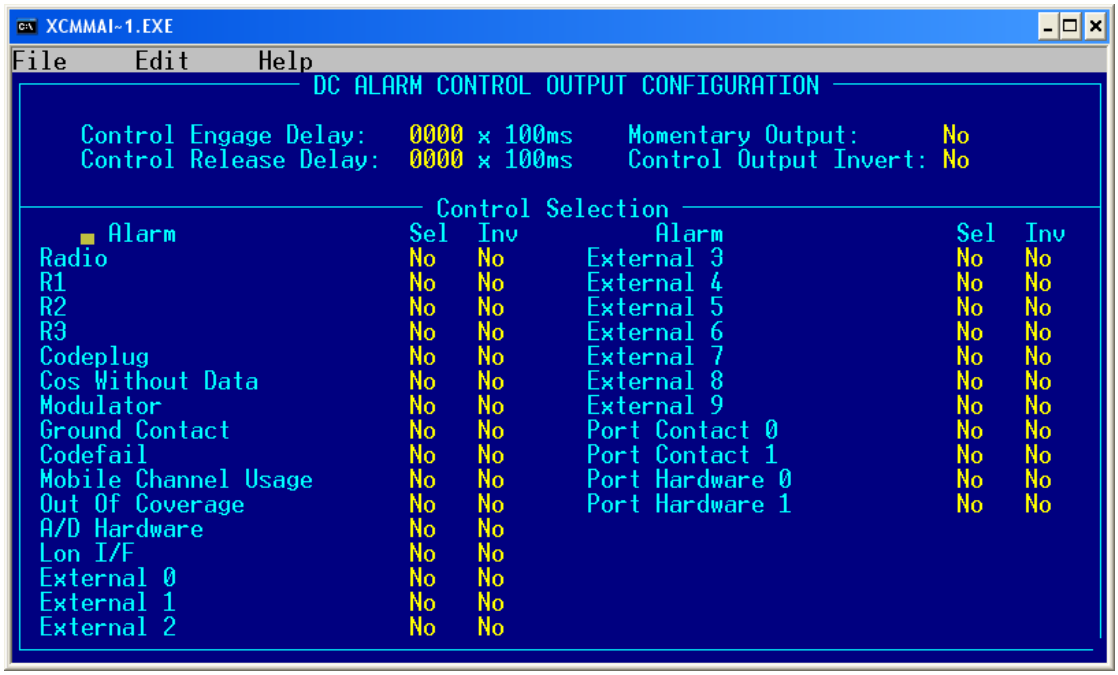


Figure 6-26 DC Alarm Control Configuration

The DC Alarm Control has the following configuration adjustments:

- **Control Engage Delay** - delays output activation.
- **Control Release Delay** – delays output de-activation.
- **Momentary Output** – Allows for a single pulse on activation.
- **Control Output Invert** – No for active closed output, or Yes for active open output.
- **Alarm Sel** – Select Yes allow the Alarm condition specified to control the output.
- **Alarm Inv** – Select Yes or NO to configure the state of the alarm condition required to control the output. The alarm condition must also have Sel set to Yes.

6.4.7.5 DC1 Codeline Configuration Screen

The Timecode Configuration Screen, Figure 6-27, is divided into two sections: **US&S 5XX Timecode Configuration** and **Station Data**.

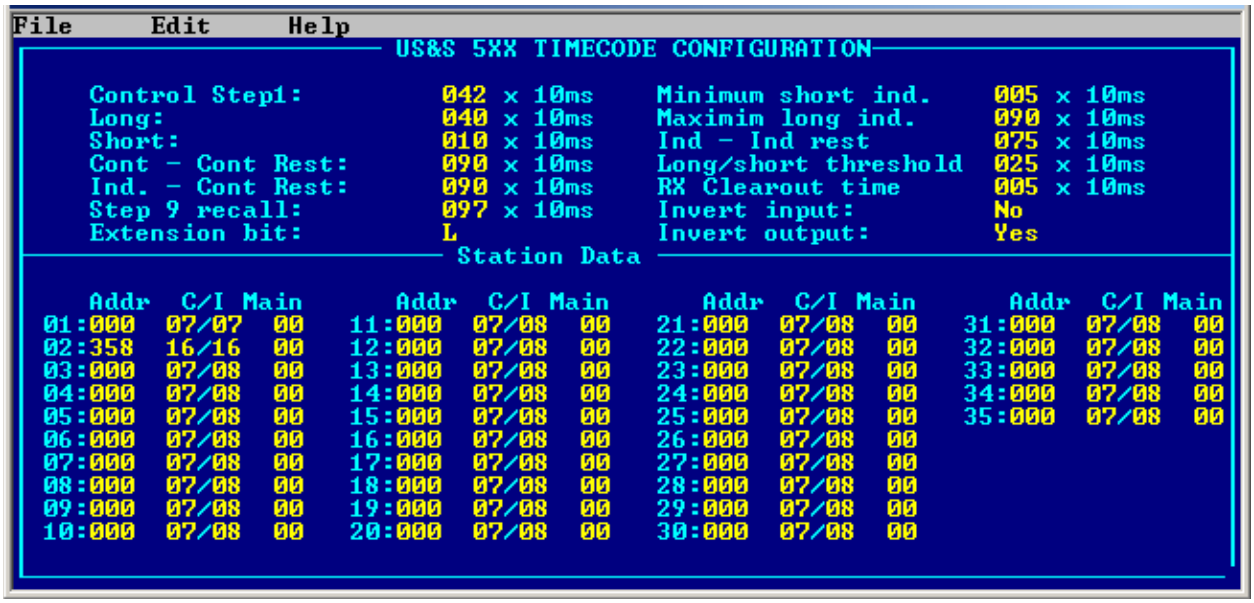


Figure 6-27 DC Codeline Configuration Screen

- The **US&S 5XX Timecode Configuration** section provides a means to modify step timing and other parameters as required.
  - ♦ As described below, a default set of parameters may be applied which will be suitable for most configurations.

- The **Station Data** section allows entry of station and pup addresses.
  - The fields are filled in as follows:

	Addr	C/I	Main
Node #:	**aaa**	**cc/ii**	**mm**

where:

aaa is the 3-digit address of the field unit

cc is the number of control bits (default of 7)

ii is the number of indication bits (default of 8)

mm is the address of the main unit where multiple field units are installed

- **DC Codeline Configuration Screen Pulldown Menus**

- **File Menu**

Pressing **ALT-F** will display the File menu,

- Selecting the **Return** entry returns the display to the Main Edit Screen.
- All data on the Configuration Screen is saved when the .XCM file is saved from the Main Edit Screen.

- **Edit Menu**

Pressing **ALT-E** will display the Edit Menu. This menu has three entries:

- **Default**
  - When this entry is selected and the **ENTER** key pressed, the Timecode Configuration section fields are set to the most commonly used timing settings as shown in Figure 6-28.

- **Copy**
  - When this entry is selected and the **ENTER** key pressed, the contents of all fields on the screen are saved in memory and are held until the XCMMAINT utility exits.
  - This is similar to the familiar Windows copy/paste function but is local to the XCMMAINT application only.
  - The purpose of this feature is to facilitate multiple copies of identical DC codeline parameters and/or addressing across multiple .XCM files.

- **Paste**
  - When this option is selected and the **ENTER** key pressed, the fields on the Main Edit Screen are set to values saved in a previous copy operation.

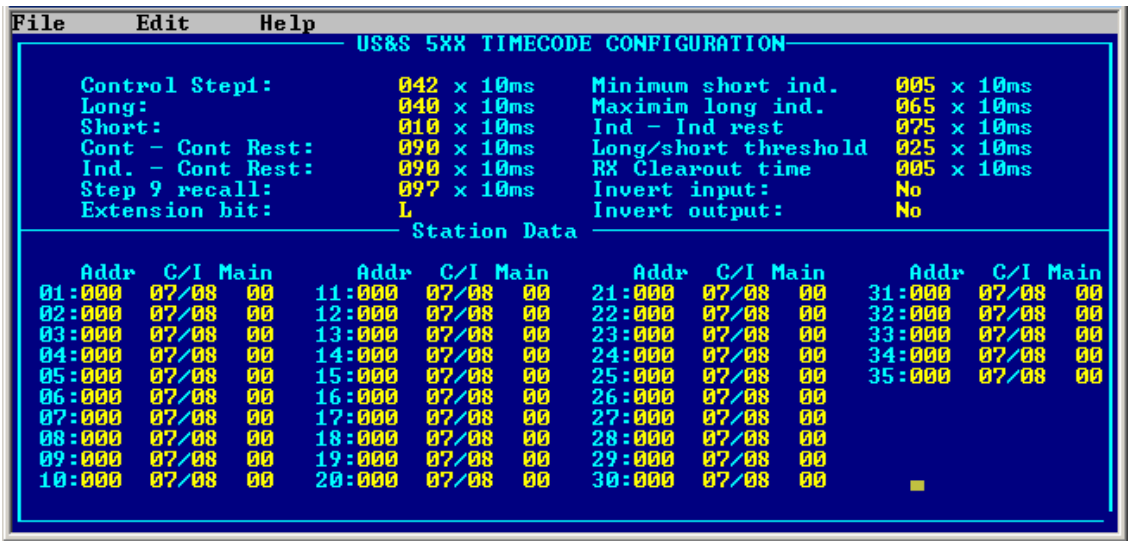


Figure 6-28 Timecode Configuration Defaults

6.4.7.6 Loading A New Executive

New versions of the executive program are distributed as XCMxxxy.BIN, where xxx is the major version number and y is the minor revision number.

- Two methods may be used to install the executive program.

6.4.7.7 Installing New Executive Program Version

See Section ☐

6.4.7.8 Reinstalling Existing Executive Program Version

When installing an executive program whose version is older than the version currently running in the BCM II, the following message will appear:

Go to Section 6.4.7.13 (GF1, GF2, GF4) for the procedure to install an existing executive program.

6.4.7.9 Installing New Xilinx Program Version

See Section 6.4.3.3.

6.4.7.10 Reinstalling Existing Xilinx Program Version

When installing a Xilinx program whose version is older than the version currently running in the BCM II, the following message will appear:

Go to Section 6.4.7.13 (GF1, GF2, GF4) for the procedure to install an existing Xilinx program.

6.4.7.11 Installing New DSP Program Version

See Section ☐

6.4.7.12 Reinstalling Existing DSP Program Version

When installing a DSP program whose version is older than the version currently running in the BCM II, the following message will appear:

Go to Section 6.4.7.13 (GF1, GF2, GF4) for the procedure to install an existing DSP program.

6.4.7.13 GF1, GF2, GF4

Use the following commands for sending and flashing file(s) to BCM II if file is an older version than what is currently installed:

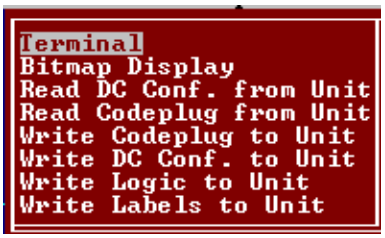
- **GF1** – send and flash Xilinx (Step 12 below)
- **GF2** – send and flash DSP (Step 15 below)
- **GF4** – send and flash executive (Step 9 below)

NOTE

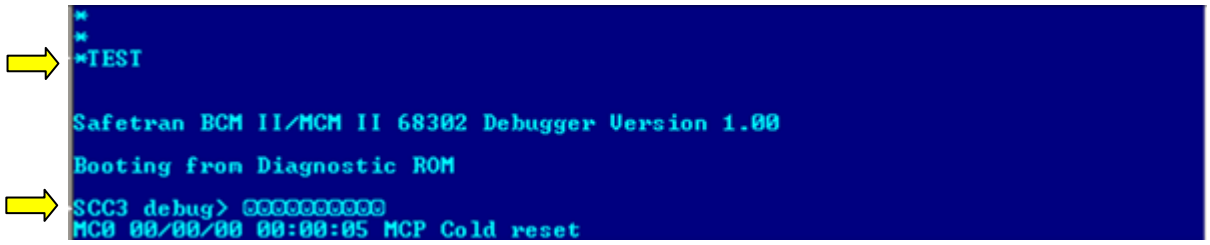
NOTE

File ‘xcmmaint.ini’ specifies the path to each file to be installed. However, if the file does not exist, then a prompt will appear asking for the path to file to be installed.

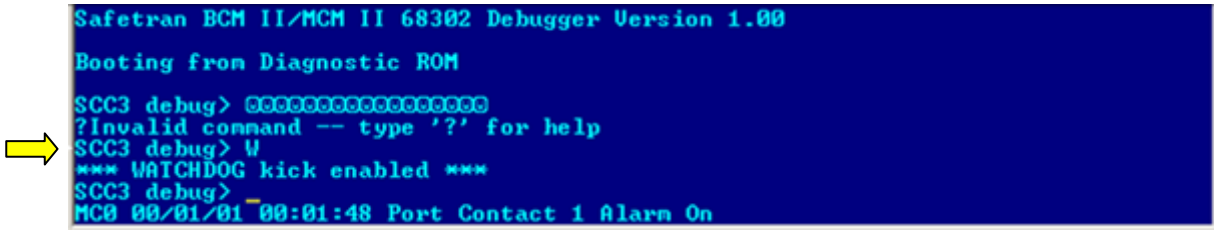
1. Run the XCMMAINT.EXE program.
   - The Main Editor Screen displays.



2. Hold down the **ALT** key and type **O**.
   - The **Online** drop-down menu displays.
3. Select **Terminal** from the drop-down menu.
   - The Online Terminal Screen displays.
4. Press the **ENTER** key
   - Verify that the "*" prompt is displayed.
5. Enter **test** and then press **ENTER** key. BCM II will reset.
6. While the unit is resetting, press **CTRL** and **A** keys together and hold them down until the following screen is observed:

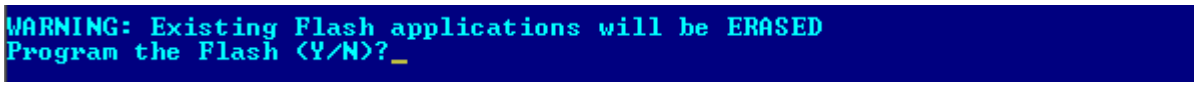


7. When **SCC3 debug>** appears, press **Enter** key
8. Enter **W** followed by **Enter** key to enable kicking of system watchdog.



9. For sending and flashing executive firmware enter **GF4** followed by **Enter** key to start the firmware upload operation. A window will appear showing the percentage of upload completed.

10. After upload is complete, prompt will appear as follows:



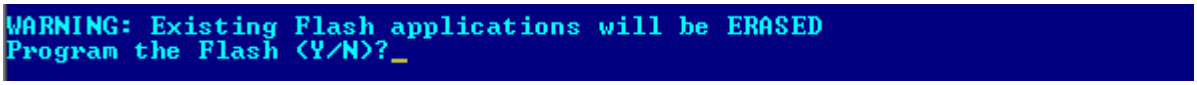
Enter the following:

- **Y** to write file to flash memory. System will restart.
- **N** to abort operation.

11. During system restart, executive firmware will read Xilinx and DSP firmware from flash memory. If there is an incompatibility between executive firmware and Xilinx or DSP one of the following error messages will be displayed on front-panel display:
"DSP Load Started" - This message stays on the display.
:Incorrect Xilinx" - This message appears for 2 seconds and then resets.
In this case proceed to step 12. Otherwise, firmware updating is complete.

12. If coming from step 11, then cycle power and immediately perform steps 6, 7, and 8. Otherwise to upload new **Xilinx** firmware, perform steps 5, 6, 7, and 8. Then, enter **GF1** followed by **Enter** key to start the firmware upload operation. A window will appear showing the percentage of upload completed.

13. After upload is complete, prompt will appear as follows:



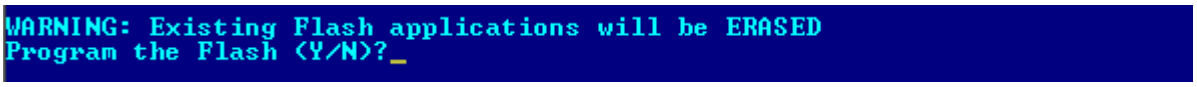
Enter the following:

- **Y** to write file to flash memory. System will restart.
- **N** to abort operation.

14. During system restart, executive firmware will read Xilinx and DSP firmware from the flash memory. If there is an incompatibility between the executive firmware and Xilinx or DSP one of the following error messages will be displayed on front-panel display:
"DSP Load Started" - This message stays on the display.
"Incorrect Xilinx" - This message appears for 2 seconds and then resets.
In this case proceed to step 15. Otherwise, firmware updating is complete.

15. If coming from step 14, then cycle power and immediately perform steps 6, 7, and 8. Otherwise to upload new **DSP** firmware, perform steps 5, 6, 7, and 8. Then, enter **GF2** followed by **Enter** key to start the firmware upload operation. A window will appear showing the percentage of upload completed.

16. After upload is complete, prompt will appear as follows:



Enter the following:

- **Y** to write file to flash memory. System will restart.
- **N** to abort operation.

17. Firmware updating is now complete.

6.5 MTR3000 ALIGNMENT

The MTR3000 Base Station is the only component of the BCP II requiring periodic alignment. Refer to the MTR3000 Service Manual (Motorola Document Number: 68007024097), for detailed instructions.

NOTE

NOTE

The MTR3000 is factory aligned to meet customer performance standards and should not require alignment when initially installed. Realignment of the Base Station is needed only when the operating frequency or power output must be changed or when the receiver settings require adjustment.

6.5.1 General Alignment Procedures

Refer to the Motorola manual for the MTR3000 for alignment information.

6.5.1.1 Front Panel Removal Procedure

The front bezel of the MTR3000™ is removed by grasping the notches on the sides of the bezel and firmly pulling back to disengage the locking clips.

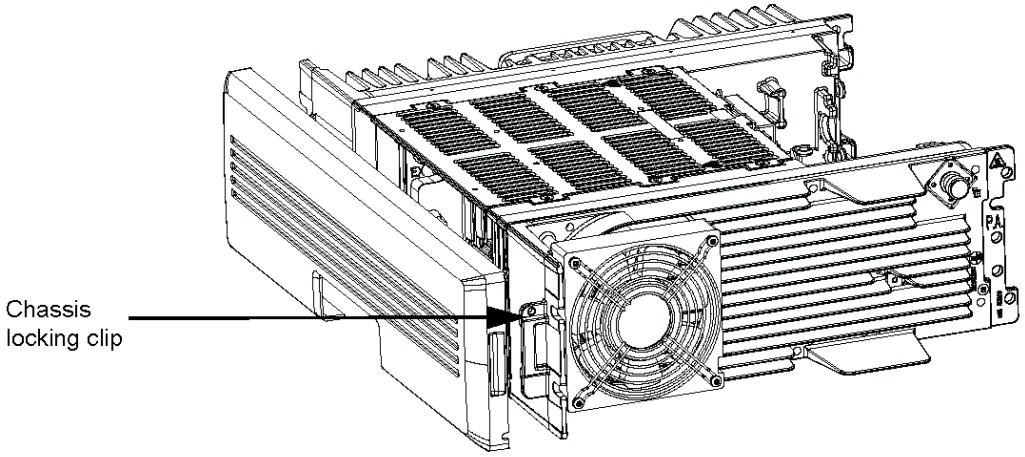


Figure 6-29 MTR3000 Front Panel

6.5.1.2 Test Setup

Figure 6-30 shows connections between the MTR3000 and the PC. The connection procedure is:

1. Connect the Type A USB end of the cable to the USB port of the PC.

2. Connect the Type B end of the cable to the USB connector on the front of the MTR3000.

3. Start the Motorola Service software on the PC. (Motorola Service software is required to communicate with the MTR3000).

Figure 6-30 PC to MTR3000 Connection

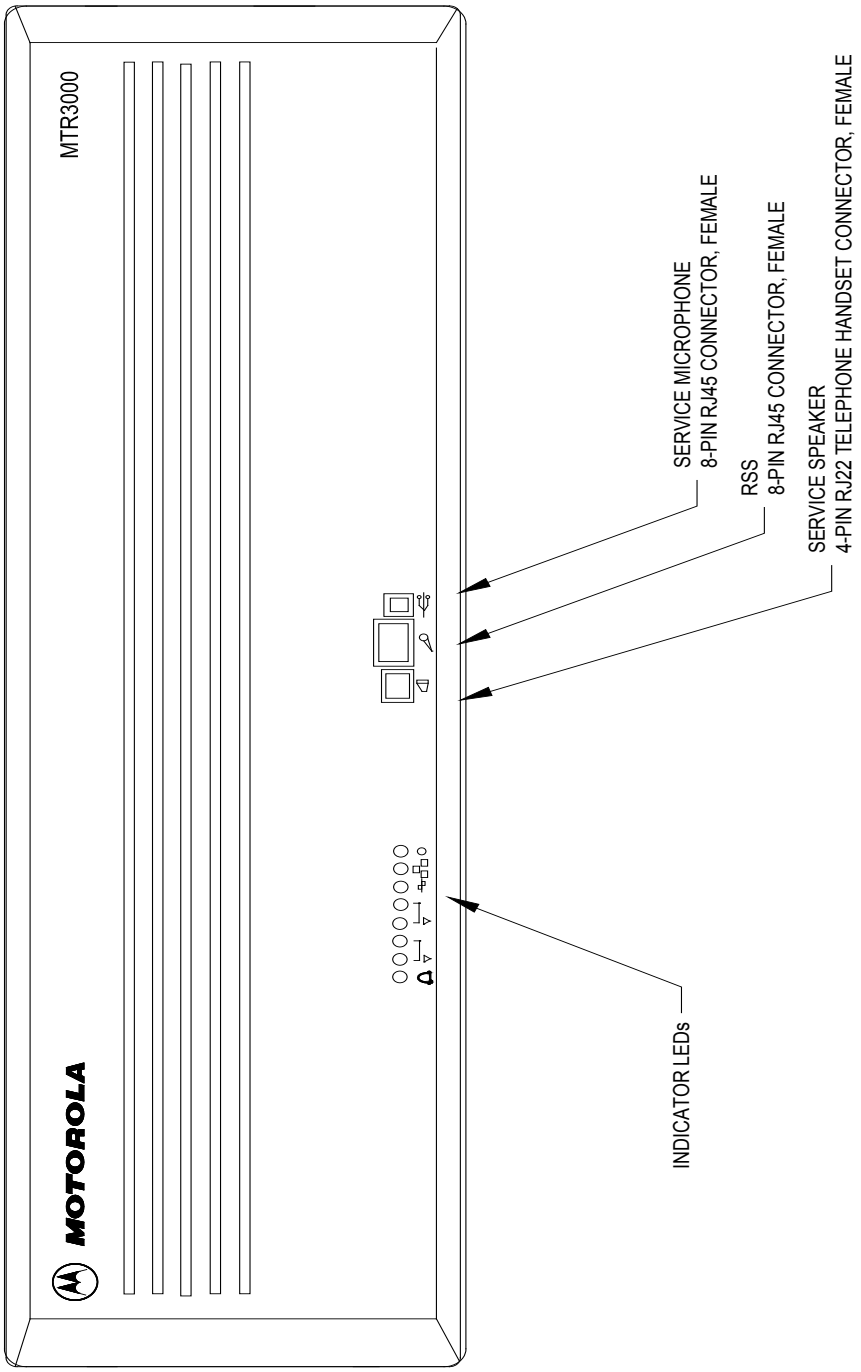


Figure 6-31 MTR3000 Front View

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SECTION 7
TROUBLESHOOTING

7.0 TROUBLESHOOTING

7.1 GENERAL

Extensive error and status indications have been provided to aid in maintaining and troubleshooting the BCP II. Two information levels are available, depending on whether a laptop computer is available.

7.2 CODE SYSTEM APPLICATION

Initial troubleshooting involves determining the most likely location of the fault. On a code line with a number of field and base stations, it is relatively simple to locate the common denominator if all fields are not responding. This could be the leased circuit between the base stations and the office, or the modems and or associated circuits. In order to isolate the fault, the following information may be helpful.

7.2.1 Serial Link

BCP II's are polled from the office using HDLC polled protocol. Serial traffic can be monitored on a laptop, or by connecting a protocol analyzer to the serial port. Also, the TX and RX LEDs of the modem should be alternately flashing at a rapid rate.

NOTE

NOTE

On startup, it may take a few minutes for the modem LEDs to start flashing. This delay is dependent on the polling cycle of the office.

Once fast polling has started, the polling will pause every ten seconds for approximately 500ms and then resume again. Irregular pauses are an indication of noisy lease lines and/or clocking problems.

NOTE

NOTE

The serial cable connecting the modem to the BCM II must be wired as follows:

2-2	5-5	17-17
3-3	7-7	24-24
4-4	15-15	

A straight cable containing all 25 wires will not work with some modems.

Using the laptop, the MONE * $100 command monitors the polling on serial port J1.

NOTE

Generally used to highlight certain information relating to the topic under discussion.

A typical poll and response would be as follows:

```
MC0 00/00/00 00:01:06 IN  layer 1 port $100 link $2
MC0 00/00/00 00:01:06 $0000  02 11
MC0 00/00/00 00:01:06 OUT layer 1 port $100 link $2
MC0 00/00/00 00:01:06 $0000  02 33
MC0 00/00/00 00:01:06 IN  layer 1 port $100 link $2
MC0 00/00/00 00:01:06 $0000  02 11
MC0 00/00/00 00:01:06 OUT layer 1 port $100 link $2
```

The MOND command halts data monitoring.

Data messages are reported as IN (inbound) or OUT (outbound). Inbound messages are always directed to the office while outbound messages are always directed to a field unit. By using the ATCS datagram structure provided, the messages can be decoded to determine their labels, destinations, and source addresses.

NOTE

In the destination and source address fields, a zero (0) is always represented by the character A (e.g., 50 is written as 5A).

7.2.2 RF System Troubleshooting

Verify receipt of transmission from the WCP field radios by observing the RF RX LED indicator on the BCM II front panel, or by monitoring port $300 on the DIAGNOSTIC PORT.

If the LED lights, proceed to paragraph 7.2.2.2.

NOTE

Generally used to highlight certain information relating to the topic under discussion.

7.2.2.1 RF TX Troubleshooting

If the RF RX response is seen each time,but the BCP II does not acknowledge these indications with a transmit indication, check the following:

1. Antenna connections and reflected power

2. Verify radio self-test alarms using the AL command. If necessary, reset the radio to repeat the self-tests using the TEST command.

3. Radio power supply voltage - Verify that the voltage level does not drop during transmissions.

4. Radio output power - Verify peak transmit current (±8 Amperes) or use an RF wattmeter.

5. Data inverted - Check code plug location $180. Attempt to write one of the following values: $41, $51, $61 or $71.

6. Verify ATCS message format using the MONE 2 $300 command. Ensure the correct site address and code line number are used and that an indication message is being sent periodically to the proper office address.

7. Attempt a manual key-up by using the front-panel switches, or by placing the radio in service mode and using the PTT command.

7.2.2.2 RF RX Troubleshooting

No reception from the WCP field radios.

1. Verify that the PWR LED on the BCM II front panel is lighted.

2. Verify that all self-tests are passed.

3. Antenna connections and reflected power

4. Verify radio self-test alarms using the AL command. If necessary, reset the radio to repeat the self-tests using the TEST command.

5. Radio power supply voltage - Verify that the voltage level does not drop during transmissions.

6. Data inverted - Check code plug location $180. Attempt to write one of the following values: $41, $51, $61 or $71.

7. Verify ATCS message format using the MONE 2 $300 command. Ensure the correct site address and code line number are used and that an indication message is being sent periodically to the proper office address.

SECTION 8
MTR3000 BASE STATION DESCRIPTION

8.0 MTR3000 BASE STATION DESCRIPTION

8.1 GENERAL

The MTR3000™ station houses an entire transceiver in just 3 rack units (5.25” or 133 mm). Key station modules can easily be located on the MTR3000™ station. The MTR3000™ Base Station is divided into functional modules that separate the frequency specific and transmitter power specific circuits from other circuits and has separate modules for control interface. These modules are self-contained functional blocks with module specific alarms. This design facilitates the field replaceable unit (FRU) concept of field repair to maximize system uptime.

With the MTR3000™ station, peripherals such as additional circulators and low pass filters are mounted in a peripheral tray adjacent to the radio station. All I/O cables for the peripherals are terminated with connectors at labeled locations on the back of the peripheral tray.

For detailed information on the MTR3000™ refer to the Motorola MTR3000 Service Manual (Motorola Document Number 68007024096-E).

Figure 8-1 MTR3000™ Base station

8.2 BACKPLANE INTERFACE BOARD

The Backplane Interface Board (mounted across the rear of the base station) is constructed with connectors on both sides. The connectors on both sides of the module connects to various base station plug-in modules as well as allow interface connections between the base station and the phone lines, Power Supply, PA control signals, antenna relay, and other communications and maintenance equipment. A metal shield mounts over the rear of the backplane interface board to provide protection for the circuit board foils and connector solder pads, as well as Electro Static Discharge (ESD) protection and EMI/RFI shielding, as shown in Figure 8-2.

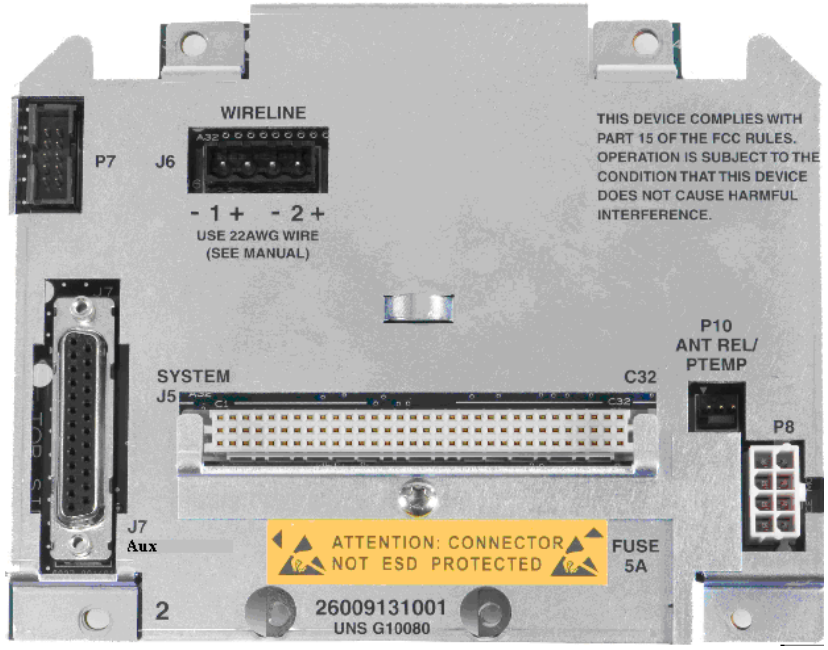


Figure 8-2 Backplane View

Table 8-1 MTR3000 Backplane Connectors

Type of Connection	Description	Connector Type
J5	System (User Interface)*	96 Pin Euro
J6	Wireline (User Interface)*	4 Conductor Terminal Block
J7	Aux System (User Interface)*	DB25
P7	Power Amplifier Control	10 Pin
P8	Power Supply	8 Pin
P10	Antenna Relay and Peripheral Temperature	3 Pin

* User Interface - These connectors connect to external user devices.

The J7 Aux connection on the MTR3000 is the main analog radio interface to the station. Table 8-2 shows the signal names and functions.

Table 8-2 MTR3000 J7 Aux Backplane Connections

Pin #	Pin Assignment	Input/Output	Signal Characteristics
1	TX Audio	I	Transmit Audio – Nominal input level is 80 mVrms for60% deviation with scaling factor set to 100%. 600 Ω input impedance.
2	GPI_1	I/O	Output Logic Low: 0.5 VDC max Output Logic High: Open Collector with 10K pull-up to 5 V Input Logic Low: 0 to 0.8 VDC Input Logic High: 3.0 to 14 VDC
3	Aux RX Audio	O	Auxiliary Receive Audio
4	GPIO_2	I/O	Programmable I/O
5	GPIO_10	I/O	Programmable I/O
6	GPIO_9	I/O	Programmable I/O
7	RX Audio	O	Receive Audio
8	GPIO_6	I/O	Programmable I/O
9	GND	--	Ground
10	GPIO_7	I/O	Programmable I/O
11	Same as Pin 2	I/O	Same as Pin 2
12	Same as Pin 10	I/O	Same as Pin 10
13	TX Data	I	Low Speed Data, PL, or DPL
14	Reserved	--	Reserved for Future Use
15	GPIO_3	I/O	Programmable I/O
16	GND	--	Ground
17	GND	--	Ground
18	GND	--	Ground
19	GND	--	Ground
20	Fused 14.2VDC	--	Power Source for 3rd Party
21	GPIO_8	I/O	Programmable I/O
22	Emph TX Audio	I	Emphasized TX Audio
23	GPI_4	I/O	Programmable Input
24	GPIO_5	I/O	Programmable I/O
25	Same as Pin 8	I/O	Same as Pin 8

The J5 connection on the MTR3000 supports a reduced function set relative to the MTR2000 J5 connection. Table 8-3 shows the supported functionality for the MTR3000 J5 backplane connection.

Table 8-3 MTR3000 J5 System Connector, Row A Pins

Pin #	Pin Assignment	Input/Output	Signal Characteristics
1	Reserved	O	---
2	Reserved	O	---
3	N/C	O	---
4	AC Fail	O	TTL Output, Active High
5	Reserved	I	---
6	Reserved	I	---
7	Reserved	I	---
8	Reserved	I	---
9	Reserved	I	---
10	Reserved	O	---
11	Reserved	O	---
12	Reserved	O	---
13	Antenna Relay	O	OCO, 200 mA, Active Low
14	Reserved	O	---
15	N/C	---	---
16	N/C	---	---
17	Reserved	I	---
18	Accessory 14.2 VDC	O	+14.2 VDC
19	GND	---	---
20	5 VDC	O	+5.1 ±0.25 VDC
21	Reserved	O	---
22	Spare	I	---
23	N/C	---	---
24	N/C	---	---
25	N/C	---	---
26	Ext PTT (-)	I	Opto-Isolated PTT Input
27	GND	---	---
28	Reserved	I/O	---
29	Ext PTT (+)	I	Opto-Isolated PTT Input
30	AC Fail Relay (NO)	O	Normally Open Relay Contact
31	GND	---	---
32	Accessory 14.1 VDC	O	+14.2 VDC

Table 8-4 MTR3000 J5 System Connector, Row B Pins

Pin #	Pin Assignment	Input/Output	Signal Characteristics
1	Reserved	O	---
2	Reserved	O	---
3	Carrier Operated Relay (Common)	O	Common Relay Contact
4	Carrier Detect Switch	O	TTL output, Active High
5	Reserved	I	---
6	Reserved	I	---
7	Reserved	I	---
8	Reserved	I	---
9	Reserved	I	---
10	N/C	---	---
11	Reserved	I/O	---
12	Reserved	I/O	---
13	Reserved	---	---
14	Reserved	I	---
15	GND	---	---
16	N/C	---	---
17	N/C	---	---
18	Accessory 14.2 VDC	O	+14.2 VDC
19	GND	---	---
20	5 VDC	O	+5.1 ±0.25 VDC
21	Reserved	O	---
22	N/C	---	---
23	N/C	---	---
24	N/C	---	---
25	N/C	---	---
26	N/C	I	---
27	GND	---	---
28	Reserved	O	---
29	AC Fail Replay (Common)	O	
30	Reserved	O	---
31	GND	---	---
32	Accessory 14.2 VDC	O	+14.2 VDC

Table 8-5 MTR3000 J5 System Connector, Row C Pins

Pin #	Pin Assignment	Input/Output	Signal Characteristics
1	Reserved	O	---
2	Reserved	O	---
3	Carrier Operated Replay (Normally Open)	O	Normally Open Relay Contact
4	Reserved	O	---
5	Reserved	I	---
6	Reserved	I	---
7	Reserved	I	---
8	Reserved	I	---
9	RF Relay Control Out (Auxiliary I/O)	O	OCO, 200 mA, 40V, Active High
10	Ext PTT* Out (Auxiliary I/O)	O	TTL Input
11	RSSI	O	Typically 0.5 VDC for -120 dBm to 4.5 VDC for -40 dBm carrier. Variation with carrier level at approximately 50mV/dBm
12	Reserved	I/O	---
13	N/C	---	---
14	Aux RX Audio	O	---
15	GND	---	---
16	GND	---	---
17	Reserved	O	---
18	Accessory 14.2 VDC	O	+14.2 VDC
19	GND	---	---
20	5 VDC	O	+5.1 ±0.25 VDC
21	Reserved	O	---
22	N/C	---	---
23	N/C	---	---
24	GPIO_10	I/O	TTL Input/Output
25	N/C	---	---
26	N/C	---	---
27	GND	---	---
28	Reserved	I	---
29	GPIO_9	I/O	TTL Input/Output
30	Reserved	I	---
31	GND	---	---
32	Accessory 14.2 VDC	O	+14.2 VDC

* Indicates an active low signal

8.2.1 Siemens A26762 Base Station/BCM II Interface Cable

The Siemens A26762 Base Station/BCM II interface cable is shown in Figure 8-3 below. This cable provides the interconnection between the MTR3000 and the Siemens A53444 Base Station Control Module).

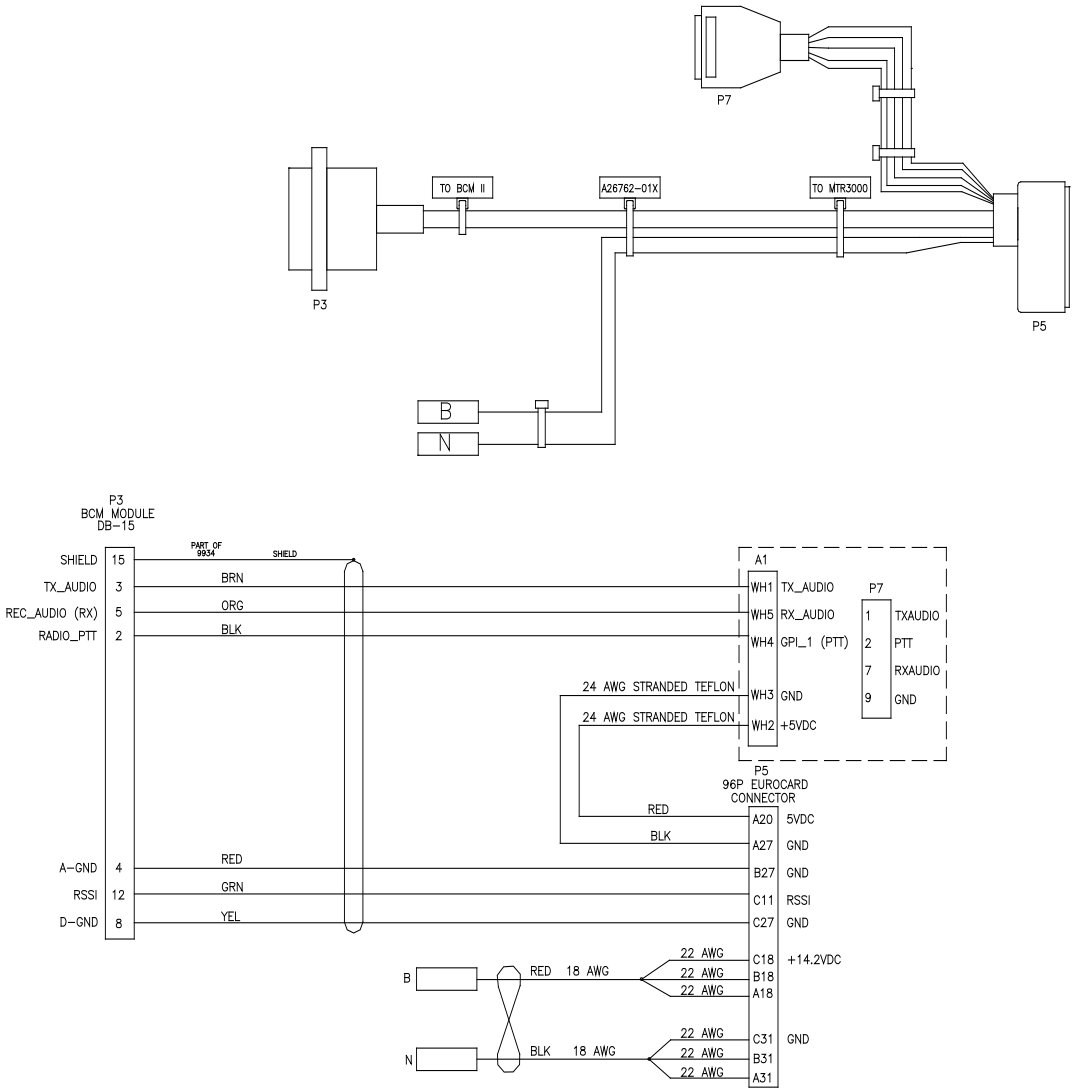


Figure 8-3 A26762 Interface Cable Pin-out

8.3 STATION CONTROL MODULE

The SCM circuitry performs the digital signal processing, data formatting and audio routing for the MTR3000 Base station (BR) and provides the external interfaces to the rest of the site.

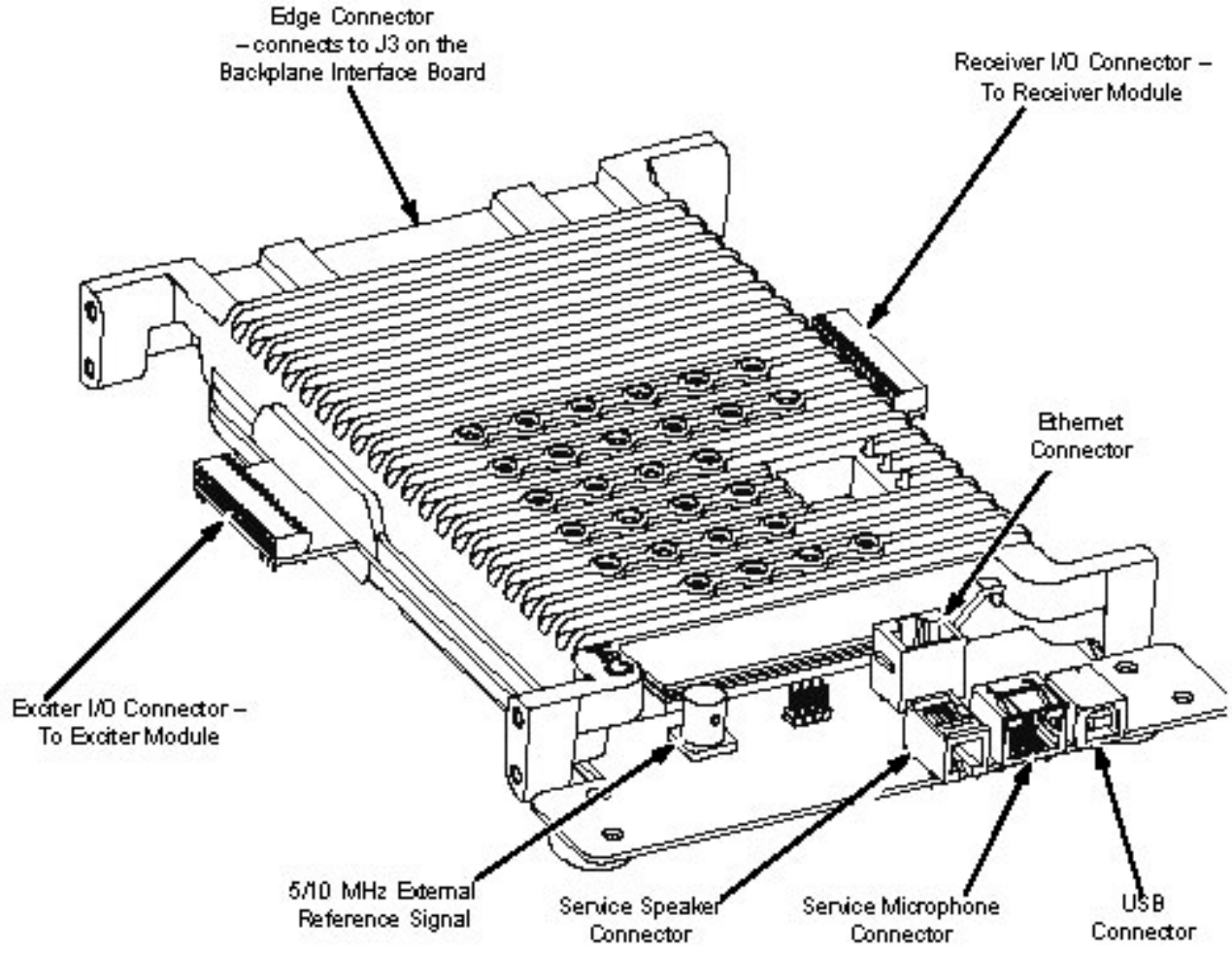


Figure 8-4 Station Control Module

8.3.1 Status Indicator and Connectors

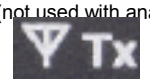
Figure 8-5 shows the front panel of the Station Control Module. The following tables describe the connectors and LEDs.

Figure 8-5 Station Control Module (Front View)

Table 8-6 Control Connector Definitions

Connector Name	Connector Type	Description
Service	USB Type B	Service Computer connection. This connector is accessible with front cover in place. VBUS (+5 volts) is not provided on the USB connector to prevent potential damage to the Service Computer.
Mic	RJ45 (8 pin)	Microphone connection. Compatible with microphone GMMN4063 or equivalent (older model, GMN6147). This connector is accessible with front cover in place. Supported in analog mode only. **Note:** The MTR3000 does not support the 3 control buttons on the GMN6147 microphone for speaker volume, Rx monitor, and Intercom control functions.
Speaker	4P4C (4 pin)	Speaker connection. Compatible with Service Speaker HSN1000 or HSN1006. This connector is accessible with front cover in place. Supported in analog mode only
Ethernet	RJ45 (8 pin) (Vertical)	Provides for network connections (e.g. IP Site Connect). The front cover must be removed to access this connector. Alternatively, a short extension cable (straight or crossover) can be used to route this connection to the rear of the station.
Ext Ref	BNC (Vertical)	External reference input. The front cover must be removed to access this connector. Alternatively, a short extension cable can be used to route this input to the rear of the station.

Table 8-7 LED Functions and Conditions

LED Function Name	Color	State	Condition
Power/Status, TX Slot 1, TX Slot 2, RX Slot 1, RX Slot 2	Amber	Flashing	Station Booting Up
Mode	Blue		
Power/Status 	Off	Off	Station Off
	Green	Flashing	Station Operating Normally, with DC power
		Solid	Station Operating Normally, with AC power
	Red	Flashing	Station Operational - Minor Alarm
		Solid	Station Not Operational and locked - Major Alarm
	Amber	Flashing	Station in Service Mode
		Solid	Station is Disabled (Dekeyed)
Transmit Slot 1 	Off	Off	Transmitter is not transmitting
	Green	Solid	Transmitter is transmitting
		Flashing	Transmitter is transmitting, but at reduced power
Transmit Slot 2 (not used with analog) 	Off	Off	Transmitter is not transmitting
	Green	Solid	Transmitter is transmitting
		Flashing	Transmitter is transmitting, but at reduced power
Receive Slot 1 	Off	Off	Receiver qualifier has not been met
	Green	Solid	Receiver qualifier has been met
Receive Slot 2 (not used with analog) 	Off	Off	Receiver qualifier has not been met
	Green	Solid	Receiver qualifier has been met
Mode 	Off	Off	Analog Mode (FM)
	Blue	Solid	Digital Mode (2 Slot TDMA, 4FSK)
		Flashing	DMM feature is active, but no calls are currently being processed.
Ethernet 	Off	Off	No Ethernet connection
	Green	Solid	Linked
		Flash	Network Traffic
Ext Ref 	Off	Off	No external reference is present
	Amber	Solid	Training process is completed, and the calibration data has been written to the EEPROM, or an external reference is present after training (which the base station has phase locked to).
	Green	Solid	Locked to external reference, and training is in progress

8.4 RECEIVER MODULES

The Receiver Module consists of a Receiver RF board in a clamshell housing assembly. The Receiver Module provides the Receiver functionality for the MTR3000 Base Station and performs highly-selective bandpass filtering and dual down-conversion of the desired RF signal. A custom Receiver IC then performs an analog-to-digital conversion of the desired received signal and outputs a differential data signal to the Station Control Module (SCM).

Figure 8-6 Receiver Module

8.5 TRANSMITTER

The MTR3000™ base station utilizes a transmitter design that has the capability through the Radio Service Software to be programmed for 12.5 kHz and 25 kHz bandwidths, on a per channel basis. This allows a single station to be programmed to function in various bandwidths without changing hardware. The transmitter is comprised of two main frequency sensitive components: the Exciter and the Power Amplifier (PA).

8.5.1 Exciter Module

The Exciter Module (in conjunction with the Power Amplifier Module) provides the transmitter functions for the station. Contained within a metal clamshell housing, the Exciter board generates a low-level modulated Radio Frequency (RF) signal that is delivered to the power amplifier module for further amplification and output to the transmit antenna. The Exciter Module interfaces directly with the Station Control Module (SCM), which provides control signals and monitoring, and routes transmit digitized audio to the Exciter.

The RF carrier is generated by a frequency synthesizer consisting of synthesizer circuitry and Voltage-Controlled Oscillator (VCO) circuitry. Exciter module control signals, monitoring, and audio processing are handled by the Station Control Module (SCM).

Figure 8-7 Exciter Module

8.5.2 Power Amplifier

The Power Amplifier (PA) is a forced convection-cooled RF power amplifier. It accepts a low-level modulated RF signal from the Exciter Module, and amplifies it for transmission via the site transmit antenna port. The PA is non-linear, and is therefore used for continuous wave (CW) applications only. The output power is continually monitored and regulated by a feedback and control loop, with a power output control voltage being generated by the transmitter control circuitry located on the PA Input/Output boards.

Figure 8-8 MTR3000 100 Watt Power Amplifier Module

8.6 POWER SUPPLY

The Power Supply accepts an AC or a DC input (AC input = 85 to 264 VAC, 50/60 Hz, DC input = 21.6 to 32 VDC) and generates three output DC voltages to power the base station modules: +28.6 VDC, +14.2 VDC and +5.1 VDC.
The Power Supply is a high-frequency switched mode design, all contained in a metal heat-sink mounted on the left-hand side of the base station. The design provides for output overvoltage/over-current protection.

The AC input connection is made at the rear of the base station via an IEC-type connector keyed to accept only high temperature type mating connectors. Also provided is a Battery Backup connection (see DC mode above). Power supply cooling when necessary, is provided by an external fan (located near the middle of the heatsink) which provides forced air across the power supply heatsink fins.

Figure 8-9 MTR3000 Power Supply Module

NOTE

NOTE

When both AC and DC sources are present at the station power supply, AC will always take precedence.

CAUTION

THE STANDARD POWER SUPPLY DOES NOT HAVE BATTERY CHARGING OR BATTERY REVERTING CAPABILITY, AND SHOULD **NOT** BE DIRECTLY CONNECTED TO BATTERIES. THE MTR3000 POWER SUPPLY DOES HAVE A CONNECTION FOR AC POWER AND AN INTERFACE TO A BATTERY CHARGER. BATTERY CHARGING AND REVERTING APPLICATIONS **REQUIRE** THE USE OF AN EXTERNAL MOTOROLA APPROVED BATTERY REVERTING CHARGER (See Table 8-8).

Table 8-8 Approved Battery Reverting Charger

Battery Reverting Charger	Model Number	Both Cables Required
24V Charger	L1884	Z691, Charger Load Cable Z692, Charger Battery Cable

NOTE

Consult the Battery Reverting Charger Detailed Technical Specifications and Ordering Guide for additional information.

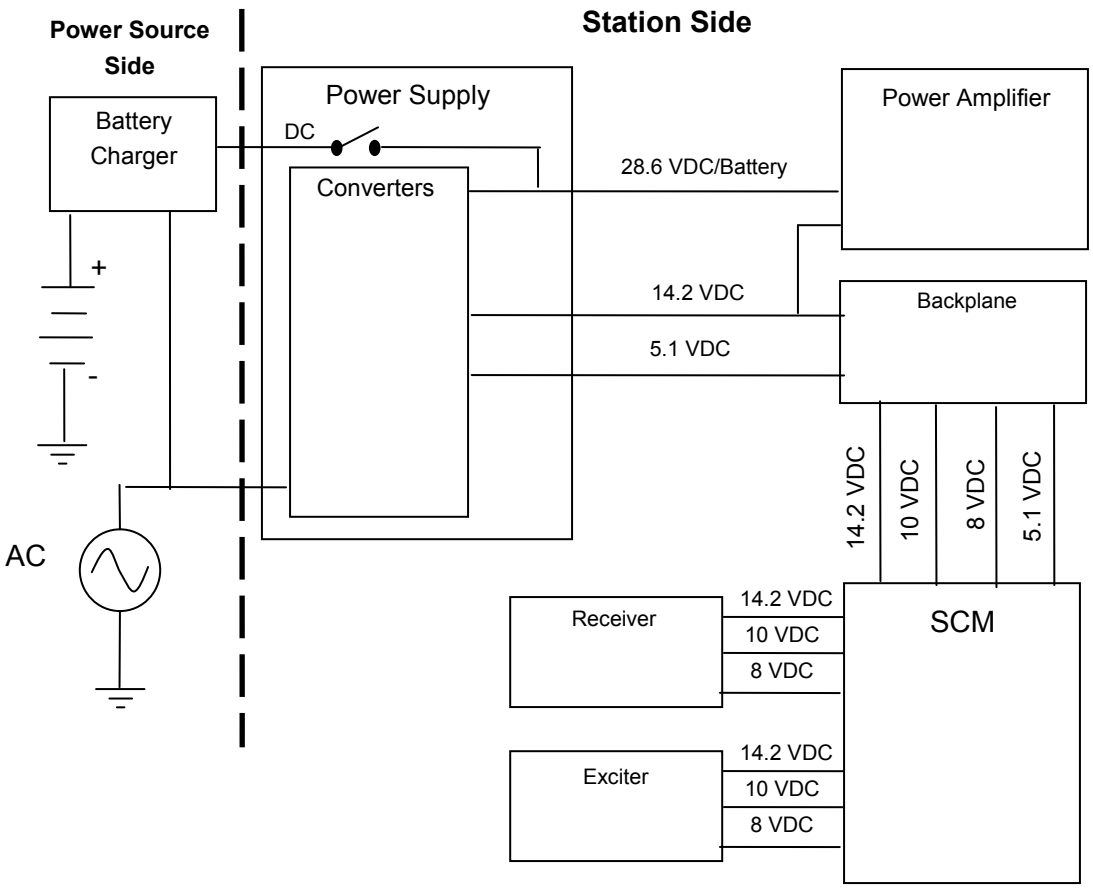


Figure 8-10 MTR3000 AC and DC Power Distribution

APPENDIX A
ADVANCED TRAIN CONTROL SYSTEM

A. ADVANCED TRAIN CONTROL SYSTEM

A.1 OVERVIEW

The Advanced Train Control System (ATCS) standardizes the message formats and addressing scheme used by all railroads for train control applications. The system operates by sending and receiving standard datagrams (using a standard addressing scheme) between the various ATCS compatible signaling and operating equipment. Addresses are provided for wayside equipment, central office equipment, on-board equipment, base stations, maintenance equipment, railcars, and anything else found in a railroad environment. These messages convey operating instructions and status information such as track-and-time permits, codeline controls and indications, hot-box data, etc.

A typical ATCS network is shown in Figure A-1. Centralized Train Control (CTC) office equipment communicates with the onboard and wayside equipment via Base Communication Packages (BCPs), controlled by Cluster Controllers (CCs). Network Management System (NMS) office equipment monitors the dynamic performance of the network. Field radios are a mixture of Wayside Communication Packages (WCPs) and Spread-Spectrum Radios (SSRs). All communications use ATCS datagrams or packets.

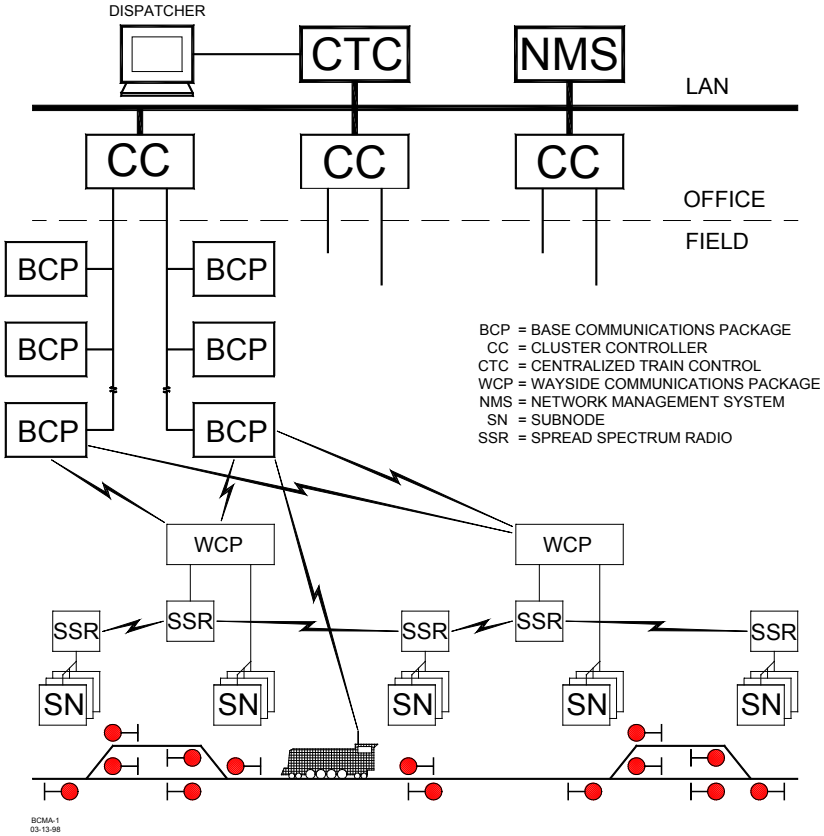


Figure A-1 Typical ATCS Network

A.2 ATCS ADDRESSING

Each ATCS datagram carries with it a destination address (i.e., the address of the equipment it is destined for), and a source address (i.e., the equipment that generated it). These addresses are constructed with slight differences for the various uses. For example, on-board equipment will have a Type 1 (locomotive) address while wayside equipment will have a Type 7 (wayside) address. A number of the various types of addresses used are described in the following paragraphs. For further information concerning ATCS addressing, refer to the following specifications:

ATCS Specification 200 (March 1993) - ATCS Protocols
ATCS Specification 200 (March 1993) - Communications Architecture
ATCS Specification 250 (March 1993) - ATCS Message Formats
ATCS Specification 700 (March 1993) - CPC Specification
ATCS Specification 157 (March 1993) - CPC Operation
R/Link ATCS Radio Code Line System Application Logic Generation Guide (Siemens Document No. C-00-94-06)

A.2.1 Locomotive Addresses (Type 1)

Each locomotive address consists of twelve digits in the following format: **1.RRR.VVVVVV.DD**

where:

1	=	Locomotive address type
RRR	=	Railroad number (see Appendix D)
VVVVVV	=	Locomotive number
DD	=	Device on board locomotive (e.g., Engineers display)

A.2.2 Office Equipment Addresses (Type 2)

Each office equipment address consists of ten digits in the following format: **2.RRR.NN.DDDD**

where:

2	=	Office equipment address type
RRR	=	Railroad number (see Appendix D)
NN	=	Unit in the office (e.g., CTC computer, A53401 Packet Switch, etc.)
DDDD	=	Application in the office (e.g., maintenance alarm monitoring)

A.2.3 Base Station Address (Type 3)

Each address consists of ten digits in the following format: **3.RRR.NN.DDDD**

where:

3	=	Wire line address type
RRR	=	Railroad number (see Appendix D)
NN	=	Node number (railroad defined)
DDDD	=	Base device number (railroad defined)

The ATCS specification recommends that the BCP node number be the same as the node number of the CC (A47620) to which it is connected. The device number is user defined, and can be set to any convenient value.

A.2.4 Wayside Equipment (Type 5)

The type 5 wayside address was used on earlier ATCS systems and is the default addressing scheme for Advanced Railroad Electronic System (ARES) wayside equipment. Although the ARES network differs slightly from the ATCS specification, for purposes of this discussion, the two can be considered identical systems.

Each address consists of ten digits in the following format: **5.RRR.NN.LL.GG**

where:

5	=	Wayside address type
RRR	=	Railroad number (see Appendix D)
NN	=	Node or routing region number
LL	=	Code-line number
GG	=	Group or location number

This addressing scheme does not have the ability to address multiple devices at each location. The node number typically follows the node number of the CC controlling the base stations for the location.

A.2.5 Wayside Equipment (Type 7)

This is the default ATCS wayside addressing scheme.

Each address consists of fourteen digits in the following format: **7.RRR.LLL.GGG.SS.DD**

where:

7	=	Wayside address type
RRR	=	Railroad number (see Appendix D)
LLL	=	Code-line or region number
GGG	=	Group or location number
SS	=	Equipment or subnode at location
DD	=	Device controlled by this equipment

The LLL fields are normally assigned by each railroad according to internal conventions, and may represent a region, district, code line, or other area designation that shows it is part of the railroad.

The GGG field must be coordinated between the CTC equipment and field equipment configuration.

For the SS field, two subnode numbers are always pre-assigned at each location. The wayside-to-office communications device is defined as number 01, and number 02 is reserved for the wayside-to-wayside communications system. Any additional equipment (e.g., the R/Link™ I/O modules), will therefore have subnode numbers starting with 03.

Device numbers (DD field) are allocated in sequence beginning at 01. Each piece of field equipment has at least one internal device, but it may have more depending on the equipment. Examples of full ATCS addresses for a wayside code system would be as follows:

For CP Rail, code line 8, control point 1: 7.105.008.001.03.02.

For the WCP radio at the same location : 7.105.008.001.01.01.

A.2.6 Other Address Types

Other address types are defined in ATCS for future applications. Please refer to the appropriate ATCS specifications for full details.

A.3 ATCS MESSAGE FORMATS

The major fields in an ATCS message are shown in figure A-2.

Figure A-2 Major Fields Of An ATCS Message

The **Destination** field is the address of the recipient equipment. For example, if this is an indication message coming from a wayside code unit, the destination address will be the CTC dispatching equipment (2.RRR.NN.DDDD).

The **Source** field is the sender's address (e.g., 7.RRR.LLL.GGG.SS.DD).

The number in the message number (**M#**) field is allocated by the sender in a sequential fashion so that the recipient can detect duplicate, missing, or out of order messages.

The **Label** field describes the type of data carried by the message. Many different labels have been defined in ATCS Specification 250. Additional labels are defined by suppliers to perform custom functions.

The **Data** field carries the particular data required for the type of message defined by the **Label** field.

A.4 ATCS RADIO NETWORK – LAYER 1

The ATCS radio network consists of pairs of UHF channels. These channels are as follows:

Channel Number	Base to Mobile Frequency	Mobile to Base Frequency
1	935.8875	896.8875
2	935.9375	896.9375
3	935.9875	896.9875
4	936.8875	897.8875
5	936.9375	897.9375
6	936.9875	897.9875

NOTE

NOTE

Transmission on the channels is baseline FSK. the deviation of the carrier to a higher frequency is interpreted as a logical 0 and to a lower frequency as a logical 1. The bit rate is 4800 bits per second. Nominal channel separation is 12.5kHz.

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APPENDIX B
ATCS SPECIFICATION 250 RAILROAD CODE LIST

B. ATCS SPECIFICATION 250 RAILROAD CODE LIST

The following chart lists the codes assigned to all carriers in accordance with ATCS Specification No. 250 and includes the railway carrier name along with the alphabetical and numerical codes assigned to each. In the event a discrepancy exists between the information in the following list and the current AAR specification, the AAR specification shall prevail.

ID	Company Name	RR Mark	ATCS
001	Aberdeen And Rockfish Railroad Company	AR	009
002	Akron & Barberton Belt Railroad Company	ABB	002
003	Alabama & Florida Railway Co	AF(LR)	917
004	Alameda Belt Line	ABL	014
005	Alameda Corridor Transportation Authority	ACTA	015
006	Alaska Hydro-Train	AHT	039
007	Alaska Railroad Corporation	ARR	005
008	Alexander Railroad Company	ARC	049
009	Algers Winslow And Western Railway Company	AWW	004
010	Algoma Central Railroad Inc	AC	008
011	Allegheny & Eastern Railroad Inc	ALY	532
012	Alley Railroad Company		664
013	Almanor Railroad Company	AL	046
014	Alton & Southern Railway Company	ALS	032
015	Amador Central Railraod Company	AMC	019
016	Andalusia & Concecuh Railroad Company	ACRC	173
017	Angelina & Neches River Railroad Company	ANR	035
018	Anthracite Railway Inc	ATRW	176
019	Apache Railway Company	APA	011
020	Apalachicola Northern Railroad Company	AN	012
021	Appanoose County Community Railroad Inc	APNC	226
022	Arcade And Attica Railroad Corporation	ARA	013
023	Arkansas And Missouri Railroad Co	AM	906
024	Arkansas Louisiana & Mississippi (Missouri) Railro	ALM	016
025	ARTC		047
026	Ashley, Drew & Northern Railway Company	AND	020
027	Ashtabula Carson & Jefferson Railroad	ACJR	235
028	Atchison, Topeka And Santa Fe Railway Company Ats	ATSF	022
029	Atcs Shared Network	ATCS	340
030	Atcs Testing & Field Evaluation	ATCR	050
031	Atcs Testing & Field Evaluation	ATCT	620
032	Atlantic & Western Railway, L P	ATW	025
033	Austin Railroad	AUNW	924
034	Austin, Todd And Ladd Railroad Company	ATLT	514
035	Baltimore And Annapolis Railroad Company	BLA	053
036	Bangor & Aroostook Railroad Company	BAR	056
037	Bath And Hammodsport Railroad Company	BH	079
038	Batten Kill Railroad Inc	BKRR	086
039	Bauxite & Northern Railway Company	BXN	084
040	Bay Colony Railroad Corporation	BCLR	082
041	Bayside Railway Co		021
042	BC HYDRO RAIL	BCE	072
043	BC RAIL LTD	BCOL	997
044	Beaufort And Morehead Railroad Company	BMH	068
045	Beech Mountain Railroad Company	BEEM	060
046	Belfast And Moosehead Lake Railroad Company	BML	087
047	Belt Railway Company Of Chicago	BRC	083
048	Belton Railroad Company	BRR	207
049	Berlin Mills Railway	BMS	073
050	Bessemer And Lake Erie Railroad Company	BLE	061

ID	CompanyName	RR Mark	ATCS
051	Birmingham Southern Rr Co	BS	065
052	Black River & Western Corporation	BRW	066
053	Bloomer Line, The	BLOL	223
054	Blue Mountain And Reading Railroad	BMRG	256
055	Border Pacific Railroad Co	BOP	225
056	Boston And Maine Corporation	BM	069
057	Brandon Corporation	BRAN	081
058	Brandywine Valley Railroad Company	BVRY	067
059	Broken Hill Proprietary Co.		042
060	Brownsville And Rio Grande International Rr	BRG	170
061	Buffalo Southern Railroad Inc	BSOR	085
062	Burlington Junction Railway	BJRY	383
063	Burlington Northern (Manitoba) Ltd	BNML	457
064	Burlington Northern Railroad Company	BN	076
065	Burlington Northern Santa Fe	BNSF	777
066	C&J Railroad Investment Company	CJRR	565
067	Cadillac And Lake City Railway Co	CLK	093
068	Cadiz Railroad Company	CAD	092
069	Cairo Terminal	CTML	162
070	California Western	CWR	100
071	CALTRAIN	CALTRAIN	708
072	Camas Prairie Railnet Inc	CSP	952
073	Cambria And Indiana Railroad Company	CI	101
074	Canada And Gulf Terminal Railway Company, The	CGT	116
075	Canadian National Railways	CN	103
076	Caney Fork And Western Rr	CFWR	187
077	Canton Railroad Company	CTN	097
078	Cape Fear Railways Inc	CF	099
079	Carolina Rail Services Inc	CRIJ	988
080	Carrollton Railroad	CARR	113
081	Carthage Knightstown & Shirley Railroad	CKSI	396
082	Cedar Rapids & Iowa City Railway Company	CIC	111
083	Cedar Valley	CVAR	313
084	Central California Traction Company	CCT	112
085	Central Indiana & Western Railroad Co Inc	CEIW	949
086	Central Michigan Railway Co	CMGN	472
087	Central Montana Rail Inc	CM	374
088	Central New York Railroad Corporation	CNYK	151
089	Central Vermont Railway	CV	120
090	Central Western Railway Corp	CWRL	527
091	Charles City Rail Lines	CCRY	967
092	Chattahoochee Industrial Railroad	CIRR	222
093	Chattahoochee Valley	CHV	124
094	Chelatchie Praire Railraod	CCPR	155
095	Chesapeake And Ohio Railway Company	CO	125
096	Chesapeake Western	CHW	179
097	Chestnut Ridge Railway Company	CHR	117
098	Chicago And Northwestern	CNW	131
099	Chicago And West Pullman	CWP	172
100	Chicago And Western Indiana	CWI	132

ID	CompanyName	RR Mark	ATCS
101	Chicago Central & Pacific Railroad Co	CC	569
102	Chicago Heights Terminal Transfer Railroad Company	CHTT	139
103	Chicago Illinois Midland	CIM	130
104	Chicago Short Line Railway Company	CSL	147
105	Chicago Southshore & South Bend Railroad	CSS	168
106	Cimarron Valley Railroad, L C	CVR	378
107	City Of Columbia	CT	090
108	City Of Prineville Railway	COP	166
109	Claremont Concord Railroad Corporation	CCRR	188
110	Clarendon And Pittsford Railroad Company, The	CLP	169
111	Cliffaide Railroad Company	CLIF	181
112	Colonels Island Railroad Co	CISD	164
113	Colorado & Wyoming Rwy Co	CW	158
114	Colorado Springs & Eastern	CSE	319
115	Columbia & Cowlitz Railway Company	CLC	163
116	Columbia & Silver Creek Railroad Company	CLSL	165
117	Columbus And Greenville Railway	CAGY	177
118	Conemaugh & Black Lick Railroad Company	CBL	215
119	Connecticut Central	CCCL	416
120	Connecticut Department of Transportation	CDOT	007
121	Consolidated Rail Corporation	CR	190
122	Cooperstown And Charlotte Valley Rwy	CACV	114
123	Copper Basin Railway Inc	CBRY	909
124	Corinth And Counce	CCR	201
125	Corman	RJCR	970
126	Cotton Belt (St. Louis Southwestern Rwy Company)	SSW	694
127	CP RAIL SYSTEM	CP	105
128	Crab Orchard & Egyptian Railroad	COER	089
129	CSXT	CSXT	171
130	Curtin Milburn	CMER	180
131	Cuyahoga Valley Railway Company, The	CUVA	186
132	D & I Railroad Company	DAIR	211
133	Dakota Minnesota & Eastern Railroad Corp	DME	912
134	Dakota Rail Inc	DAKR	221
135	Dakota Southern Railway Company	DSRC	526
136	Dansville And Mount Morris Railroad Company, The	DMM	220
137	Dardanelle & Russellville Railroad Company,	DR	191
138	Davenport Rock Island And North Western Railway Co	DRI	192
139	Delaware & Hudson Railway Company Inc	DH	195
140	Delaware Coast Line Rr Co	DCLR	214
141	Delta Valley & Southern Railway Company	DVS	193
142	Denver Union Terminal Ry Co.	DUT	288
143	Dequeen And Eastern Railroad Company,	DQE	200
144	Des Moines Union	DMU	202
145	Detroit And Mackinac	DM	204
146	Dominion And Atlantic	DA	209
147	Doniphan Kensett & Searcy Railway	DKS	210
148	DRGW	DRGW	197
149	Duluth & Northeastern Railroad Company,	DNE	212
150	Duluth Missabe And Iron Range Railway Company	DMIR	213

ID	CompanyName	RR Mark	ATCS
151	Duluth Winnipeg And Pacific Railway Company	DWP	216
152	Dunn-Erwin Railway Corporation	DER	219
153	East Camden & Highland Rr Co	EACH	242
154	East Cooper And Berkeley Railroad Company	ECBR	229
155	East Erie Commercial Railroad	EEC	040
156	East Jersey Railroad And Terminal Company	EJR	245
157	East St. Louis Junction Rr	ESLJ	233
158	East Tennessee Railway, L P	ETRY	257
159	Eastern Shore Railroad Inc	ESHR	251
160	Edgmoor & Manetta	EM	232
161	El Dorado And Wesson Railway Company	EDW	247
162	Elgin Joliet & Eastern Railway Company	EJE	238
163	Escanaba And Lake Superior Railroad Company	ELS	241
164	Esquimalt And Nanaimo	EN	246
165	Essex Terminal Railway Company The	ETL	228
166	Eureka Southern	EUKA	368
167	Everett Railroad	EV	231
168	Falls Creek	FCRK	267
169	Farmrail Corporation	FMRC	280
170	FCA - Ferrovia Centro - Atlantica SA	??	029
171	Ferdinand & Huntingburg	FRDN	273
172	Ferrocarril De Chihuahua Al Pacifico,	CHP	284
173	Ferrocarriles Nacionales De Mexico	NDM	266
174	Ferrocarriles Nacionales De Mexico	SBC	283
175	Ferrocarriles Nacionales De Mexico -	FCP	738
176	Ferrocarriles Unidos Del Sureste, S.A.	SE	281
177	Florida Central Railroad Co	FCEN	986
178	Florida East Coast Railway Company	FEC	263
179	Florida Midland Railroad Co Inc	FMID	507
180	Fonda, Johnstown And Gloversville	FJG	264
181	Fordyce And Princeton Railroad Co	FP	265
182	Fore River	CRY	908
183	Fort Smith And Van Buren	FSVB	279
184	Fort Worth & Western Railroad	FWWR	277
185	Galveston Railroad L P	GVSR	567
186	Galveston Warves	GWF	303
187	Galveston, Houston And Henderson	GHH	293
188	Garden City Western Railway Company, The	GCW	287
189	Genesee And Wyoming Railroad Company	GNWR	320
190	Georgetown Railroad Company	GRR	302
191	Gettysburg Railway	GBRY	294
192	Gloster Southern Railroad Company	GLSR	916
193	GO TRANSIT	GOT	954
194	Goderich - Exeter Railway Company	??	027
195	Golden Triangle Railroad	GTRA	295
196	Grafton And Upton Railroad Company	GU	323
197	Grainbelt Corporation	GNBC	443
198	Grand River	GRNR	322
199	Grand Trunk Western Railroad Incorporated	GTW	308
200	Graysonia, Nashville And Western	GNA	307

ID	CompanyName	RR Mark	ATCS
201	Great River Railroad	GTR	271
202	Great Southwestern	GSWR	305
203	Great Western Railway Company, The	GWR	311
204	Green Bay And Western	GBW	312
205	Green Hills Rural Development	GHRD	980
206	Green Mountain Railroad Corporation	GMRC	314
207	Gulf And Mississippi	GMSR	392
208	Hammersley Iron (Australia)		041
209	Hampton & Branchville Railroad Company	HB	330
210	Hartford And Slocomb Railroad Company	HS	366
211	Hartwell Railway Company	HRT	334
212	Helena Southwestern Railroad Company	HSW	331
213	High Point Thomasville & Denton Railroad Company	HPTD	366
214	Hillsboro And North Eastern Railway	HLNE	338
215	Hillsdale County Railway Company, Inc.	HCRC	326
216	Hillside (Australia)		018
217	Hollis & Eastern R R Co	HE	328
218	Houston Belt & Terminal Railway Company	HBT	342
219	Huntsville & Madison County Railroad Authority	HMCR	391
220	Huron And Eastern Railway Company Inc	HESR	890
221	Hutchinson And Northern Railway Company, The	HN	332
222	Illinois Central Railroad Company	IC	360
223	Indian Creek Railroad Company	ICRK	380
224	Indiana & Ohio Rail Corp.	INOH	344
225	Indiana Hi-Rail Corporation	IHRC	352
226	Indiana Rail Road Corporation	INRD	780
227	Indianapolis Union Railway	IU	363
228	Indonesia (Indonesian State Railways)		093
229	International Bridge And Terminal Company, The	IBT	358
230	Interstate Railroad Company	SOU	381
231	Iowa Interstate Railroad Ltd	IAIS	316
232	Iowa Northern Railroad	IANR	341
233	Iowa Southern Railroad Company	ISR	272
234	Iowa Traction Railroad Company	IATR	994
235	ITS - Highway Advanced Transportation Controller		051
236	ITS - Non-ATCS Railroad		052
237	Jefferson Warrior Railroad Co Inc	JEFW	254
238	Kankakee Beaverville And Southern Railroad Company	KBSR	399
239	Kansas And Missouri Railway	KM	414
240	Kansas City Southern Railway Company	KCS	400
241	Kansas City Terminal Railway Company	KCT	401
242	Kentucky And Tennessee Railway	KT	405
243	Keokuk Junction Railway	KJRY	365
244	Kiamichi Railroad Company Llc	KRR	424
245	Knox & Kane Railroad Company	KKRR	376
246	Kwt Railway Inc	KWT	996
247	Kyle Railroad Company	KYLE	377
248	Lake Erie & Northern	LEN	421
249	Lake Erie, Franklin & Clarion Railroad Company	LEF	423
250	Lake Superior & Ishpeming Railroad Company	LSI	425

ID	CompanyName	RR Mark	ATCS
251	Lake Terminal Railroad Company, The	LT	404
252	Lamoille Valley Railroad Company	LVRC	452
253	Lancaster And Chester Railway Company	LC	426
254	Landisville Railroad Inc (Formerly Amherst Industr	AMHR	071
255	Laurinburg And Southern Railroad Company	LRS	427
256	Levin-Richmond Terminal Corporation	PRT	606
257	Lewis & Clark Railway Co	LINC	355
258	Little Rock & Western Railway, L P	LRWN	485
259	Little Rock Port Railroad	LRPA	435
260	Livonia, Avon & Lakeville Railroad Corporation	LAL	398
261	Logansport & Eel River Short-Line Co Inc	LER	304
262	Long Island Railroad Company	LIRR	436
263	Longview, Portland & Northerm Railway Company	LPN	450
264	Los Angeles Junction Railway Company	LAJ	428
265	Louisana & Arkansas Railway Company	LA	441
266	Louisiana & Delta Railroad Inc	LDRR	972
267	Louisiana And North West Railroad Company, The	LNW	442
268	Louisville And Wadley Railway Company	LW	451
269	Louisville New Albany & Corydon Railroad	LNAL	446
270	Lowville And Beaver River Railroad Company, The	LBR	447
271	Ludington & Northern Railway	LUN	430
272	Madison Railroad (A Div Of City Of Madison Port Au	CMPA	144
273	Magma Arizona Railroad Company	MAA	463
274	Mahoning Valley Railway Company, The	MVRY	504
275	Maine Central Railroad Company	MEC	456
276	Manufacturers Junction Railway Company	MJ	459
277	Manufacturers Railway Company	MRS	460
278	Marinette, Tomahawk & Western Railroad	MTW	520
279	Maryland And Delaware Railroad Company	MDDE	454
280	Maryland And Pennsylvania Railroad Company	MPA	463
281	Maryland Midland Railway Inc	MMID	495
282	Maryland Rail Commuter	MARC	003
283	Massachusetts Bay Transportation Authority	MBTA	006
284	Massachusetts Central Railroad Corporation	MCER	461
285	Massena Terminal Railroad Company, The	MSTR	471
286	Mccloud Railway Company	MCR	466
287	Mckeesport Connecting Railroad Company	MKC	583
288	Meridian & Bigbee Railroad Company	MBRR	462
289	Metra		892
290	Mexican Pacific Railroad Company, Inc.	MDP	285
291	Mg Rail Inc	MGRI	388
292	Michigan-Wisconsin Transportation Company	MWTT	512
293	Mid Atlantic Railroad Co., Inc.	MRR	877
294	Middletown & Hummelstown Railroad Company	MIDH	479
295	Middletown & New Jersey Railway Company Inc	MNRR	475
296	Midland Terminal Co, The	MDLR	385
297	Midlouisana Rail Corporation	MDR	919
298	Midsouth Corporation	MSRC	905
299	Milwaukee Road	MILW	140
300	Minnesota Commercial Railway Co	MNNR	973

ID	CompanyName	RR Mark	ATCS
301	Minnesota Dakota & Western Railway Company	MDW	610
302	Mississippi & Skuna Valley Railroad Company	MSV	503
303	Mississippi Delta Railroad	MSDR	786
304	Mississippi Export Railroad Company	MSE	506
305	Mississippian Railway Cooperative Inc	MSRW	502
306	Missouri Pacific Railroad Company	MP	494
307	Missouri-Kansas-Texas Railroad Co.	MKT	490
308	Mobile & Gulf Railroad Company	MG	483
309	Modesto And Empire Traction Company	MET	524
310	Monongahela Connecting Rr Co.	MCRR	498
311	Monongahela Railway Company	MGA	497
312	Montana Rail Link Inc	MRL	671
313	Morristown & Erie Railway Inc	ME	511
314	Moscow, Camden & San Augustine Railroad	MCSA	548
315	MRS Logistics of South America	??	028
316	Muncie And Western Railroad Company	MWR	464
317	N D C Railroad Company	NDCR	902
318	N J Transit Rail Operations (Commuter Carrier)	NJTR	574
319	Napa Valley Railroad Co	NVRR	402
320	Nash County Railroad Corp	NCYR	776
321	Nashville And Eastern Railroad Corp	NERR	934
322	National Railroad Passenger Corporation	AMTRAK	891
323	National Railways Of Mexico (Ferrocarriles Naciona	NDM	286
324	New Hampshire Northcoast Corp	NHN	787
325	New Hope & Ivyland Rail Road	NHRR	585
326	New York & Lake Erie Railroad	NYLE	545
327	New York Cross Harbor Railroad Terminal Corp	NYCH	573
328	New York Susquehanna And Western Railway Corp	NYSW	546
329	Nicolet Badger Northern Railroad Inc	NBNR	476
330	Nittany & Bald Eagle Railroad Co	NBER	249
331	Norfolk & Portsmouth Belt Line Railroad Company	NPB	549
332	Norfolk And Western Railway Company	NW	550
333	Norfolk Southern	NS	555
334	North Carolina & Virginia Railroad Co Inc	NCVA	531
335	North Shore Railroad Co	NSHR	248
336	North Stratford Railroad Corporation	NSCR	570
337	Northwestern Oklahoma Railroad Company	NOKL	591
338	Northwestern Pacific Railroad Company	NWP	559
339	Oakland Terminal Railroad Company	OTR	586
340	Octoraro Railway, Inc.	OCTR	587
341	Ogden Union Railway And Depot Company, The	OURD	956
342	Ohi-Rail Corporation	OHIC	579
343	Oil Creek & Titusville Lines	OCTL	948
344	Okanagan Valley Railway Company	OKAN	945
345	Oklahoma Central Railroad Co	OCR	270
346	Oklahoma, Kansas And Texas Railroad	OKKT	593
347	Old Augusta Railroad Company	OAR	578
348	Omaha Lincoln And Beatrice Railway Company	OLB	598
349	Ontario Central Railroad Corporation	ONCT	589
350	Ontario Midland Railroad Corporation	OMID	588

ID	CompanyName	RR Mark	ATCS
351	Ontario Northland Railway (Ontario Northland Trans	ONT	754
352	Oregon & Northwestern Railroad Co.	ONW	596
353	Oregon Pacific & Eastern Railway Company	OPE	597
354	Oregon, California & Eastern Railway	OCE	603
355	Ottertail Valley Railroad Co Inc	OTVR	983
356	Ottumwa Terminal Railroad Co	OTT	276
357	Paducah & Illinois Railroad Company	PI	614
358	Paducah & Louisville Railroad	PAL	907
359	Panther Valley Railroad Corporation	PVAL	575
360	Patapsco & Back Rivers Railroad Company	PBR	609
361	Pearl River Valley Railroad Company	PRV	636
362	Pecos Valley Southern Railway Company, The	PVS	644
363	Pee Dee River Railroad Corp	PDRR	010
364	Peninsula Terminal Company	PT	643
365	Peoria And Pekin Union Railway Company	PPU	645
366	Philadelphia Belt Line Railroad Company, The	PBL	608
367	Philadelphia Bethlehem And New England Railroad Co	PBNE	659
368	Pickens Railway Company	PICK	624
369	Pioneer And Fayette Railroad Company	PF	630
370	Pioneer Valley Railroad Company	PVRR	611
371	Pittsburg & Shawmut Railroad Inc	PSR	627
372	Pittsburgh Chartiers & Youghiogheny Railway Compan	PCY	629
373	Pittsburgh, Allegheny & Mckees Rocks Rr Co	PAM	607
374	Plymouth Short Line Ltd	PSLL	566
375	Pocono Northeast Railway, Inc.	PNER	618
376	Point Comfort & Northern Railway Company	PCN	651
377	Port Bienville Railroad	PBVR	677
378	Port Of Tillamook Bay Railroad	POTB	637
379	Port Royal Railroad	PRYL	393
380	Portland Terminal Company	PTM	619
381	Portland Traction Company	PRTD	632
382	Prescott And Northwestern Railroad Company	PNW	634
383	Providence And Worcester Railroad Company	PW	631
384	Quebec Central Railway Company	QC	658
385	Queensland Rail (Australia)		036
386	Quincy Railroad Company	QRR	656
387	Rac (Railway Association Of Canada)		033
388	Rarus Railway Company	RARW	516
389	Red River Valley & Western Railroad Co	RRVW	321
390	Renfe (National Railways Of Spain)		119
391	River Terminal Railway Company, The	RT	665
392	Robe (Australia)		044
393	Roberval And Saguenay Railway Company, The	RS	669
394	Rochester & Southern Railroad Inc	RSR	941
395	Rockdale Sandow & Southern Railroad Company	RSS	675
396	Rocky Mountain Railcar And Railroad Inc	RMRR	915
397	Roscoe Snyder & Pacific Railway Company	RSP	673
398	Sabine River & Northern Railroad Company	SRN	678
399	Saint Lawrence Railroad	SLAW	705
400	Saint Marys Railroad Company	SM	682

ID	CompanyName	RR Mark	ATCS
401	Salt Lake Garfield And Western Railway Company	SLGW	690
402	San Diego & Imperial Valley Railroad Co Inc	SDIY	315
403	San Luis Central Railroad Company	SLC	696
404	San Manuel Arizona Railroad Company	SMA	794
405	Sand Springs Railway Company	SS	707
406	Sandersville Railroad Company	SAN	691
407	Santa Maria Valley Railroad Company	SMV	741
408	Savannah State Docks Railroad Company	SSDK	679
409	Sequatchie Valley Railroad Inc	SQVR	910
410	Shore Fast Line Railroad Company Sflr 2	SFLR	255
411	Sierra Railroad Company	SERA	716
412	Singapore (Singapore)		076
413	Sisseton Southern Railway Co	SSOR	440
414	Somerset Railroad Corporation	SOM	772
415	SOO Line Rail Company	SOO	030
416	South Branch Valley Rail Road	SBVR	732
417	South Brooklyn Railway Company	SBK	718
418	South Buffalo Railway Company	SB	719
419	South Carolina Central Railroad Co Inc	SCRF	582
420	South Central Tennessee Railroad Corporation	SCTR	672
421	Southeast Kansas Railroad Company	SEKR	944
422	Southeastern Penn Transp Authority	SEPTA	024
423	Southern Indiana Railway Inc	SIND	720
424	Southern New Jersey Light Rail Transit	??	026
425	Southern Pacific Transportation Company	SP	721
426	Southern Railway Company	SOU	724
427	Southern San Luis Valley Railroad Company	SSLV	706
428	St Maries River Railroad Company	STMA	698
429	STA		048
430	Staten Island Railway Corporation	SIRY	389
431	Steelton & Highspire Railroad Company	SH	799
432	Stewartstown Railroad Co	STRT	729
433	Stockton Terminal And Eastern Railroad	STE	739
434	Strasburg Railroad Company	SRC	686
435	Strouds Creek And Muddlety Railroad	SCM	687
436	Sunset Railway Company	SUN	734
437	Tacoma Muncipal Belt Line Railway	TMBL	759
438	Tasrail		119
439	Tennessee Railway Company	SCM	767
440	Tennessee, Alabama And Georgia Railway	SOU	755
441	Tennken Railroad Company Inc	TKEN	745
442	Terminal Railroad Association Of St Louis	TRRA	757
443	Terminal Railway Alabama State Docks	TASD	758
444	Texas & Northern	TN	795
445	Texas Central Railroad Company	TEXC	750
446	Texas City Terminal Railway Company	TCT	761
447	Texas Mexican Railway Company, The	TM	762
448	Texas North Western Railway Company	TXNW	747
449	Texas South-Eastern Railroad Company	TSE	765
450	Texas, Oklahoma & Eastern Railroad Company	TOE	764

ID	CompanyName	RR Mark	ATCS
451	Thailand (Thai State Railways)		102
452	Tippecanoe Railroad Company	TIPP	753
453	Tonawanda Island Railroad Inc	TIRL	743
454	Towanda And Monroeton Shippers Lifeline, Inc.	TMSS	752
455	Transkentucky Transportation Railroad Co Inc	TTIS	773
456	Tranz Rail (Tasmania)		057
457	Trintity Railway Express		751
458	Trona Railway Company	TRC	779
459	TTCI Test Unit 1	TTCI	884
460	TTCI Test Unit 2	TTCI	885
461	TTCI Test Unit 3	TTCI	886
462	TTCI Test Unit 4	TTCI	887
463	TTCI Test Unit 5	TTCI	888
464	TTCI Test Unit 6	TTCI	889
465	Tucson, Cornelia & Gila Bend Railroad Company	TCG	783
466	Tulsa-Sapulpa Union Railway Company L L C	TSU	709
467	Turtle Creek Industrial Railroad Inc	TCKR	744
468	Tuscola And Saginaw Bay Railway Company Inc	TSBY	770
469	Union Pacific Railroad Company	UP	802
470	Union Railroad Company	URR	803
471	Union Railroad Of Oregon	UO	800
472	United South Eastern Railways Company	SE	281
473	Unity Railways Company	UNI	806
474	Upper Merion And Plymouth Railroad Company	UMP	808
475	Utah Railway Company	UTAH	811
476	Valdosta Southern Railroad	VSO	816
477	Vandalla Railroad Company	VRRC	781
478	Ventura County Railway Company	VCY	821
479	Vermont Railway Inc	VTR	817
480	Via Rail Canada Inc	VIA	818
481	Victrack (Australia)		017
482	Virginia Railway Express	VRE	023
483	Visalia Electric Railroad Company	VE	824
484	Walking Horse & Eastern Railroad Co Inc	WHOE	390
485	Warren & Saline River Railroad Company	WSR	832
486	Washington Central Railroad Company, Inc. Wcrc	WCRC	943
487	Washington County Railroad Corporation	WACR	812
488	Washington Terminal	WATC	849
489	Waterloo Railway Company	WLO	835
490	Wctu Railway Company	WCTR	844
491	Weatherford Mineral Wells & Northwestern	WMWN	837
492	West Jersey Short Line, Inc.	WJSL	387
493	West Shore Railroad Corp	WTSE	882
494	West Tennessee Railroad Corp	WTNN	258
495	West Virginia Northern Railroad	WVN	866
496	Western Railroad Company	WRRC	838
497	Westrail (Australia)		038
498	White Pass & Yukon	WPY	845
499	Willamette Valley Railway Company, Inc	WVR	863
500	Wilmington Terminal Railroad Inc	WTRY	981

ID	CompanyName	RR Mark	ATCS
501	Winchester And Western Railroad Company	WW	850
502	Winifrede Railroad Company	WNFR	852
503	Winston-Salem Southbound Railway Company (Csx Tran	WSS	854
504	Wisconsin & Calumet Railroad	WICT	382
505	Wisconsin & Southern Railroad Company	WSOR	879
506	Wisconsin Central Limited	WC	260
507	Yancey Railroad Company	YAN	876
508	Youngstown & Austintown Railroad Co	YARR	372
509	Youngstown & Southern Railway Company	YS	875
510	Yreka Western Railroad Company	YW	873
511	UK ATCS Testing and Field Evaluations	????	974
512	Network Rail - London North Eastern - UK	????	975
513	Network Rail - London North Western - UK	????	976
514	Network Rail - Scotland - UK	????	977
515	Network Rail - South East - UK	????	978
516	Network Rail - Western - UK	????	979

APPENDIX C
BCM CODE PLUG PARAMETERS

C. BCM CODE PLUG PARAMETERS

C.1 CODE PLUG PARAMETERS

Code plug parameters for Siemens's BCM Firmware, Versions 4.01 through 4.05, are listed in Table C-1. For additional information regarding subsequent revisions to the firmware, contact Siemens Customer Service.

It is recommended that users only modify these parameters using the supplied utility program. However, if the parameters are manipulated directly, care should be taken that the wrong locations are not inadvertently modified.

NOTE

NOTE

Time values are expressed in 10-millisecond increments. For example, 15 seconds would be expressed as 1500.

Many values are bit-mapped. Bit 0 is defined as the value 01, bit 1 as 02, bit 3 as 04, etc. Actual value to be programmed is the sum of all required bits (e.g., if bits 1, 2, and 4 are set, the value is (2+4+16) = $16 (22 decimal)).

All values are in decimal, except where specifically indicated with the hexadecimal prefix ($).

Table C-1 WCM Code Plug Parameters

Location	Description	Default Value
$01	Manufacturer equipment code	$01
$02	ATCS equipment code	$01
$02 thru $09	ATCS address of FPD. The values are interpreted as 16 nibbles with the last nibble specifying the address length. Zero is coded as $A. Example: 7A.22.51.6A.28.A1.A1.0E This is used to set the FPD address when the attached equipment cannot provide the address via an XID process.	Null
$0A thru $11	ATCS address to which health and malfunction report messages should be sent. Example: 2A.22.A1.AA.AA.00.00.0A	Null

Table C-1 Continued

Location	Description	Default Value
$12	Local processing options bit map Bit 0 - Enable site code line application logic Bit 1 - Enable duplicate reject suppress facility Bit 2 - Enable site simulation Bit 3 - Enable site ladder logic Bit 6 - Enable AMCI Alert messages	Null
$13	Maximum number of ground contact attempts per radio channel	6
$14 thru $17	Time between ground contact attempts	6000
$18 thru $1B	Layer 4 duplicate elimination timer value	1500 (15 sec.)
$1C thru $1F	Ground contact expiration timer value	Reserved
$20 thru $27	ATCS address for cluster controller time requests	Null
$28	Out-of-coverage radio channel. If this value is $FF, no channel change is performed when entering out-of-coverage mode.	1
$29 thru $2A	Not used	Null
$2B	Alarm enable bits Bit 0 - External alarm 5 Bit 1 - Port 0 contact failure Bit 2 - Port 1 contact failure Bit 3 - Port 2 contact failure Bit 4 - Port 0 hardware failure Bit 5 - Port 1 hardware failure Bit 6 - Port 2 hardware failure Bit 7 - Not used	Null
$2C	Alarm enable bits Bit 0 - Mobile channel usage (COS too long) Bit 1 - Out of coverage (lost contact) Bit 2 - A/D failure Bit 3 - External alarm 0 Bit 4 - External alarm 1 Bit 5 - External alarm 2 Bit 6 - External alarm 3 Bit 7 - External alarm 4	Null
$2D	Alarm enable bits Bit 0 - Radio failure Bit 1 - Radio bus failure Bit 2 - Radio power amplifier Bit 3 - Radio AC power failure Bit 4 - Code plug CRC failure Bit 5 - Carrier without data Bit 6 - Rf modulator failure Bit 7 - Ground contact failure	Null

Table C-1 Continued

Location	Description	Default Value
$2E thru $3C	Not used	Null
$3D	This parameter specifies the number of ground network messages that must be received within the period configured (see 'Regain contact window') for contact to be regained ($44 thru $47).	1
$3E	Ground contact options Bit 0 - Enable ground contact procedure Bit 1 - Restrict channel cycle to default only Bit 2 - Enable passive contact if active contact fails Bit 3 - Send ground contact status to clients Bit 4 - Send ground contact status on mode change Bit 5 - Use time message exchange (Version 1 Spec.) Bit 6 - Always use code plug address for GC attempt	$15
$3F	Not used	Null
$40 thru $43	Rf poll expiration timer	1770 (60 sec.)
$44 thru $47	Time within which ground contact messages are to be received (see $3D)	1770 (60 sec.)
$48 thru $4B	Not used	Null
$4C thru $4F	Channel 2 rf retry interval	400 (4 sec.)
$50 thru $53	Channel 4 rf retry interval	490
$54 thru $57	Channel 6 rf retry interval	760
$58 thru $5B	Channel 8 rf retry interval	1080
$5C thru $5F	Channel 10 rf retry interval	1450
$60 thru $63	Channel 12 rf retry interval	2000
$64 thru $67	Channel 14 rf retry interval	2900
$68 thru $6B	Channel 16 rf retry interval	3900
$6C thru $6F	Retry quantum time	91
$70 thru $73	Retry slope	30
$74 thru $77	Flow recovery time before starting recovery	500 (5 sec.)
$78 thru $7B	Flow recovery time limit	1000 (10 sec.)
$7C thru $7F	Beacon timer	$FFFFFFFF
$80 thru $83	Cluster controller reset timer	1000 (10 sec.)
$84 thru $85	Number of fast beacons	5
$86 thru $87	Maximum number of beacon retries	6

Table C-1 Continued

Location	Description	Default Value
$88 thru $8F	ATCS address to which beacons are to be sent. The values are interpreted as 16 nibbles with the last nibble specifying the address length. Zero is coded as $A. Unused bytes can be set to 0 (null). Example: 2A.22.51.6A.28.00.00.0A	Null
$90	Network layer options Bit 0 - Enable NAK packets to ground network Bit 1 - Enable service signals to ground network Bit 2 - Enable emergency messages by channel group Bit 3 - Enable lost contact when out of coverage Bit 4 - Suppress layer 3 duplicate elimination Bit 5 – Ignores COS test before transmit when set	Null
$91	Broadcast Bit 0 - Enable wayside broadcast on zero device address	Null
$92	Wireline Bit 0 - Inhibits rf transmission of wayside wire line addresses	1
$93	Emergency turnaround Bit 0 - No turnaround Bit 1 - Turnaround on trunk failure Bit 2 - Always turnaround emergencies	1
$94 thru $97	Network address change time. If the BCM receives a local network address that is different from that of a client's current address (i.e. the BCM network address is redefined), this parameter determines the period before the BCM is reset.	1500 (15 sec.)
$98 thru $A3	Not used	0
$A4 thru $A5	Number of null rf frames after each transmission. When set to $FFFF, BCP is keyed continuously.	0
$A6 thru $A7	Maximum number of bits per non-emergency message. When set to $FFFF, no limit applies.	4800
$A8 thru $A9	Maximum number of bits per emergency message	14400
$AA thru $AD	Not used	0
$AE thru $B1	Minimum value for channel retry random access timer (channel idle)	130
$B2 thru $B5	Maximum value for channel retry random access timer (channel idle)	130
$B6 thru $B9	Minimum value for channel retry random access timer (channel receiving sync bits)	1
$BA thru $BD	Maximum value for channel retry random access timer (channel receiving sync bits)	80

Table C-1 Continued

Location	Description	Default Value
$BE thru $C1	Minimum value for channel retry random access timer (channel receiving busy bits)	1
$C2 thru $C5	Maximum value for channel retry random access timer (channel receiving busy bits)	200
$C6 thru $C9	Minimum value for channel retry random access timer (busy bit status not yet defined - less than 3 received)	1
$CA thru $CD	Maximum value for channel retry random access timer (busy bit status not yet defined)	80
$CE thru $D1	Maximum time before carrier-without-data alarm	$FFFFFFFF
$D2 thru $D5	Mobile channel usage timer	$FFFFFFFF
$D6 thru $D9	Out-of-coverage timer since last rf message	6000
$DA thru $DD	Minimum channel idle time	75
$DE thru $E1	Maximum channel idle time	150
$E2	Rf link options Bit 0 - Enable null rf link address for ground contact messages	1
$E3 thru $E5	Not used	0
$E6 thru $E9	Radio key-up time	4
$EA thru $ED	Radio dekey time	1
$EE	Radio type 0 = None 1 = MCS 2000 2 = MSF 3 = MTR 2000	1
$EF	Radio usage	5
$F0	Minimum radio channel. Set to desired channel for single-channel operation or to lowest channel used in scanning.	1
$F1	Maximum radio channel. Set to desired channel for single-channel operation or to highest channel used in scanning.	6
$F2	Default (single-channel operation) or first (scanned operation) radio channel.	
$F3 - $F7	Remainder of radio channel scan sequence. These parameters (including $F2) determine the scan sequence of the ground contact process. Location $F2 is the channel on which the unit begins scanning. The channels in the list must be in the range of valid channels. If the complete list is not used, unused channels must be set to $FF.	1,2,3,4,5,6

Table C-1 Continued

Location	Description	Default Value
$F8	SSI enable. Negative value relating to BASE RSSI (dB). Normally set to -125 ($7D)	0
$F9	Minimum SSI	0
$FA	SSI scaling multiplier.	0
$FB	SSI scaling divisor.	0
$FC	SSI simulation	0
$FD - $FE	Not used	
$FF	RF transmit power. Reserved for future application. 0 = Low 1 = High 2 = Auto	
$100 - $103	Port 0 contact failure timer	6000
$104 - $105	Port 0 link (polling) address. Undefined when set to $FFFF Start of polling range for certain emulations (WCP)	$FFFF
$106 thru $107	Port 0 group link address	$FFFF
$108	Port 0 options Bit 0 - Inhibit XID exchange Bit 1 - Enable emergency bit in message Bit 2 - Enable time stamp Bit 3 - Enable ADM mode failure Bit 4 – Reset BCM on port contact alarm	0
$109	Port 0 usage 5 - Ground equipment 6 - OBC equipment 18 - WIU equipment $FF - Not used	18
$10A	Port 0 configuration Bit 0 - RTS/CTS handling required Bit 1 - RS232 / RS422 selection Bit 2 - RTS always asserted Bit 3 - Async port configuration Bit 4 - External modem equipped Bit 5 - Idle character enable Bit 6 - Locomotive ID unit equipped Bit 7 - External TXCLOCK port option	0

Table C-1 Continued

Location	Description	Default Value
$136	Lontalk (tm) configuration flag: 0 = not used; 1 = used	
$137	DC configuration : 0 = None 1 = US&S 506 2 = US&S 514 3 = J Code 4 = K Code 5 = Alarm	
$138 - $13D	Not used	
$13E thru $141	General purpose timer value. Used for either locomotive ID unit receive time-out or code line protocol poll timer	$FFFFFFFF
$142 thru $143	Internal entity link address	1
$144 thru $145	Link address for ground network	$23
$146 thru $147	Link address for emergency transmission	$25
$148 thru $149	Link address for transmission to rf user	$27
$14A thru $14B	HDLC broadcast address	$00FF
$14C thru $14D	HDLC control messages	$00FF
$14E thru $155	Not used	$0000
$156 thru $157	Rf idle frame address	$0000
$158 thru $159	Rf link layer address for frames to locomotives	$0001
$15A thru $15B	Rf link layer address for frames to non-locomotives	$0004
$15C thru $15D	Rf link layer address for frames to wire line-connected waysides	$0003
$15E thru $15F	Rf link layer address for frames to rf-connected wayside	$0005
$160 thru $161	Rf link layer address for frames to ground network	$0023
$162 thru $163	Rf link layer address for emergency frames to ground network	$0025
$164 thru $165	Rf link layer address for frames to other rf users	$0027

Table C-1 Continued

Location	Description	Default Value
$166 thru $167	Rf link layer address for broadcast frames	$00FF
$168 thru $174	Reserved for channel frequency configuration	
$175	Not used	0
$176	Asic - not used	
$177	Asic configuration value	
$178 thru $17D	Asic frame sync pattern	$90E0 $2254 $00F6
$17E	Transmitter configuration digital loopback Bit 0 - Invert busy bit status Bit 1 - Hardware busy bit input Bit 2 - Enable analog loopback Bit 3 - Enable digital loopback Bit 4 - Invert transmit data Bit 5 - Invert receive data Bit 6 - Bit sync enable Bit 7 - N/A (always 0)	$4A
$17F	Transmitter configuration analog loopback Bit 0 - Invert busy bit status Bit 1 - Hardware busy bit input Bit 2 - Enable analog loopback Bit 3 - Enable digital loopback Bit 4 - Invert transmit data Bit 5 - Invert receive data Bit 6 - Bit sync enable Bit 7 - N/A (always 0)	$41
$180	Transmitter configuration open loopback Bit 0 - Invert busy bit status Bit 1 - Hardware busy bit input Bit 2 - Enable analog loopback Bit 3 - Enable digital loopback Bit 4 - Invert transmit data Bit 5 - Invert receive data Bit 6 - Bit sync enable Bit 7 - N/A (always 0)	$51
$181 thru $183	Not used	0
$184 thru $18D	Hardware initialization values (factory only)	
$18E thru $191	Alert initial delay time	$FFFFFFFF

Table C-1 Continued

Location	Description	Default Value
$192 thru $195	Alert response delay time	$FFFFFFFF
$196 thru $197	Alert report rate	$FFFF
$198 thru $199	Not used	$FFFF
$19A thru $19D	Alert retry time	$FFFFFFFF
$19E thru $1A1	Alert delivery delay time	$FFFFFFFF
$1A2 thru $1A9	Alert report address	0,0,0,0,0,0,0,0
$1AA thru $1AD	Not used	0
$1B0	Enable version field. This parameter determines if the version field is included in datagrams.	1
$1B1	This parameter determines the format of the health and malfunction/self-test report messages. The 89 spec. (0), 90 spec. (1) and latest spec. (3) versions are supported.	3
$1B2	This parameter determines the format of the communications statistics message. Versions 1 and 3 are supported.	3
$1BE thru $1BF	CRC of unprotected portion of code plug	$DEAD
$1C0 thru $1C5	Encrypted password for protected portion of code plug	MCP
$1C6 thru $1D4	Serial number as 15 ASCII bytes	
$1D5 thru $1D7	Maintenance date. Format: 3 unsigned bytes, DD/MM/YY	
$1D8 thru $1D9	Procuring railroad. Format: Unsigned integer. This parameter is used for the procuring railroad number for the Version 3 Health Report.	
$1DA thru $1DB	Not used	0
$1DC thru $1DD	ATCS hardware revision number. Format: Unsigned integer. This parameter is used for the ATCS hardware revision in the Version 3 Health Report.	

Table C-1 Continued

Location	Description	Default Value
$1DE thru $1DF	ATCS software revision number. Format: Unsigned integer This parameter is used for the ATCS software revision in the Version 3 Health Report.	
$1E0 thru $1E1	Power-up count. Format: Unsigned integer. This parameter is used for recording the number of power-ups the unit has performed.	0
$1E2 thru $1E3	Rf modulator failure count. Format: Unsigned integer. This parameter is used for recording the number of modulator self-test failures.	0
$1E4 thru $1E5	Radio failure count. Format: Unsigned integer. This parameter is used for recording the number of radio self-test failures.	0
$1E6 thru $1E7	A/D converter failure count. Format: Unsigned integer. This parameter is used for recording the number of A/D self-test failures.	0
$1E8 thru $1E9	Client port 0 failure count. Format: Unsigned integer. This parameter is used for recording the number of client port self-test failures.	0
$1EA thru $1EB	Client port 1 failure count. Format: Unsigned integer. This parameter is used for recording the number of client port self-test failures.	0
$1EC thru $1ED	Client port 2 failure count. Format: Unsigned integer. This parameter is used for recording the number of client port self-test failures.	0
$1EE thru $1F5	Manufacturer hardware revision number. Format: 8 bytes, ASCII. This parameter is used for the manufacturer hardware revision in the Version 3 Health Report.	
$1F6 thru $1FD	Not used	0
$1FE thru $1FF	Restricted code plug CRC for restricted code plug area. Format: Unsigned integer.	$DEAD

C.2 TRANSMITTER CONFIGURATION CODEPLUG PARAMETER DESCRIPTIONS

These paragraphs detail the bit state combinations that may be assigned to the transmitter configuration code-plug, position $180, for the following systems:

- Siemens A53410 Base Communications Package (MTR3000)
- Siemens A53411 Wayside Communications Package (MDS)

Within an ATCS network, the transmitter configuration codeplug parameters of the associated communications packages (Figure A-1) must be compatible to ensure proper communications. The compatible inversion states for the Siemens BCP, the Siemens WCP and/or the Motorola MCP are summarized in Table C-2. The corresponding codeplug values for each inversion state are also included.

Table C-2 System Configuration Compatibility Summary

Siemens BCP		Siemens WCP		Motorola MCP	
MTR3000 Inversion	**MTR3000 Loc. $180 Codeplug Value**	**MDS Inversion**	**MDS Loc. $180 Codeplug Value Loc. $180**	**Spectra MCP Inversion**	**Spectra MCP Loc. $180 Codeplug Value Loc. $180**
Rx = No Tx = No	41	TX = Yes Rx = Yes	71	TX = Yes Rx = Yes	71
Rx = Yes Tx = Yes	71	TX = No Rx = No	41	TX = No Rx = No	41
Rx = No Tx = Yes	51	TX = Yes Rx = No	51	TX = Yes Rx = No	51
Rx = Yes Tx = No	61	TX = No Rx = Yes	61	TX = No Rx = Yes	61

C.2.1 Codeplug Position $180 Transmit/Receive Configuration

The bit assignment for position $180 is as follows:

Bit Position	Function Assignment	Hexadecimal Position Assignment
0	Invert Busy Bit Status	16^0
1	Hardware Busy Bit Input	
2	Enable Analog Loopback	
3	Enable Digital Loopback	
4	Invert Transmit Data	16^1
5	Invert Receive Data	
6	Bit Sync Enable	
7	No Function Assignment (always 0)	

NOTE

NOTE

Bit state values assign options to single bits, where: 1= Yes, 0 = No.

The bit states for position $180 are as follows:

$51 (default) TX= YES RX = NO

Bit Position	Function Assignment	Bit State	Hexadecimal Value
0	Invert Busy Bit Status	1	1
1	Hardware Busy Bit Input	0	
2	Enable Analog Loopback	0	
3	Enable Digital Loopback	0	
4	Invert Transmit Data	1	50
5	Invert Receive Data	0	
6	Bit Sync Enable	1	
7	Bit 7	0	

$41 TX= NO RX = NO

Bit Position	Function Assignment	Bit State	Hexadecimal Value
0	Invert Busy Bit Status	1	1
1	Hardware Busy Bit Input	0	
2	Enable Analog Loopback	0	
3	Enable Digital Loopback	0	
4	Invert Transmit Data	0	40
5	Invert Receive Data	0	
6	Bit Sync Enable	1	
7	Bit 7	0	

$61 TX= NO RX = YES

Bit Position	Function Assignment	Bit State	Hexadecimal Value
0	Invert Busy Bit Status	1	1
1	Hardware Busy Bit Input	0	
2	Enable Analog Loopback	0	
3	Enable Digital Loopback	0	
4	Invert Transmit Data	0	60
5	Invert Receive Data	1	
6	Bit Sync Enable	1	
7	Bit 7	0	

$71 TX= YES RX = YES

Bit Position	Function Assignment	Bit State	Hexadecimal Value
0	Invert Busy Bit Status	1	1
1	Hardware Busy Bit Input	0	
2	Enable Analog Loopback	0	
3	Enable Digital Loopback	0	
4	Invert Transmit Data	1	70
5	Invert Receive Data	1	
6	Bit Sync Enable	1	
7	Bit 7	0	

C.3 PHD2000 TRANSMITTER CONFIGURATION CODEPLUG PARAMETER DESCRIPTIONS

The Motorola Phd2000 BCP codeplug is slightly different from the Siemens MCP codeplug. The Phd2000 BCP codeplug utilizes a separate address location for setting the inversion bits of its transmitter and receiver. In addition to setting the proper inversion bits it is necessary to change the settings of the Transmitter Configuration Analog Loopback and Digital Loopback Tests. Failure to set these parameters correctly will cause the Modulator self test to fail.

Within an ATCS network, the transmitter configuration codeplug parameters of the associated communications packages communications (Figure A-1) must be compatible to ensure proper communications. The compatible inversion states for the Phd2000 BCP, the Siemens WCP and/or the Motorola MCP are summarized in Table C-3. The corresponding codeplug values for each inversion state are also included.

Table C-3 Motorola PHD2000 BCP Codeplug Configuration Summary

Motorola Phd2000 BCP		Siemens WCP		Motorola MCP	
MSF5000 Inversion	**MSF5000 Loc. $178 (TX) Loc. $183 (RX) Codeplug Values**	**MCS2000 Inversion**	**MDS Loc. $180 Codeplug Value**	**Spectra MCP Inversion**	**Spectra MCP Loc. $180 Codeplug Value**
Rx = No Tx = No	$178 = 05 $181 = 13 $182 = 0B $183 = 03	TX = Yes Rx = Yes	71	TX = Yes Rx = Yes	71
Rx = Yes Tx = Yes	$178 = 0D $181 = 15 $182 = 0D $183 = 07	TX = No Rx = No	41	TX = No Rx = No	41
Rx = No Tx = Yes	$178 = 05 $181 = 13 $182 = 0B $183 = 07	TX = Yes Rx = No	51	TX = Yes Rx = No	51
Rx = Yes Tx = No	$178 = 0D $181 = 15 $182 = 0D $183 = 03	TX = No Rx = Yes	61	TX = No Rx = Yes	61

C.3.1 Codeplug Position $178 Receiver Configuration

The bit assignments for position $178 are as follows:

Bit Position	Function Assignment	Hexadecimal Position Assignment
0	Number of frame sync mismatches	16^0
1	Number of frame sync mismatches	
2	Number of frame sync mismatches	
3	Invert RX data	

NOTE

Bit state values assign options to single bits, where: 1= Yes, 0 = No.

The bit states for position $178 are as follows:

$05 RX = NO

Bit Position	Function Assignment	Bit State	Hexadecimal Value
0	Number of frame sync mismatches	1	5
1	Number of frame sync mismatches	0	
2	Number of frame sync mismatches	1	
3	Invert RX data	0	

$0D RX = YES

Bit Position	Function Assignment	Bit State	Hexadecimal Value
0	Number of frame sync mismatches	1	D
1	Number of frame sync mismatches	0	
2	Number of frame sync mismatches	1	
3	Invert RX data	1	

C.3.2 Codeplug Position $181 Transmitter Configuration Digital Loopback

The bit assignments for position $181 are as follows:

Bit Position	Function Assignment	Hexadecimal Position Assignment
0	Invert Busy Bit	16^0
1	Hardware Busy Bi	
2	Invert Transmitted Data	
3	Enable Analog Loopback	
4	Enable Digital Loopback	16^1
5	No Function Assignment (always 0)	
6	No Function Assignment (always 0)	
7	No Function Assignment (always 0)	

NOTE

NOTE

Bit state values assign options to single bits, where: 1= Yes , 0 = No.

The bit states for position $181 are as follows:

$13 INVERT TX= NO

Bit Position	Function Assignment	Bit State	Hexadecimal Bit Value
0	Invert Busy Bit	1	3
1	Hardware Busy Bit	1	
2	Invert Transmitted Data	0	
3	Enable Analog Loopback	0	
4	Enable Digital Loopback	1	10
5	Bit 5	0	
6	Bit 6	0	
7	Bit 7	0	

$15 INVERT TX = YES

Bit Position	Function Assignment	Bit State	Hexadecimal Bit Value
0	Invert Busy Bit	1	5
1	Hardware Busy Bit	0	
2	Invert Transmitted Data	1	
3	Enable Analog Loopback	0	
4	Enable Digital Loopback	1	10
5	Bit 5	0	
6	Bit 6	0	
7	Bit 7	0	

C.3.3 Codeplug Position $182 Transmitter Configuration Analog Loopback

The bit assignments for position $182 are as follows:

Bit Position	Function Assignment	Hexadecimal Position Assignment
0	Invert Busy Bit	16^0
1	Hardware Busy Bit	
2	Invert Transmitted Data	
3	Enable Analog Loopback	

NOTE

NOTE

Bit state values assign options to single bits, where: 1= Yes, 0 = No.

The bit states for position $182 are as follows:

$0B INVERT TX= NO

Bit Position	Function Assignment	Bit State	Hexadecimal Bit Value
0	Invert Busy Bit	1	B
1	Hardware Busy Bit	1	
2	Invert Transmitted Data	0	
3	Enable Analog Loopback	1	

$0D INVERT TX = YES

Bit Position	Function Assignment	Bit State	Hexadecimal Bit Value
0	Invert Busy Bit	1	D
1	Hardware Busy Bit	0	
2	Invert Transmitted Data	1	
3	Enable Analog Loopback	1	

C.3.4 Codeplug Position $183 Transmitter Configuration Normal (OPEN)

The bit assignments for position $183 are as follows:

Bit Position	Function Assignment	Hexadecimal Position Assignment
0	Invert Busy Bit	16^0
1	Hardware Busy Bit	
2	Invert Transmitted Data	
3	Enable Analog Loopback	

NOTE

NOTE

Bit state values assign options to single bits, where: 1= Yes, 0 = No.

The bit states for position $183 are as follows:

$0B TX= NO

Bit Position	Function Assignment	Bit State	Hexadecimal Bit Value
0	Invert Busy Bit	1	3
1	Hardware Busy Bit	1	
2	Invert Transmitted Data	0	
3	Enable Analog Loopback	0	

$0D TX = YES

Bit Position	Function Assignment	Bit State	Hexadecimal Bit Value
0	Invert Busy Bit	1	7
1	Hardware Busy Bit	1	
2	Invert Transmitted Data	1	
3	Enable Analog Loopback	0	

APPENDIX D
GENERIC GROUNDING PROCEDURES

D. GENERIC GROUNDING PROCEDURES

D.1 GENERAL

With all R-Link radio applications care should be taken to prevent ground differentials between the grounding points that can cause equipment damage. Perform the following recommendations when grounding equipment and enclosures.

D.2 EXTERNAL BUILDING GROUND

(Figure D-1) Grounding electrodes should be a minimum of 8 feet in length and located approximately 2 feet away from each corner of the building with the top of each element at least 6 inches below grade. Spacing between electrodes should not exceed 15 feet. The ground elements should be bonded together with a ring of #2 AWG solid copper wire. All below grade connections shall be Cadwelded.

The following items should be connected to the ground ring using a #2 AWG solid copper conductor:

- All hydro ground elements within 6 feet of the ground ring
- All metal objects within 50 feet of the building (e.g., fuel storage tanks)
- Air gap surge protectors on the common ground side of the arrestors (as direct as possible through the floor)
- A conductor from each ground electrode to the closest corner of the building, passed up through the floor and up the inside wall to connect with an internal ground ring located 6 inches from the inside ceiling

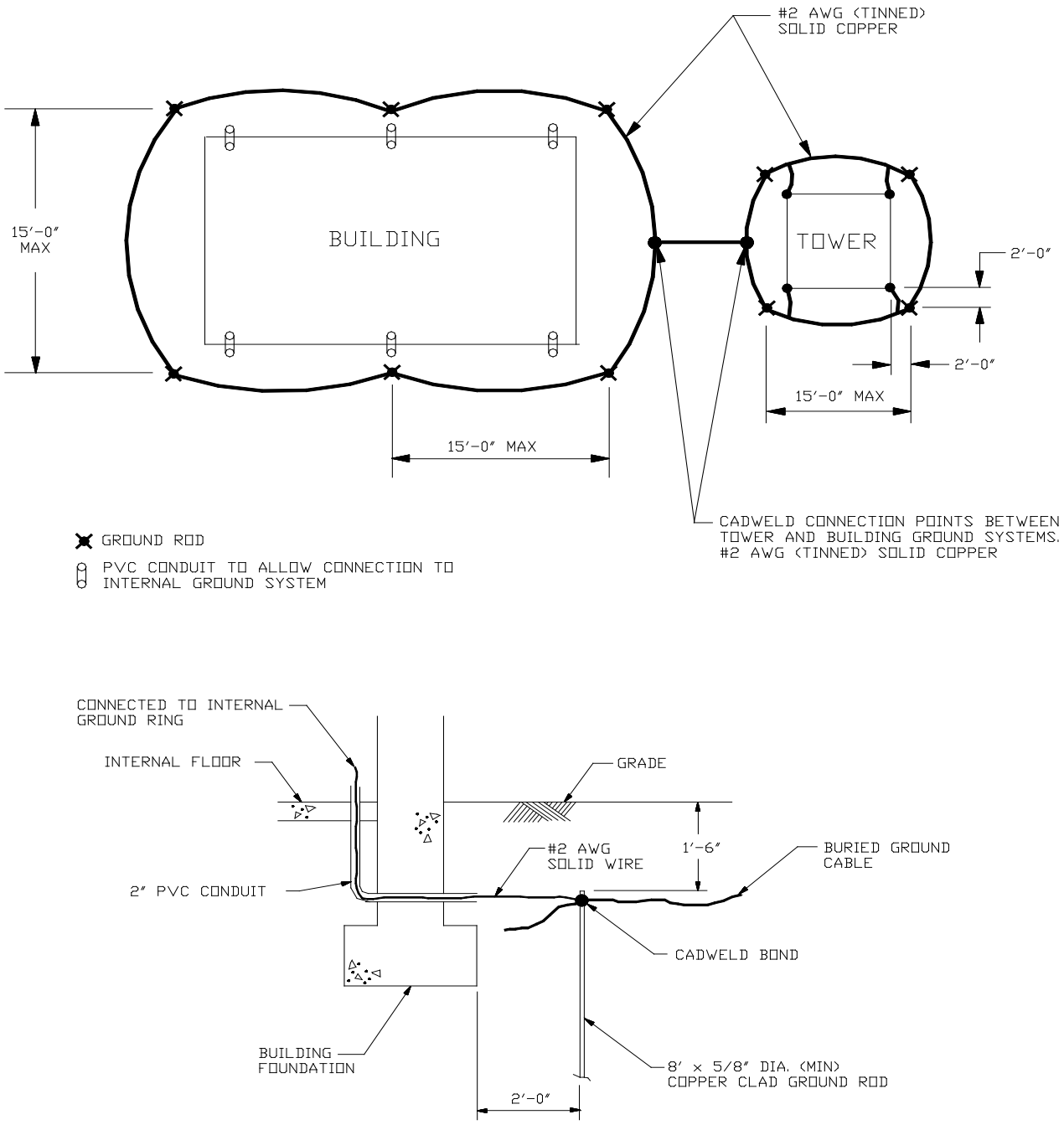


Figure D-1 Typical Ground Connections

D.3 INTERNAL BUILDING GROUND

The internal ground ring should be #2 AWG copper, and may be stranded. The following items should be connected to the internal ground ring using a minimum #6 AWG stranded copper conductor:

- All relay racks
- AC panels
- Battery system surge protectors
- Building doors
- Cable trays

NOTE

NOTE

Bonding conductor connections to the ground ring should be made using split brass bolts (see Figure D-4).

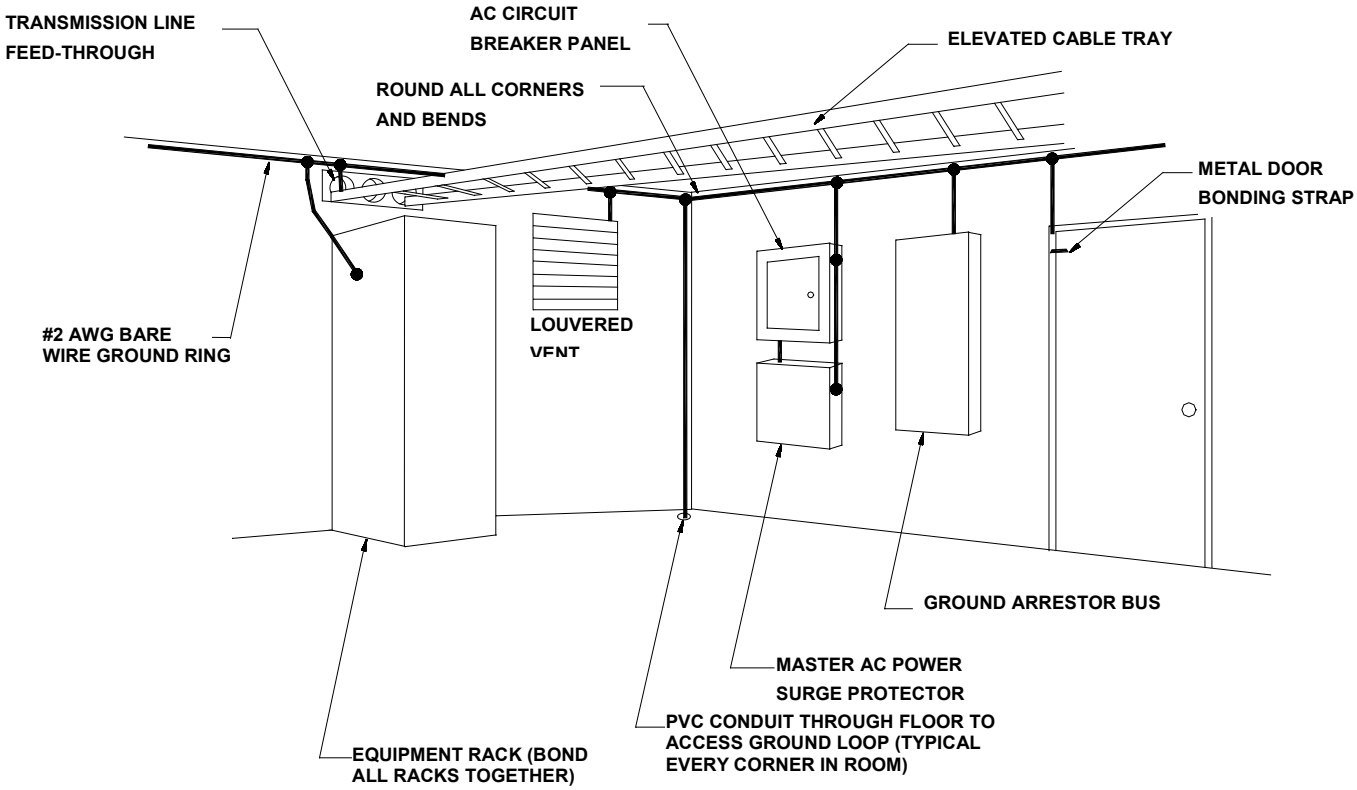


Figure D-2 Typical Internal Building Ground

D.4 ANTENNA GROUND

A good RF ground will determine the quality of a radio antenna system. Poor grounds result in antennas not operating efficiently. It is possible to burn up between 50 and 90 percent of the RF power heating the ground losses under the antenna instead of propagating into the air. Ground resistances can vary from very low values of 5 ohms to more than 100 ohms. RF power is dissipated in the ground resistance. The following factors that affect ground resistance are:

- The conductivity of the soil
- The composition of the soil
- The water content of the soil

Note that the ideal ground depth depends on the level of the local water table; it is rarely at ground level and can be several feet below grade.

D.4.1 Antenna Ground – Roof-Mount Yagi

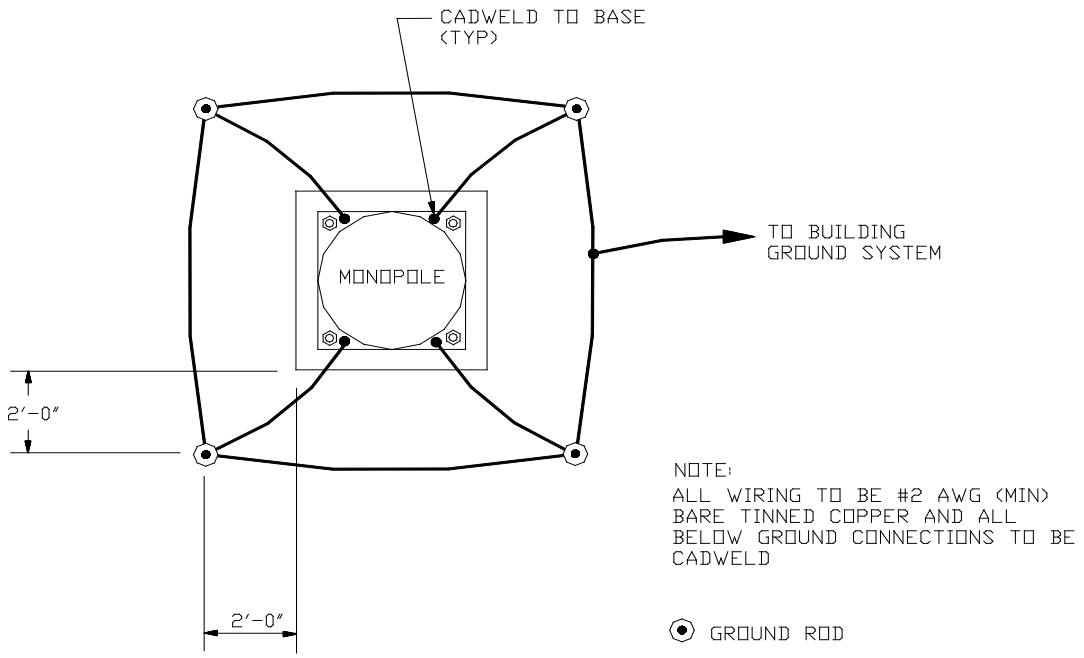
Roof-mounted Yagi antennae should have the pipe mast grounded to the outside grounding ring with a minimum #2 AWG solid copper conductor. The Heliax ground kit should be connected within 1 foot of the cable entry to the building and connected to the copper conductor. A lightning surge protector is not required if the Yagi antenna is less than 10 feet above the building roof. The inside terminating connector on the antenna Heliax should be bonded to the internal ground ring.

D.4.2 Antenna Ground – Towers and Poles

As with all elevated metal objects, antennas will attract lightning strikes. This necessitates the need for an adequate and effective ground to minimize electrical noise and interference. (Figure D-3) On tower and pole equipped sites, the antenna must be well grounded by means of a #2 AWG solid copper conductor connection from the ground ring to the tower or pole grounding element(s). The tower ground system must have 5 ohms or less earth resistance. The antenna cable should be grounded to the tower/pole-grounding conductor where the cable bends and leaves the tower/pole towards the building.

The messenger wire for the cable should be bonded to the tower/pole ground and the external building ground ring. The antenna cable should be grounded outside the building, within 1 foot of the building entry, to the external building ground ring via a #2 AWG solid conductor. A lightning arrestor should be installed on the Heliax cable within 1 foot of the building entrance, and bonded to the internal ground ring.

Surge arrestors or a lightning protector should be installed at the point where the antenna cable enters the building or cabinet. The lightning protector should be properly grounded at the single-point chassis ground. Connectors must be weatherproofed to prevent corrosion to enable efficient grounding.



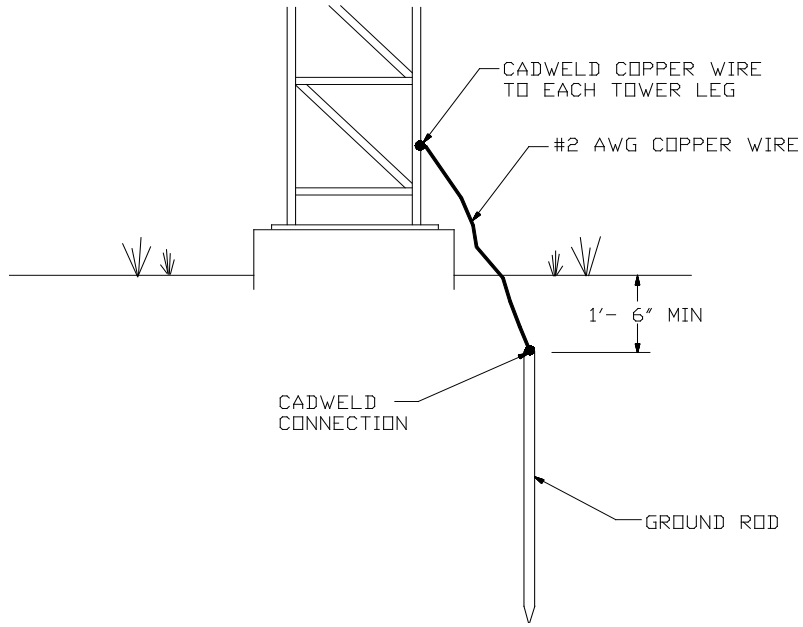


Figure D-3 Typical Tower and Pole Ground Connections

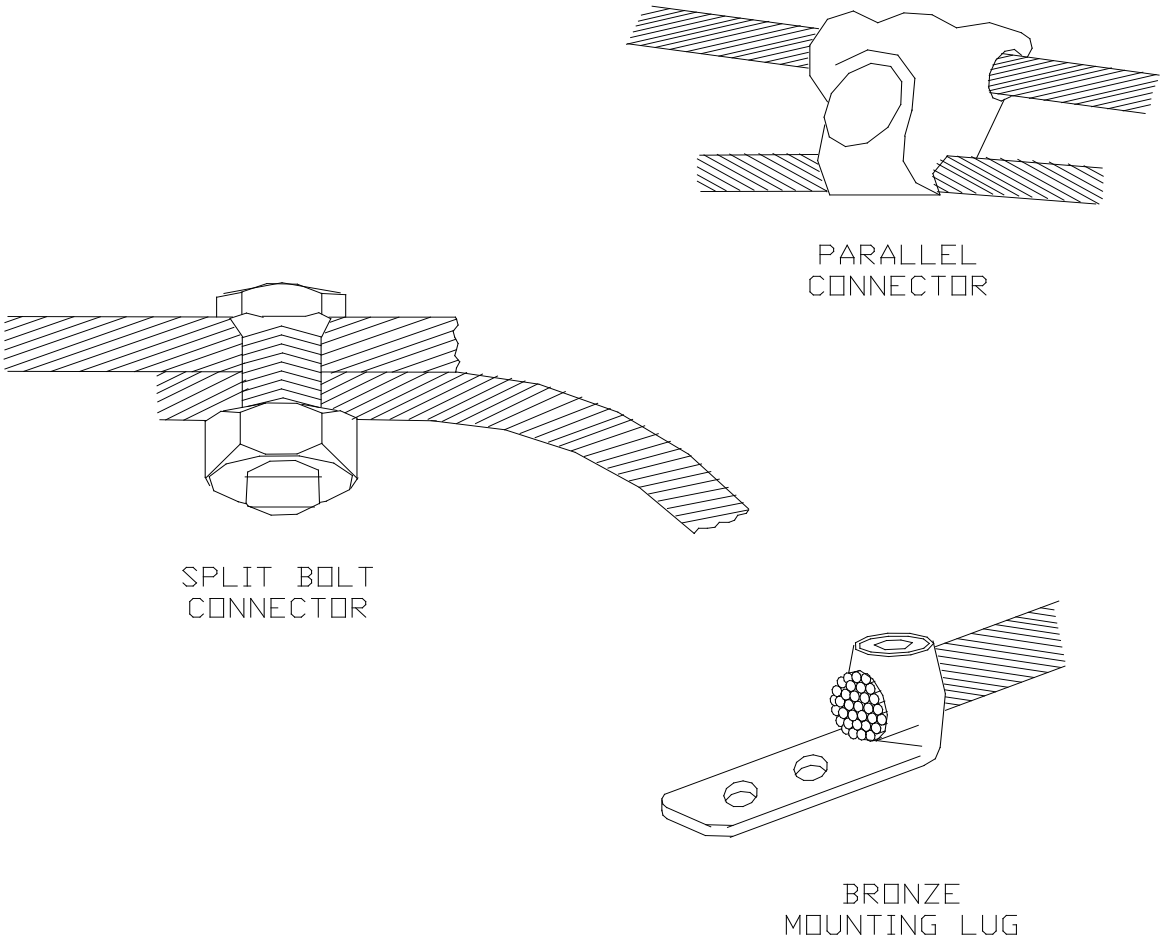


Figure D-4 Typical Connections for Grounding and Bonding

D.5 AC POWER GROUND

AC power grounding should be to the standards set forth by the applicable local or regional electrical code. When bonding AC panels to the internal ground ring, the connection should be made to the outside surface of the panel. Hydro ground electrodes should be bonded to the building ground electrodes only if they are within 6 feet of each other. A surge protector should be installed on the main electrical panel for any ungrounded electrical feed in or out of the building, and the connection to all air gap suppressors removed.

D.6 COMMUNICATIONS GROUND

All power and telephone company grounds should be made common to the communications ground. A surge arrester such as a Polyphaser™ should be installed at the point where the cable enters the building.

D.7 CABLING

Cabling shall be installed to minimize inductive coupling that would otherwise allow surge energy to bypass the protective and isolating elements in the system. The input/output conductors entering the building shall follow a path as short as possible to the air gap surge protectors. These conductors shall not be within 3 inches of other conductors including the signal wires from the surge protectors to the relay racks. The signal wires from the surge protectors to the relay rack shall be dressed together and separated from power and other signal wires by 3 inches. The signal wires between the relay isolation and the Safetran equipment shall be dressed together and separated from power or other signal wires by 3 inches. Where physical separation is not possible, the wires should be run at right angles to each other.

D.8 SURGE PROTECTION

Surge protection should be provided on battery/charger systems to prevent the system from rising to dangerous voltages with reference to building ground. The protectors should be installed in series with a circuit breaker so if they fail in the short mode the circuit breaker will open and the system will remain isolated from ground.

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APPENDIX E
RF CABLE AND CONNECTOR REFERENCE DATA

E. RF CABLE AND CONNECTOR REFERENCE DATA

E.1 GENERAL

E.2 JUMPER APPLICATIONS

In confined spaces (for example on combiners or equipment racks) use ¼" super-flexible cables. In applications where a small bending radius is not usually required (for example jumpers between main feeders and antennas) the larger 3/8" and ½" cables are preferred. Their lower attenuation compared to super-flexible cables makes them ideal for longer jumper cables.

E.3 CONNECTORS

Coaxial cable N-connectors provide excellent electrical matching of the connector to the cable and ensure low VSWR (typically 1/10 dB). Excellent mechanical matching will ensure weatherproofing. They have the following features:

- Silver-plated connectors to reduce Intermodulation
- DIN connectors for higher power applications

E.4 ACCESSORIES (RECOMMENDED)

The following accessories used in conjunction with coaxial cables will help to ensure a long lasting and cost-effective system:

- Cold-shrink for weatherproofing
- Snap-in hangers for easier installation
- Surge arrestors for equipment protection

Table E-1 Transmission Line System Components

E.4.1 Foam Coaxial Cable					
	3/8”	½”	7/8”	1-1/4”	1-5/8”
Attenuation dB / 100ft (dB / 100m)					
875 MHz	3.27 (10.8)	2.17 (7.13)	1.21 (3.98)	0.896 (2.94)	0.757 (2.49)
960 MHz	3.47 (11.4)	2.29 (7.52)	1.28 (4.20)	0.945 (3.10)	0.80 (2.62)
Average Power Rating, KW					
875 MHz	0.712	1.07	2.29	3.45	4.57
960 MHz	0.678	1.01	2.16	3.27	4.32
Suggested Cable Length, ft (m)					
806 – 960 MHz	40 (12)	65 (20)	115 (35)	155 (47)	185 (56)

Table E-2 Coaxial Cable Selection Guide 50-ohm, Foam Dielectric

Attenuation dB / 100ft (dB / 100m) Standard conditions: VSWR 1.0; ambient temp 75°F (24°C)					
3/8”	½”	7/8”	1-1/4”	1-5/8”	High Power Plenum Foam
3.55 (11.6)	2.34 (7.68)	1.31 (4.30)	0.96 (3.17)	0.82 (2.69)	Not recom-mended
Average Power Rating, KW Standard conditions: VSWR 1.0; ambient temp 104°F (40°C) Inner conducture 212°F (100°C)					
3/8”	½”	7/8”	1-1/4”	1-5/8”	High Power Plenum Foam
0.663	0.994	2.11	3.20	4.22	1.90

Table E-3 3/8" 50-ohm Foam Dielectric Coaxial Cable Attenuation and Average Power

(Not recommended for SSR or R-Link applications)

Frequency (MHz)	Attenuation dB/100ft (dB /100m)	Average Power (kW)
894	3.34 (11.0)	0.704
960	3.47 (11.4)	0.678

Table E-4 ½" 50-ohm Foam Dielectric Coaxial Cable Attenuation and Average Power

(Suitable for SSR or R-Link applications)

Frequency (MHz)	Attenuation dB/100ft (dB /100m)	Average Power (kW)
894	2.20 (7.22)	1.05
960	2.29 (7.51)	1.01

Table E-5 ½" N-Connector Loss VSWR, Low VSWR Specifications, Type N

Frequency Band (GHz)	Connector Type	Assembly VSWR, Maximum (R.L., dB)				
		1-25 ft (0.3-8m)	25-100 ft (8-30m)	100-200 ft (30-60m)	200-500 ft 60-150m)	> 500 ft (150m)
0.824 – 0.960	N Male	1.08 (28.3)	1.08 (28.3)	1.10 (26.4)	1.12 (24.9)	1.12 (24.9)
	N Female	1.08 (28.3)	1.08 (28.3)	1.10 (26.4)	1.12 (24.9)	1.12 (24.9)

Table E-6 7/8" 50-ohm Foam Dielectric Coaxial Cable

(Recommended for Long Range SSR and MCP RF Data Links)

Frequency (MHz)	Attenuation dB/100ft (dB /100m)	Average Power (kW)
894	1.23 (4.03)	2.25
960	1.28 (4.20)	2.16

Table E-7 7/8" N-Connector Loss VSWR, Low VSWR Specifications, Type N

Frequency Band (GHz)	Connector Type	Assembly VSWR, Maximum (R.L., dB)				
		1-25 ft (0.3-8m)	25-100 ft (8-30m)	100-200 ft (30-60m)	200-500 ft 60-150m)	> 500 ft (150m)
0.824 – 0.960	Male and Female	1.06 (28.3)	1.07	1.10 (26.4)	1.10 (26.4)	1.10 (26.4)

Table E-8 ½" Coaxial Cable Loss dB Comparison Reference

Manufacturer (Part No.)	894 MHz	960 MHz
Cableware (FLC12-50J)	2.20 dB	2.29 dB
Celldyne by Eupen (5128)	2.12 dB	2.20 dB
Amphenol (AFC4-50J)	2.20 dB	2.29 dB
Andrew (LDF4-50A)	2.20 dB	2.29 dB
Hi Tech Soft Flex	2.489 dB	2.589 dB

Table E-9 Base Radio Main Feeder Cable Coaxial Cable Selection Guide - 50 ohm "Air" Dielectric

Attenuation dB / 100ft (dB / 100m) Standard conditions: VSWR 1.0; ambient temp 75°F (24°C)					
	1-5/8”	2-1/4”	3”	4”	5”
1000 MHz	0.70 (2.30)	0.59 (1.93)	0.56 (1.84)	0.43 (1.41)	---
Average Power Rating, kW Standard conditions: VSWR 1.0; ambient temp 104°F (40°C) Inner conducture 212°F (100°C)					
	1-5/8”	2-1/4”	3”	4”	5”
1000 MHz	4.94	6.61	10.7	17.2	---

Table E-10 1-1/4" 50 ohm Foam Dielectric Coaxial Cable Base Radio Main Feeder

Frequency (MHz)	Attenuation (dB/100ft)	Average Power (kW)
894	0.907	3.41
960	3.10	3.27

Table E-11 1-1/4" Connector LOSS Low VSWR Specifications Base Radio Main Feeder

Frequency Band (GHz)	Connector Type	Assembly VSWR, Maximum (R.L., dB)				
		1-25 ft (0.3-8m)	25-100 ft (8-30m)	100-200 ft (30-60m)	200-500 ft 60-150m)	> 500 ft (150m)
0.824 – 0.894	N Male	1.08 (28.3)	1.09 (27.3)	1.12 (24.9)	1.15 (23.1)	1.20 (20.8)
	7/16 DIN	1.08 (28.3)	1.09 (27.3)	1.10 (26.4)	1.15 (23.1)	1.20 (20.8)

Table E-12 1-5/8" 50-ohm Foam Dielectric Coaxial Cable Base Radio Main Feeder

Frequency (MHz)	Attenuation (dB/100ft)	Average Power (kW)
894	0.767	4.51
960	0.800	4.32

Table E-13 1-5/8" Connector LOSS Low VSWR Specifications Base Radio Main Feeder

Frequency Band (GHz)	Connector Type	Assembly VSWR, Maximum (R.L., dB)				
		1-25 ft (0.3-8m)	25-100 ft (8-30m)	100-200 ft (30-60m)	200-500 ft 60-150m)	> 500 ft (150m)
0.824 – 0.894	7/16 DIN Male	1.06 (30.7)	1.08 (28.3)	1.10 (26.4)	1.15 (23.1)	1.20 (20.8)
	7/16 DIN Female	1.10 (26.4)	1.13 (24.3)	1.18 (21.6)	1.20 (20.8)	1.22 (20.1)

Table E-14 1-5/8" 50-ohm Air Dielectric Coaxial Cable Base Radio Main Feeder

Frequency (MHz)	Attenuation (dB/100ft)	Average Power (kW)
894	0.658	5.24
960	0.684	5.05

Table E-15 ½" N-Connector

Frequency Band GHz	Connector Type	Assembly VSWR, Maximum (R.L., dB)			
		0-10 ft (0-3m)	10-20 ft (3-6m)	20-100 ft (6-30m)	> 100 ft (> 30m)
0.01 – 2.3	N-Males	1.10 (26.4)	1.10 (26.4)	1.15 (23.1)	1.15 (23.1)
	N-Females	1.15 (23.1)	1.15 (23.1)	1.15 (23.1)	1.20 (20.8)

APPENDIX F
RF PROPAGATION BRIEF

F. RF PROPAGATION BRIEF

F.1 WAVELENGTH VS FREQUENCY

The frequency of an electromagnetic wave is the number of cycles that occur in one second. If either the frequency or length of a wave is known, the unknown value can be calculated as follows:

where C = 3 x 10^8 meters per second (mps)

Frequency (Hz) = C / Wavelength (λ)

Wavelength (λ) = C / Frequency (Hz)

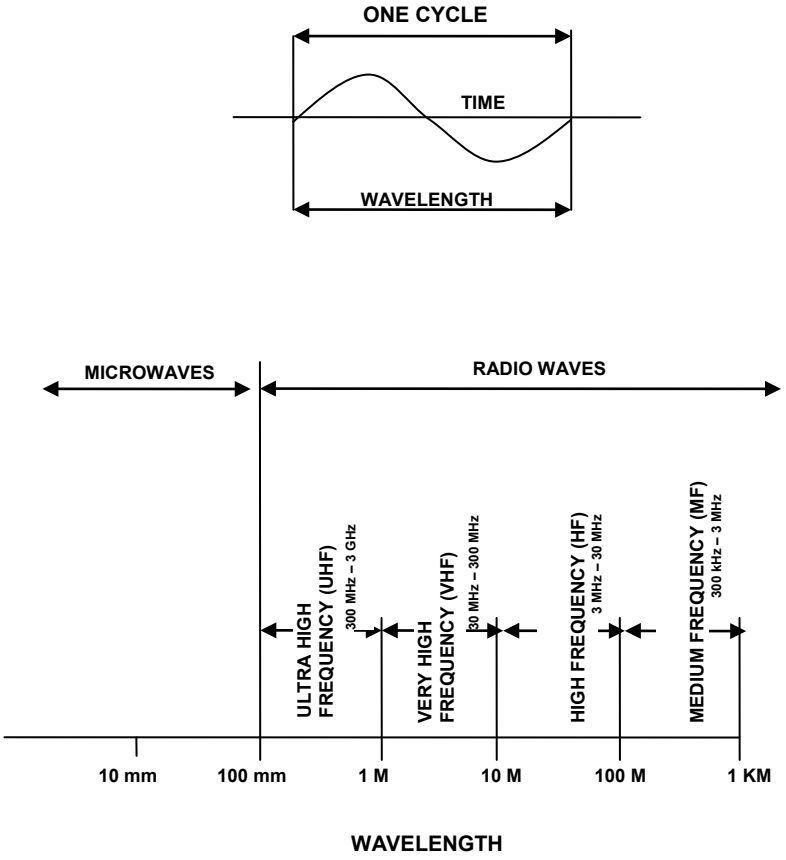
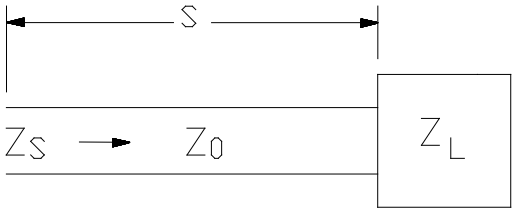


Figure F-1 Wavelength vs Frequency

F.1.1 Quarter and Half Wavelength Lines

Sections of transmission lines that are exactly a quarter-wavelength or a half-wavelength in length have important impedance-transforming properties, and are often used at radio frequencies.

Impedance inversion by quarter-wavelength lines. Refer to Figure F-2. The load of impedance Z_L connected to a piece of transmission line of length ***s*** is exactly a quarter-wavelength (or an odd number of quarter-wavelengths) and line is lossless. Therefore, the formula for impedance Z_8, seen when looking toward the load, is as follows:



$$Z_8 = Z_O2 / Z_L$$

Figure F-2 Loaded Line

F.2 CURRENT AND VOLTAGE DISTRIBUTIONS

The length of an antenna, like a transmission line, is a sizable portion of a wavelength – even several wavelengths. It is a circuit with distributed constants. A voltage is applied at one point, resulting in a voltage and current at that point. Traveling waves are then initiated, and possibly standing waves are set up, resulting in voltage and current on the antenna that will generally vary from one point to the next. This antenna voltage and current distribution will have an effect on the radiated field. The field depends chiefly on the antenna length measured in wavelengths, its power losses, and the terminations at its ends, if any. In addition, the thickness of the antenna wire is of importance, but for practical purposes antennas may be assumed to be lossless, and of wire whose diameter is infinitely small when compared to a wavelength.

There is a similarity to the distribution of voltage and current on a piece of quarter-wave transmission line that is open-circuited at the far end. Just as a voltage minimum and current maximum appear at the antenna feed point, so an identical situation exists $\lambda/4$ away from the open circuit on a transmission line.

Refer to Figure F-3 below. The current distributions on antennas with lengths that are multiples of λ/2 are logical extensions of those of the half-wave antenna, and similarly comparable to equivalent transmission lines. The voltage distributions are omitted for simplicity.

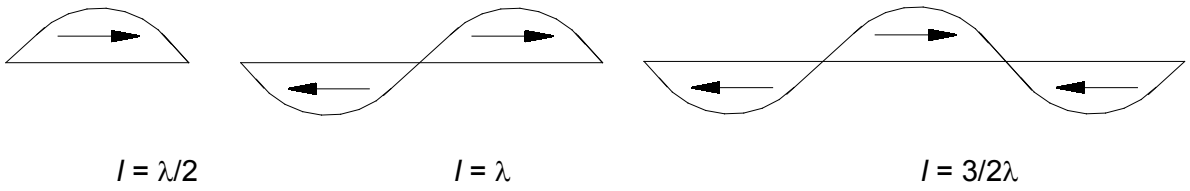


Figure F-3 Current Distribution on Resonant Dipoles

F.3 EFFECTIVE RADIATED POWER (ERP)

There is an importance difference between output power and Effective Radiated Power (ERP): output power is regulated by the FCC for bands below 470 MHz, and ERP is not regulated. This lack of regulation can potentially impact a system's transmission capabilities and may be the reason for interference problems.

ERP is the transmitter output power multiplied by the net gain of the antenna system.

ERP = transmitter output power x net gain of antenna system

The net gain of the antenna system is equal to the transmission losses (caused by transmission lines, duplexers, cavity filters, and isolators) subtracted from the gain of the antenna.

To calculate the ERP, convert all components to decibels (dB) and then add the losses (-) and gains (+) of the antenna system to get the result. Perform the following steps:

1. Convert the output power (Po) from watts to dB above a watt (dBW)

   dBW = 10 LOG Po

2. Add the net gain of the antenna system to get the ERP in dBW

3. Convert the ERP in dBW back to watts

   Watts = 10 dBW/10

Example:

Po = 250 watts	=	+24.0 dBW
Antenna system losses	=	-2.5 dB
Antenna gain	=	+6.5 dBd

ERP	=	+28.0 dBw = 631 watts

ERP is used in determining a coverage area because it includes power from the antenna, rather than simply the output power from the transmitter.

F.4 RESONANT ANTENNAS

A resonant antenna corresponds to a resonant transmission line. All antennas described after the elementary doublet have been resonant. An antenna is an opened-out transmission line, open-circuited at the far end and of resonant length. The source is low-impedance, and must be placed at a low-impedance point to avoid upsetting the standing-wave pattern. The nearest suitable point for this, from an open circuit, is a quarter-wavelength away.

APPENDIX G
VOLTAGE DROP TABLES

G. VOLTAGE DROP TABLES

Table G-1 Conductor Size for 10% Voltage Drop - 12 Volts

12 Volts – 10% Drop Wire Sizes (gage) – Based on Minimum CM Area																			
Total Current on Circuit (Amps)	Length of Conductor from Source of Current to Device and Back to Source - Feet																		
	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
5	18	18	18	18	18	16	16	14	14	14	12	12	12	12	12	10	10	10	10
10	18	18	16	16	14	14	12	12	10	10	10	10	8	8	8	8	8	8	6
15	18	16	14	14	12	12	10	10	8	8	8	8	8	6	6	6	6	6	6
20	16	14	14	12	12	10	10	8	8	8	6	6	6	6	6	6	4	4	4
25	16	14	12	12	10	10	8	8	6	6	6	6	6	4	4	4	4	4	2
30	14	12	12	10	10	8	8	6	6	6	6	4	4	4	4	2	2	2	2
40	14	12	10	10	8	8	6	6	6	4	4	4	2	2	2	2	2	2	2
50	12	10	10	8	8	6	6	4	4	4	2	2	2	2	2	1	1	1	1
60	12	10	8	8	6	6	4	4	2	2	2	2	2	1	1	1	0	0	0
70	10	8	8	6	6	6	4	2	2	2	2	1	1	1	0	0	0	2/0	2/0
80	10	8	8	6	6	4	4	2	2	2	1	1	0	0	0	2/0	2/0	2/0	2/0
90	10	8	6	6	6	4	2	2	2	1	1	0	0	0	2/0	2/0	2/0	3/0	3/0
100	10	8	6	6	4	4	2	2	1	1	0	0	0	2/0	2/0	2/0	2/0	3/0	3/0

Table G-2 Conductor Sizes for 10% Voltage Drop - 24 Volts

24 Volts – 10% Drop Wire Sizes (gage) – Based on Minimum CM Area																			
Total Current on Circuit (Amps)	Length of Conductor from Source of Current to Device and Back to Source - Feet																		
	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
5	18	18	18	18	18	18	18	18	16	16	16	16	14	14	14	14	14	14	12
10	18	18	18	18	18	16	16	14	14	14	12	12	12	12	12	10	10	10	10
15	18	18	18	16	16	14	14	12	12	12	10	10	10	10	10	8	8	8	8
20	18	18	16	16	14	14	12	12	10	10	10	10	8	8	8	8	8	8	6
25	18	16	16	14	14	12	12	10	10	10	8	8	8	8	8	6	6	6	6
30	18	16	14	14	12	12	10	10	8	8	8	8	8	6	6	6	6	6	6
40	16	14	14	12	12	10	10	8	8	8	6	6	6	6	6	6	4	4	4
50	16	14	12	12	10	10	8	8	6	6	6	6	6	4	4	4	4	4	2
60	14	12	12	10	10	8	8	6	6	6	6	4	4	4	4	2	2	2	2
70	14	12	10	10	8	8	6	6	6	6	4	4	4	2	2	2	2	2	2
80	14	12	10	10	8	8	6	6	6	4	4	4	2	2	2	2	2	2	2
90	12	10	10	8	8	6	6	6	4	4	4	2	2	2	2	2	2	1	1
100	12	10	10	8	8	6	6	4	4	4	2	2	2	2	2	1	1	1	1

Table G-3 Conductor Sizes for 10% Voltage Drop - 32 Volts

32 Volts – 10% Drop Wire Sizes (gage) – Based on Minimum CM Area																			
Total Current on Circuit (Amps)	Length of Conductor from Source of Current to Device and Back to Source - Feet																		
	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
5	18	18	18	18	18	18	18	18	18	18	18	16	16	16	16	14	14	14	14
10	18	18	18	18	18	18	16	16	14	14	14	14	14	12	12	12	12	12	12
15	18	18	18	18	18	16	14	14	14	12	12	12	12	10	10	10	10	10	10
20	18	18	18	16	16	14	14	12	12	12	10	10	10	10	10	8	8	8	8
25	18	18	16	16	14	14	12	12	10	10	10	10	10	8	8	8	8	8	8
30	18	18	16	14	14	12	12	10	10	10	10	8	8	8	8	8	6	6	6
40	18	16	14	14	12	12	10	10	8	8	8	8	8	6	6	6	6	6	6
50	16	14	14	12	12	10	10	8	8	8	6	6	6	6	6	6	6	4	4
60	16	14	12	12	10	10	8	8	8	6	6	6	6	6	6	4	4	4	4
70	14	14	12	10	10	8	8	8	6	6	6	6	6	4	4	4	4	2	2
80	14	12	12	10	10	8	8	6	6	6	6	4	4	4	4	2	2	2	2
90	14	12	10	10	10	8	6	6	6	6	4	4	4	4	2	2	2	2	2
100	14	12	10	10	8	8	6	6	6	4	4	4	4	2	2	2	2	2	2

Table G-4 Conductor Sizes for 3% Voltage Drop - 12 Volts

12 Volts – 3% Drop Wire Sizes (gage) – Based on Minimum CM Area																			
Total Current on Circuit (Amps)	Length of Conductor from Source of Current to Device and Back to Source - Feet																		
	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
5	18	16	14	12	12	10	10	10	8	8	8	6	6	6	6	6	6	6	6
10	14	12	10	10	10	8	6	6	6	6	4	4	4	4	2	2	2	2	2
15	12	10	10	8	8	6	6	6	4	4	2	2	2	2	2	1	1	1	1
20	10	10	8	6	6	6	4	4	2	2	2	2	1	1	1	0	0	0	2/0
25	10	8	6	6	6	4	4	2	2	2	1	1	0	0	0	2/0	2/0	2/0	3/0
30	10	8	6	6	4	4	2	2	1	1	0	0	0	2/0	2/0	3/0	3/0	3/0	4/0
40	8	6	6	4	4	2	2	1	0	0	2/0	2/0	3/0	3/0	3/0	4/0	4/0	4/0	4/0
50	6	6	4	4	2	2	1	0	2/0	2/0	3/0	3/0	4/0	4/0	4/0				
60	6	4	4	2	2	1	0	2/0	3/0	3/0	4/0	4/0	4/0						
70	6	4	2	2	1	0	2/0	3/0	3/0	4/0	4/0								
80	6	4	2	2	1	0	3/0	3/0	4/0	4/0									
90	4	2	2	1	0	2/0	3/0	4/0	4/0										
100	4	2	2	1	0	2/0	3/0	4/0											

Table G-5 Conductor Size foe 3% Voltage Drop - 24 Volts

24 Volts – 3% Drop Wire Sizes (gage) – Based on Minimum CM Area																			
Total Current on Circuit (Amps)	Length of Conductor from Source of Current to Device and Back to Source - Feet																		
	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
5	18	18	18	16	16	14	12	12	12	10	10	10	10	10	8	8	8	8	8
10	18	16	14	12	12	10	10	10	8	8	8	6	6	6	6	6	6	6	6
15	16	14	12	12	10	10	8	8	6	6	6	6	6	4	4	4	4	4	4
20	14	12	10	10	10	8	6	6	6	6	4	4	4	4	2	2	2	2	2
25	12	12	10	10	8	6	6	6	4	4	4	4	2	2	2	2	2	2	2
30	12	10	10	8	8	6	6	4	4	4	2	2	2	2	2	1	1	1	1
40	10	10	8	6	6	6	4	4	2	2	2	2	1	1	1	0	0	0	2/0
50	10	8	6	6	6	4	4	2	2	2	1	1	0	0	0	2/0	2/0	2/0	3/0
60	10	8	6	6	4	4	2	2	1	1	0	0	0	2/0	2/0	3/0	3/0	3/0	3/0
70	8	6	6	4	4	2	2	1	1	0	0	2/0	2/0	3/0	3/0	3/0	3/0	4/0	4/0
80	8	6	6	4	4	2	2	1	0	0	2/0	2/0	3/0	3/0	3/0	4/0	4/0	4/0	4/0
90	8	6	4	4	2	2	1	0	0	2/0	2/0	3/0	3/0	4/0	4/0	4/0	4/0	4/0	
100	6	6	4	4	2	2	1	0	2/0	2/0	3/0	3/0	4/0	4/0	4/0				

Table G-6 Conductor Sizes for 3% Voltage Drop - 32 Volts

32 Volts – 3% Drop Wire Sizes (gage) – Based on Minimum CM Area																			
Total Current on Circuit (Amps)	Length of Conductor from Source of Current to Device and Back to Source - Feet																		
	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
5	18	18	18	18	16	16	14	14	12	12	12	12	10	10	10	10	10	10	8
10	18	16	16	14	14	12	12	10	10	10	8	8	8	8	8	6	6	6	6
15	16	14	14	12	12	10	10	8	8	8	6	6	6	6	6	6	6	4	4
20	16	14	12	12	10	10	8	8	6	6	6	6	6	4	4	4	4	4	2
25	14	12	12	10	10	8	8	6	6	6	6	4	4	4	4	2	2	2	2
30	14	12	10	10	8	8	6	6	6	4	4	4	4	2	2	2	1	1	1
40	12	10	10	8	8	6	6	4	4	4	2	2	2	2	2	1	1	1	1
50	12	10	8	8	6	6	4	4	2	2	2	2	2	1	1	0	0	0	0
60	10	8	8	6	6	4	4	2	2	2	2	1	1	0	0	0	2/0	2/0	2/0
70	10	8	6	6	6	4	2	2	2	1	1	0	0	0	2/0	2/0	2/0	3/0	3/0
80	10	8	6	6	4	4	2	2	1	1	0	0	0	2/0	2/0	3/0	3/0	3/0	3/0
90	8	6	6	6	4	2	2	2	1	0	0	2/0	2/0	2/0	3/0	3/0	3/0	4/0	4/0
100	8	6	6	4	4	2	2	1	0	0	2/0	2/0	2/0	3/0	3/0	3/0	4/0	4/0	4/0

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