



INSTALLATION & OPERATION

A53105 WAYSIDE COMMUNICATION PACKAGE CENTRAL PROCESSING UNIT II (WCP CPU II)

SEPTEMBER 2013 (REVISED MAY 2014)

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

DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	9-18-98		Initial Release
B	6-8-99		First Revision
C	7-23-01		Update to reflect changes to WCP CPU II configuration
D	4-11-13	Entire Book	MCS2000 radio replacement with MDS9710 Update XCMMAINT software
E	9-6-13	Entire Book	Update to include replacement radio MDS SD9 Update XCMMAINT Software Rebrand to Siemens Rail Automation
E.1	5-13-14	Entire Book	Remove old branding references

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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

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

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

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

If there are any questions, contact Siemens Application Engineering.

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

Static electricity can damage electronic circuitry, particularly low voltage components such as the integrated circuits commonly used throughout the electronics industry. Therefore, procedures have been adopted industry-wide which make it possible to avoid the sometimes invisible damage caused by electrostatic discharge (ESD) during the handling, shipping, and storage of electronic modules and components. Siemens Rail Automation has instituted these practices at its manufacturing facility and encourages its customers to adopt them as well to lessen the likelihood of equipment damage in the field due to ESD. Some of the basic protective practices include the following:

- 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/insertor 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 Insertor (or equivalent) are highly recommended).
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

For information concerning ESD material applications, please contact the Technical Support Staff at 1-800-793-7233. ESD Awareness Classes and additional ESD product information are also available through the Technical Support Staff.

GLOSSARY

AAR:	<u>Association of American Railroads</u> - An organization that establishes uniformity and standardization among different railroad systems.
ABM:	<u>Asynchronous Balance Mode</u> – Used as an identifier for a HDLC protocol.
ADM:	<u>Asynchronous Disconnect Mode</u> – Used as an identifier for a HDLC protocol.
AEI:	<u>Automatic Equipment Identification</u> - Equipment installed at sites along the track to read and report train consist information.
ARES:	<u>Advanced Railroad Electronics System</u> - Made by Rockwell International as an alternative to AAR ATCS.
ATCS:	<u>Advanced Train Control System</u> - A set of standards compiled by the AAR for controlling all aspects of train operation.
BCM II:	<u>Base Control Module II</u> – The Safetran 53444 assembly that centrally controls the functions of the BCP II.
BCP II:	<u>Base Communications Package II</u> - Defined by the ATCS specifications as the transmitter / receiver base station and associated processors to handle communications between mobile and central office equipment.
BER:	<u>Bit Error Rate</u> - Expresses the quality of a communications in the number of errors per bits sent.
BPSK:	<u>Binary Phase Shift Keying</u> - A method of modulating a carrier signal to carry two bits of information in every cycle.
CBT:	Common Base Technology – A term referring to product design using a modular based approach.
CC:	<u>Cluster Controller</u> - An ATCS ground network node responsible for the control of BCP II's.
CHIPS:	The number of bits in the PN code used to represent each data bit.
CODEPLUG:	An area of non-volatile memory in a BCM II or WCM that contains site configuration data.
CPC:	<u>Central Protocol Converter</u> - Modular component of Safetran's R/Link™ Radio Control System that converts CTC code line control and indication message data to ATCS-compatible data.
CRC:	<u>Cyclic Redundancy Check</u> - The CRC on a data packet is normally calculated and appended to the data so that the receiver can verify that no data was lost or corrupted during transit.
CSAT:	<u>Cut Section SAT</u> - A Signaling Application Task allowing a Virtual Circuit to be broken in a manner similar to a relay contact in a pole line system.
CMSA/CA:	<u>Carrier-Sense-Multiple-Access/Collision Avoidance</u> - A scheme for allowing multiple transmitters sharing a single medium to cooperatively timeshare with a minimum of overlap and interference.

GLOSSARY

CTC:	<u>Central Traffic Control System</u>
CTS:	<u>Clear To Send</u>
DAX:	<u>Downstream Adjacent Crossing</u> - A prediction indication for a remote GCP located somewhere other than the equipment feed point.
DATAGRAM:	In general, any ATCS packet. Several types of datagrams are defined for specific functions within an ATCS environment.
dB:	Abbreviation for decibel. The standard unit for expressing transmission gain or loss and relative power levels. Decibels indicate the log ratio of power output to power input.
dB _i :	Abbreviation for decibels referenced to an isotropic (unipole) antenna.
dB _m :	Abbreviation for decibels above (or below) one milliwatt.
DCE:	<u>Data Communications Equipment</u> - A device that merely transports but does not originate or consume data.
DEVICE:	Specific to the Contents Listing, MCF Approval Listing, and Diagnostic Terminal Utility, a device represents the smallest possible breakdown of an ATCS address which may identify a Virtual Circuit, cut section, signal SAT, module, etc.
DT:	<u>Diagnostic Terminal</u> - A DOS-based PC utility for configuring a module and reading status and diagnostic information.
DTE:	<u>Data Terminal Equipment</u> - Any device (printer, terminal, PC, host computer) that originates or consumes data over a transmission facility.
ECD:	<u>External Configuration Device</u> - The EEPROM on the interface connector used for storing the module configuration data.
EIA:	<u>Electronics Industries Association</u> - A standards organization in the U.S. specializing in the electrical and functional characteristics of interface equipment.
ECP:	<u>Emergency Control Protocol</u>
ERP:	<u>Effective Radiated Power</u> - The product of the antenna power (transmitter power less transmission-line loss) times either the antenna power gain or the antenna field gain squared.
FEP:	<u>Front End Processor</u> - An ATCS ground network node responsible for providing network access to ground host and terminal users (provides network interfacing).
FIFO:	<u>First In, First Out</u> - A buffer or shift register configured so that the first data queued is the first data dequeued - i.e. the sequence is preserved.
FSK:	<u>Frequency Shift Keying</u> - A baseband modulation technique that conveys digital information over analog facilities by associative discrete logical states with pre-defined frequencies.

GLOSSARY

GMSK:	<u>Gaussian Mask Shift Keying</u> - A complex signal conditioning process employed by the BCM II prior to audio transmission.
GENI (F):	<u>Genesys Field Protocol</u>
GENI (O):	<u>Genesys Office Protocol</u>
GTC:	<u>Ground Terminal Computer</u>
HAYES AT COMMAND:	A set of commands defined by the Hayes Corporation for the control and configuration of modems.
HD POLE LINE:	Wires strung along wayside poles for carrying signal aspect and other train control signals. HD stands for Home/Distant, referring to track block signals.
HDF:	<u>Hardware Description Files</u> - A utility file for configuring a module and reading status and diagnostic information.
HDLC:	<u>High-level Data Link Control</u> - A serial protocol for exchanging synchronous information.
IDTU:	<u>Installers Diagnostic Terminal Utility</u> - A DOS-based PC utility for configuring a module and reading status and diagnostic information.
IN SERVICE CHECK NUMBER:	A number, unique to a particular HD/LINK module, that is logged in the Event Log when the HD/LINK module is in service.
IP:	<u>Internet Protocol</u> - ISO Model Layer 3 (network) protocol that performs proper routing of packets.
LAN:	<u>Local Area Network</u> - A limited network where the data transfer medium is generally wires or cable.
LEFT NEIGHBOR:	The Group displayed on the Main Window virtual-circuit configuration display to the left of the MCF documented Group.
LINK MARGIN:	The amount of received signal strength beyond the receiver threshold reserved to compensate for normal signal fluctuations.
LOD:	<u>Light Out Detector</u> - A device that monitors current flowing in a circuit such as a signal light, switch, etc., for the purpose of detecting a fault condition in the circuit.
LSB:	Least Significant Bit of a binary number (having the lowest numerical weight)
MCF:	<u>Module Configuration File</u> - The HD/LINK configuration software.
MCI:	<u>Module Configuration Information</u> - The collection of database records that represents the MCF data.
MCP/WCP:	<u>Mobile/Wayside Communications Package</u> - The radio and associated processor used by mobile and wayside ATCS compatible equipment to communicate to the central office.

GLOSSARY

MCP:	<u>Mobile Communications Package</u> - The radio and associated processor used by mobile ATCS compatible equipment to communicate to the central office.
MCS:	Harmon Protocol
MCS2000	The Motorola 900MHz radio used in the WCP.
MDF:	<u>Module Description Files</u> – The configuration and capability information for the MEF.
MEF:	<u>Module Executable File</u> - The HD/LINK executable software.
MSB:	Most Significant Bit of a binary number (having the greatest numerical weight)
NUL:	<u>Null</u> – Used as an identifier for a HDLC protocol.
NULL MODEM:	A cable or other device that connects two DTE devices directly by emulating the physical connections of a DCE (the Transmit output of each DTE is connected to the Receive input of the other DTE).
OUT SERVICE CHECK NUMBER:	A number, unique to a particular HD/LINK module, that is logged in the Event Log when the HD/LINK module is out of service.
POL	<u>Polled</u> – Used as an identifier for a HDLC protocol.
PN CODE:	<u>Pseudo Noise code</u> - A binary code mathematically optimized in such a way that when used to modulate a transmit carrier signal, the energy is spread evenly over the complete band.
QPSK:	<u>Quadrature Phase Shift Keying</u> - A method of modulating a carrier signal in such a way that each cycle carries four bits of information.
RCI:	<u>Receive Clock In</u>
RIGHT NEIGHBOR:	The Group displayed on the Main Window virtual-circuit configuration display to the right of the MCF documented Group.
RS232:	EIA interface standard between DTE and DCE, employing serial binary data interchange.
RS422:	EIA interface standard that extends transmission speeds and distances beyond RS232, employing a balanced-voltage system with a high level of noise immunity.
RSSI:	<u>Received Signal Strength Indication</u> - A numerical value indicating the relative strength of received carrier.
RTS:	<u>Ready To Send</u>
RTU:	<u>Remote Terminal Unit</u> - Also known as Field Code Unit or Code Unit. Used to perform non-vital I/O under control of a central office unit.
RXD:	<u>Receive Data</u>
SAT:	<u>Signaling Application Task</u> - A Virtual Circuit of cut sections.

GLOSSARY

SB9600:	A specification for a proprietary 2-wire data bus used by Motorola for control and programming of microprocessor-based two-way radio equipment.
SCM:	<u>System Control Module</u> – The module within a Motorola ATCS base station that centrally controls the functions of the transceiver and all other components of the station.
SCS:	<u>Safetran Code System</u>
SIGNAL ASPECT:	The appearance of a fixed signal conveying an indication as viewed from the direction of an approaching train; the appearance of a cab signal conveying an indication as viewed by an observer in the cab.
SIN:	<u>Site (Subnode) Identification Number</u> - A twelve-digit ATCS address representing the module as a subnode on the network.
SPREAD SPECTRUM:	A method of radio transmission in which the transmitted energy is evenly spread over the complete bandwidth of the radio, resulting in a low RF profile.
SSI:	<u>Signal Strength Indicator</u> - A measure of the relative strength of an incoming RF signal when it was received by a BCP II.
SSR:	<u>Spread Spectrum Radio</u> - A transmitter/receiver that uses a method of radio transmission in which the transmitted energy is evenly spread over the complete bandwidth of the radio, resulting in small RF signature.
TCI:	<u>Transmit Clock In</u>
TCO:	<u>Transmit Clock Out</u>
TCP/IP:	<u>Transmission Control Protocol / Internet Protocol</u> - The Internet protocol used to connect a world-wide internetwork of universities, research laboratories, military installations, organizations, and corporations. The TCP/IP includes standards for how computers communicate and conventions for connecting network and routing traffic.
TXD:	<u>Transmit Data</u>
UAX:	<u>Upstream Adjacent Crossing</u> - A control indication typically driven from a remote GCP (DAX) location.
UCN:	<u>Unique Check Number</u> - A configuration validation number calculated from the contents of an approved MCF and issued to be entered into an HD/LINK module for the purpose of verifying proper configuration.
UDP:	<u>User Datagram Protocol</u> - A transport protocol used primarily for the transmission of network management information. Not as reliable as TCP.
VCE:	<u>Virtual Circuit Editor</u> - The functional element of the HD/LINKer program used to graphically design the group-specific virtual line circuit configurations of the H/D LINK Vital I/O Modules.
VPI:	<u>Vital Parallel Input</u> – A module input circuit the function of which affects the safety of train operation.

GLOSSARY

VRO:	<u>Vital Relay Output</u> – A module output circuit the function of which affects the safety of train operation.
VSAT:	<u>Virtual Circuit SAT</u> – A software Virtual Circuit termination device known as a Signaling Application Task for providing logical functionality, and possessing its own unique ATCS address
WCM:	<u>Wayside Control Module</u> – The Safetran A53105 assembly that centrally controls the functions of a WCP
WCP:	<u>Wayside Communications Package</u> – The transmitter/receiver and associated control processors that handle communications between field equipment and BCP II equipment.
WIU	<u>Wayside Interface Unit</u> –
XCM FILE:	An MS-DOS file with an “.XCM” extension. A Safetran codeplug file for the BCM II or WCM.

CHANGE NOTICE

The following changes have been incorporated into Revision E of the WCP CPU II Installation and Operation Manual, Document No. COM-00-97-10.

8-9-13:

Global

- ◆ Changed Version from D to E
- ◆ Changed "WCP Radio" to "ATCS Radio"
- ◆ Automated TOC
- ◆ Updated paragraph numbering
- ◆ Changed font to Verdana

Section 1

Page 1-2

- ◆ 1.1 Add bullet "uses UHF 900 MHz, 30 watt radio"
- ◆ 1.3 Specifications, Input Voltage: changed 9V to 10V

Section 2

No Change

Section 3

No Change

Section 4

Page 4-3

- ◆ Para 4.2.3, NOTE, Updated MDS publication information for SD9 radio

Page 4-15

- ◆ Replaced Figure 4-5, replaced Figure 4-6

Page 4-16

- ◆ Replaced Figure 4-7, replaced Figure 4-8

Page 4-17

- ◆ Replaced Figure 4-9

Page 4-18

- ◆ Replaced Figure 4-10

Page 4-19

- ◆ Replaced Figure 4-11

Page 4-31

- ◆ Para 4.4.3.6, replaced Figure

Page 4-33

- ◆ Addition of MDSvR9 and MDSSD9 Radio Settings

Page 4-34

- ◆ Para 4.4.4.2, Addition of: "Some radio selections will not show the Channel Field"

Page 4-35

- ◆ Replace Figure 4-18

Page 4-36

- ◆ Replace Figure 4-19, Replace Figure 4-20

Section 5

No Change

Appendix A

No Change

Appendix B

Replaced with new Railroad List

Appendix C

No Change

Appendix D
No Change
Index
No Change

SECTION I

INTRODUCTION

1.0 INTRODUCTION

1.1 SCOPE

This manual describes the installation, operation, and diagnostics of the WCP CPU II portion of the Siemens Rail Automation WCP Radio System. The system includes the 53105 WCP CPU II, the 53106 DC/DC Converter, and the 53412 ATCS Radio. Complete installation instructions for all WCP components are provided in the Wayside Communications Package Installation Manual (Document No. COM-00-98-01).

The WCP CPU II is periodically upgraded with additional features; therefore, prospective users are encouraged to contact Siemens Rail Automation Corporation for the latest technical information, or to request customization.

1.2 WCP CPU II OVERVIEW

Major features of the unit are:

- Full software compatibility with existing Motorola mobile radio
- RS232 / RS422 connection option on two client ports
- High-speed (1.2Mb/s) client LAN port allows WCP to directly connect to other Safetran vital and non-vital I/O modules concurrently.
- 16-character front-panel display provides clear diagnostic messages
- Front-panel push-button configuration – no laptop needed during routine maintenance
- Outbound RSSI reading provides additional system information of signal strength at WCP location.
- Split WCP CPU II / ATCS Radio / DC-DC converter package simplifies maintenance issues, and provides for more flexible installation options
- Optional on-board ladder-logic processing for code system applications
- Protocol emulation and conversion of many industry standard code-line protocols
- Full non-volatile event log built in with hardware real-time clock
- Can be software upgraded to 9600 baud RF operation
- Uses UHF 900 MHz data radio

1.3 SPECIFICATIONS

Input Voltage:	10V to 36V DC
Input Isolation:	2000V rms
Power Consumption:	295mA @ 13.8V
Client Ports:	2 x RS232 / RS422 25-pin D connectors, software selectable to 256k baud. 1 x LonTalk® 1.2Mb/s twisted pair
Display:	16-character Alphanumeric
Configuration:	Locally via front-panel switches / display Locally via laptop PC Remotely via Siemens Network Management System
Aux I/O:	Two opto-isolated inputs 10V DC to 36V DC Two switchable supply outputs to 1.5A
LED Indications:	RF TX, RF RX, Power On, LAN activity, Echelon® Service
Dimensions:	2.44 inches (6.2 centimeters) wide 8.82 inches (22.4 centimeters) high 9.57 inches (24.31 centimeters) deep
Weight:	4.625 pounds (2.1 kilograms)
Operating Temperature Range:	-40 °F to +158 °F (-40 °C to +70 °C)

1.4 ORDERING INFORMATION

To order, specify the WCP CPU II part number, 9000-53105-0001.

SECTION II FUNCTIONAL DESCRIPTION

2.0 FUNCTIONAL DESCRIPTION

2.1 WAYSIDE COMMUNICATIONS PACKAGE OVERVIEW

The WCP CPU II, Figure 2-1, is used in an Advanced Train Control System (ATCS) data network. It provides the interface between the ATCS RF network, an Echelon® LonTalk® Local Area Network (LAN), vital and non-vital code units, wayside inspection devices, and RS232/422 communication devices.

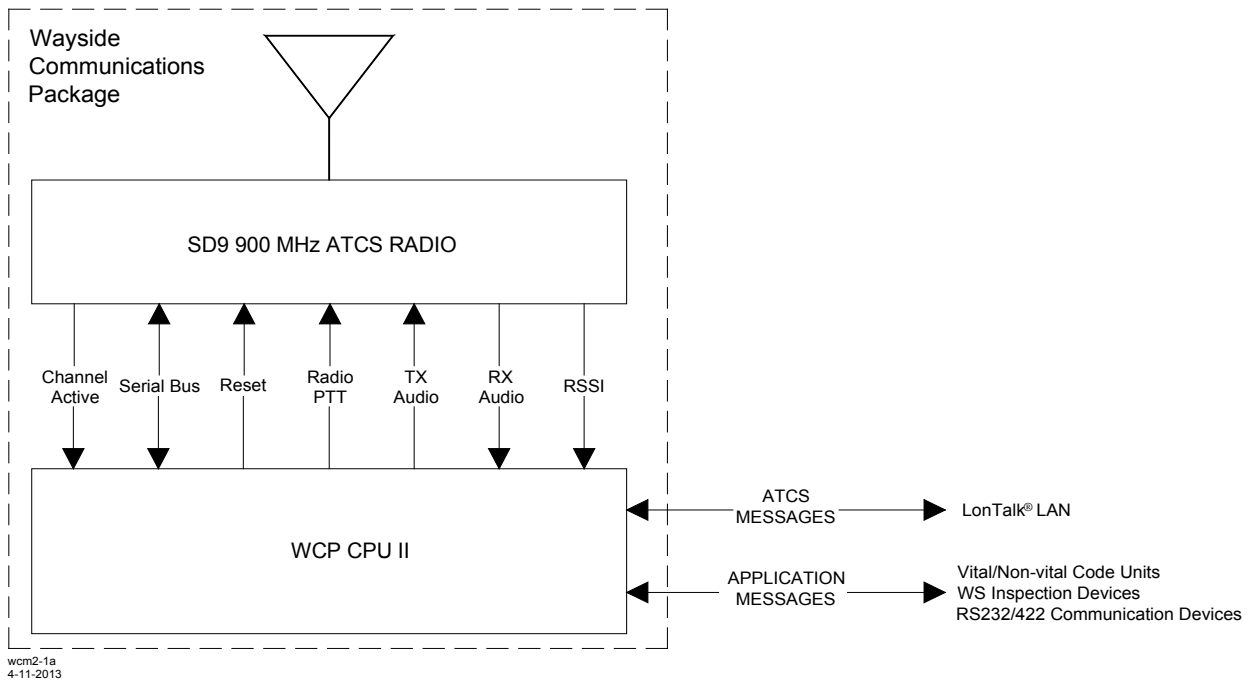


Figure 2-1 WCP II Simplified Block Diagram

2.2 ATCS/APPLICATION MESSAGE TRANSMISSION

ATCS messages (see Appendix A) to be transmitted over the ATCS RF network are processed by the WCP CPU II into two functional signals: Radio PTT (push-to-talk), which initiates Mobile Radio transmission; and TX Audio, a sinusoidal representation of the ATCS and Application Messages. The TX Audio signal is used within the Mobile Radio to FM modulate an RF carrier, which is fed to the antenna for transmission over the ATCS RF network. At the completion of the ATCS messages, the Radio PTT signal is removed and Mobile Radio transmission stops. The transmitted messages may be received via a serial port or from the LAN.

2.2.1 ATCS RF Message Reception

Messages received from the ATCS RF network are demodulated by the Mobile Radio and a corresponding RX Audio signal is fed to the WCP CPU II. This signal, together with a Receive Signal

Strength Indication (RSSI) signal, are processed by the WCP CPU II and applied in the ATCS Message format to the LAN or in various Applications Message formats (protocols) to units connected to the serial port. The ATCS Message destination is determined by the ATCS Address (see Appendix A for a description of the ATCS address scheme).

2.2.2 Physical Communication Links

Physical Communication between the WCP and other devices is via serial cable. Communication between the WCP and the LAN is via twisted wire pair.

2.2.3 Initialization

At WCP startup, the WCP CPU II generates a Reset signal to initialize the ATCS Radio.

2.3 WCP CPU II DESCRIPTION

The WCP CPU II, Figure 2-2, consists of three functional circuits interconnected by a common data bus, the Transceiver/Processor (T/P), the Gaussian Mask Shift Key (GMSK) Modem, and the LAN Controller. Each of these circuits is able both to receive and transmit message data. Transmission circuit selection is determined by the ATCS destination address. For example, when an ATCS message is received via the serial port addressed to equipment on the ATCS RF network, the GMSK Modem is enabled to transmit. In the same way, when equipment connected to the LAN is addressed, LAN Controller transmission is enabled.

Master control of the data bus is exercised by the T/P. Messages are routed through the WCP CPU II in accordance with client (configuration) data resident within memory (flash EEPROM) of the T/P. ATCS messages are converted from serial to parallel format by the receiving circuit and placed on the data bus. The message is then analyzed by the T/P and the appropriate circuit is enabled for transmission. During the transmission process, the parallel message data is converted to serial format by the transmitting circuit and routed to the specified ATCS address.

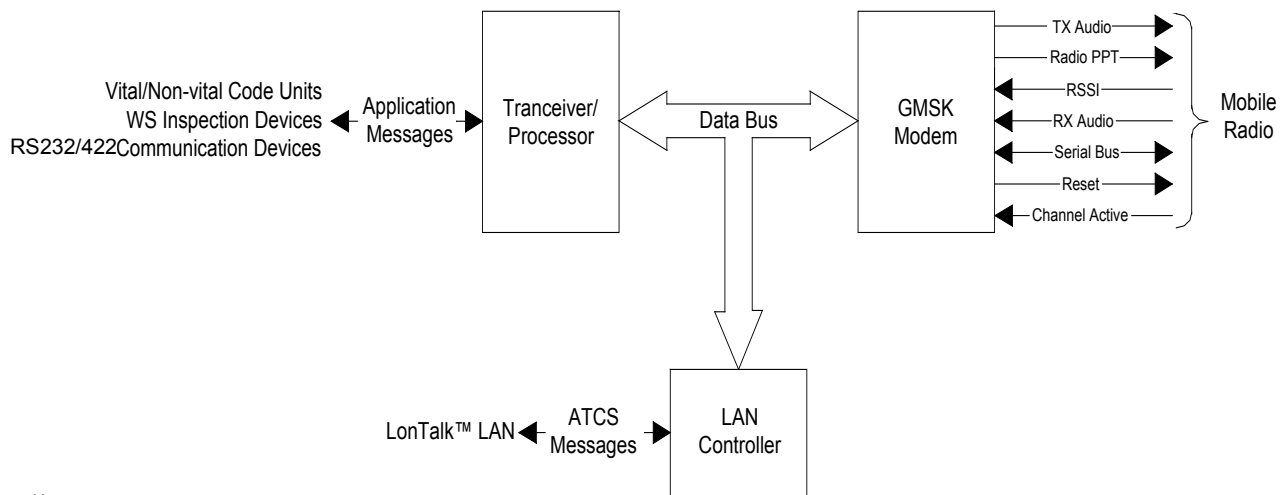


Figure 2-2 WCP II Simplified Block Diagram

SECTION III PHYSICAL DESCRIPTION

3.0 PHYSICAL DESCRIPTION

3.1 GENERAL

The WCP CPU II is designed to replace existing WCP CPU Modules, in particular for wayside signaling applications. It is designed to work in conjunction with the ATCS mobile radio family and the A53106 DC/DC converters.

3.2 FRONT PANEL CONTROLS AND INDICATORS

The front panel controls and indicators, and the function of each, are listed in Table 3-1 and are identified on Figure 3-1.

Table 3-1 Front Panel Control & Indicator Functions

Indicator/Control	Type	Function
POWER	LED	Lighted when power is applied to the 53105
LAN	LED	Lights to indicate activity on the local area network (LAN)
SERVICE	LED	Echelon [®] service indication. Normally extinguished. Lighted to indicate Echelon [®] adapter is not configured or is malfunctioning. Also lights when the SERVICE push button is pressed.
SERVICE	Push-button Switch	Used to identify the 53105 on the twisted pair LonTalk [®] LAN during installation. This allows the network installer to download custom configuration data to the 53105.
RF-RX	LED	Lighted to indicate 53105 is successfully synchronized to an incoming message
RF-TX	LED	Lighted when WCP radio is keyed and transmitting
ENTER	Push-button Switch	Confirms selection options (see below)
SELECT	Push-button Switch	Selects between various operating and configuration options
16-Character Alphanumeric Display		Displays various status and configuration messages depending on display mode

3.3 EXTERNAL CONNECTORS

The WCP CPU II is equipped with five 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, and an 8-pin power connector. The pin assignments for each of these connectors are described in the following paragraphs.

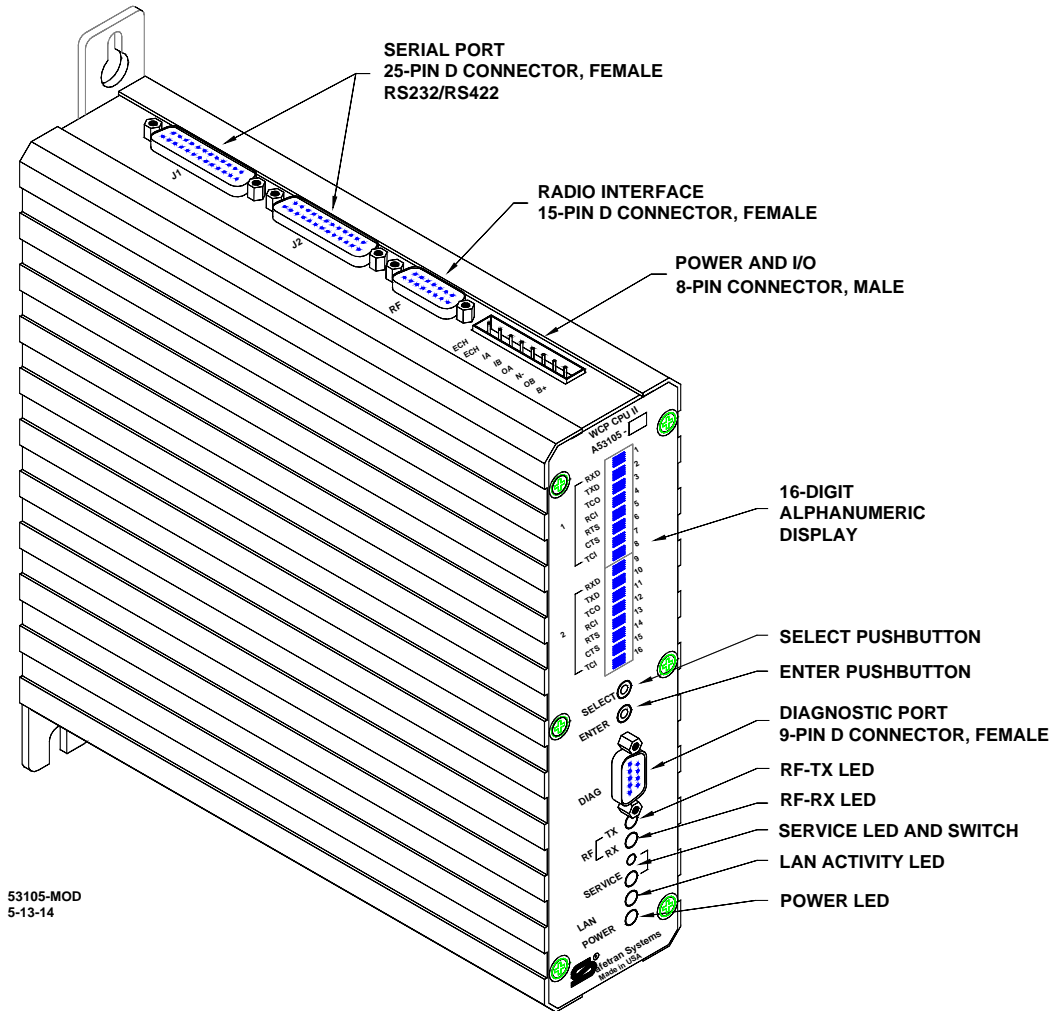


Figure 3-1 WCP CPU II, A53105

3.3.1 25-Pin D-Type Client Port Connectors (Female)

The female, 25-pin, D-type connectors (J1 and J2) located on the top of the 53105 enclosure provide serial client ports that can be configured for RS232 or RS422 operation during configuration. 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 3-2 lists the pin assignments for the 25-pin connectors.

Table 3-2 25-Pin Female D-Type Connector Pin Assignments

Pin	RS232	RS422
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

3.3.2 15-Pin D-Type Radio Connector (Female)

The female, 15-pin, D-type connector (RF) located on the top of the 53105 enclosure provides interface to the ATCS radio. Table 3-3 lists the pin assignments for the 15-pin connector.

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

Pin	Function
2	Radio Push-to-Talk out
3	TX Audio
4	Analog Ground
5	RX Audio
7	Radio Reset
8	Logic Ground
9	SB9600 bus (+)
10	SB9600 bus (-)
12	RSSI

3.3.3 9-Pin D-Type Diagnostic Connector (Female)

The female, 9-pin, D-type connector located on the front panel provides access to the 53105 diagnostic and configuration data during maintenance operations. Table 3-4 lists the pin assignments for this connector. Use a straight-through cable to connect to the diagnostic computer.

Table 3-4 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
9	Test pin (Factory use only).

3.3.4 8-Pin Power Connector (Male)

The male, 8-pin, power, LonTalk[®], and I/O connector contacts are numbered from the front of the 53105 case with pin 8 nearest the 15-pin connector. Table 3-5 lists the connector pin assignments.

Table 3-5 8-Pin Male Connector Pin Assignments

Pin	Function
1	B12 +
2	Output B
3	N12 -
4	Output A
5	Input B
6	Input A
7	Echelon LonTalk [®] TWP (twisted wire pair)
8	Echelon LonTalk [®] TWP (twisted wire pair)

SECTION IV CONFIGURATION

4.0 CONFIGURATION

4.1 CODE PLUG 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 WCP CPU II. While most of the parameters are factory set and do not require user alteration, site-specific data such as local ATCS address, remote FEPC address, client port assignments, system timers, hardware configuration, and etc. may be programmed on site by field maintenance personnel. This is accomplished in one of four ways:

1. Manually, by means of the front panel push buttons and display (see paragraph 4.2).
2. Using the configuration editor in XCMMAINT.EXE and uploading the complete modified code plug information (see paragraph 4.4). This is the recommended method.
3. The MCM II Configuration Utility (9VB26) is a windows based configuration program. Uploading the complete modified code plug information is the recommended method.
4. 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 XCMMAINT configuration/on-line 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 WCP CPU II. This allows code plug files for each WCP 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.

4.2 EEPROM MEMORY STRUCTURE

All user data and executable programs within the WCP CPU II are stored in a 256kbyte block of on-board flash EEPROM memory. The WCP CPU II logical memory map is shown in Figure 4-1.

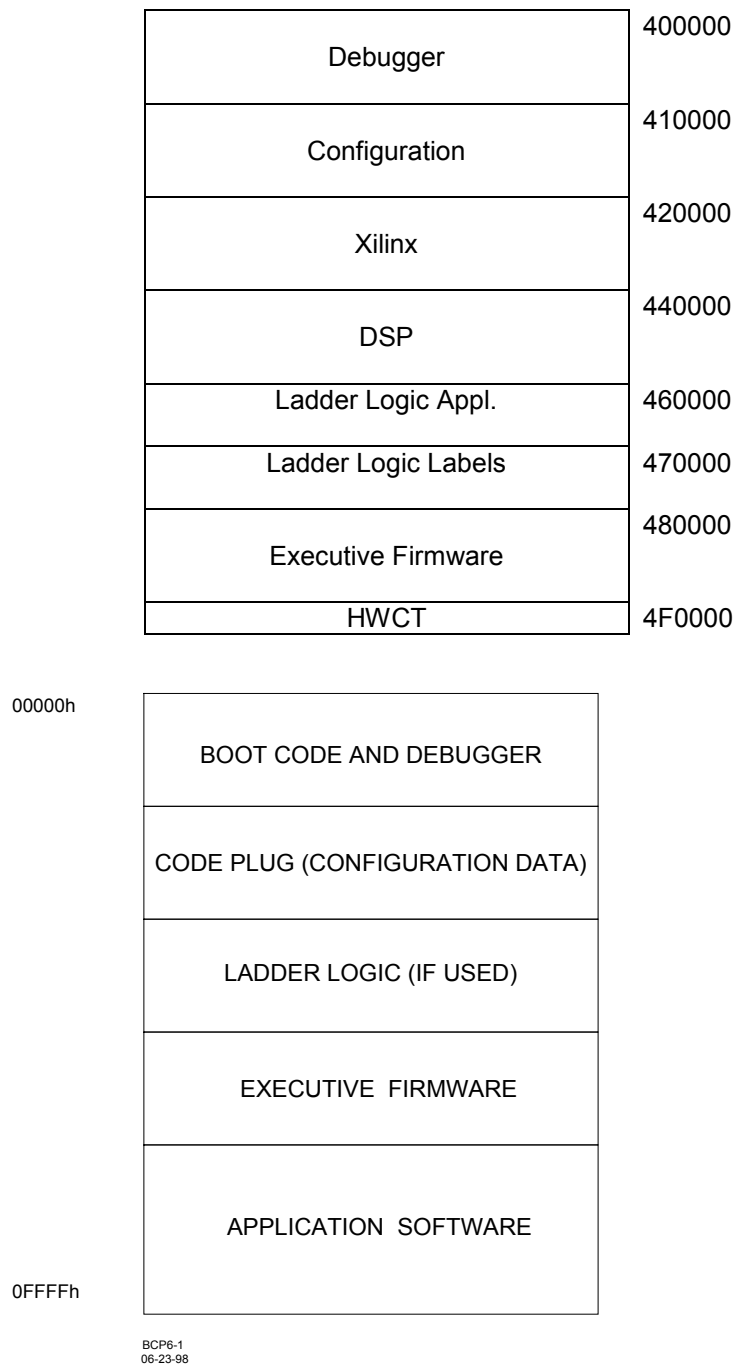


Figure 4-1 WCM II Memory Configuration Map

The memory sections of the WCP CPU II's on-board flash EEPROM are described in the following paragraphs.

4.2.1 Boot Code

Boot Code refers to the bootstrap program that is run when the system is powered up or reset. This code performs a system self-test and exits to the loaded application software or the debugger. The boot code is preloaded at the factory but can be updated with newer versions by field personnel.

4.2.2 Debugger

This program provides low-level diagnostics and direct access to hardware and firmware for testing purposes. The debugger is bundled with the boot code and is therefore field upgradable.

4.2.3 Code Plug

The code plug is the section of memory set aside for storage of configuration data specific to the installation site. All field-programmable data such as ATCS addresses, channel information, timer values, etc. are stored in the code plug. See Appendix C for details.

NOTE**NOTE**

The term “code plug” is also used for the same configuration data storage function in the associated ATCS radio, but access to the latter is only possible by using a separate utility with different maintenance hardware.

MDS™ SD9 Data Radio Service Instructions (MDS Publication MDS 05-4846A01, Rev F)

4.2.4 Ladder Logic

The ladder logic is an optional application task that consists of compiled Boolean equations for decision-making based on local I/O and data traffic. There is a stand-alone utility for creating and compiling ladder logic files that is separate from the module configuration utility.

4.2.5 Executive

The executive program is a set of application tasks that can be considered the “operating system” for the Wayside Communications Module. These application tasks are preloaded at the factory but may be field upgraded to accommodate newer applications.

4.2.6 Application Task

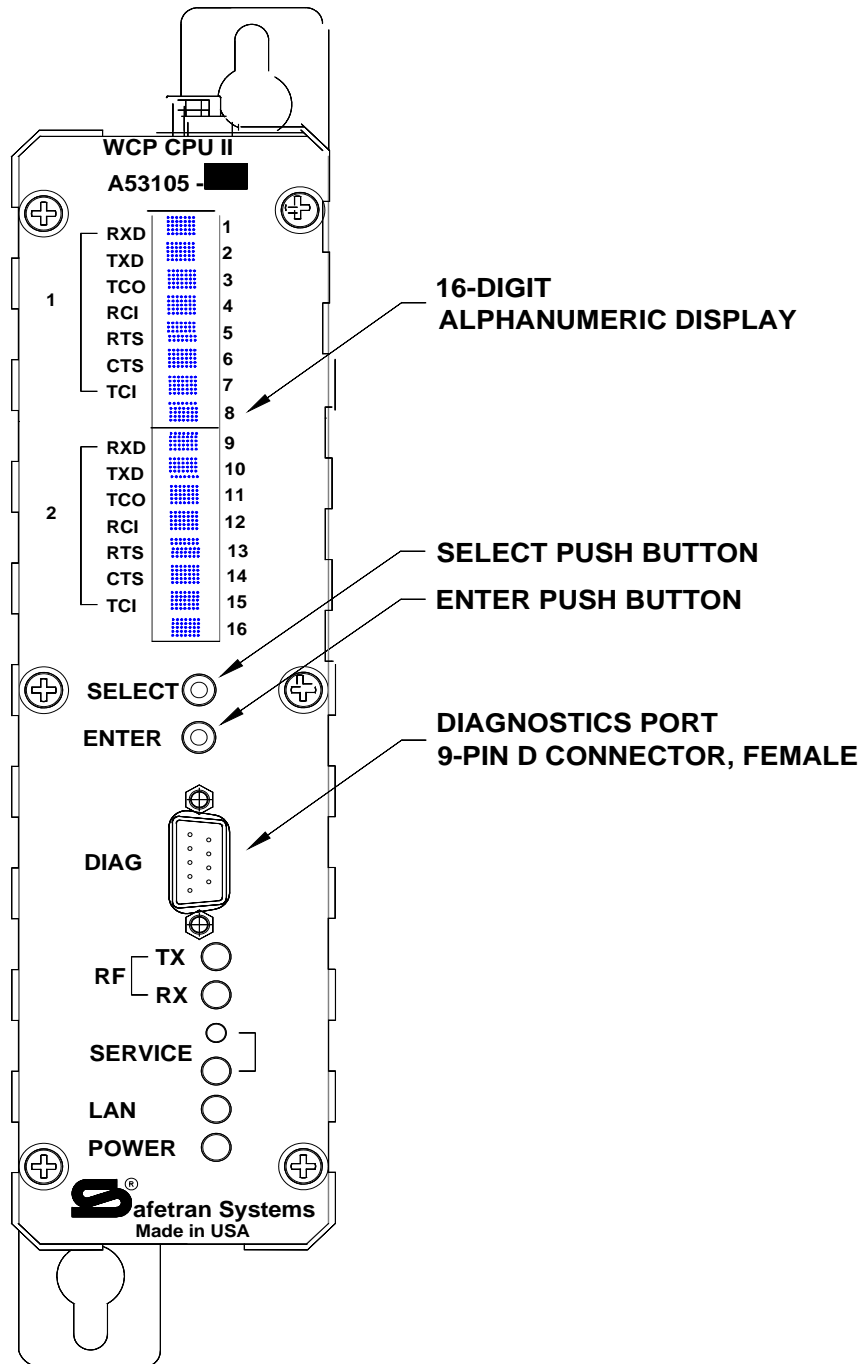
An application task accommodates any site-specific program that is run or loaded, and which uses components of the executive program for I/O, system access and low-level functions.

4.3 FRONT PANEL CONFIGURATION

Each time power is applied, the WCP CPU II performs a series of tests to evaluate its operational status. The tests performed and their results are presented on the alphanumeric display (see Figure 4-2). 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 WCP CPU II to normal operation. (If the **ENTER** push button is pressed, the unit will reset.)



WCP6-2-MOD
5-13-14

Figure 4-2 WCP CPU 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.

These functions may be sequentially accessed as follows:

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

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 and displayed graphically in Figure 4-3.

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.

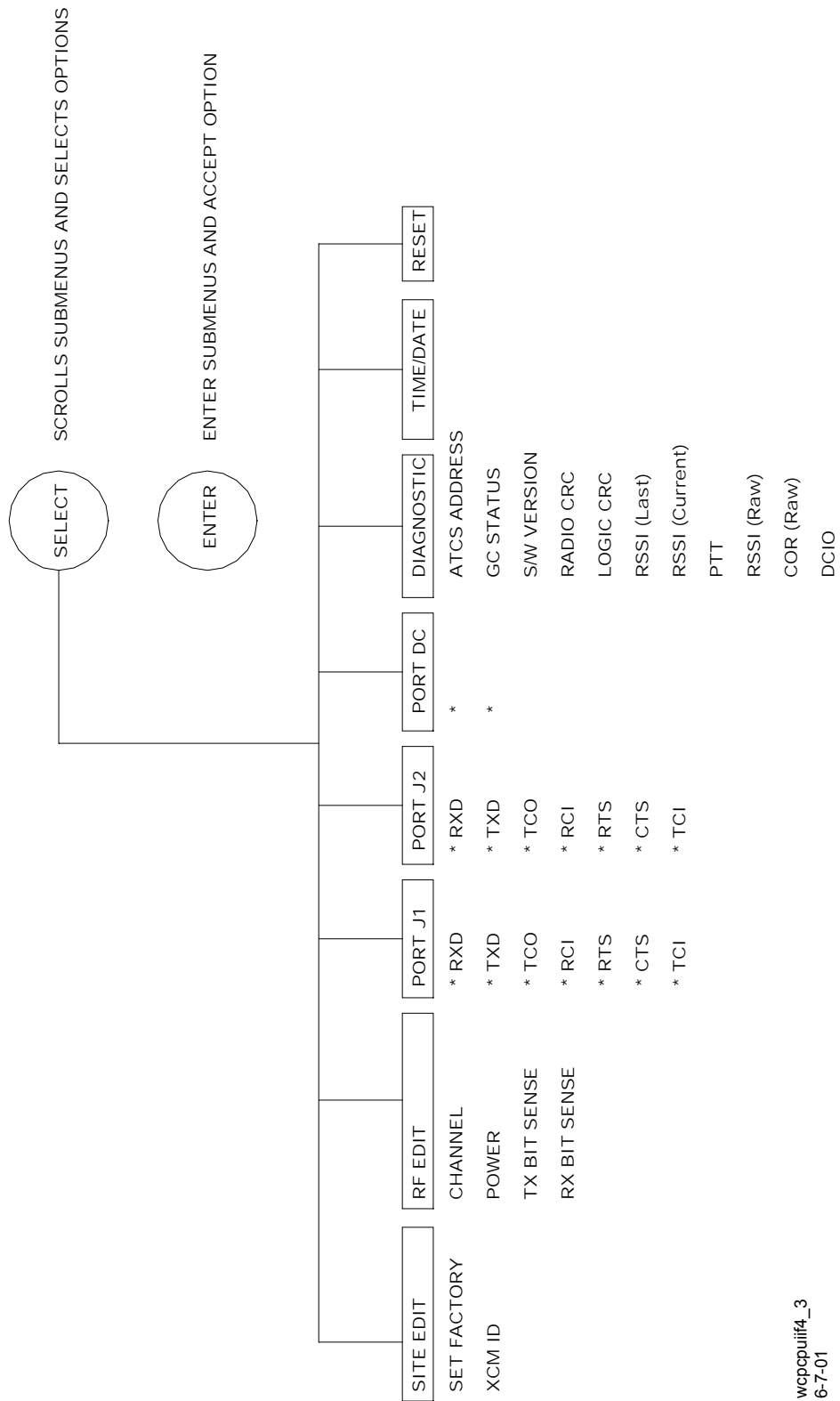
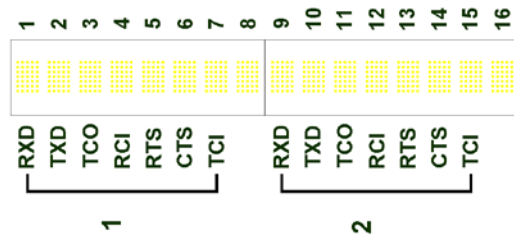


Figure 4-3 WCP CPU II Function Menu Structure

4.3.1 Alphanumeric Display

The Alphanumeric Display is divided into two sections as shown in Figure 4-2. The seven most-significant bits of each section are identified by an acronym as shown at right.



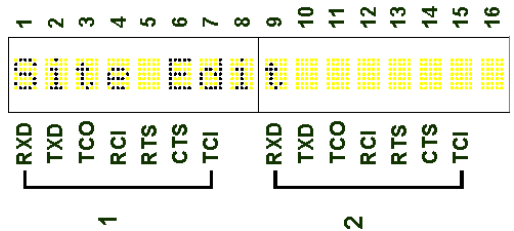
The acronyms in section 1 have no relevance at this time. The acronyms in section 2 correspond to and identify the relevant serial bits of WCP CPU II ports J1 and J2 and the local, opto-isolated I/O of the power connector J4. The definitions for these acronyms are listed in Table 4-1.

Table 4-1 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

4.3.2 Site Edit

The **Site Edit** function display is shown at right.



The subfunctions listed in Table 4-2 may be accessed from this function.

Table 4-2 Site Edit Subfunctions

Subfunction Display	Item/Value Range	Description
Set	Default CP	Default codeplug setting
XCM id: (1)	Enable	Uses configured ATCS address
	Disable	Obtains ATCS address from connected code unit
Railroad:	001 – 999	Railroad number of local address
Line:	001 – 999	Code-line number of local address
Group:	000 – 999	Group number of local address
Snode:	00 – 99	Subnode number of local address

(1) Should be Enabled for MCP

4.3.3 RF Edit

The **RF Edit** function display is shown at right.

The subfunctions listed in Table 4-3 may be accessed from this function.

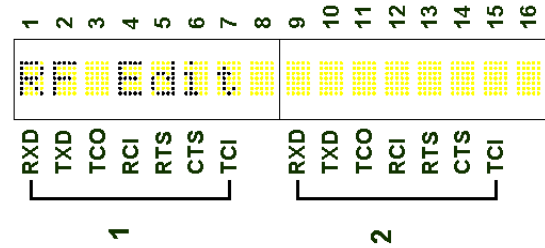


Table 4-3 RF Edit Subfunctions

Subfunction Display	Item/Value Range	Description
Chan:	1-6	Selects radio channel
Power:	Auto	Refer to paragraph 4.4
	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

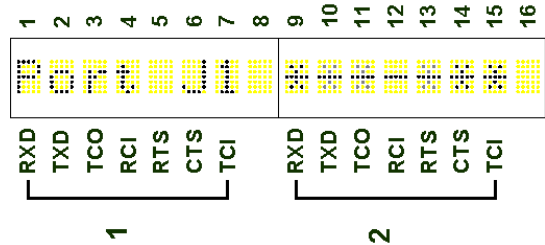
4.3.4 Port J1

The **Port J1** function display is shown at right.

The subfunctions listed in Table 4-4 may be accessed from this function.

This function also monitors the serial bit activity of connector J1. The serial bits are displayed in section 2.

A zero (0) is represented by a dash (–) and a one (1) is represented by an asterisk (*).



4.3.5 Port J2

The **Port J2** function display is shown at right.

Subfunctions corresponding to those listed in Table 4-4 may be accessed from this function. This function also monitors the serial bit activity of connector J2. The serial bits are displayed in section 2. A zero (0) is represented by a dash (–) and a one (1) is represented by an asterisk (*).

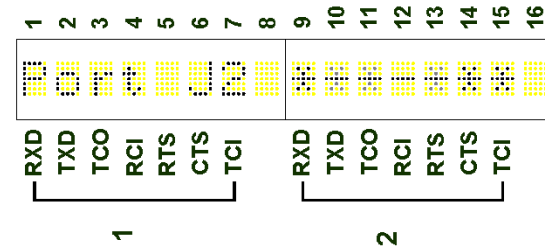


Table 4-4 Port J1 Subfunctions

Subfunction Display	Item/Value Range	Description
See Note below.	Wayside	Selects wayside equipment. Default Value.
	Mobile	Selects mobile equipment.
See Note below.	Not Used	Selects serial port communications protocol.
	HDLC ADM	
	HDLC ABM	
	HDLC POL	
	HDLC UI	
	HDLC NUL	
	GENI (0)	
	ECP	
	BCP GENI	
	MCS 1	
	ASYNCR	
	SSR	
	DC	
	SCS128	
	GENI (F)	
	CN2000A	
	CN2000B	
	CN DHP	
	SLIP	
	SLIPMCas	
	CENTRA	
	FRM RLY	
	BGENI(O)	
	GESERIES6	
	PPP	
	PPPMCast	
GPRS(bu)		
GPRScont		
GENIO(A)		
ARES		
Baud: ### See Note below.	300	Selects serial port communications baud rate.
	600	
	1200	
	2400	
	4800	
	9600	
	19.2 (K)	
See Note below.	RS422 RS232	Serial port configuration.
See Note below.	SYNC ASYNCR	Clock sync mode.
Poll = # See Note below.	0 – 127	Module polling address
Max Poll	0 – 127	Sets poll range

NOTE

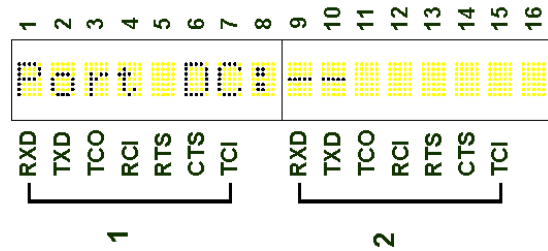
NOTE

Subfunction default display is dependent on current Codeplug parameters.

4.3.6 Port DC

The **Port DC** function display is shown at right.

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 subfunctions are available from this function.



4.3.7 Diagnostics

The **Diagnostics** function display is shown at right.

The subfunctions listed in Table 4-5 may be accessed from this function. Typical values for each subfunction display are shown.

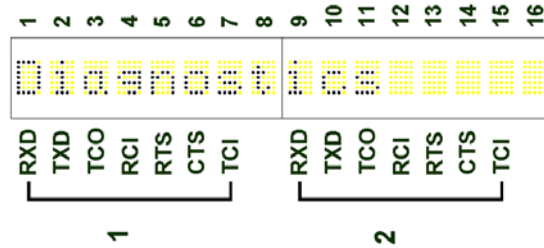


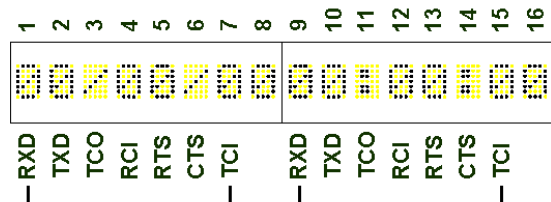
Table 4-5 Diagnostic Subfunctions

Subfunction Display	Item/Value	Description
X:	755AA5AAA1A1A1	Local ATCS address display. Varies per site.
GC:	Passive	Displays whether ground contact has been established.
	Active	
XCM Ver.	MCM-II V01.17.40	Displays version of installed software
Conf. CRC:	D757	CRC of site configuration file
TEST	F3FF	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 read from analog input.
DCIO_IN	LL	State of parallel input channels1 and 2. H is for high and L is for low. Leftmost value is channel 1 and rightmost is channel 2.
	HH	

4.3.8 Date and Time

The **Date and Time** function display is shown at right.

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



4.3.9 Reset

The **Reset** function display is shown at right:

When this function is activated, it first resets the WCP CPU II and then conducts a series of tests to determine WCP CPU II operational status. Table 4-6 list the tests performed.

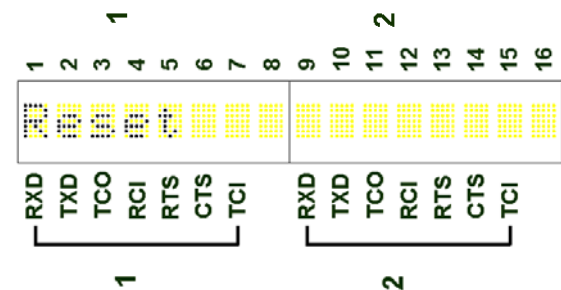


Table 4-6 WCP CPU II Self Tests

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 other radios
HDLCL PORT 0 **	OK /FAILED	Verifies the client ports via an internal loopback test of the TX and RX data paths
HDLCL PORT 1 **	OK /FAILED	Verifies the client ports via an internal loopback test of the TX and RX data paths
DC PORT	OK/FAIL	Test DC input channels by looping DC outputs to inputs. Test is disabled.
LON PORT *****	OK/FAILED	Resets LON port

NOTE**NOTE**

Function and subfunction displays are automatically turned off approximately 12 minutes after the **SELECT** or **ENTER** push buttons are last activated.

4.4 WCP CPU II Configuration PROGRAMS

The WCP CPU II Configuration programs (XCMMMAINT.EXE, MCM II Configuration Utility, or similar name) and associated files are distributed on a CD ROM.

- The XCMMMAINT.EXE program, MCM II Configuration Utility, 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.

4.4.1 Installation

To install the XCMMaint Configuration or the MCM II Configuration Utility 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.
3. Copy the files from CD to the folder.
4. Create a shortcut to the XCMMaint's executable file onto the computer desktop.

4.4.2 Using the WCP CPU II Configuration Program

Connect the serial port of the PC to the Diagnostic Port on the front of the WCP CPU II as shown in Figure 4-4.

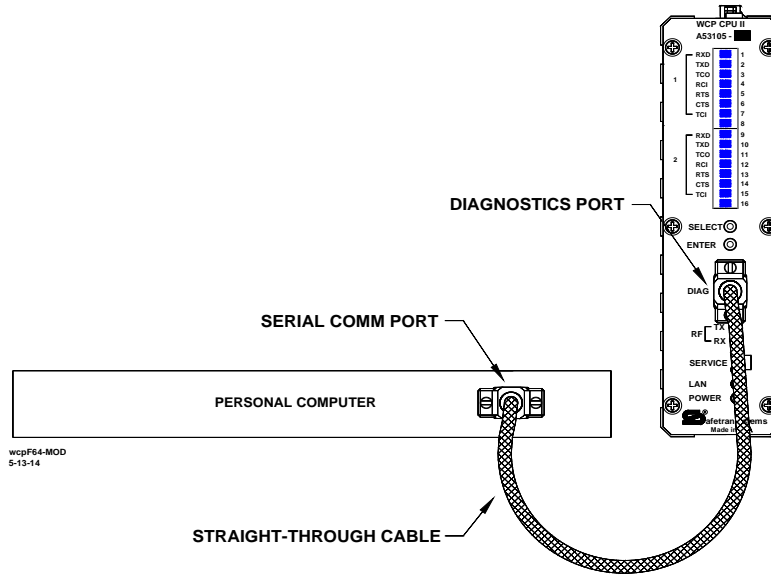


Figure 4-4 WCP CPU to Personal Computer Interconnection Diagram

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

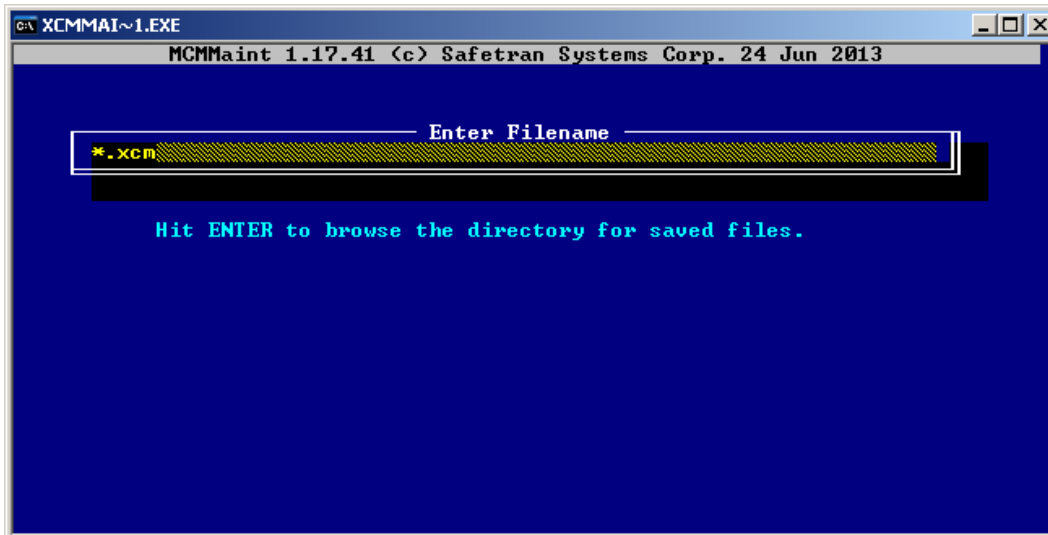


Figure 4-5 XCMMAINT Opening Screen

4.4.2.1 Accessing A Saved Codeplug

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 4-6, displays within the Startup Screen.

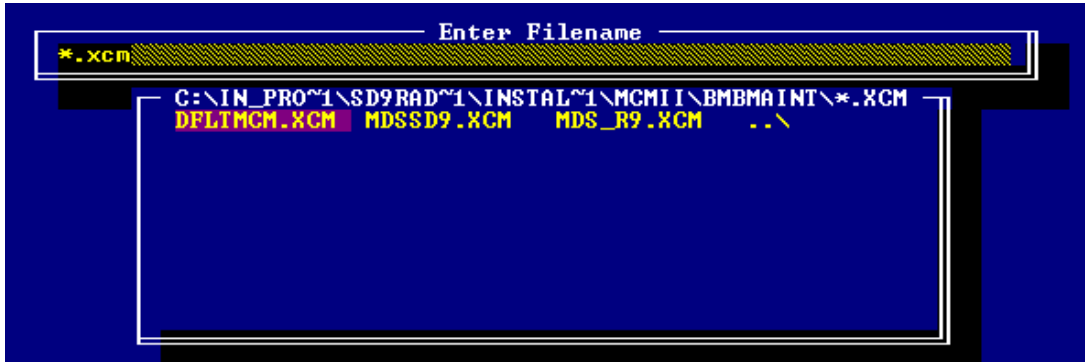


Figure 4-6 Codeplug File List

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 4-7.

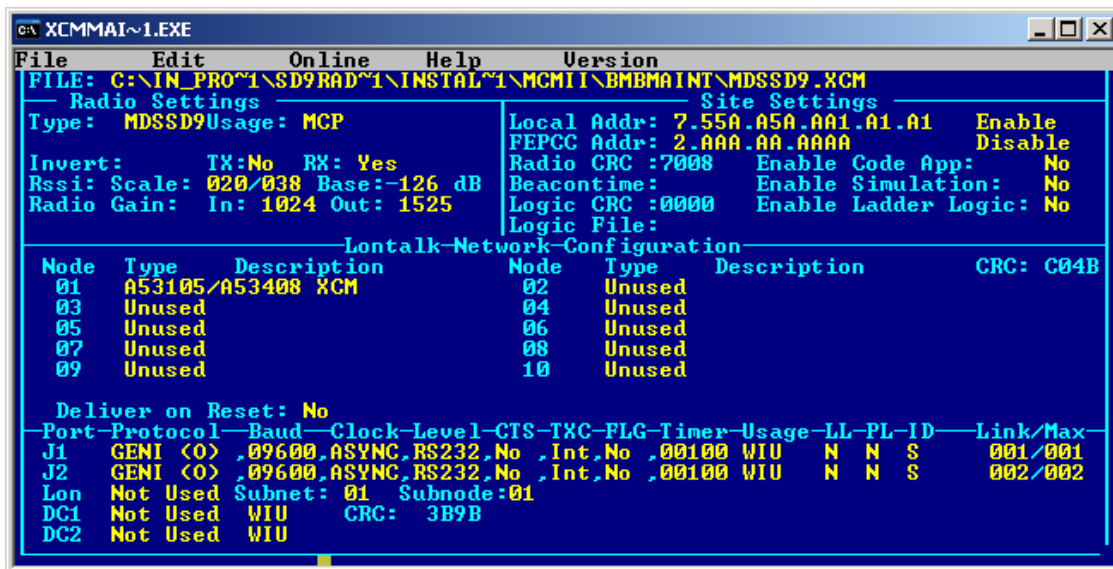


Figure 4-7 Typical Main Editor

4.4.2.2 Read WCP Codeplug

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

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

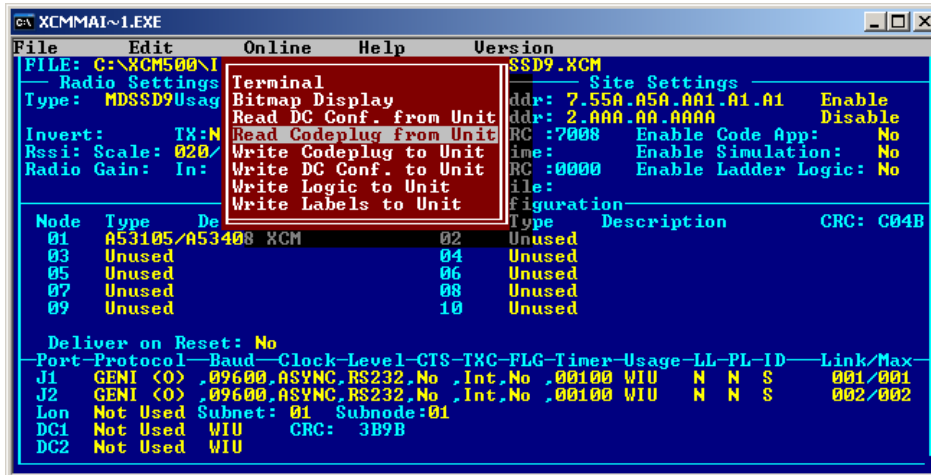


Figure 4-8 Read WCP Codeplug

- The codeplug file is read from the WCP CPU II and displayed as shown in Figure 4-9

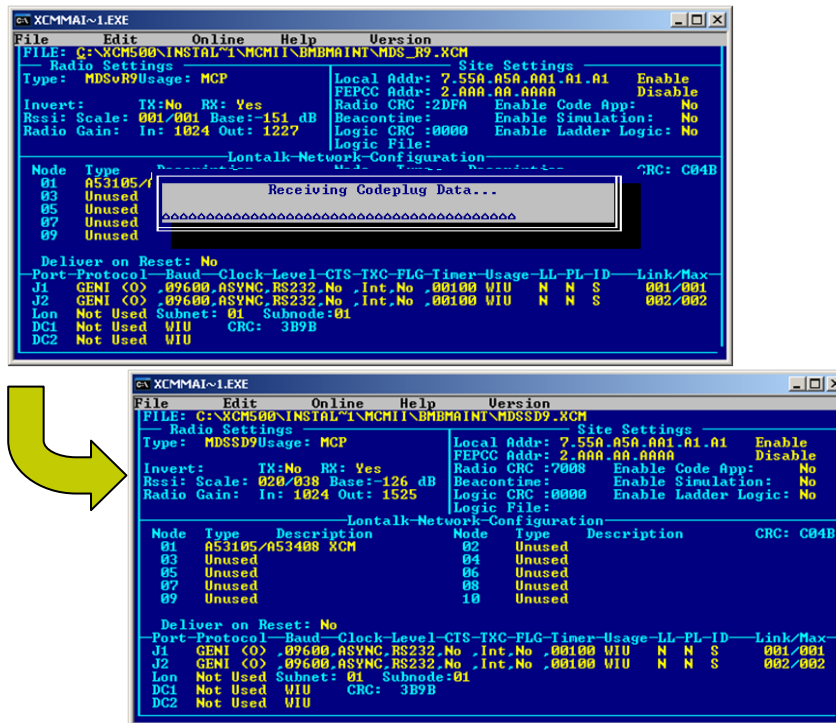


Figure 4-9 Codeplug Data Read from WCP

4.4.3 Using The 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

These sections are described in the following paragraphs.

The name and path for the selected file is identified at the upper left corner of the display.

- At the top of the display is the Menu Bar.
- The Menu Bar contains the names of three drop-down menus or functions and a **Help** and **Version** screen 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.

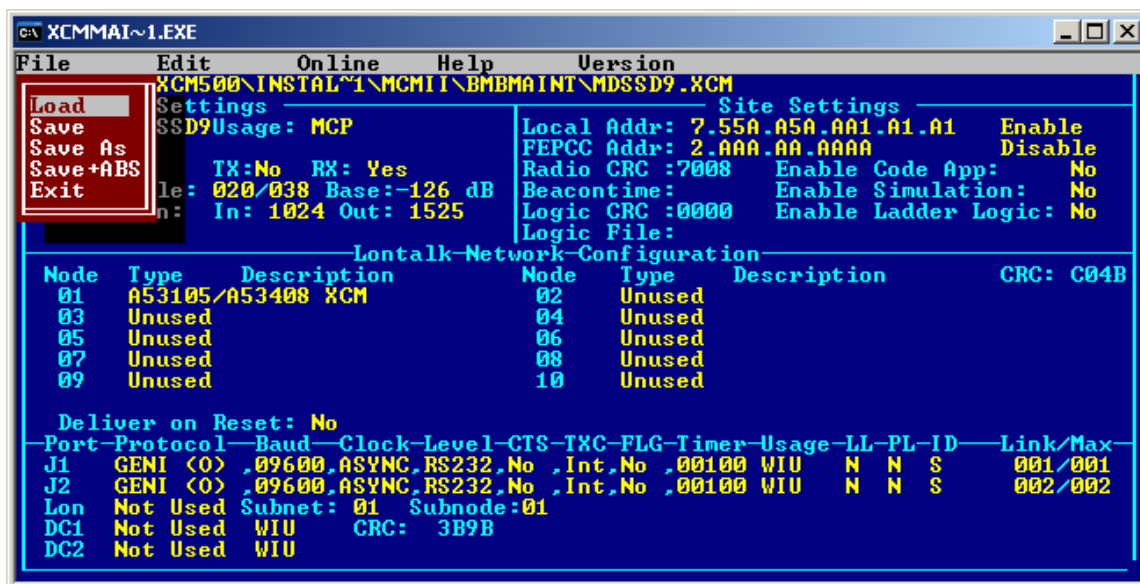


Figure 4-10 Main Editor Screen

4.4.3.1 File Menu

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

- **Load** – this entry allows another codeplug file (.XCM extension) to be loaded, replacing the one currently displayed.

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

1. Highlight the **Load** entry using the arrow keys, as required.



2. Press the **Enter** key.

The following prompt is displayed:



3. Enter a file name by performing one of the following actions:
 - a. Type the file name (maximum of eight characters plus the .XCM extension) at the **Enter Filename** prompt.
 - b. Press the **Enter** key to bring up the Codeplug File List, Figure 4-6 and make a file selection from the presented list using the arrow keys.
4. Press the **Enter** key.

The file path is shown on the first line of the screen as shown in Figure 4-11.

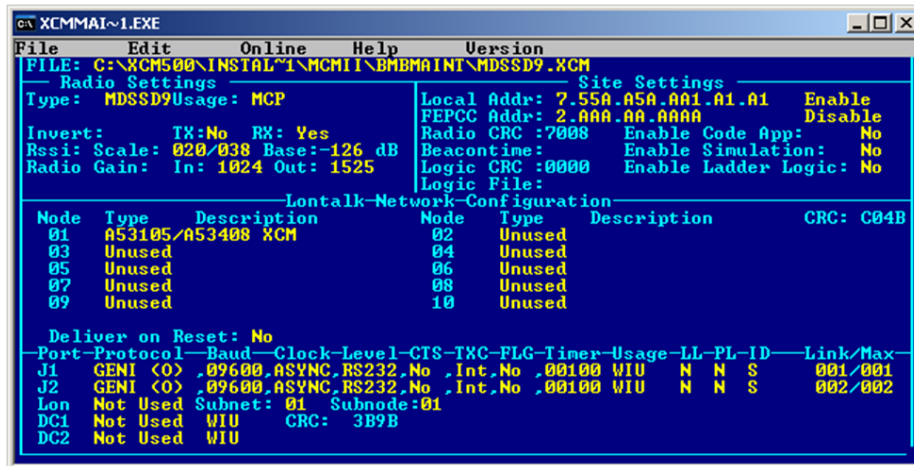


Figure 4-11 XCM File Name Path

Save

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:
 - a. Type the file name (maximum of eight characters plus the **.XCM** extension) at the **Enter Filename** prompt.
 - b. Press the **Enter** key to bring up the Codeplug File List, **Error! Reference source not found.**, 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).

Verify
Codeplug modified - save?

- a. Type **Y** (yes) to save the changes to the configuration or **N** (no) to discard the changes to the configuration.
- b. Press the **Enter** key.

The Main Editor Screen closes and the DOS prompt is displayed or the Desktop is shown.

4.4.3.2 Edit Function

The **Edit** function (**Alt-E**) does not display a drop-down menu, but is used to move from one editing data field to the next.

- When editing the LonTalk® Network Configuration, selection of **Alt-E**, while an I/O device is selected, will cause a secondary edit screen to be displayed. Refer to paragraph 4.4.6 for additional information.
- When editing the 'Type' field in Radio Settings section, selecting **Alt-E** results in default radio settings to be automatically set. See section 4.4.3.2.

4.4.3.3 Online Menu

The **Online** (**Alt-O**) drop-down menu contains eight entries that are described below.

Terminal

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

A blank screen appears displaying only the Menu bar containing the name of the three available drop down menus: **File**, **Online**, and **Upload**.

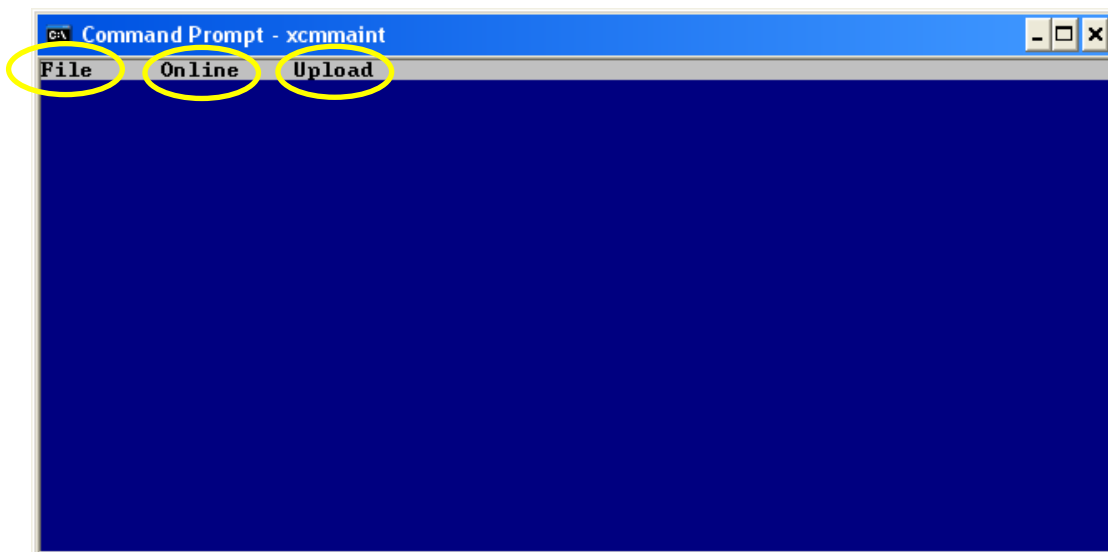
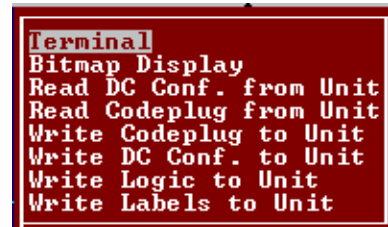


Figure 4-12 Terminal Sub Menus

File Menu

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

Edit

This closes the Online Terminal Screen and returns to the Main Editor Screen display.



Status

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



Log Open

This brings up the following prompt:



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

All subsequent WCP CPU 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.

Viewing and/or Logging the WCP CPU II Event Log

- a. Press the **ENTER** key.
A "*" prompt is displayed.
- b. To create a new event log for logging WCP CPU II events, select **Log Open** from the **Terminal's** drop-down **File** menu.
 - 1) Type a log file name to be created (the **.log** extension will be appended) and press **Enter**.
- c. Type **LOG** at the "*" prompt.
- d. Press the **Enter** key.

The event log of the WCP CPU II is displayed on the Screen as shown in figure 4-9a. As each new event occurs, it is added to the end of the event log file. Note that 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.
- Pressing the **Esc** key interrupts the log display and disables log command execution.
- e. 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.

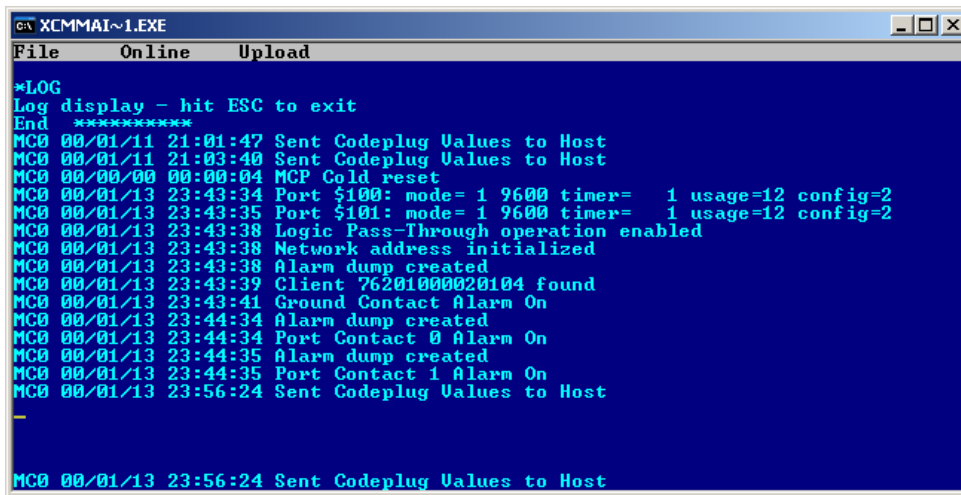


Figure 4-13 Online Terminal Screen Event Log

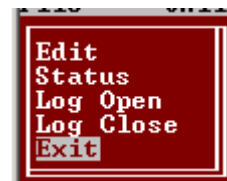
Log Close

This will close the currently open log file, if any, without prompting.



Exit

This terminates the program and the DOS prompt is displayed or the Desktop is shown.



Online Menu

This screen is the same as the Main Editor's **Online** drop-down menu.

Online Terminal Screen Commands

From the terminal screen (Alt-O, Terminal), a number of diagnostic, status, and troubleshooting commands may be initiated. To obtain a list of available commands:

- Press the **Enter** key
A "*" prompt is displayed.
- Type **HELP**.
HELP appears on the screen to the right of the *.
- Press the **Enter** key.
The Command List is displayed within the Online Terminal Screen as shown in Figure 4-14

```

File      Online  Upload
*
*
*
*HELP
Display Codeplug Contents - DCP
Display DC Configuration - DDC
Display Client List       - CL
Enter Service Mode       - SERV
Version Identification    - VER
Base Station List        - BSTAT
Communication Statistics  - CSTAT
HDLC Statistics          - HSTAT
Manufacturer Statistics   - MSTAT
Alarm Logging            - AL <en/ds>
View log                 - LOG <CLEAR>
Status Logging           - SL <en/ds>
Key or Dekey Radio      - PTT <en/ds>
Radio Simplex Operation - SIMP <en/ds>
COS status               - COS <en/ds>
Enter Channel Number    - CHAN <number>
Send Local Message      - LOCAL <label> <message>
Self Test                - TEST <1=cold / 0=warm>
Patch Codeplug          - PCP <location> <new_value>
Disable Tracing Mechanism - MOND <layer> <port> <link>
Enable Tracing Mechanism - MONE <layer> <port> <link>
Send Mobile Message     - SEND <layer> <port> <link> <msg>
Error Rate Test         - ERT <mode> <layer> <port> <full report> <pattern>
Enable / Disable SWI    - SWI en/ds
Enable / Disable LADL   - LADL en/ds
Program Codeplug        - FPROG
Show HW/SW Version Info - SCT
Reset RSSI Statistics   - RSSI
Reset MCS/SB9600       - RIFRESET 1=MCS reset, 2=SB reset, 3=SB prog. other=PPP
PPP Status              - PPP
Ping                    - PINGIP address, client num <0!1>
Timer Status            - TIMERS
Set Date                 - DATE <year> <month> <day>
Set Time                 - TIME <hour> <minute> <second>
*
OST

```

Figure 4-14 Online Terminal Screen Command List

NOTE

NOTE

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

Online Terminal Screen Command Initiation

To implement a command from the Online Terminal Screen proceed as follows:

- a. Press the **Enter** key.

An * is displayed at the top left of the Screen, verifying that the program is communicating with the WCP CPU II.

- b. Type the command followed by a space and the desired parameter designation.

Commands requiring multiple parameters are entered with a space between each parameter. For example; a 'Enable Tracing Mechanism' command is entered as:

***MONE <space><layer><space><port> ,space><link>.**

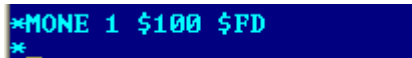
Valid layers for this command are 1 and 2.

Typical Port numbers are:

- \$100 for serial port J1
- \$101 for serial port J2
- \$300 for the RF Port

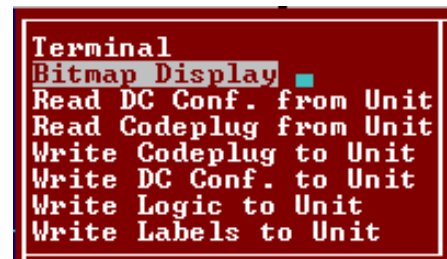
- c. Press the **Enter** key.

The command executes and the results are displayed on the Screen as shown below:



Bitmap Display

Bitmap Display – This entry displays the Bitmap screen, Figure 4-15, which is an online dynamic display of the logic state of any physical inputs or outputs associated with the WCP CPU II via ladder logic. The logic state of all internal bit fields 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 determined using this screen.



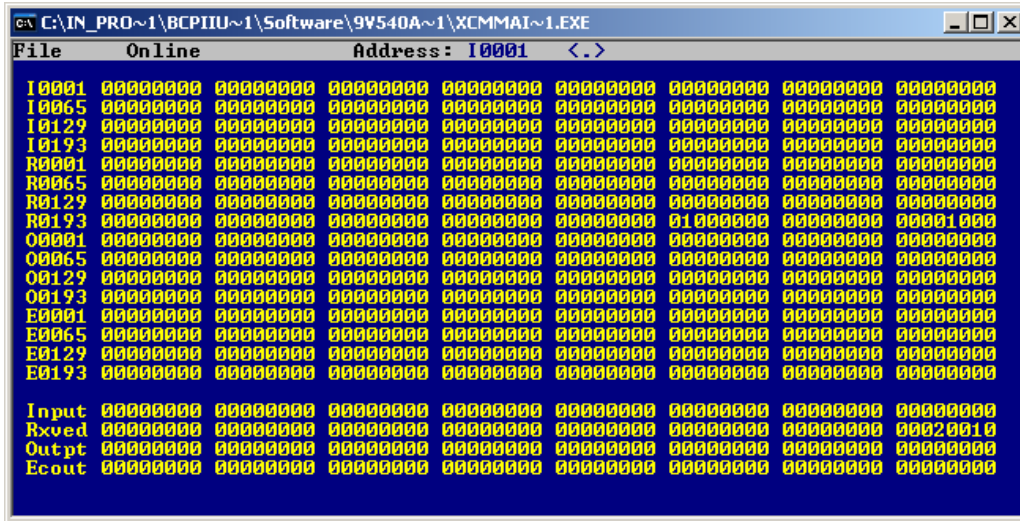
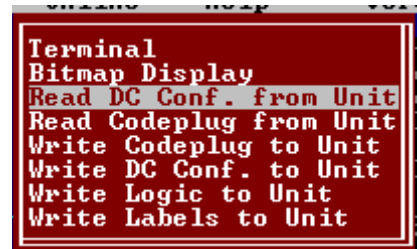


Figure 4-15 Bitmap Display Screen

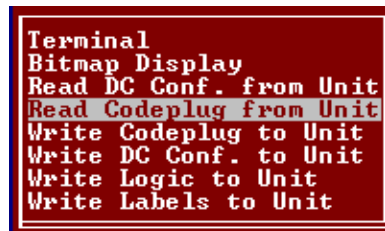
Read DC Conf. From Unit

Read DC Conf. from Unit. – by selecting this function and pressing **ENTER**, the configuration of the DC port of the WCP CPU II (associated with connector J4) is read. The **Receiving data** popup box will display briefly as the data is read. The main edit screen will be updated to reflect the configuration data that is read.



Read Codeplug From Unit

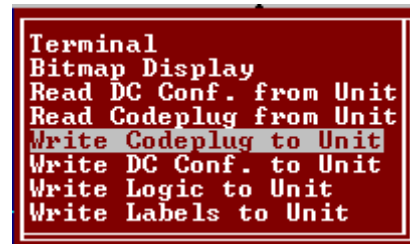
Read Codeplug from Unit – by selecting this function and pressing **ENTER**, the Codeplug portion of the WCP CPU II configuration data is read. This is a 512-byte data array that stores all the user-modifiable WCP CPU II configuration information. The **Receiving data** popup box (see above) will display 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

Write Codeplug to Unit– by selecting this function and pressing **ENTER**, all the configuration data appearing on the main edit screen will be written to the WCP CPU II’s non-volatile memory.

The **sending data** popup box will display briefly as codeplug data is written.



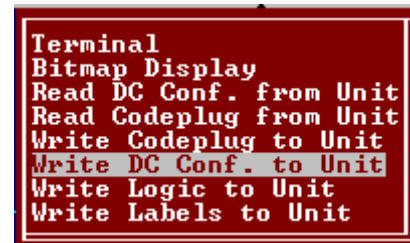
CAUTION

EXISTING CODEPLUG DATA IN THE WCP CPU II WILL BE OVERWRITTEN AND IRRETRIEVABLY LOST.

Write DC Configuration To Unit

Write DC Conf to Unit. – by selecting this function and pressing **ENTER**, the DC configuration data on the main edit screen (**DC1**) will be written to the WCP CPU II. Note that this data is not part of the 512-byte codeplug described in Appendix C.

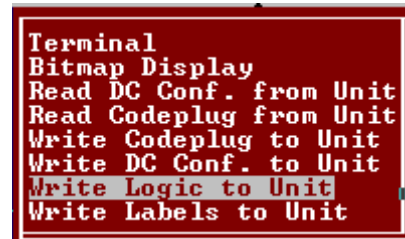
The **Sending data** popup box (see previous page) will display briefly while the data is being uploaded.



Write Logic To Unit

- **Write Logic to Unit** – This function uploads compiled ladder logic to the WCP CPU II if the following conditions are met:

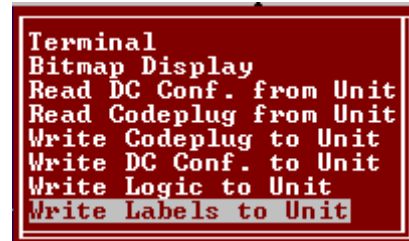
1. Appropriate ladder logic has been compiled
2. The name of the logic file generated has been entered on the main edit screen (in the Site Settings section). The file extension (.LLW) is omitted.



After the upload sequence is complete, the WCP CPU 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 WCP CPU II unchanged.

Write Labels To Unit

Write Labels to Unit – by selecting this function and pressing **ENTER**, the tokenized label file associated with the ladder logic is uploaded to the WCP CPU 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 will have the same base filename, but file extension (.LLM). As a result, it is only necessary to specify the base filename in the **Logic File** field on the main edit screen.



4.4.3.4 Upload (Alt-U)

This performs firmware upgrading and has the following three drop-down selections:

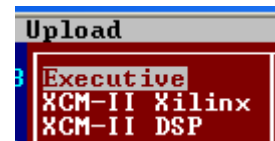


The files associated with each of the three drop-down menus are stored on the installation CD. File 'xcmaint.ini' specifies the path to each of these files.

Executive

The executive firmware consists of MCM II's operating system software and system application software. As MCM II's executive firmware is changed and updated by Siemens, select this command to flash an updated executive into MCM II. Upon selecting this command, configuration program will automatically establish a session with the MCM II unit and write new executive to 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 MCM II configuration program to accomplish re-flashing of executive firmware:

As shown below, XCMaint.exe establishes a connection with MCMII.



Then, new executive firmware is serially sent to MCM II as shown below. Screen is updated to reflect serial completion status.



New executive firmware is now completely serially sent to MCM II. New executive firmware is written to flash memory. Upon completion of flash operation, MCM II will automatically reboot.

```
FlashRAM. Rebooting.

*
*
*
Flash programming completed
Booting from Diagnostic ROM

Safetran MCM II 68302 Debugger Version 2.00
Booting from Diagnostic ROM
```

4.4.3.5 Help Window

The **Help** window, Figure 4-16, provides general help instructions.

```
Esc to exit
MCMMaint 1.17.41 (c) Safetran Systems Corp. 24 Jun 2013

[MAIN_HELP]
Place the cursor over the field to be modified. Some fields
can be overtyped, while others require you to make a
selection using the TAB (or Shift-TAB) key. You can also use
the mouse to move the cursor.

Context-sensitive help is available for some configuration
fields by entering Alt-H (or right-clicking the mouse) while
the cursor is in that field. Some fields need to be expanded
with the Alt-E option.

Call Safetran at 1-800-793-7233 for support on this product.
```

Figure 4-16 MCMMAINT Help Window

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:

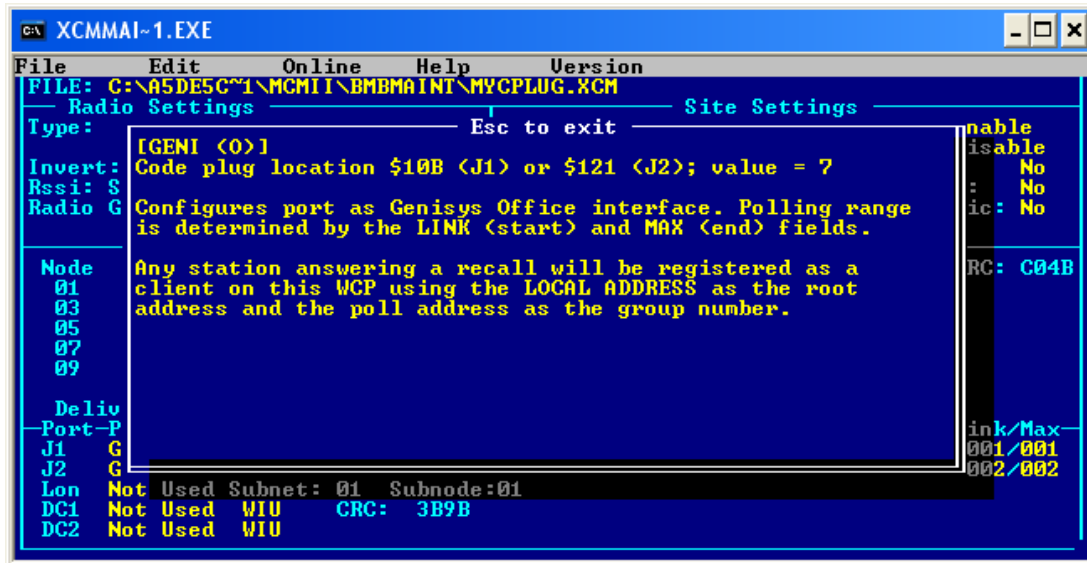
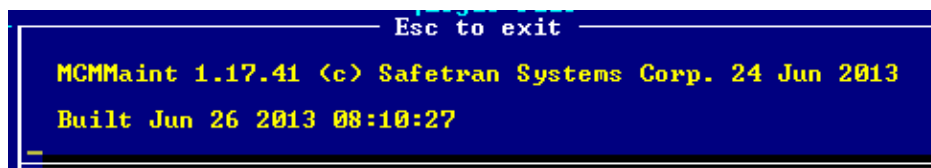


Figure 4-17 Help Window Example

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

4.4.3.6 Version Window (Alt-V)

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



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

4.4.4 RF Settings Displays

4.4.4.1 Radio Type and Usage Fields

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

1. The **Type:** field selection range and the default field configuration for each selected radio type are shown below. To set radio settings' parameters to their default values, enter **Alt-E** while cursor is positioned on **Type** field. The following shows the default settings for each radio type.

◆ None

```

Radio Settings
Type: None Usage: ---
    
```

◆ MCS

```

Radio Settings
Type: MCS Usage: ---
Channel: Min:01 Max:06 Def:02
Invert: TX:No RX: Yes
Rssi: Scale: 009/025 Base:-137 dB
Radio Gain: In: 1024 Out: 1250
    
```

◆ MSF

```

Radio Settings
Type: MSF Usage: ---
Invert: TX:Yes RX: Yes
Rssi: Scale: 060/210 Base:-132 dB
Radio Gain: In: 1024 Out: 1664
    
```

◆ MTR

```

Radio Settings
Type: MTR Usage: ---
Invert: TX:No RX: Yes
Rssi: Scale: 001/002 Base:-125 dB
Radio Gain: In: 1024 Out: 0970
    
```

MTR3000 - Gain Out = 0970

```

Radio Settings
Type: MTR Usage: ---
Invert: TX:No RX: Yes
Rssi: Scale: 001/002 Base:-125 dB
Radio Gain: In: 1024 Out: 0640
    
```

MTR2000 (Discontinued) - Gain Out = 0640

◆ PHD

```

Radio Settings
Type: PHD Usage: ---
Invert: TX:Yes RX: Yes
Rssi: Scale: 070/067 Base:-152 dB
Radio Gain: In: 1024 Out: 1664
    
```

◆ ASTRO

```

Radio Settings
Type: ASTRO Usage: ---
Channel: Min:01 Max:06 Def:02
Invert: TX:Yes RX: Yes
Rssi: Scale: 070/067 Base:-152 dB
Radio Gain: In: 0000 Out: 0000
    
```

◆ EFJ

```

Radio Settings
Type: EFJ Usage: ---
Invert: TX:Yes RX: No
Rssi: Scale: 040/206 Base:-110 dB
Radio Gain: In: 1024 Out: 1664
    
```


◆ KENWD

```

Radio Settings
Type: KENWD Usage: ---
Channel: Min:01 Max:06 Def:02
Invert: TX:No RX: Yes
Rssi: Scale: 001/001 Base:-151 dB
Radio Gain: In: 1024 Out: 1227

```

◆ MDS

```

Radio Settings
Type: MDS Usage: ---
Channel: Min:01 Max:06 Def:02
Invert: TX:Yes RX: No
Rssi: Scale: 060/138 Base:-146 dB
Radio Gain: In: 1024 Out: 1250

```

◆ MDSvR9

```

Radio Settings
Type: MDSvR9 Usage: MCP
Invert: TX:No RX: Yes
Rssi: Scale: 001/001 Base:-151 dB
Radio Gain: In: 1024 Out: 1227

```

◆ MDSSD9

```

Radio Settings
Type: MDSSD9 Usage: MCP
Invert: TX:No RX: Yes
Rssi: Scale: 020/038 Base:-126 dB
Radio Gain: In: 1024 Out: 1525

```

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

- ◆ BCP
- ◆ MCP

For current WCP applications, set **Usage:** to **MCP** and **MDS** for the **Radio:** field. See Figure 4-18.

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

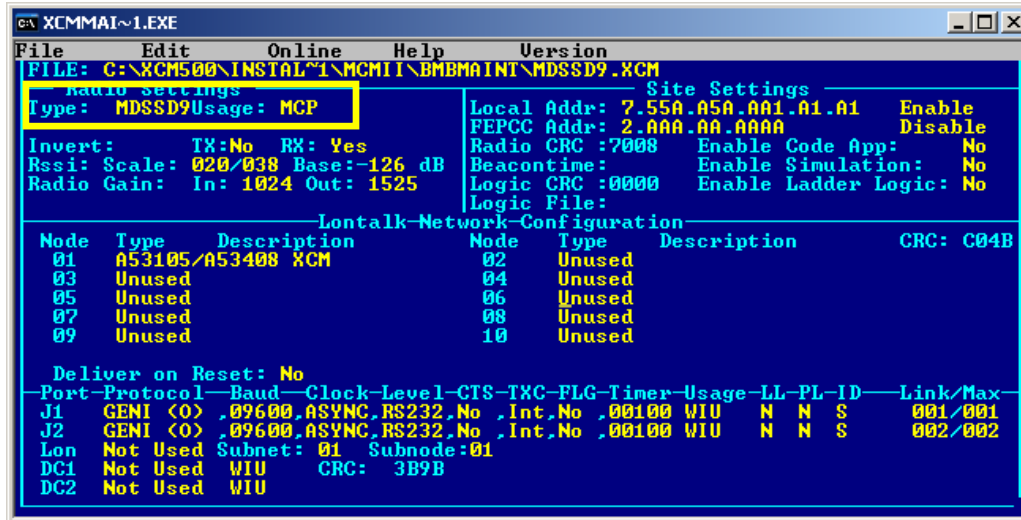


Figure 4-18 Main Editor Screen - Radio and Usage Selection

4.4.4.2 Channel Field

Each of the **Channel:** fields, figure 4-12, may be set to any value from **01** to **06**. However, to avoid unwanted channel scanning, it is recommended that the **Min:** and **Max:** fields be set to the value of the **Def:** (Default) field. Some radio selections will not show the Channel Field.

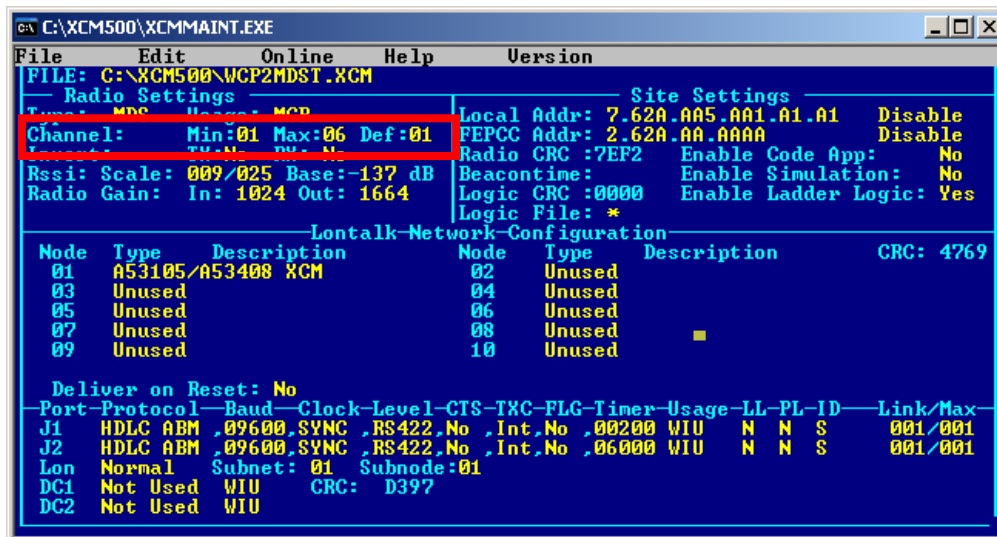


Figure 4-19 RF Channel Setting Selection

4.4.4.3 Invert Field

The Invert TX and Invert RX field has the following options:

- No
- Yes

The Invert: fields, Figure 4-20, may be used to invert the bit-sense of the transmitted data from or the received data by the WCP. This function is intended for cross-functionality with foreign equipment.

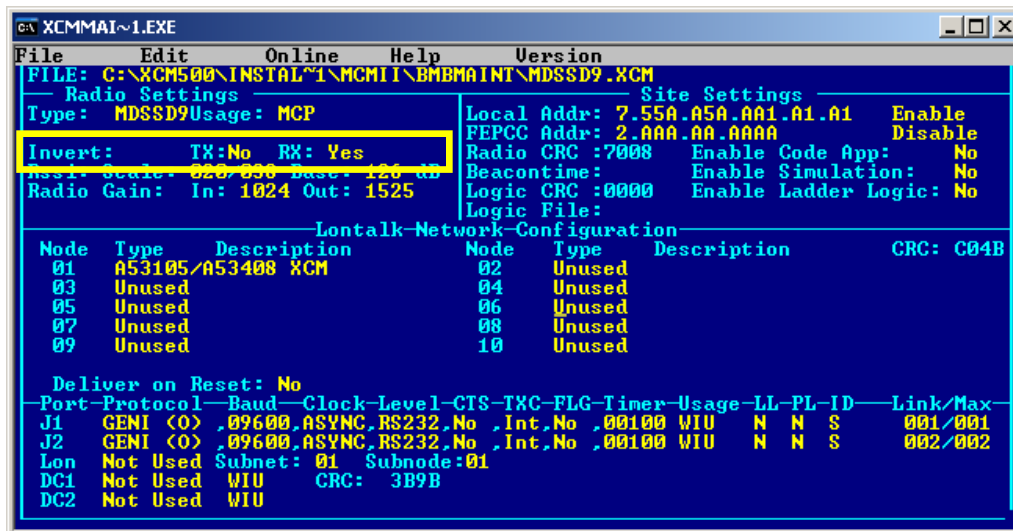


Figure 4-20 Main Editor Screen - Bit-sense Setting Selection

4.4.4.4 RSSI Scale and Base Fields

RSSI (Received Signal Strength Indicator) scaling and base values (see Figure 4-21) are included on the configuration screen only for compatibility with foreign equipment. Default values will result in proper RSSI reporting for current Siemens WCP equipment.

- To set fields to their default values, move cursor to 'Type' field in Radio Settings section and enter **Alt-E**.

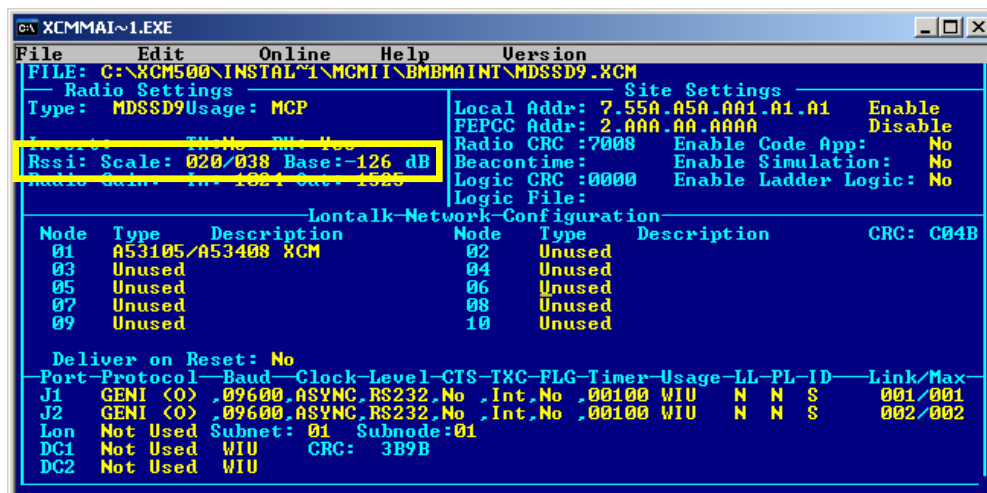


Figure 4-21 Main Editor Screen - Radio SSI (RSSI) Selection

4.4.4.5 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.

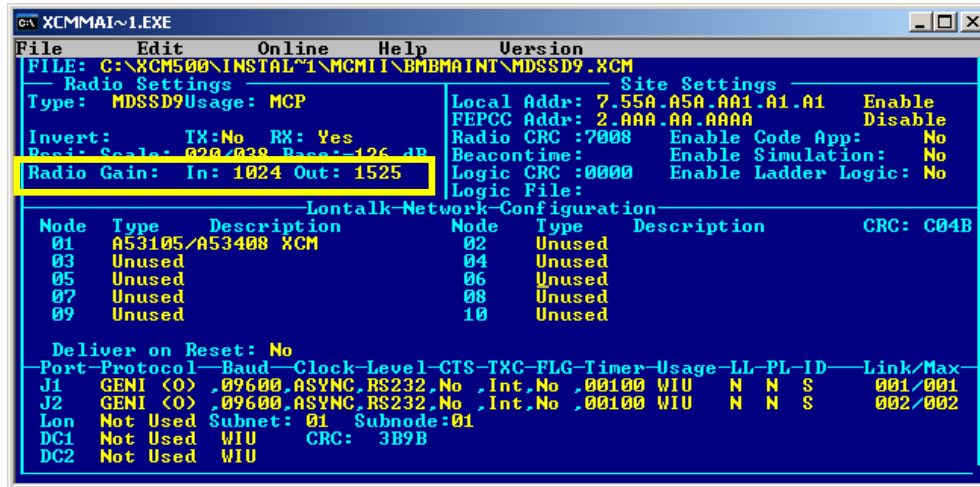


Figure 4-22 Main Editor Screen - Radio Gain

4.4.4.6 Default Value Setup

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

- This will overwrite the following radio parameters (when applicable):
 - Invert: TX
 - Invert: RX
 - Rssi: Scale
 - Base:
 - Radio Gain: In
 - Radio Gain: Out

4.4.5 Site Setting Displays

4.4.5.1 Local Addr Field

1. This address defines the ATCS address assigned to this unit. Field selection range:

0.000.00.0000 to 9.999.99.9999

NOTE**NOTE**

A numeric zero is translated to an alphabetic 'A'. 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 MCM II. Since MCM II is a wayside equipment, ATCS address format is 7.RRR.LLL.DDD.SS.DD where:

- 7 = wayside address type
- RRR = Railroad number(see Appendix B)
- LLL = Code-line or region number(railroad defined)
- DDD = Group or location number(railroad defined)
- SS = Equipment or subnode
- DD = Device controlled by this equipment

2. This address should be set to **Enable** when non-vital I/O is not using Siemens **R/Link I/O modules**.(see figure 4-16).
3. This address should be set to **Disable** when non-vital I/O uses Siemens **R/Link I/O modules**.

The screenshot shows the main editor screen for XCMMAI-1.EXE. The window title is 'C:\ XCMMAI-1.EXE'. The menu bar includes File, Edit, Online, Help, and Version. The file path is 'C:\A5DE5C71\MCMII\BMBMAINT\MYCPLUG.XCM'. The screen is divided into several sections:

- Radio Settings:**
 - Type: MDSor9 Usage: ---
 - Invert: TX:Yes RX: No
 - Rssi: Scale: 001/001 Base: -151 dB
 - Radio Gain: In: 1024 Out: 1227
- Site Settings:**
 - Local Addr: 7.55A.A5A.AA1.A1.A1 Enable
 - PERCC Addr: 2.AAA.AA.AAAA Disable
 - Radio CRC :E310 Enable Code App: No
 - Beacontime: Enable Simulation: No
 - Logic CRC :0000 Enable Ladder Logic: No
 - Logic File:
- Lontalk Network Configuration:**

Node	Type	Description	Node	Type	Description	CRC: C04B
01	A53105/A53408	XCM	02	Unused		
03	Unused		04	Unused		
05	Unused		06	Unused		
07	Unused		08	Unused		
09	Unused		10	Unused		
- Deliver on Reset: No**
- Port Configuration:**

Port	Protocol	Baud	Clock	Level	CTS	TXC	FLG	Timer	Usage	LL	PL	ID	Link/Max
J1	GENI <O>	09600	ASYNC	RS232	No	Int	No	00100	WIU	N	N	S	001/001
J2	GENI <O>	09600	ASYNC	RS232	No	Int	No	00100	WIU	N	N	S	002/002
- Lon:** Not Used Subnet: 01 Subnode: 01
- DC1:** Not Used WIU CRC: 3B9B
- DC2:** Not Used WIU

Figure 4-23 Main Editor Screen - Site Local Address Selection

4.4.5.2 FEPCC Addr Field

1. Field selection range:

0.000.00.0000 to 9.999.99.9999

NOTE

NOTE

A numeric zero is translated to an alphabetic 'A'. The default value of **A.AAA.AA.AAAA** corresponds to a setting of **0.000.00.0000**.

2. When the **Enable** function is selected, this field sets FEP/CC address to use on initial inbound transmissions (see figure 4-18). This field is needed on systems where the WCP equipment does not support packets with a zero destination length.
3. When the **Disable** function is selected, the address set into the **FEPCC Addr:** field is ignored. This field normally set to **Disable**.

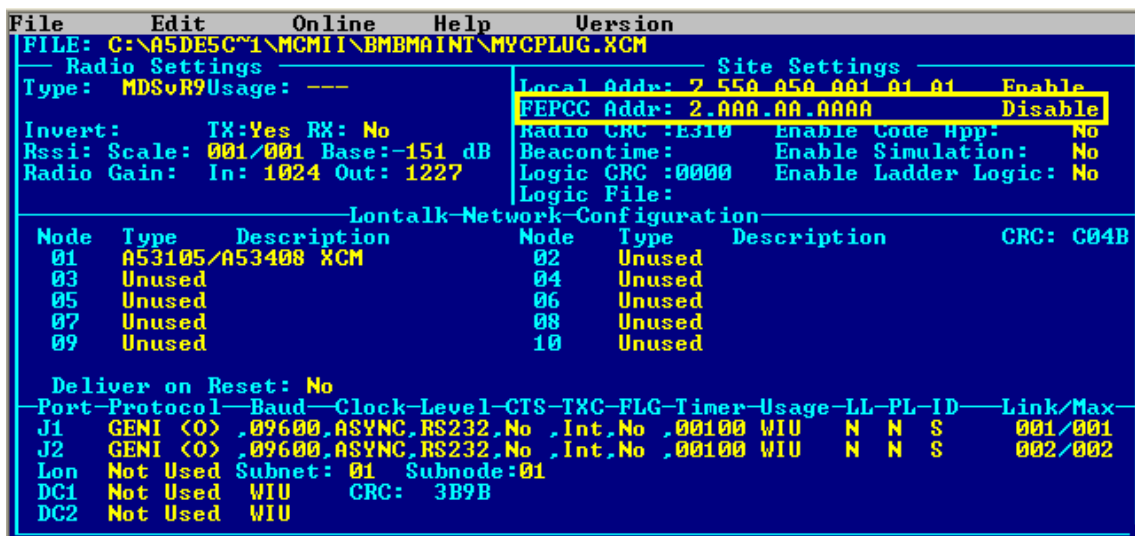


Figure 4-24 Main Editor Screen - FEPCC Address Selection

4.4.5.3 Enable Code App Field

1. Field selection range:

No = If not using Siemens R/Link I/O modules
Yes = If using Siemens R/Link I/O modules

2. This field enables the internal MCM code system application when used with Siemens **R/Link I/O modules** (see Figure 4-25).

```

FILE: C:\A5DE5C~1\MCMIT\BMBMAINT\MYCPLUG.XCM
----- Radio Settings ----- Site Settings -----
Type: MDS Usage: --- Local Addr: 7.55A.A5A.AA1.A1.A1 Enable
FEPCC Addr: 2.AAA.AA.AAAA Disable
Invert: TX:Yes RX: No Radio CRC :E310 Enable Code App: No
Rssi: Scale: 001/001 Base:-151 dB Beacontime: Enable Simulation: No
Radio Gain: In: 1024 Out: 1227 Logic CRC :0000 Enable Ladder Logic: No
Logic File:
----- Lontalk-Network-Configuration -----
Node Type Description Node Type Description CRC: C04B
01 A53105/A53408 XCM 02 Unused
03 Unused 04 Unused
05 Unused 06 Unused
07 Unused 08 Unused
09 Unused 10 Unused
Deliver on Reset: No
Port-Protocol-Baud-Clock-Level-CTS-TXC-FLG-Timer-Usage-LL-PL-ID-Link/Max
J1 GENI <O> ,09600,ASYNC,RS232,No ,Int,No ,00100 WIU N N S 001/001
J2 GENI <O> ,09600,ASYNC,RS232,No ,Int,No ,00100 WIU N N S 002/002
Lon Not Used Subnet: 01 Subnode:01
DC1 Not Used WIU CRC: 3B9B
DC2 Not Used WIU

```

Figure 4-25 Main Editor Screen - Site Enable Code Application Selection

4.4.5.4 Enable Simulation Field

1. Field selection range:

No = Disables manipulation of bits from diagnostic terminal

Yes = Enables manipulation of bits from diagnostic terminal

2. This field enables simulation, allowing inputs from the diagnostic program to toggle bits in the ladder logic application (see Figure 4-26).

```

C:\XCM500\XCMMAINT.EXE
File Edit Online Help Version
FILE: C:\XCM500\WCP2MDST.XCM
----- Radio Settings ----- Site Settings -----
Type: MDS Usage: MCP Local Addr: 7.62A.AA5.AA1.A1.A1 Disable
Channel: Min:01 Max:06 Def:01 FEPCC Addr: 2.62A.AA.AAAA Disable
Invert: TX:No RX: No Radio CRC :66E4 Enable Code App: No
Rssi: Scale: 009/025 Base:-137 dB Beacontime: Enable Simulation: Yes
Radio Gain: In: 1024 Out: 1664 Logic CRC :0000 Enable Ladder Logic: Yes
Logic File: *
----- Lontalk-Network-Configuration -----
Node Type Description Node Type Description CRC: 4769
01 A53105/A53408 XCM 02 Unused
03 Unused 04 Unused
05 Unused 06 Unused
07 Unused 08 Unused
09 Unused 10 Unused
Deliver on Reset: No
Port-Protocol-Baud-Clock-Level-CTS-TXC-FLG-Timer-Usage-LL-PL-ID-Link/Max
J1 HDLC ABM ,09600,SYNC,RS422,No ,Int,No ,00200 WIU N N S 001/001
J2 HDLC ABM ,09600,SYNC,RS422,No ,Int,No ,06000 WIU N N S 001/001
Lon Normal Subnet: 01 Subnode:01
DC1 Not Used WIU CRC: D397
DC2 Not Used WIU

```

Figure 4-26 Main Editor Screen - Site Enable Simulation Selection

4.4.5.5 Enable Ladder Logic Field

1. Field selection range:

No = Don't use Ladder Logic
Yes = Use Ladder Logic

2. This field enables the internal ladder (PLC) logic. If disabled, indications from the R/Link I/O modules are passed straight through to the office, and office controls are passed straight through to the R/Link I/O module outputs. If enabled, indications and controls data are processed by ladder logic program before being routed to destination for final processing (see Figure 4-27).

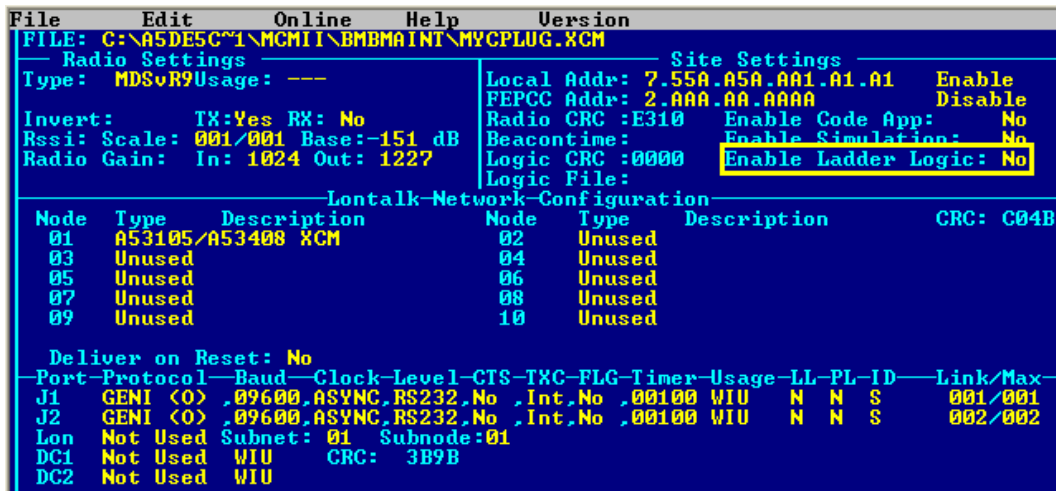


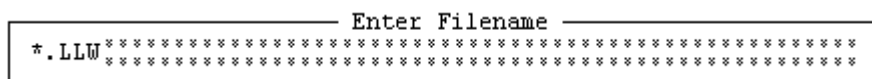
Figure 4-27 Main Editor Screen - Site Enable Ladder Logic Selection

4.4.5.6 Logic File Field

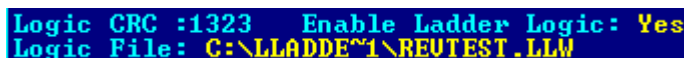
1. Field selection range:

Blank with **Enable Ladder Logic** set to **No**.
***** with **Enable Ladder Logic** set to **Yes**.

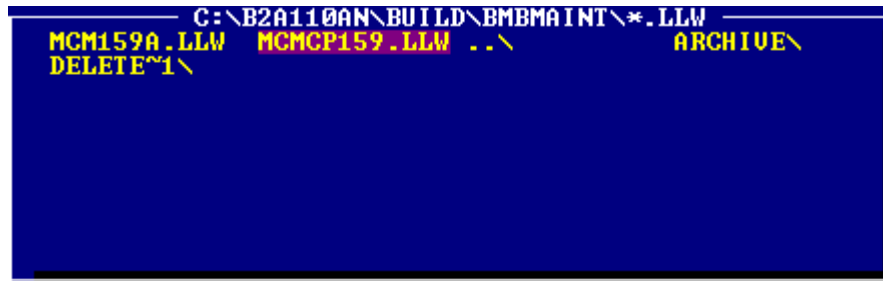
2. When the **Logic File: *** field is highlighted and **Enter** is pressed, the following prompt is displayed:



3. To enter a ladder logic file name, perform one of the following:
4. Type the path name and file name (maximum of eight characters per name plus the .LLW extension) at the **Enter Filename** prompt.



- 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.



The selected Ladder Logic file is displayed in the **Logic File:** field as shown in Figure 4-28.

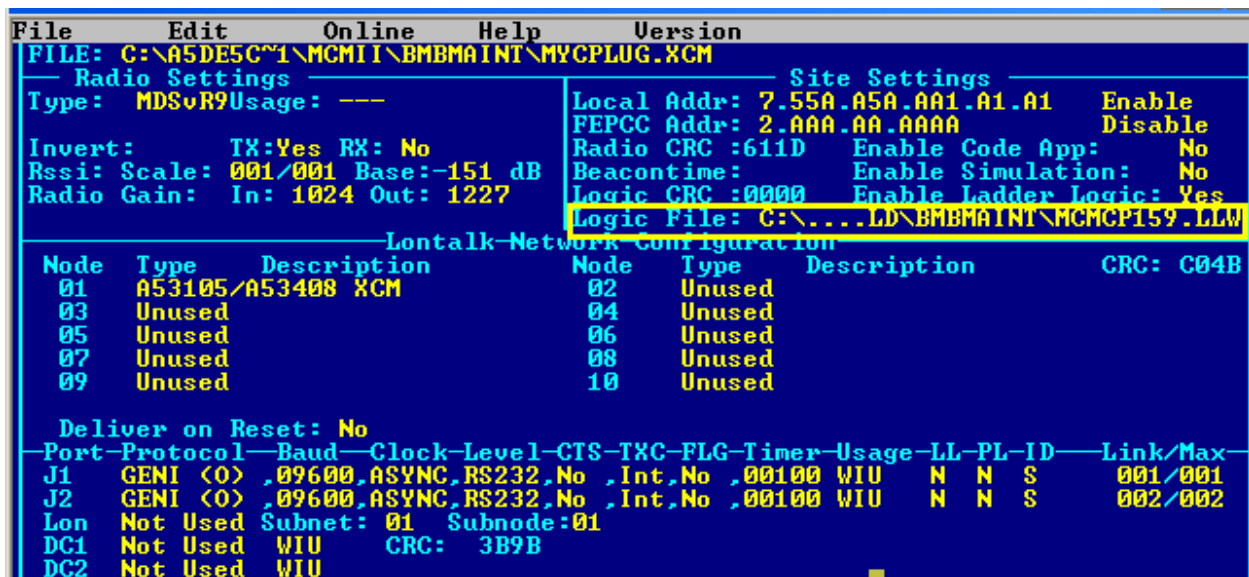


Figure 4-28 Main Editor Screen - Site Logic File Designation

4.4.6 LonTalk® Network Configuration

Siemens R/Link I/O modules are assigned to Echelon® nodes in this section (see Figure 4-29). Selections are toggled for each node by using the spacebar (see Figure 4-30).

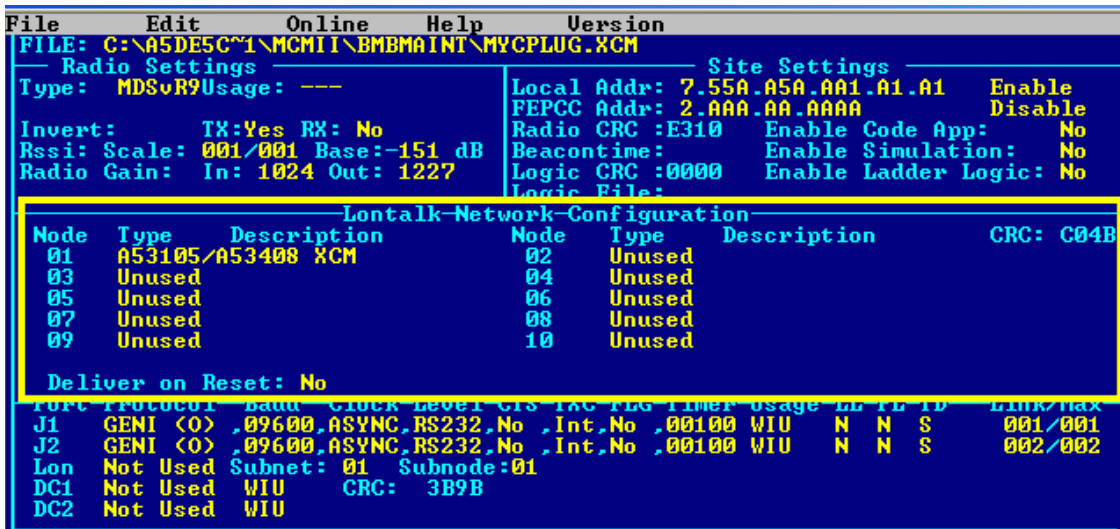


Figure 4-29 Main Editor Screen - LonTalk® Network Configuration

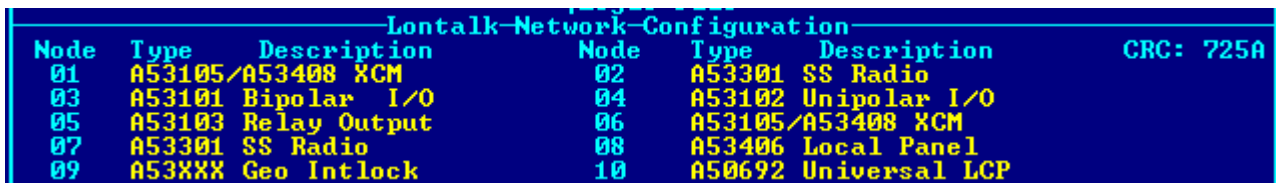


Figure 4-30 LonTalk® Network Configuration Component Selection

1. Field selection range:
 - a. Node 01 A53105/A53408 XCM
 - b. Node 02 Unused
 A53301 SS Radio
 - c. Nodes 03-10 Unused
 A53101 Bipolar I/O
 A53102 Unipolar I/O
 A53103 Relay Output
 A53105/A53408 XCM
 A53301 SS Radio
 A53406 Local Panel
 A53XXX Geo Intlock
 A50692 Universal LCP

2. **R/Link** I/O modules selected for a node require individual configuration and installation. I/O module configuration is accomplished as follows:
 - a. Use arrows keys or mouse to select the node to be configured.
 - b. Press the Space Bar until the desired I/O module is displayed (see Figure 4-31).
 - c. Press **Alt – E**.
3. The corresponding **R/Link** I/O configuration screen, Figure 4-31, displays.

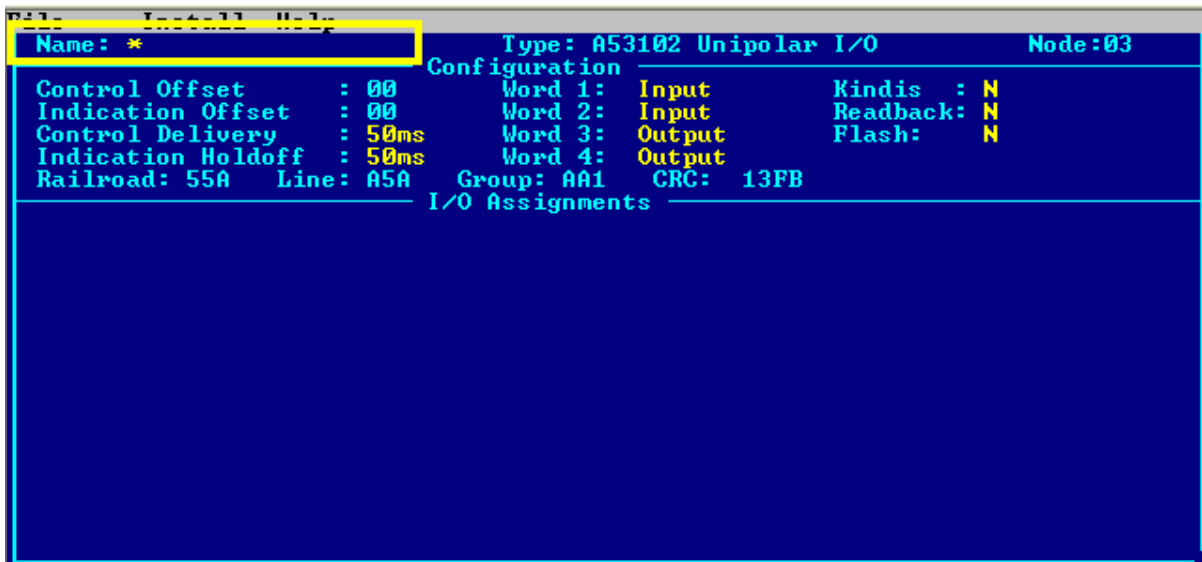
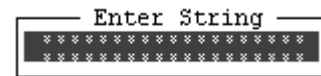


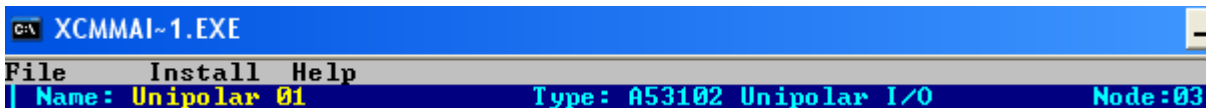
Figure 4-31 I/O Configuration Screen

- d. Select the **Name** field and press **Enter**. The **Enter String** window displays (see right).



- 1) Enter a descriptive name for the module to be configured; i.e. **UNIPOLAR 01**.
- 2) Press **Enter**.

The name entered appears in the **Name** field.



- e. Select the **Kindis** field (see Figure 4-32) as required.

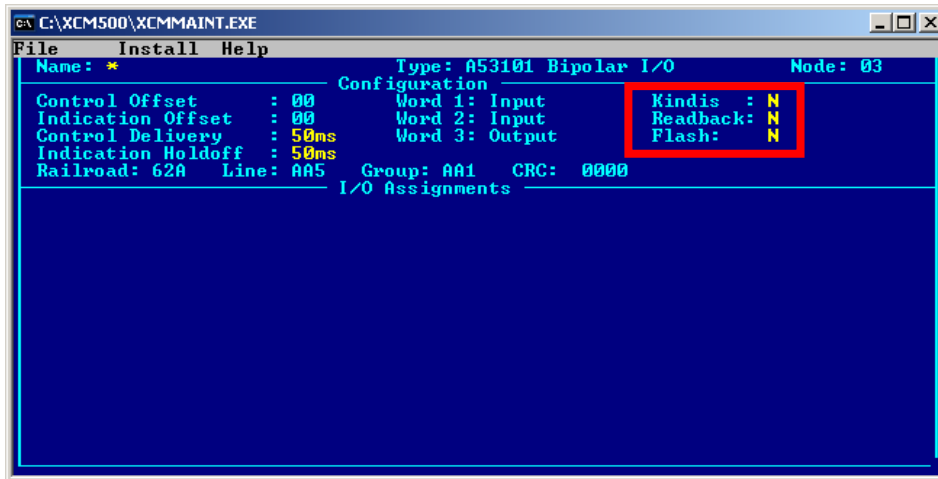


Figure 4-32 Kindis, Readback, Flash Configuration

The **Kindis** field is available for Bipolar and Unipolar I/O. Kindis refers to a local external battery that is used in a hardware checking configuration to verify indications. Selections are toggled using the spacebar.

- 1) Select **N** (default) to disable the Kindis function
 - 2) Select **Y** to enable the Kindis function.
- f. Select the Readback field as required.

The **Readback** field is available for Bipolar, Unipolar, and Relay Output I/O. Readback refers to a hardware check on delivered outputs, using a logical indication readback to verify that the output was actually delivered. Selections are toggled using the spacebar.

- 1) Select **N** (default) to disable the Readback function
- 2) Select **Y** to enable the Readback function.

NOTE

NOTE

Although the **Flash** field is available for Bipolar and Unipolar I/O, it is used in factory testing only.

- g. Select the **Control Delivery** field (see Figure 4-33).

The **Control Delivery** field determines the duration time of the output signal.

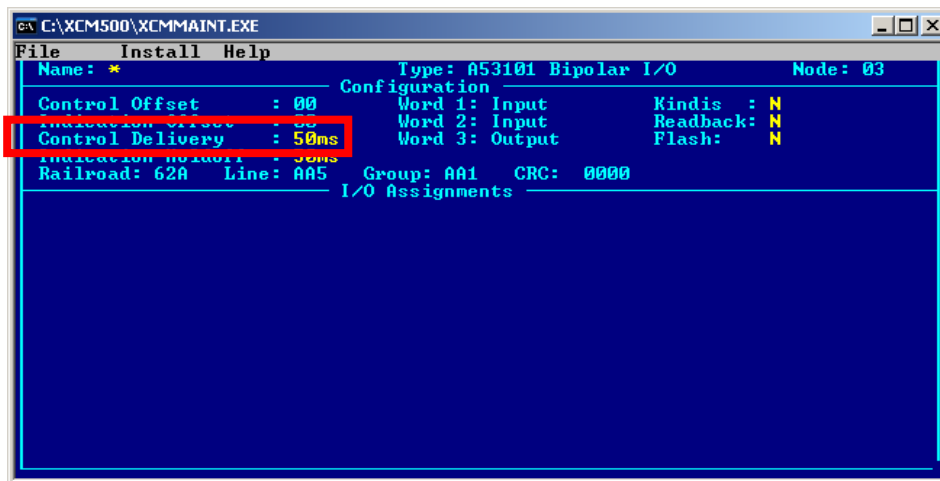


Figure 4-33 Bipolar I/O Delivery and Holdoff Delay

- h. Field selection range:

50ms
100ms
200ms
500ms
1sec
2sec
Latch

- i. Using the Spacebar, select appropriate Control Delivery time.
j. Select the **Indication Holdoff** field (see Figure 4-34).

The **Indication Holdoff** field determines the delay time between the receipt of an input signal and acceptance of the input signal as valid.

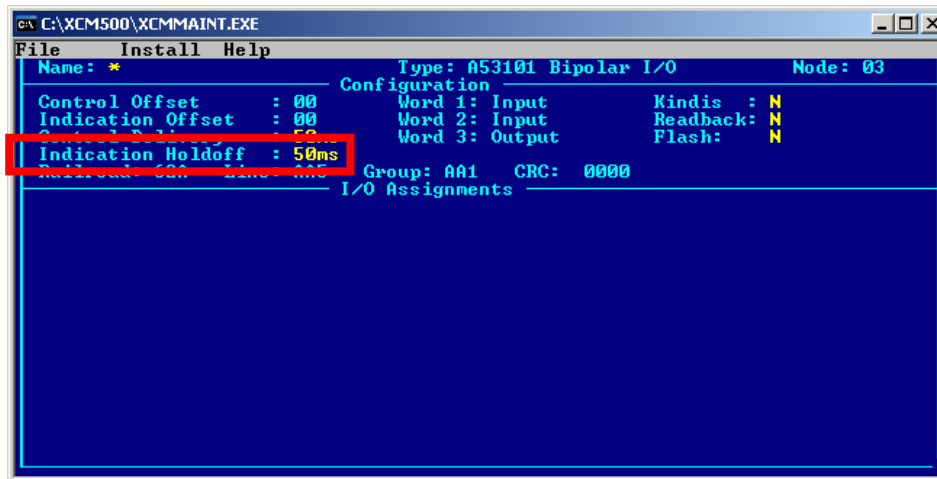


Figure 4-34 Indication Holdoff

- k. Field selection range:
 - 50ms
 - 100ms
 - 200ms
 - 500ms
 - 1sec
 - 2sec
- l. Using the Spacebar, select the appropriate **Indication Holdoff** time.

4.4.6.1 Install Menu

The Install (**Alt-I**) drop-down menu, accessed from the I/O Configuration screen, contains five entries that are described below. Upon completion of module installation, module will restart.

- **Read** – This entry reads the configuration data from an existing installed **R/Link** I/O module. This is a similar procedure to reading the code plug of the WCP CPU II. The ‘waiting for data’ popup box shown below displays briefly as the information is read. The edit screen will update to reflect the configuration data that has been read.



- When the **Install** entry is selected and the **ENTER** key pressed, the system responds with the following popup prompt:



- Each R/Link I/O module has a **SERVICE** button on the front panel. For the I/O module that is to be configured with the contents on the configuration screen, momentarily press that module's service button. This will cause the configuration data displayed to be written to the I/O Module. Upon completion the I/O Module will restart.



- **Wink** – successful installation of an I/O module may be checked using the WINK function. When this item is selected and the **ENTER** key pressed, the software will strobe the I/O module under configuration. If the module has been properly installed, the front panel's CONTROL and INDICATE LED will both flash once.



- **Status** – when selected and the **ENTER** key pressed, this function reads the I/O status of the module under configuration. The **Waiting for data** popup box shown below displays briefly as the information is read.



- **Etest** - This command performs the same operation as the **Wink** command except it causes the front panel's CONTROL and INDICATE LEDs to continuously flash together every once second. To stop this command's operation press the **ESC** key.



4.4.6.2 File Menu

The File (Alt-F) drop-down menu terminates the I/O Configuration screen and returns to the main configuration screen.



4.4.7 WCP CPU II Port Configuration

See Figure 4-35.

4.4.7.1 Serial Client Ports J1 and J2

The **J1** and **J2 Port** field selection range descriptions are presented in Table 4-7.

Table 4-7 Client Port Field Descriptions

Field Name	Range	Description
Protocol	See Table 4-8	Serial protocol used by client. See Table 4-8
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 MCM client port as clock source
FLG	No and Yes	Synchronous only: YES causes MCM 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(MCM 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

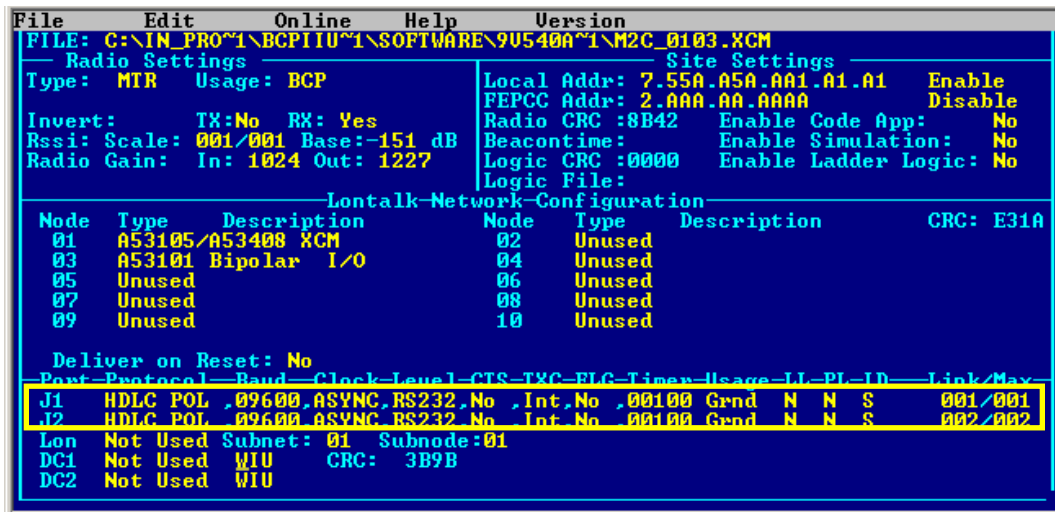


Figure 4-35 Serial Port Protocol Select

Table 4-8 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: typically used to poll ATCS base stations
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

4.4.7.2 IP Addressing

Six protocol assignments require IP addressing.

- These are:
 - ◆ **SLIP**
 - ◆ **FRM RLY**
 - ◆ **PPP**
 - ◆ **PPPMCast**
 - ◆ **GPRS(bu)**
 - ◆ **GPRScont**
- The **IP Address Assignments** screen, Figure 4-36, 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 WCP-II
 - ◆ **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.

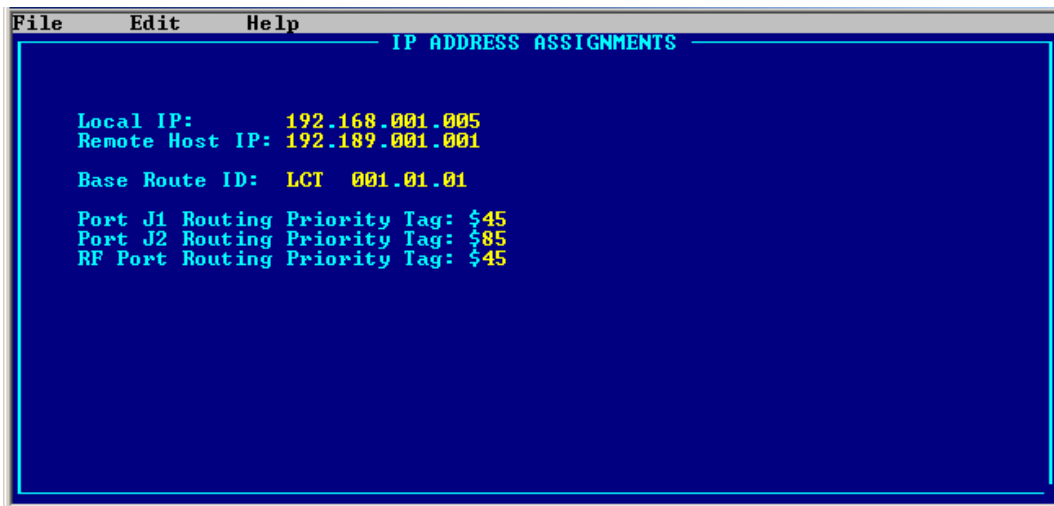


Figure 4-36 IP Address Assignments Screen

4.4.7.3 LON Port

The **Lon Port** field selection ranges are as follows (see Figure 4-37):

- **Not Used**
- **Normal** - Enables LON Port for **R/Link I/O** processing

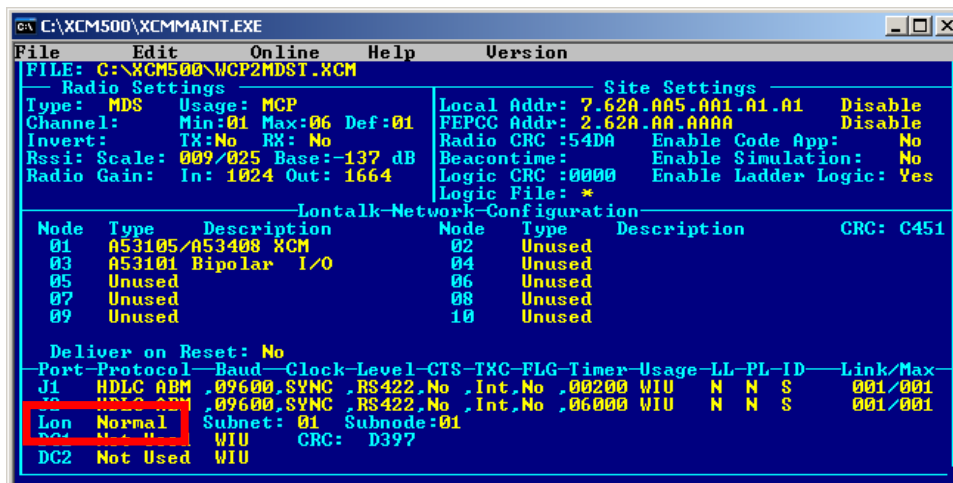


Figure 4-37 LON Enable Select

4.4.7.4 DC1 and DC2 Ports

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

Protocol	Description	Usage
Not Used	Not Used	WIU
506 Code	Emulates DC 506 office protocol. Enter ALT-E to access config screen,	WIU
514 Code	Emulates DC 514 office protocol. Enter ALT-E to access config screen	WIU
J Code	Not supported	WIU
K Code	Not supported	WIU
Alarms	J4 alarms report to office: IN1, IN2, OUT1, OUT2	WIU
Control	Control of Outputs OA and/or OB,	WIU

DC1 refers to the auxiliary I/O ports (IA and IB) which can be configured to drive a DC code line or to report a change of inputs to the office as alarms. When designated (*) codes are selected, **Alt – E** brings up the DC codeline configuration edit screen (see Figure 4-38).

2. The **DC1 and DC2 Port Baud** field selection ranges:

Usage	Description
Ground	Ground network
OBC	mobile application
WIU	WCP application

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

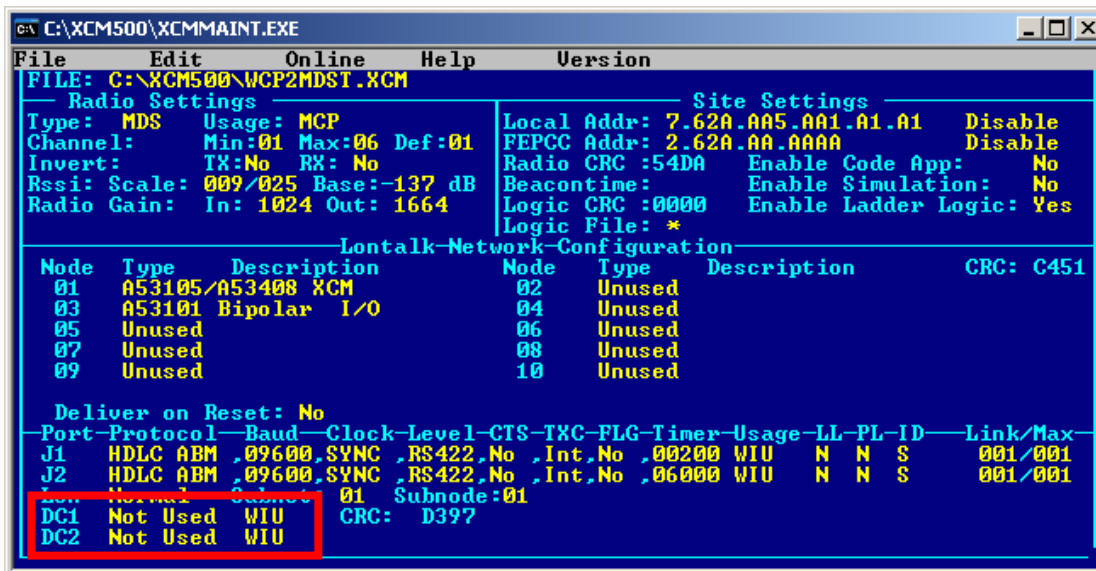


Figure 4-38 DC Protocol Select

4.4.7.5 DC1 Codeline Configuration Screen

1. The Timecode Configuration Screen, Figure 4-39, is divided into two sections: **US&S 5XX Timecode Configuration** and **Station Data**.

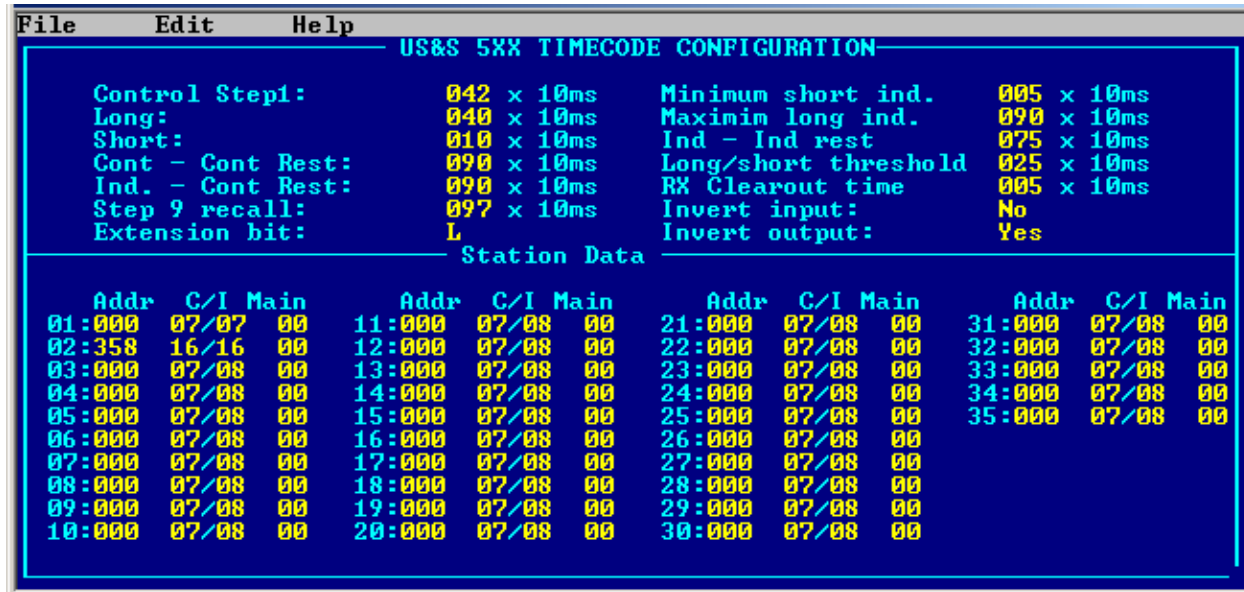


Figure 4-39 DC Codeline Configuration Screen

- a. The **US&S 5XX Timecode Configuration** section provides a means to modify step timing and other parameters as required.
 - b. As described below, a default set of parameters may be applied which will be suitable for most configurations.
1. The **Station Data** section allows entry of station and pup addresses. The fields are filled in as follows:

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





where:

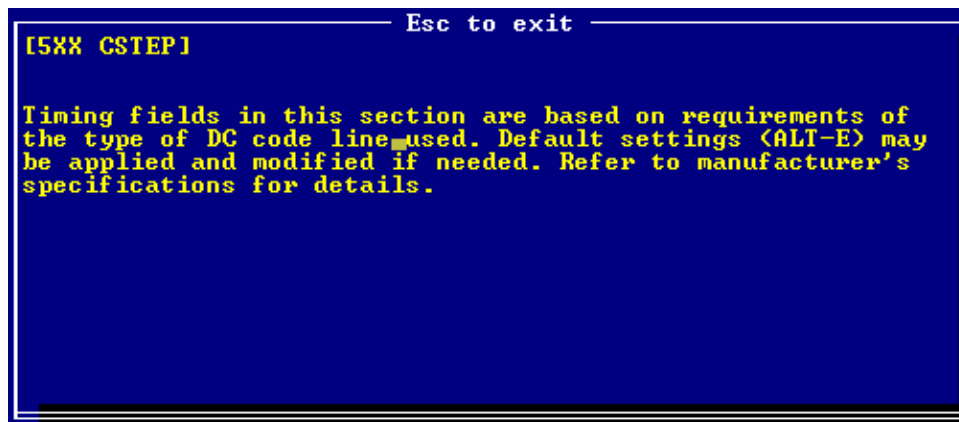
aaa is the 3-digit address of the field unit

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

2. The DC codeline configuration screen, Figure 4-39 has two pull-down menus (File and Edit) and a Help menu.
- a. Pressing ALT-F will display the File menu, which has only the option to return to the main edit screen. Any data on the DC codeline configuration edit screen will be saved when the .XCM file is saved from the main screen.
 
 - b. Pressing ALT-E will display the Edit Menu, which has three options:
 - 1) **Default** - when this option is selected and the **ENTER** key pressed, the most commonly used timing defaults are entered in the Timecode Configuration section. These defaults are shown in Figure 4-31.
 
 - 2) **Copy** - when this option is selected and the **ENTER** key pressed, the contents of all fields on the screen are saved in memory and are held until the XCMMMAINT.EXE utility exits. This is similar to the familiar Windows copy/paste function but is local to the XCMMMAINT.EXE application only. The purpose of this feature is to facilitate multiple copies of identical DC codeline parameters and/or addressing across multiple .XCM files.
 
 - 3) **Paste** - when this option is selected and the **ENTER** key pressed, the fields on the edit screen are filled in with values saved in a previous COPY operation.
 
 - c. Pressing ALT-H provides help text for each configuration parameter on the screen using either of the following 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.



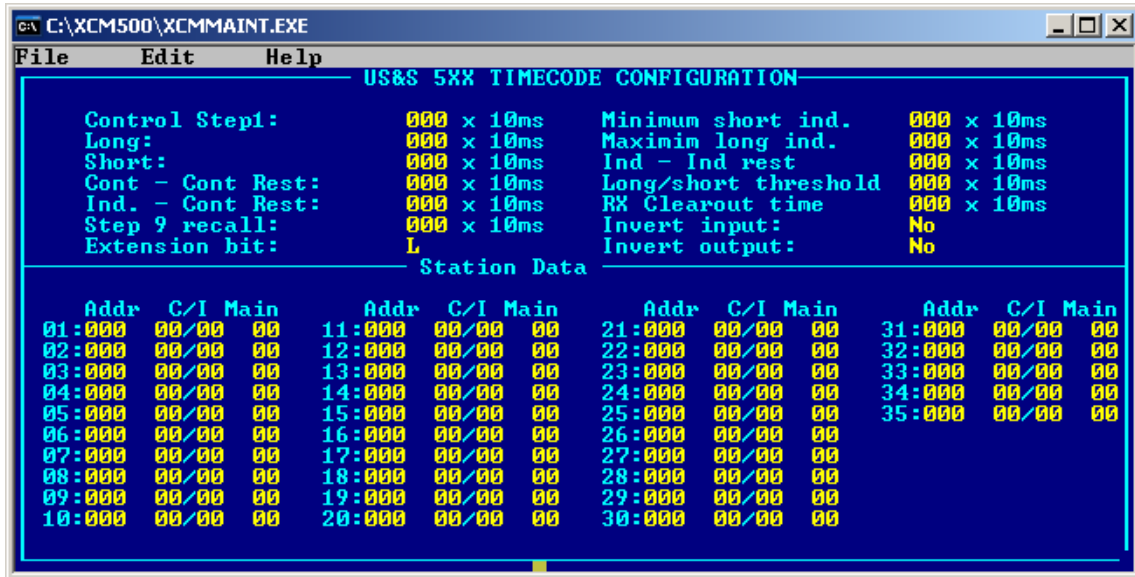


Figure 4-40 Timecode Configuration Default Settings

4.4.7.6 Loading A New Executive

New versions of the executive program are distributed as m2xxxy.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.

4.4.7.7 Installing New Executive Program Version

See Section 3.0.

4.4.7.8 Reinstalling Existing Executive Program Version

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



Go to Section 4.4.7.13 (GF1, GF2, GF4) for the procedure to install an existing executive program.

4.4.7.9 Installing New Xilinx Program Version

See Section 3.0

4.4.7.10 Reinstalling Existing Xilinx Program Version

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

```

      0110AL
Upload file is older version of software, upload canceled.
* Hit <ESC> to continue *

```

Go to Section 4.4.7.13 (GF1, GF2, GF4) for the procedure to install an existing Xilinx program.

4.4.7.11 Installing New DSP Program Version

See Section 3.0

4.4.7.12 Reinstalling Existing DSP Program Version

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

```

      0110AL
Upload file is older version of software, upload canceled.
* Hit <ESC> to continue *

```

Go to Section 4.4.7.13 (GF1, GF2, GF4) for the procedure to install an existing DSP program.

4.4.7.13 GF1, GF2, GF4

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

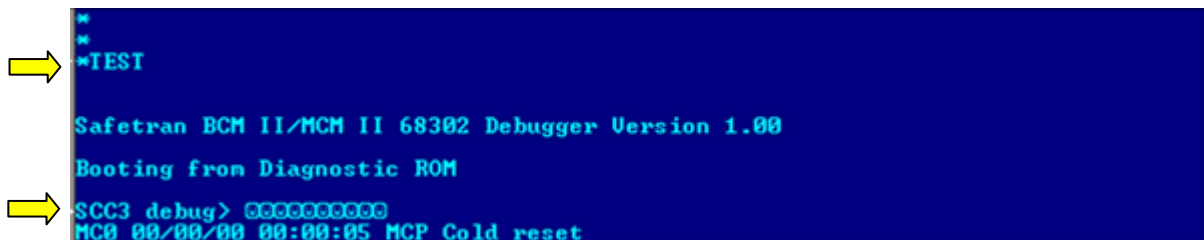
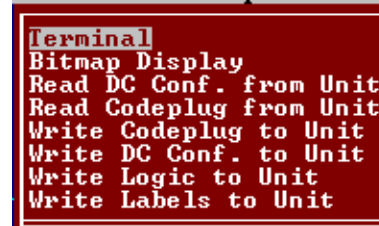
- **GF1** – send and flash Xilinx (Step 12 below)
- **GF2** – send and flash DSP (Step 15 below)
- **GF4** – send and flash executive (Step 9 below)

NOTE

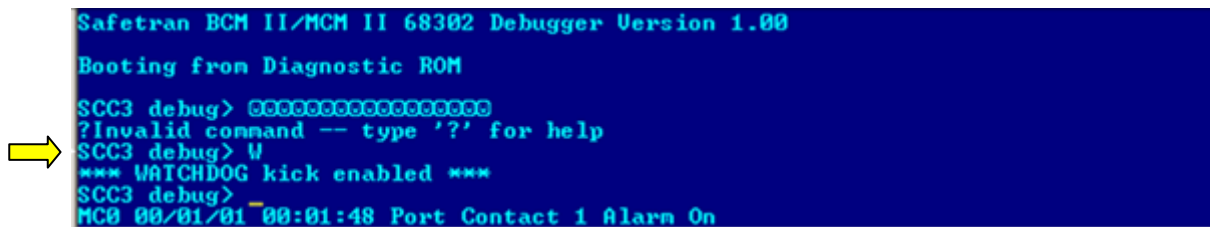
NOTE

File 'xcmaint.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 XCMMMAINT.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. MCM 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:



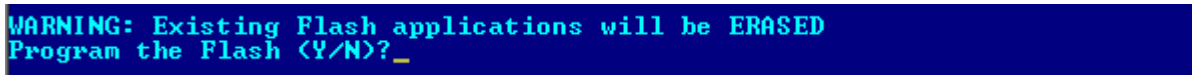
7. When **SCC3 debug>** appears, press **Enter** key
8. Enter **W** followed by **Enter** key to enable kicking of system watchdog.



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.

```

WARN                               Sending Files To XIL
Prog                               File ..\bmbxil\b2x_0104.bin: sent  8%
SCC3
Safe
SCC3 debug> @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

```

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

```

WARNING: Existing Flash applications will be ERASED
Program the Flash (Y/N)?_

```

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.

```

Prog                               Sending Files To DSP
SCC3                               File ..\bmbdsp\b2d10230.bin: sent  31%
Safe
SCC3 debug> @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

```

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

```
WARNING: Existing Flash applications will be ERASED
Program the Flash (Y/N)?_
```

Enter the following:

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

17. Firmware updating is now complete.

SECTION V

DIAGNOSTICS

5.0 DIAGNOSTICS

5.1 SELF TEST

Self test of the WCP CPU II is conducted under the following conditions:

- Power is initially applied
- Requested by the office
- 'TEST' command issued from diagnostic port

Self-test results are reported back to the office.

5.2 ON-LINE TERMINAL

An on-line debugging terminal is built into the XCMMAINT.EXE program (see paragraph 4.2) for extended diagnostics and to access the event log. To access the terminal, use the "ALT-O / Terminal" option from the main XCMMAINT.EXE screen. The commands listed in Table 5-1 are available:

(This listing can also be displayed using the "HELP" command.) When using the "HELP" command, commands that scroll off the screen may be viewed by pressing PAGEUP and PAGEDOWN keys.

Table 5-1 On-Line Terminal Commands

Command	Parameters	Function
DCP	None	Display Code plug Contents
DDC	None	Display DC Configuration
CL	None	Display Client List
SERV	None	Enter Service Mode
VER	None	Version Identification
BSTAT	None	Base Station List
CSTAT	None	Communication Statistics
HSTAT	None	HDLC Statistics
MSTAT	None	Manufacturer Statistics
AL	None	Alarm Logging
LOG	None	View log
SL	None	Status Logging
PTT	EN / DS	Key or De-key Radio
SIMP	EN / DS	Radio Simplex Operation
COS	EN / DS	COS status
CHAN	Number (1 to 6)	Enter Channel Number
LOCAL	Label, Message	Send Local Message
TEST	0 = Warm, 1 = Cold	Reset and self test
PCP	Location, Value	Patch Code plug
MOND	Layer, Port, Link	Disable Tracing Mechanism
MONE	Layer, Port, Link	Enable Tracing Mechanism
SEND	Layer, Port, Link, Message	Send Mobile Message
ERT	Mode, Layer, Port, Pattern	Error Rate Test
SWI	EN / DS	Enable / Disable SWI
LADL	EN/DS	Enable/Disable ladder logic indication/control logging
FPROG	None	Program Code plug
SCT	None	Show HW/SW version info
RSSI	None	Reset RSSI Statistics
RIFRESET	1=mcs, 2=sb, 3=sb reset	Rest MCS/SB9600
PPP	None	PPP Status
PING	IP Addr, client num: 0/1	
DATE	Year, month, day	Set date
TIME	Hour, minute, second	Set time

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 Communications 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.

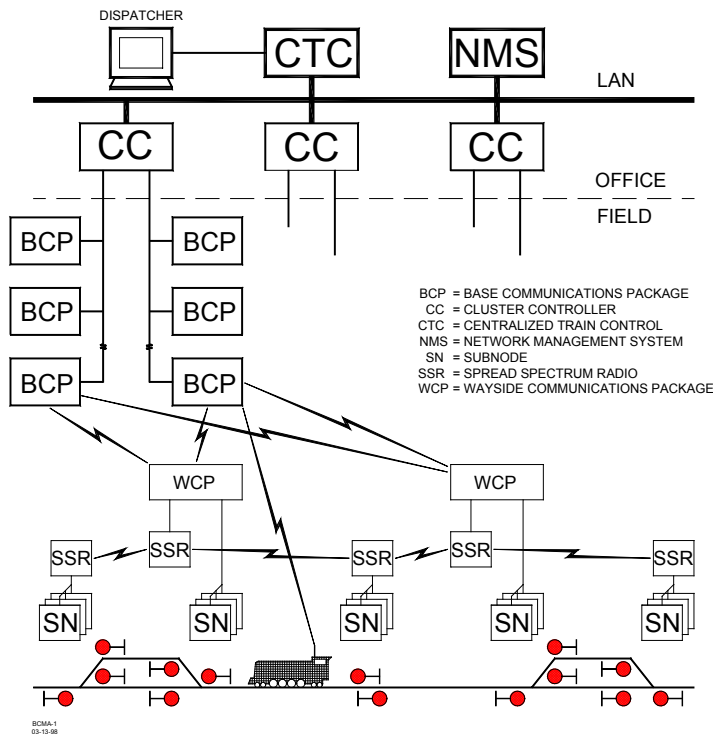


Figure A-1 Typical ATCS Network

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 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 Rail Automation 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 MCP 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.

APPENDIX B

ATCS SPECIFICATION 250 RAILROAD CODE LIST

B. RAILROAD CODE LISTING

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.

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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 Hammondsport 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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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 - Ferrovie 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	GVSF	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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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	Midlouisiana Rail Corporation	MDR	919
298	Midsouth Corporation	MSRC	905
299	Milwaukee Road	MILW	140
300	Minnesota Commercial Railway Co	MNNR	973

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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

ATCS SPECIFICATION 250 RAILROAD CODE LIST

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	Visalla 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

WCP CODEPLUG PARAMETERS

C. WCP CODEPLUG PARAMETERS

Code plug parameters for the WCP Firmware, Version XCM4.05P, 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 (\$).

Figure C-1 WCP CPU II Code Plug Parameters

Location	Description	Default Value
\$01	Manufacturer equipment code	\$01
\$02	ATCS equipment code	\$01
\$02 thru \$09	ATCS address of CC. 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 CC 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 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
\$2E thru \$3C	Not used	Null

Table C-1 Continued

Location	Description	Default Value
\$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

Table C-1 Continued

Location	Description	Default Value
\$86 thru \$87	Maximum number of beacon retries	6
\$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	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
\$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

Table C-1 Continued

Location	Description	Default Value
\$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 = MTR 2000 2 = MSF	1
\$EF	Radio usage	5
\$F0	Minimum radio channel	1
\$F1	Maximum radio channel	6
\$F2 thru \$F7	Radio channel scan sequence. These parameters 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
\$F8	SSI enable	0
\$F9	Minimum SSI	0
\$FA	SSI output scale	0
\$FB	SSI input scale	0
\$FC	SSI simulation	0
\$FD thru \$FF	Not used	
\$100 thru \$103	Port 0 contact failure timer	6000
\$104 thru \$105	Port 0 link address (site ID). Undefined when set to \$FFFF	\$FFFF
\$106 thru \$107	Port 0 group link address	\$FFFF

Table C-1 Continued

Location	Description	Default Value
\$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
\$10B	Port 0 mode 1 - HDLC ADM Mode 2 - HDLC ABM Mode 3 - HDLC Polled Mode 4 - HDLC UI Mode 6 - Null HDLC Mode 7 - Genisys Mode (Office) 8 - SCS-128 Local Control Panel 9 - LonTalk [®] Mode 10 - MCS-1 Mode 11 - ASYNC port packetizer mode 12 - Spread-Spectrum Radio Protocol 13 - US&S 506 Emulation 14 - SCS128 Emulation 15 - Genisys mode (Field)	1
\$10C	Port 0 baud rate. Value = baud rate/300	32
\$10D	Port 0 number of poll response information frames per poll	5
\$10E	Maximum poll address	0
\$10F	Alternate task number (special application)	\$FF
\$110 thru \$111	Other link address	\$FFFF
\$112 thru \$115	General purpose timer value. Used for either locomotive ID unit receive time-out or code line protocol poll timer. Recommended values: Port mode: Genisys, SCS-128, MCS-1 = \$000000A0 LonTalk [®] Mode = \$00000F00	
\$116 thru \$119	Port 1 contact failure timer	6000
\$11A thru \$11B	Port 1 link address (site ID). Undefined when set to \$FFFF	\$FFFF

Table C-1 Continued

Location	Description	Default Value
\$11C thru \$11D	Port 1 group link address	\$FFFF
\$11E	Port 1 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
\$11F	Port 1 usage 5 - Ground equipment 6 - OBC equipment 18 - WIU equipment \$FF - Not used	18
\$120	Port 1 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
\$121	Port 1 mode 1 - HDLC ADM Mode 2 - HDLC ABM Mode 3 - HDLC Polled Mode 4 - HDLC UI Mode 6 - Null HDLC Mode 7 - Genisys Mode (Office) 8 - SCS-128 Local Control Panel 9 - LonTalk [®] Mode 10 - MCS-1 Mode 11 - ASYNC port packetizer mode 12 - Spread-Spectrum Radio Protocol 13 - US&S 506 Emulation 14 - SCS128 Emulation 15 - Genisys mode (Field)	1
\$122	Port 1 baud rate. Value = baud rate/300	32
\$123	Port 1 number of poll response information frames per poll	5
\$124	Maximum Poll Address	0
\$125	Alternate task number (special application)	\$FF
\$126 thru \$127	Other link address	\$FFFF
\$128 thru \$12B	General purpose timer value. Used for either locomotive ID unit receive time-out or code line protocol poll timer	\$FFFFFFFF
\$12C thru \$141	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

Table C-1 Continued

Location	Description	Default Value
\$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
\$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

Table C-1 Continued

Location	Description	Default Value
\$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
\$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

Table C-1 Concluded

Location	Description	Default Value
\$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.	
\$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. Format: Unsigned integer. This parameter is the CRC for the restricted code plug area.	\$DEAD

APPENDIX D

GENERIC GROUNDING PROCEDURES

D. GENERIC GROUNDING PROCEDURES

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.1 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

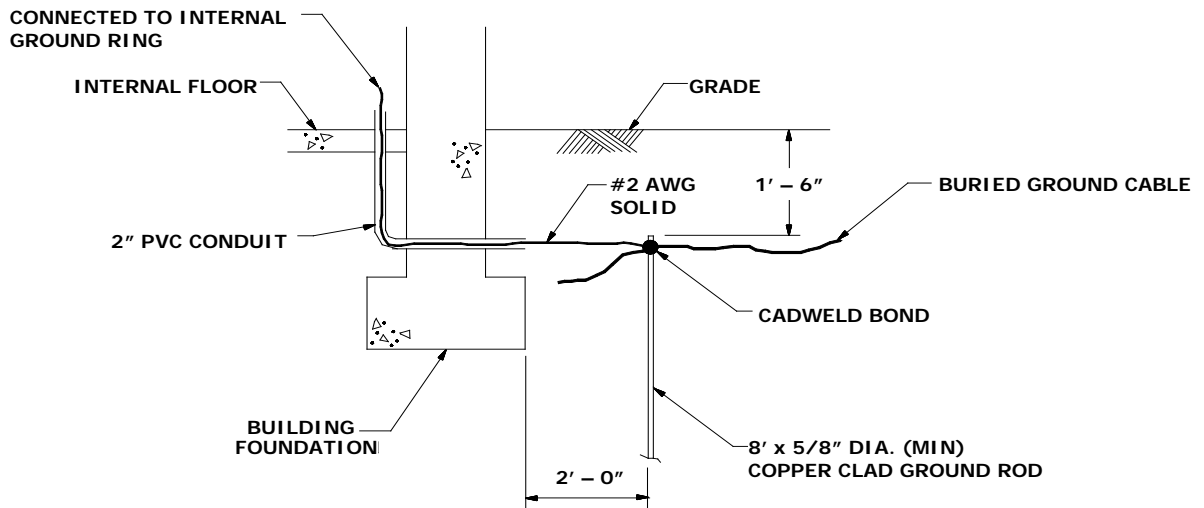
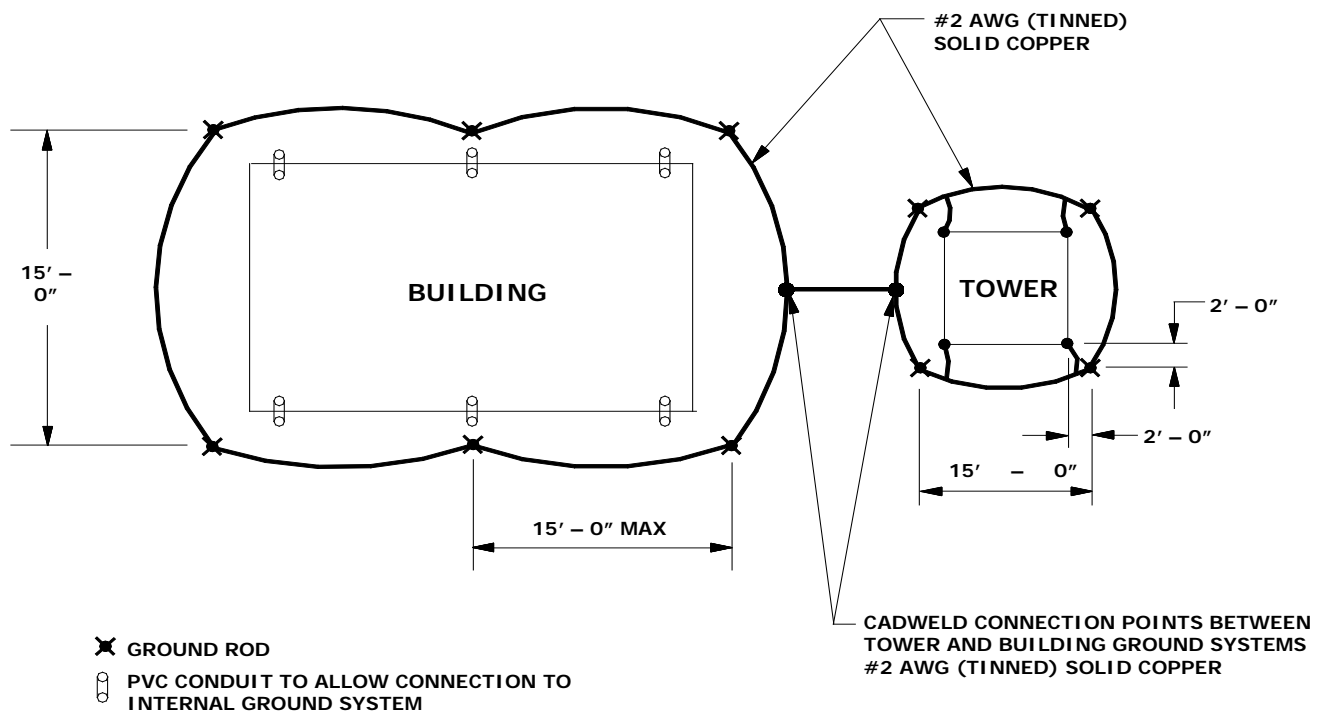


Figure D-1 Typical External Ground Connections

D.2 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).

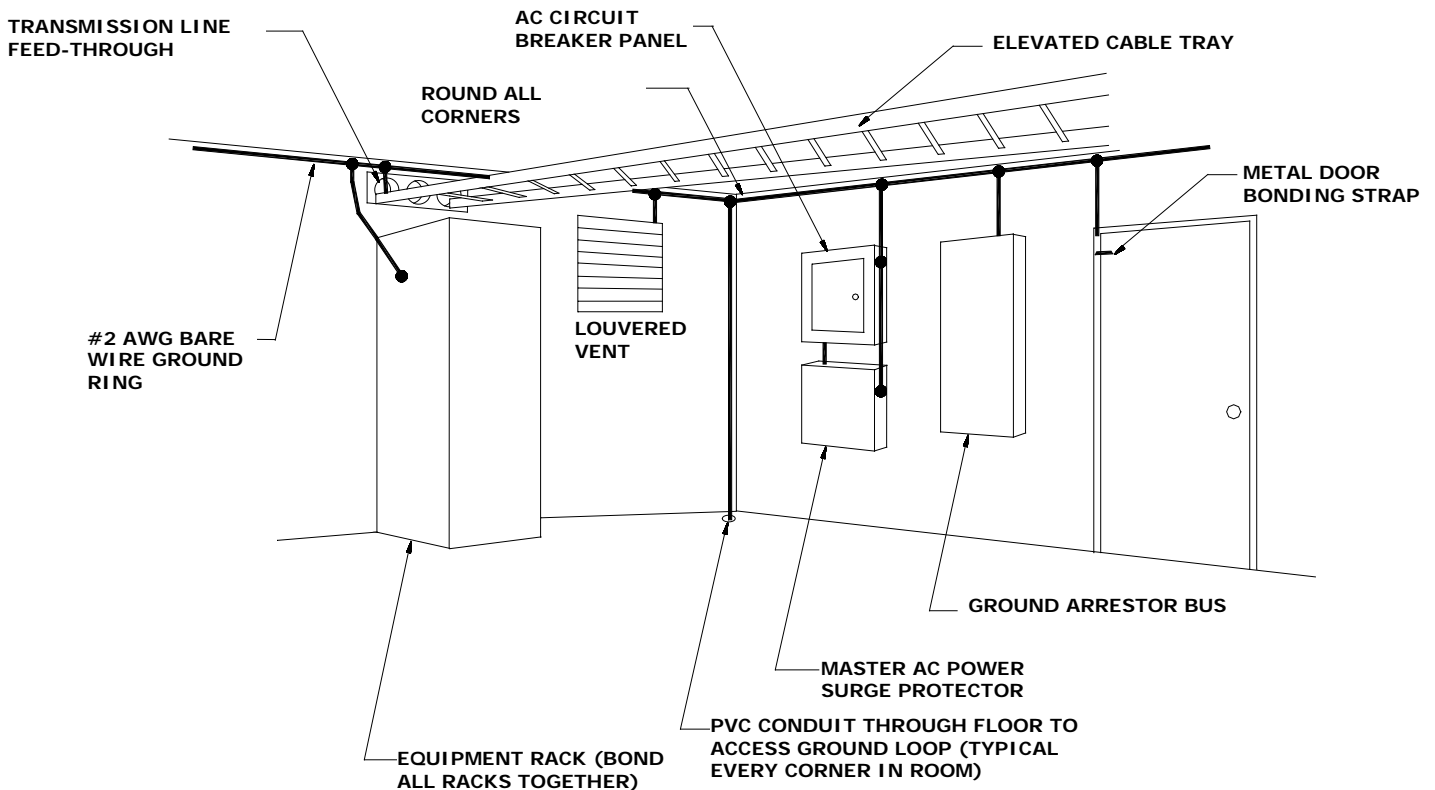


Figure D-2 Typical Internal Ground Connections

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.2.1 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 Heliac 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 Heliac should be bonded to the internal ground ring.

D.2.2 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 Heliac 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.

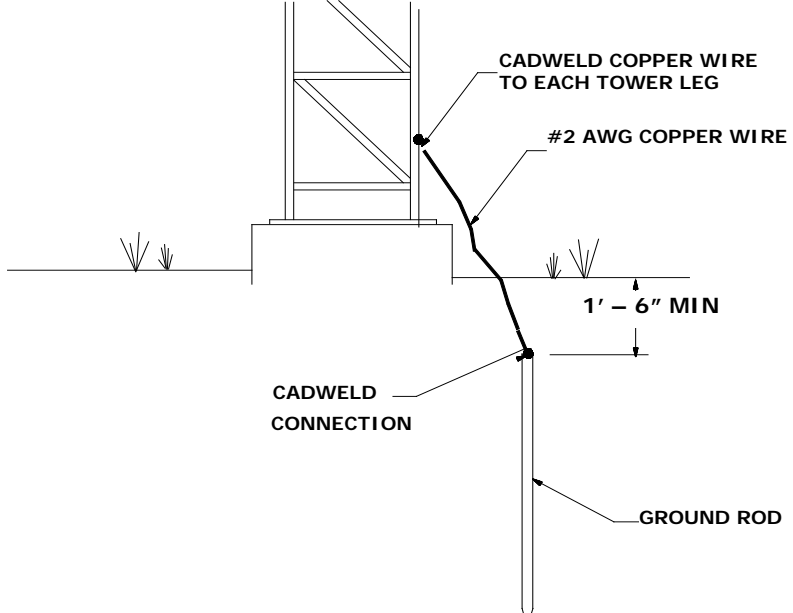
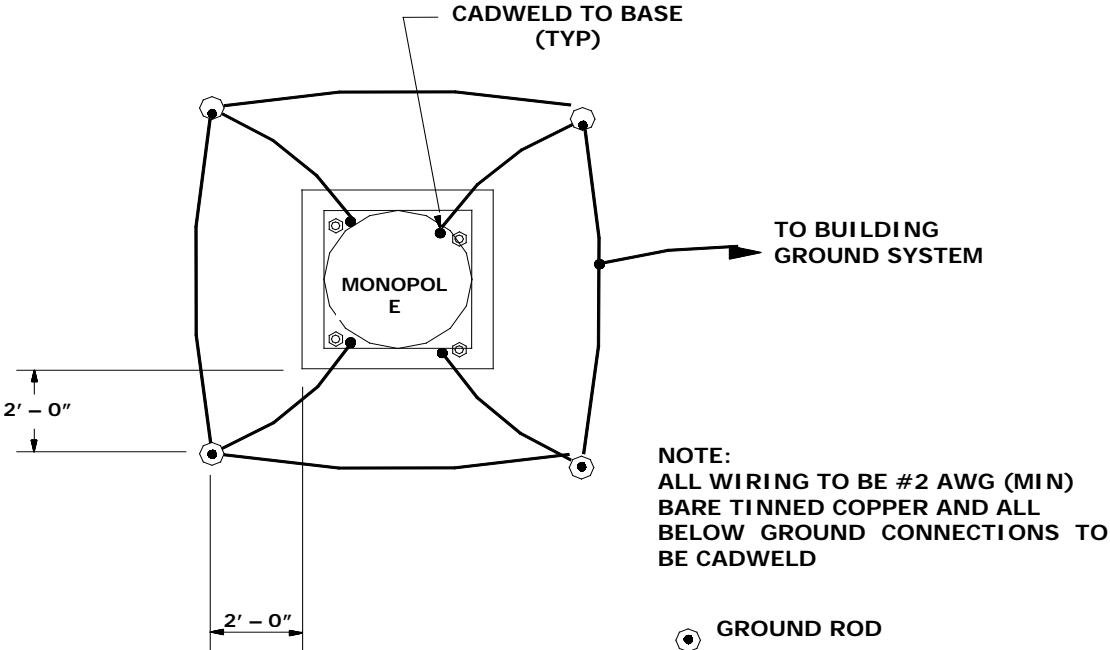


Figure D-3 Typical Tower and Pole Ground Connections

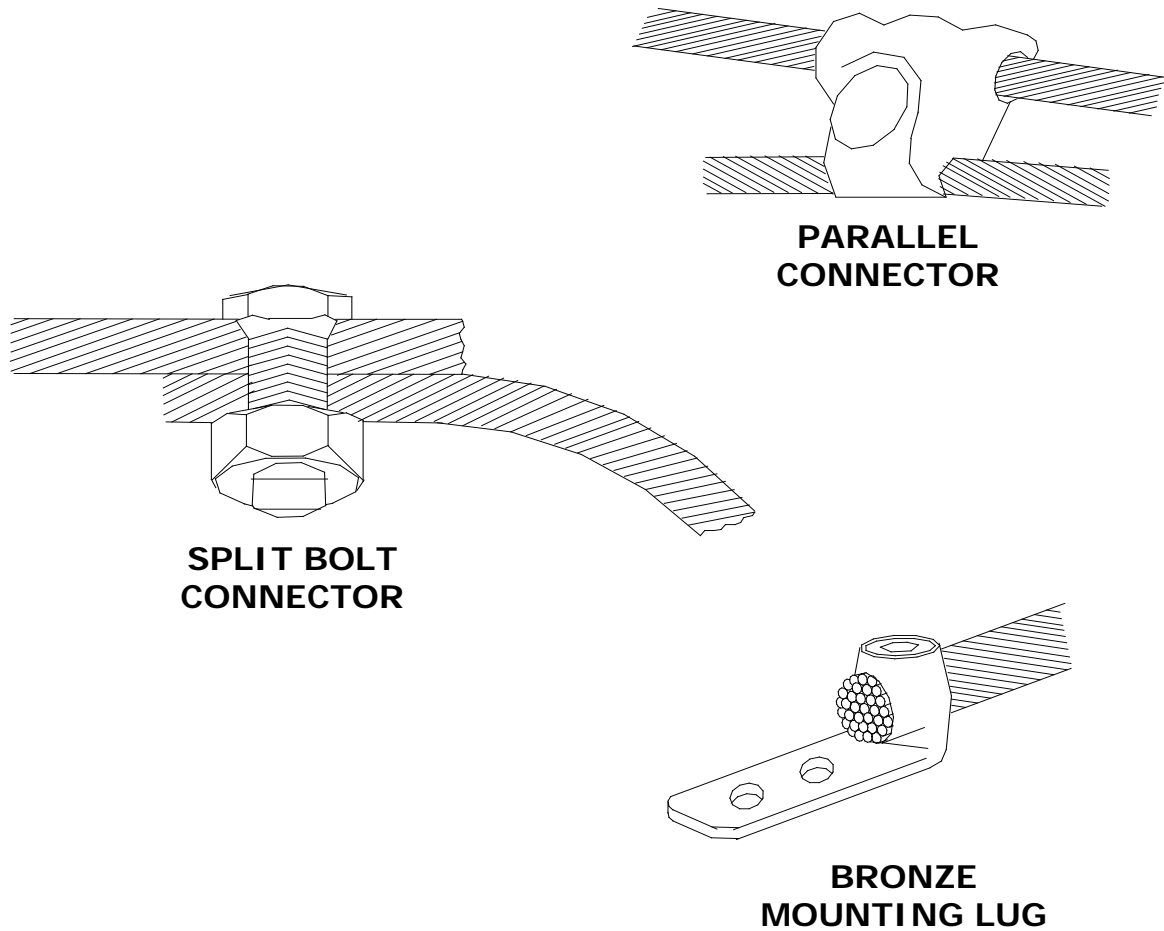


Figure D-4 Typical Connections for Grounding and Bonding

D.3 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.4 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.5 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.6 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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