SIEMENS

INSTALLATION

A53411 WAYSIDE COMMUNICATIONS PACKAGE (WCP)

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FCC RULES COMPLIANCE

The equipment covered in this manual has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference 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 own expense.

FCC PART 90 AND PART 101 REQUIREMENTS

This device contains a radio transceiver which operates under Parts 90.210 and 101.101 of the FCC rules in a licensed part of the radio spectrum. It is the user's responsibility to obtain required licensing and authorization to operate this device. Qualified personnel must perform service or repairs to the radio portion of this device. Any unauthorized modification to the radio module, shielding, or antenna system may void the user's authority to operate this device.

RF EXPOSURE WARNING 

All antenna installation and servicing is to be performed by qualified technical personnel only. When servicing or working at distances closer than 10 feet (3.05 meters), ensure the transmitter has been disabled. Depending upon the application and the gain of the antenna, the total composite power could exceed 200 watts EIRP. The antenna location should be such that only qualified technical personnel can access it, and under normal operating conditions no other person can come in contact or approach within 10 feet (3.05 meters) of the antenna.

More information on RF exposure can be found online at the following website:
www.fcc.gov/oet/info/documents/bulletins.

This device complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission, 47 CFR part 2 sub-part J
- American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard, 2003
- ANATEL, Brasil Regulatory Authority, Resolution 256 (April 11, 2001)

DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	11-17-98		Initial Release
B	7-23-01		Revision to reflect upgrade from WCP CPU to WCP CPU II
C	9-21-05		Revision to reflect MCP Cab Radio package
D	4-16-13	Entire Book	Revision to reflect MDS Radio replacement of MCS2000 Update XCMMAINT software information
E	9-6-13	Entire Book	Revision to reflect MDS SD9 Radio Update XCMMAINT software information Rebrand book to Siemens Rail Automation
E.1	5-15-14	Entire Book	Remove old branding references
E.2	10-15-18	Figure 4-7	Updated Pin 2 and 14 (the values TXD + and TXD - were reversed). Updated graphics and content to include the Ritron radio. Updated Chapter 6 with Windows software tool: MCM II Config.
E.3	12-4-18	Figure 3-4 Figure 4-3 Figure 5-5	Update power connector on Figure 3-4, Figure 4-3 and Figure 5-5. Updated temperature range on Ritron radio per Ritron manual. Updated Ritron radio dimensions.

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NOTES, CAUTIONS, AND WARNINGS

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

WARNING

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

CAUTION

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

NOTE

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

If there are any questions, contact Siemens Rail Automation Corporation 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/inserter tools designed to remove and install electrostatic-sensitive integrated circuit devices such as PROM's (OK Industries, Inc., Model EX-2 Extractor and Model MOS-40 Inserter (or equivalent) are highly recommended).
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

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:	Association of American Railroads - An organization that establishes uniformity and standardization among different railroad systems.
ABM:	Asynchronous Balance Mode – Used as an identifier for a HDLC protocol.
ADM:	Asynchronous Disconnect Mode – Used as an identifier for a HDLC protocol.
AEI:	Automatic Equipment Identification - Equipment installed at sites along the track to read and report train consist information.
ARES:	Advanced Railroad Electronics System - Made by Rockwell International as an alternative to AAR ATCS.
ATCS:	Advanced Train Control System - A set of standards compiled by the AAR for controlling all aspects of train operation.
BCM II:	Base Control Module II – The Safetran 53444 assembly that centrally controls the functions of the BCP II.
BCP II:	Base Communications Package II - Defined by the ATCS specifications as the transmitter / receiver base station and associated processors to handle communications between mobile and central office equipment.
BER:	Bit Error Rate - Expresses the quality of a communications in the number of errors per bits sent.
BPSK:	Binary Phase Shift Keying - 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:	Cluster Controller - 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:	Central Protocol Converter - 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:	Cyclic Redundancy Check - 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:	Cut Section SAT - 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:	Carrier-Sense-Multiple-Access/Collision Avoidance - A scheme for allowing multiple transmitters sharing a single medium to cooperatively timeshare with a minimum of overlap and interference.

GLOSSARY

CTC:	Central Traffic Control System
CTS:	Clear To Send
DAX:	Downstream Adjacent Crossing - 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.
dBi:	Abbreviation for decibels referenced to an isotropic (unipole) antenna.
dBm:	Abbreviation for decibels above (or below) one milliwatt.
DCE:	Data Communications Equipment - 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:	Diagnostic Terminal - A DOS-based PC utility for configuring a module and reading status and diagnostic information.
DTE:	Data Terminal Equipment - Any device (printer, terminal, PC, host computer) that originates or consumes data over a transmission facility.
ECD:	External Configuration Device - The EEPROM on the interface connector used for storing the module configuration data.
EIA:	Electronics Industries Association - A standards organization in the U.S. specializing in the electrical and functional characteristics of interface equipment.
ECP:	Emergency Control Protocol
ERP:	Effective Radiated Power - 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:	Front End Processor - An ATCS ground network node responsible for providing network access to ground host and terminal users (provides network interfacing).
FIFO:	First In, First Out - A buffer or shift register configured so that the first data queued is the first data dequeued - i.e. the sequence is preserved.
FSK:	Frequency Shift Keying - A baseband modulation technique that conveys digital information over analog facilities by associative discrete logical states with pre-defined frequencies.

GLOSSARY

GMSK:	Gausian Mask Shift Keying - A complex signal conditioning process employed by the BCM II prior to audio transmission.
GENI (F):	Genesys Field Protocol
GENI (O):	Genesys Office Protocol
GTC:	Ground Terminal Computer
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:	Hardware Description Files - A utility file for configuring a module and reading status and diagnostic information.
HDLC:	High-level Data Link Control - A serial protocol for exchanging synchronous information.
IDTU:	Installers Diagnostic Terminal Utility - 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:	Internet Protocol - ISO Model Layer 3 (network) protocol that performs proper routing of packets.
LAN:	Local Area Network - 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:	Light Out Detector - 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:	Module Configuration File - The HD/LINK configuration software.
MCI:	Module Configuration Information - The collection of database records that represents the MCF data.
MCP/WCP:	Mobile/Wayside Communications Package - The radio and associated processor used by mobile and wayside ATCS compatible equipment to communicate to the central office.

GLOSSARY

MCP:	Mobile Communications Package - The radio and associated processor used by mobile ATCS compatible equipment to communicate to the central office.
MCS:	Harmon Protocol
MCS2000	Discontinued Motorola 900MHz radio used in the legacy WCP units.
MDF:	Module Description Files – The configuration and capability information for the MEF.
MDS SD9	Microwave Data Systems SD9 - 900 MHz radio used in WCP
MEF:	Module Executable File - The HD/LINK executable software.
MSB:	Most Significant Bit of a binary number (having the greatest numerical weight)
NUL:	Null – 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	Polled – Used as an identifier for a HDLC protocol.
PN CODE:	Pseudo Noise code - 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:	Quadrature Phase Shift Keying - A method of modulating a carrier signal in such a way that each cycle carries four bits of information.
RCI:	Receive Clock In
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:	Received Signal Strength Indication - A numerical value indicating the relative strength of received carrier.
RTS:	Ready To Send
RTU:	Remote Terminal Unit - Also known as Field Code Unit or Code Unit. Used to perform non-vital I/O under control of a central office unit.
RXD:	Receive Data
SAT:	Signaling Application Task - A Virtual Circuit of cut sections.

GLOSSARY

SB9600:	A specification for a proprietary 2-wire data bus used bus Motorola for control and programming of microprocessor-based two-way radio equipment.
SCM:	System Control Module – The module within a Motorola ATCS base station that centrally controls the functions of the transceiver and all other components of the station.
SCS:	Safetran Code System
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:	Site (Subnode) Identification Number - 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:	Signal Strength Indicator - A measure of the relative strength of an incoming RF signal when it was received by a BCP II.
SSR:	Spread Spectrum Radio - 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:	Transmit Clock In
TCO:	Transmit Clock Out
TCP/IP:	Transmission Control Protocol / Internet Protocol - 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:	Transmit Data
UAX:	Upstream Adjacent Crossing - A control indication typically driven from a remote GCP (DAX) location.
UCN:	Unique Check Number - 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:	User Datagram Protocol - A transport protocol used primarily for the transmission of network management information. Not as reliable as TCP.
VCE:	Virtual Circuit Editor - 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:	Vital Parallel Input – A module input circuit the function of which affects the safety of train operation.

GLOSSARY

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

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SECTION I - INTRODUCTION

1.0 INTRODUCTION

1.1 SCOPE

WARNING

THE 53411 WAYSIDE COMMUNICATIONS PACKAGE (WCP) IS A NON-VITAL PRODUCT.

This manual is the installation guide for the Siemens 53411 Wayside Communications Package (WCP) Radio System. The WCP includes the 53105 Wayside Communications package Central Processing Unit II (WCP CPU II), the 53412 WCP Radio, and the 53106 DC-TO-DC Converter (see Figure 1-1).

NOTE

The A53470 Mobile Communications Package (MCP) Cab Radio covered in previous versions of this manual are now covered in the MCP Cab Radio manual (Siemens Document Number: COM-00-09-08).

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

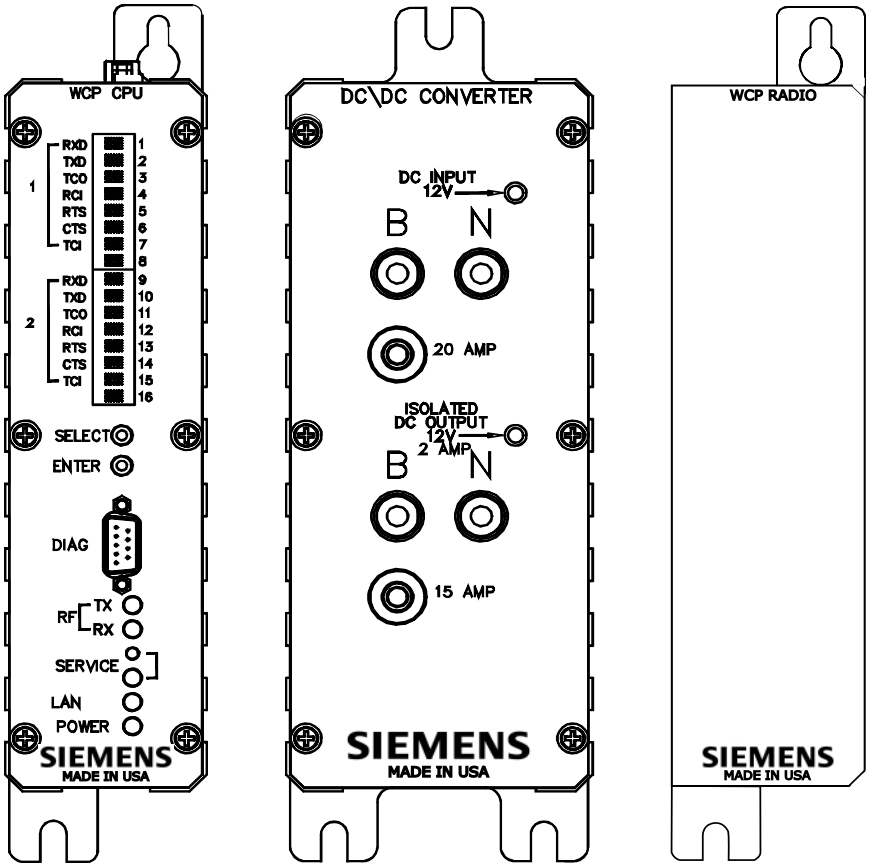

Figure 1-1 Wayside Communications Package (WCP)

1.2 APPLICABLE DOCUMENTS

Refer to the following documentation for individual information on the WCP components:

1. Wayside Communications Package Central Processing Unit II (WCP CPU II) Installation & Operation Manual (Siemens Document No. COM-00-97-10)
2. MDS™ SD9 Data Radio Service Instructions (MDS Publication MDS 05-4846A01, Rev G)
3. Ritron™ Models DTX 9650 Series Programmable FM Transceiver Modules Maintenance & Operating Manual.

1.3 SYSTEM FEATURES

- Separate modules provided with the 53411 package simplify system maintenance issues and provide for more flexible installation options.
- RS-232 / RS-422 connection option on two client ports.
- 16-character front-panel display provides clear diagnostic messages.
- High-speed (1.2Mb/s) client LAN port allows WCP to directly connect to other Siemens Mobility vital and non-vital I/O modules concurrently.
- Front-panel push-button configuration – no laptop needed during routine maintenance.
- Outbound RSSI reading provides additional system information of signal strength at WCP location.
- 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.
- Half duplexer operation at 4800 baud using GMSK direct FM signaling with extensive error detection and correction .
- 900 MHz transmitter frequency.

1.4 SPECIFICATIONS

1.4.1 WCP CPU II - A53105

Input Voltage:	9V to 36VDC
Input Isolation:	2000V rms
Power Consumption:	295mA @ 13.8V
Dimensions:	8.82 inches (22.4 centimeters) Height 2.44 inches (6.2 centimeters) Width 9.57 inches (24.31 centimeters) Depth
Weight:	4.63 pounds (2.1 kilograms)
Operating Temperature Range:	-40 °F to +160 °F (-40 °C to +70 °C)

1.4.2 WCP Radio- A53412

1.4.2.1 MDS™ SD9 Radio

Dimensions:	8.72 inches (22.15 centimeters) Height 2.3 inches (5.84 centimeters) Width 10.12 inches (25.7 centimeters) Depth
Input Voltage:	10V to 30VDC
Power Consumption:	RX: 125mA @ 13.8V TX @ 5Watts RF (SD9): 2.5A @ 13.8V TX @ 30 Watts RF Output (SD9 + RF Amp): 10.8 A @ 13.8V
Weight:	7.4 pounds (3.4 kilograms)
Operating Temperature Range:	-40 °F to +160 °F (-40 °C to +70 °C)

1.4.2.2 Ritron™ DTX 9650 Radio

Dimensions	8.72 inches (22.15 centimeters) Height 2.51 inches (6.4 centimeters) Width 10.12 inches (25.7 centimeters) Depth
Input Voltage:	11V to 16VDC
Power Consumption:	RX: 150mA @ 11-16 V TX @ 5 Watts: 3.9A @ 12.5V TX @ 15 Watts: 5.8 A @ 12.5V TX @ 30 Watts: 8.9 A @ 12.5V
Weight	6.4 pounds (2.9 kilograms)
Operating Temperature Range	-40 ºF to +160 ºF (-40 ºC to +70 ºC)

1.4.3 DC-TO-DC Converters - A53106-00XX

DC Input Voltage:	53106-00**X**1: 12VDC 53106-00**X**2: 24VDC 53106-00**X**3: 12VDC 53106-00**X**4: 24VDC 53106-00**X**5: 10-36VDC
DC Output Voltage:	53106-00**X**1: 12VDC 53106-00**X**2: 12VDC 53106-00**X**3: 12VDC 53106-00**X**4: 12VDC 53106-00**X**5: 13.8VDC
Power Rating:	53106-00**X**1: 150 W (maximum) 53106-00**X**2: 150 W (maximum) 53106-00**X**3: 75 W (maximum) 53106-00**X**4: 220 W (maximum) 53106-00**X**5: 200 W (maximum)
Dimensions:	8.8 inches (22.35 centimeters) Height 3.68 inches (9.35 centimeters) Width 9.55 inches (24.26 centimeters) Depth
Weight:	7.97 pounds (3.62 kilograms)
Operating Temperature Range:	-40 °F to +160 °F (-40 °C to +70 °C)

X = 0 - Converter is configured for Chassis Ground
X = 1 - Converter is configured for Floating Ground

1.4.4 Wayside Communications Package - A53411

Dimensions:	10.73 inches (27.24 centimeters) Height (approximately) 19 inches (48.26 centimeters) Width (standard rack mount) 16.5 inches (41.9 centimeters) Depth
Approx. Rack Weight:	34 pounds (15.3 kilograms)
Approx. Package Weight:	53.66 pounds (24.23 kilograms)

1.5 ORDERING INFORMATION

1.5.1 Configuration Options

The various configuration options available for the WCP are provided in the WCP Configuration Chart, Figure 1-2. To order, specify the basic WCP part number (9000-53411) plus the applicable dash numbers. Refer also to paragraph 5.2.

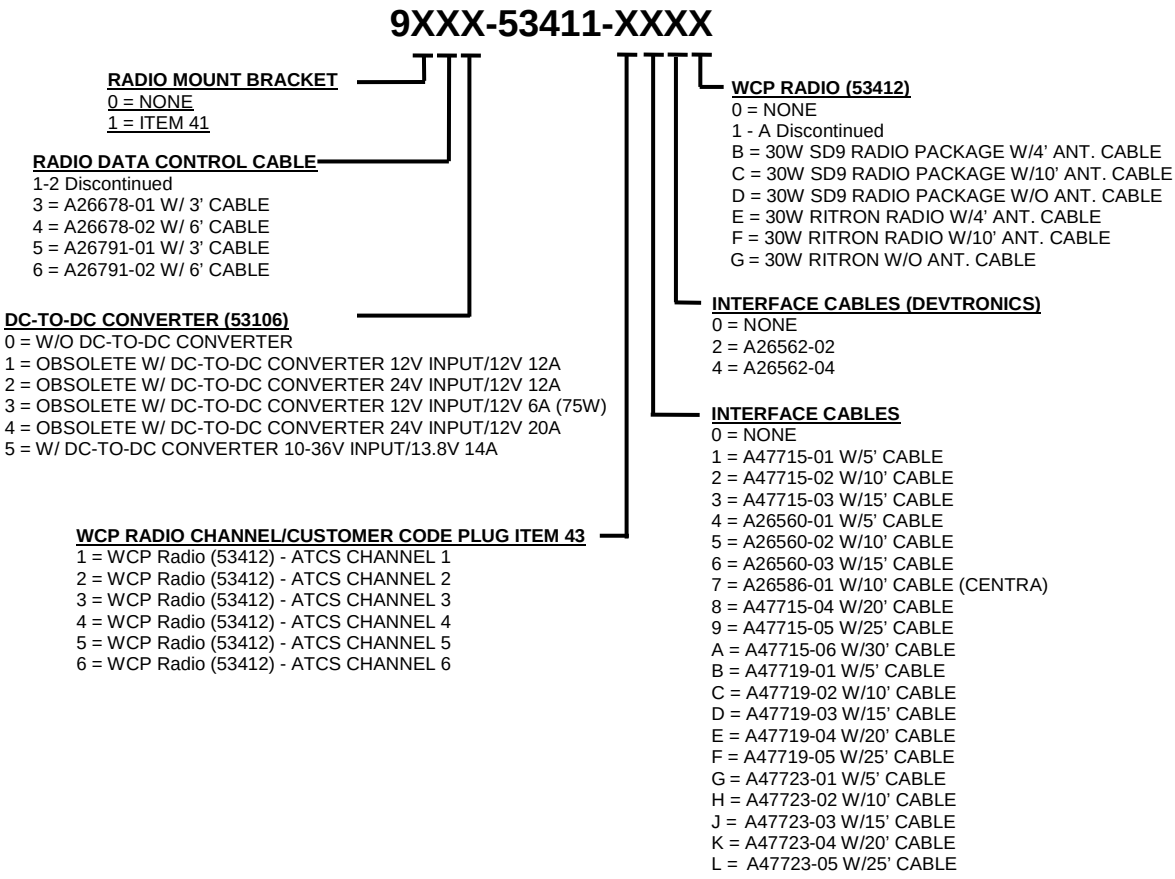

Figure 1-2 WCP Configuration Chart

1.5.2 Interconnection Cables and Connectors

The interconnection cables and connectors for the WCP are listed in Table 1-1. See also paragraph 4.3

Table 1-1 Interconnection Cables and Accessories

Description	Quantity Included	Siemens Order Number
Dual-lead, DC-power cable with 20A in-line fuse	1	Z706-02006-0000
8-pin power & I/O connector	1	Z715-09038-0008
MCM to MDS9710 Radio Data Control cable, 3 foot, Back Shell	1	9000-26678-0001
MCM to MDS9710 Radio Data Control, 6 foot, Back Shell	1	9000-26678-0002
SD9 Radio Data Control, 3 foot, Molded	1	9000-26678-0003
SD9 Radio Data Control, 6 foot, Molded	1	9000-26678-0004
CPU II to Ritron Radio Data Control, 3 foot, Molded	1	9000-26791-0001
CPU II to Ritron Radio Data Control, 6 foot, Molded	1	9000-26791-0002

1.5.3 RF Cable and Antenna Installation Options

The RF cable and antenna installation options available for the WCP Radio are listed in Table 1-2.

Table 1-2 RF Cable and Installation Material Options

Description	Quantity Included	Siemens Order Number
Yagi antenna	1	Z913-00001-0000
Antenna mast mount, 90 degree. Accommodates masts up to 2.38 inch in diameter.	1	Z801-08468-0000
Pole mast mounting bracket. Accommodates masts between 1.5 and 3.5 inches.	1	Z801-08469-0000
Coaxial RF cable, ½ inch, 50-ohm, foam dielectric	*	Z935-00006-0000
Coaxial RF cable, 7/8 inch, 50-ohm foam dielectric	*	Z935-00008-0000
Coaxial RF cable assembly, 4 foot, ½ inch, 50 ohm super flexible foam dielectric, type mini-UHF male to type N male	1	9000-26561-0001
Coaxial RF cable assembly, 3 foot, ½ inch, 50 ohm super flexible foam dielectric, type N male to type N male	1	Z801-08460-0000
Coaxial RF cable assembly, 10 foot, ½ inch , 50 ohm super flexible foam dielectric, type N male to type N male	1	Z801-08474-0000
Antenna surge arrester, bulkhead mount	1	Z803-22710-0000
RF multi-hit arrester, panel mount	1	Z803-22721-0000
Multi-hit arrester mounting hardware kit	1	Z803-22722-0000

Table 1-2 Continued

Wall feed-through for ½ inch cable	1	Z918-00012-0000
Connector, type N female, for ½ inch RF cable	1	Z709-01006-0000
Connector, type N male, for ½ inch RF cable	1	Z709-01007-0000
Connector, type N male, for 7/8 inch cable	1	Z709-01011-0000
Connector, type N female, for 7/8 inch RF cable	1	Z709-01012-0000
Grounding kit for ½ inch cable	1	Z801-08458-0000
Grounding kit for 7/8 inch cable	1	Z801-08470-0000
Weatherproofing tubing for Bulk-head RF arrester connector, type N to ½ inch RF cable	1	Z801-08462-0000
Weatherproofing tubing for Yagi antenna connector, type N to ½ inch RF cable	1	Z801-08461-0000
Weatherproofing tubing for Bulk-head RF arrester connector, type N to 3/8 inch RF cable	1	Z801-08471-0000
Weatherproofing tubing for Yagi antenna connector, type N to 3/8 inch RF cable	1	Z801-08472-0000
RF multi-hit arrester, panel mount	1	Z803-22721-0000
Hangers for ½ inch cable	10	Z801-08473-0000
Hangers for 7/8 inch cable	10	Z801-08473-0000
D connector/splice weather proofing kit	1	Z801-08467-0000
Band clamp, 2 to 3 inch diameter	10	Z918-00013-0000
* Quantity determined by installation requirements		

1.5.4 DC-to-DC Converter Options

The A53106 DC-to-DC Converter options are determined by the input power available to the WCP Radio. A53106 DC-to-DC Converter options available for the WCP Radio are listed in Table 1-3.

NOTE

NOTE

DC-to-DC converters part numbers: 9000-53106-0001, 9000-53106-0002, 9000-53106-0003, and 9000-53106-0004 are discontinued and no longer available for purchase.

Table 1-3 A53106 Dc-to-DC Converter Options

Description	Quantity Included	Siemens Order Number
Obsolete 12 VDC to 12 VDC Converter 150 Watts, Chassis Ground	1	9000-53106-0001
Obsolete 12 VDC to 12 VDC Converter 150 Watts, Floating Ground	1	9000-53106-0011
Obsolete 24 VDC to 12 VDC Converter 150 Watts, Chassis Ground	1	9000-53106-0002
Obsolete 24 VDC to 12 VDC Converter 150 Watts, Floating Ground	1	9000-53106-0012
Obsolete 12 VDC to 12 VDC Converter 75 Watts, Chassis Ground	1	9000-53106-0003
Obsolete 12 VDC to 12 VDC Converter 75 Watts, Floating Ground	1	9000-53106-0013
Obsolete 24 VDC to 12 VDC Converter 220 Watts, Chassis Ground	1	9000-53106-0004
Obsolete 24 VDC to 12 VDC Converter 220 Watts, Floating Ground	1	9000-53106-0014
10-36 VDC to 13.8 VDC Converter 200 Watts, Chassis Ground	1	9000-53106-0005
10-36 VDC to 13.8 VDC Converter 200 Watts, Floating Ground	1	9000-53106-0015

SECTION II - FUNCTIONAL DESCRIPTION

2.0 FUNCTIONAL DESCRIPTION

2.1 WCP OVERVIEW

The WCP Radio is used in an Advanced Trains Control System (ATCS) data network (See Appendix A) to perform the following general functions:

- Provide the interface between Base Control Package (BCP) and "downstream" field equipment
- Deliver ATCS messages to and receive messages from field equipment via an RF link
- Deliver application messages to and receive messages from vital and non-vital code units and RS-232/RS-422 communication devices via the serial port
- Provide the interface to optional Echelon® LonTalk® for local I/O or ancillary functions

2.2 WCP RADIO FUNCTIONAL DESCRIPTION

The main functional components of the WCP are shown in Figure 2-1. The SD9 ATCS Radio or Ritron DTX 9650 is a half-duplex radio capable of alternately receiving and transmitting messages over the same RF link.

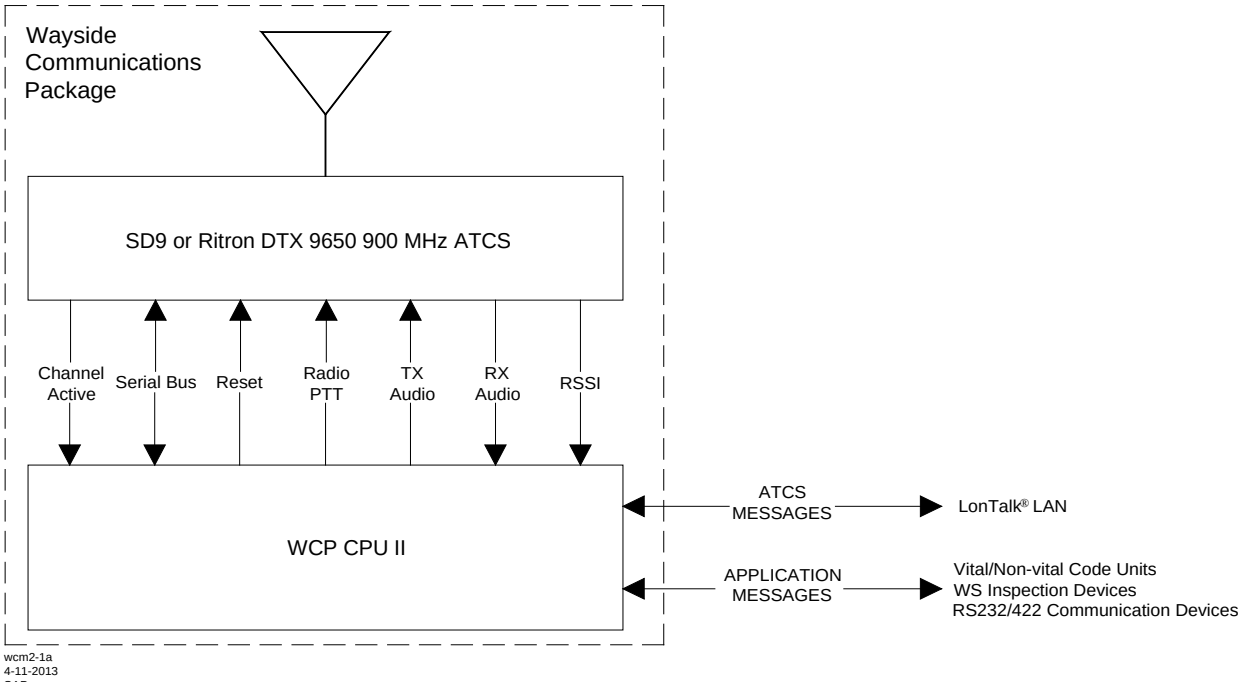

Figure 2-1 WCP Simplified Block Diagram

Messages received from the BCP via the RF link are processed by the WCP Radio as follows:

1. The RF signal is routed from the antenna to the WCP Radio, where it is demodulated to a wideband audio signal.
2. The amplitude of the wideband audio signal is detected by the WCP Radio producing a proportional DC voltage, the Received Signal Strength Indication (RSSI) signal.
3. The WCP Radio sends the RSSI and wideband audio (RX Audio) signals to the WCP CPU II.

NOTE

NOTE

The RSSI information can be displayed by the WCP Radio providing a local indication of the received signal strength for data packets or on a continuous carrier basis from BCP(s) in the area of coverage.

4. Within the WCP Radio CPU II, the message data is extracted from the RX Audio signal and compiled with the RSSI signal into an ATCS datagram and/or application message format.
5. The WCP Radio reads the application message's destination address.
6. If the address is that of the WCP Radio, the WCP Radio responds to the message as appropriate.
7. If the destination address of the message is that of a field Client device, the WCP Radio CPU II transmits the message(s) to the addressed devices via the serial port and/or LAN.

Application and ATCS messages received via the serial port or LAN are processed by the WCP Radio as follows:

1. The WCP Radio reads the application message's destination address.
2. If the address is that of the WCP Radio, the unit internally routes the message as appropriate.
3. If the destination address of the message is that of an office, mobile or other field location, the message is converted to a sinusoidal (wideband audio) format and routed to the Mobile Radio as the TX Audio signal. At the same time, the WCP Radio CPU II initiates a Push-To-Talk (PTT) request signal to the radio.
4. In response to PTT, the RX signal is transmitted over the RF channel.

WCP Radio message origination is determined by the codeplug configuration (see Appendix C). For example, the WCP Radio may be configured to originate messages when alarm inputs are energized and/or to originate WCP Radio status messages to an office based application.

WCP Radio intelligence is provided by the WCP CPU II. Control of the Mobile Radio is exercised by means of the radio RF data cable between the WCP CPU II RF connector and the Mobile Radio accessory connector, (see Figure 3-5, Figure 3-6, and Figure 3-7).

SECTION III
WCP CONNECTORS

3.0 WCP CONNECTORS

3.1 GENERAL

This section describes the connectors associated within the A53411 WCP equipment installation.

3.2 WCP CPU II 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 and I/O connector. The pin assignments for each of these connectors are described in the following paragraphs.

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

The female, 25-pin, D-type connectors (J1 and J2) located on the top of the WCP CPU II enclosure provide serial client ports that can be configured for RS-232 or RS-422 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 3-1 lists the pin assignments for the 25-pin connectors.

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

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

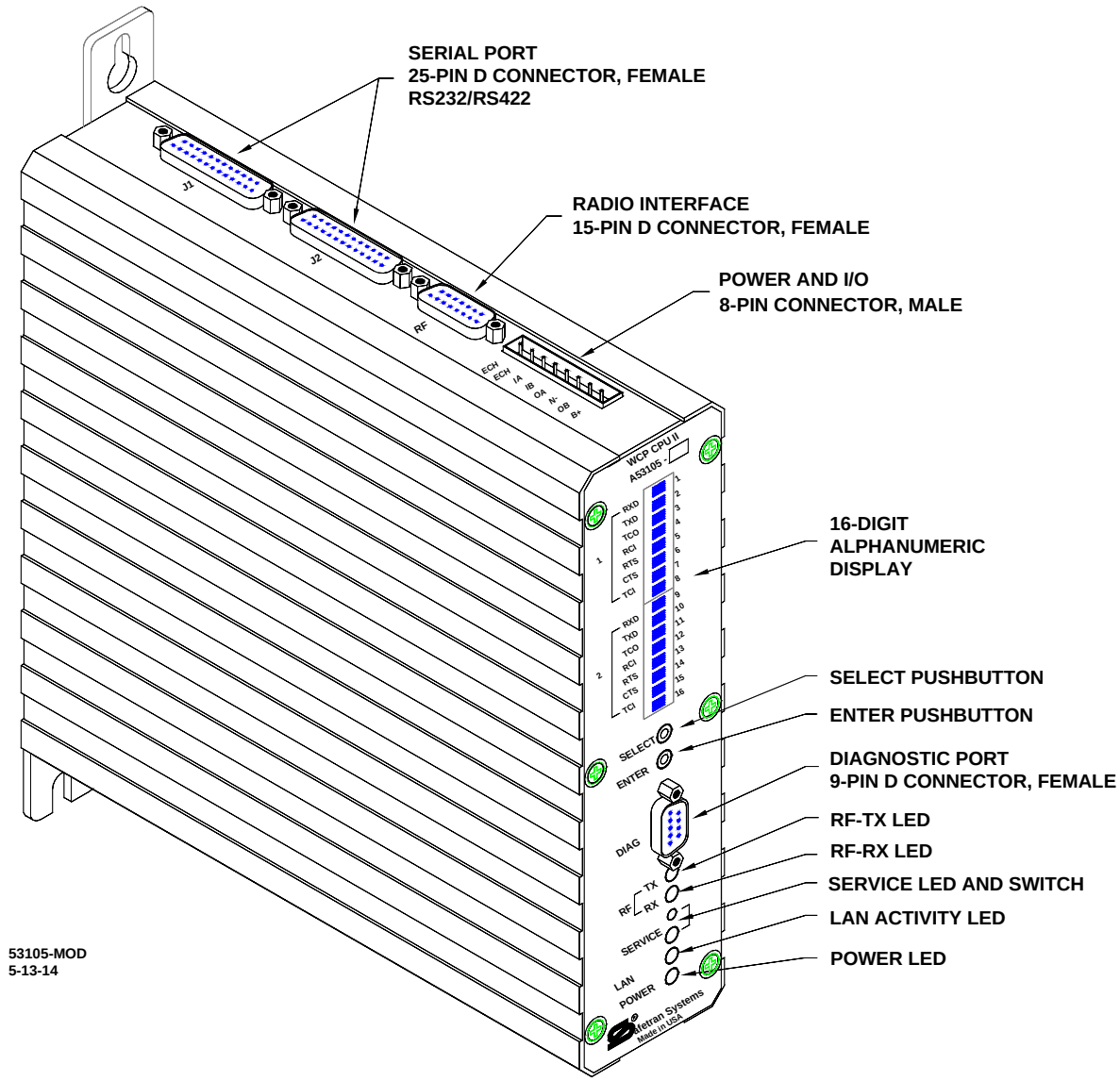

Figure 3-1 WCP CPU II, A53105

3.2.2 15-Pin D-Type Radio Connector (Female)

The female, 15-pin, D-type connector (RF) located on the top of the WCP CPU II enclosure provides interface to the WCP radio. Table 3-2 lists the pin assignments for the 15-pin connector.

Table 3-2 15-Pin Female D-Type Connector Pin Assignments

Pin	Function
1	N/C
2	Radio Push to Talk out
3	TX Audio
4	Analog Ground
5	RX Audio
7	N/C
8	Signal Ground
9	N/C
10	N/C
11	N/C
12	RSSI Out
13	N/C
14	N/C
15	N/C

3.2.3 9-Pin D-Type Diagnostic Connector (Female)

The female, 9-pin, D-type connector located on the front panel provides access to the WCP CPU II diagnostic and configuration data during maintenance operations. Table 3-3 lists the pin assignments for this connector.

Table 3-3 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).

3.2.4 8-Pin Power and I/O Connector (Male)

The male, 8-pin, power, LonTalk®, and I/O connector contacts are numbered from the front of the WCP CPU II case with pin 8 nearest the 15-pin connector. Table 3-4 lists the connector pin assignments.

Table 3-4 8-Pin Male Power and I/O 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)

3.3 DC/DC CONVERTER

The A53106 DC/DC converter is equipped with six terminals as shown in Figure 3-2. DC input terminals, **B and N**, connect to the source battery. DC output terminals, **B and N**, provide isolated DC output voltage. Test points, **DC Input** and **Isolated DC output,** provide monitoring points for the input and output voltages.

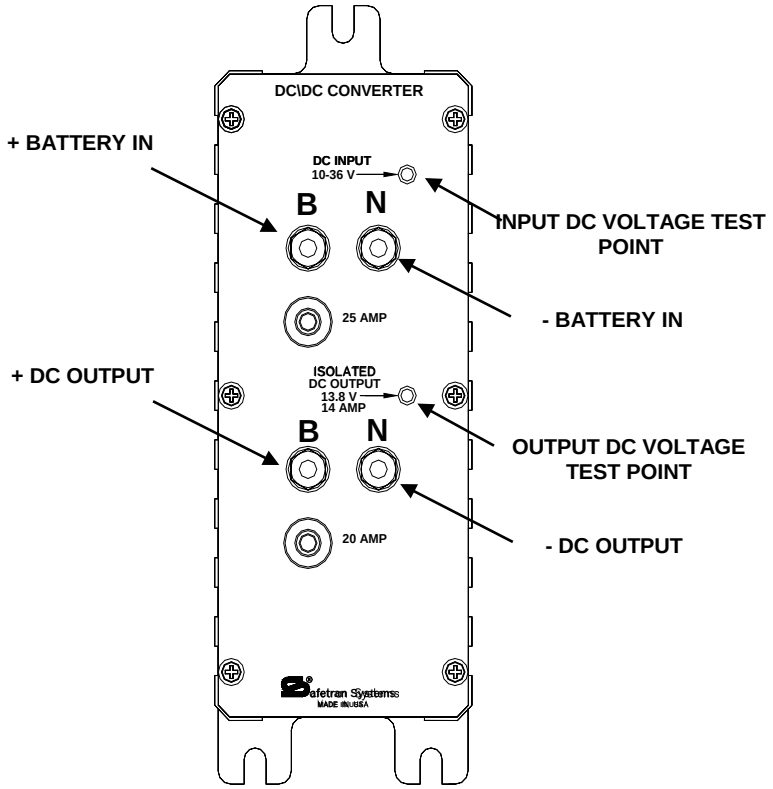

Figure 3-2 A53106 DC/DC Converter

3.4 WCP RADIO

3.4.1 SD9 Radio

The SD9 Radio is equipped with five connectors that are used during WCP installation (see Figure 3-3). These connectors include a polarized DC power connector on the radio, a DB-9 power and logic connector on the amplifier, an N-type antenna connector, and a 25-pin D-type data connector. The pin assignments for the 25-pin connector and the DB-9 connector are described in the following paragraphs.

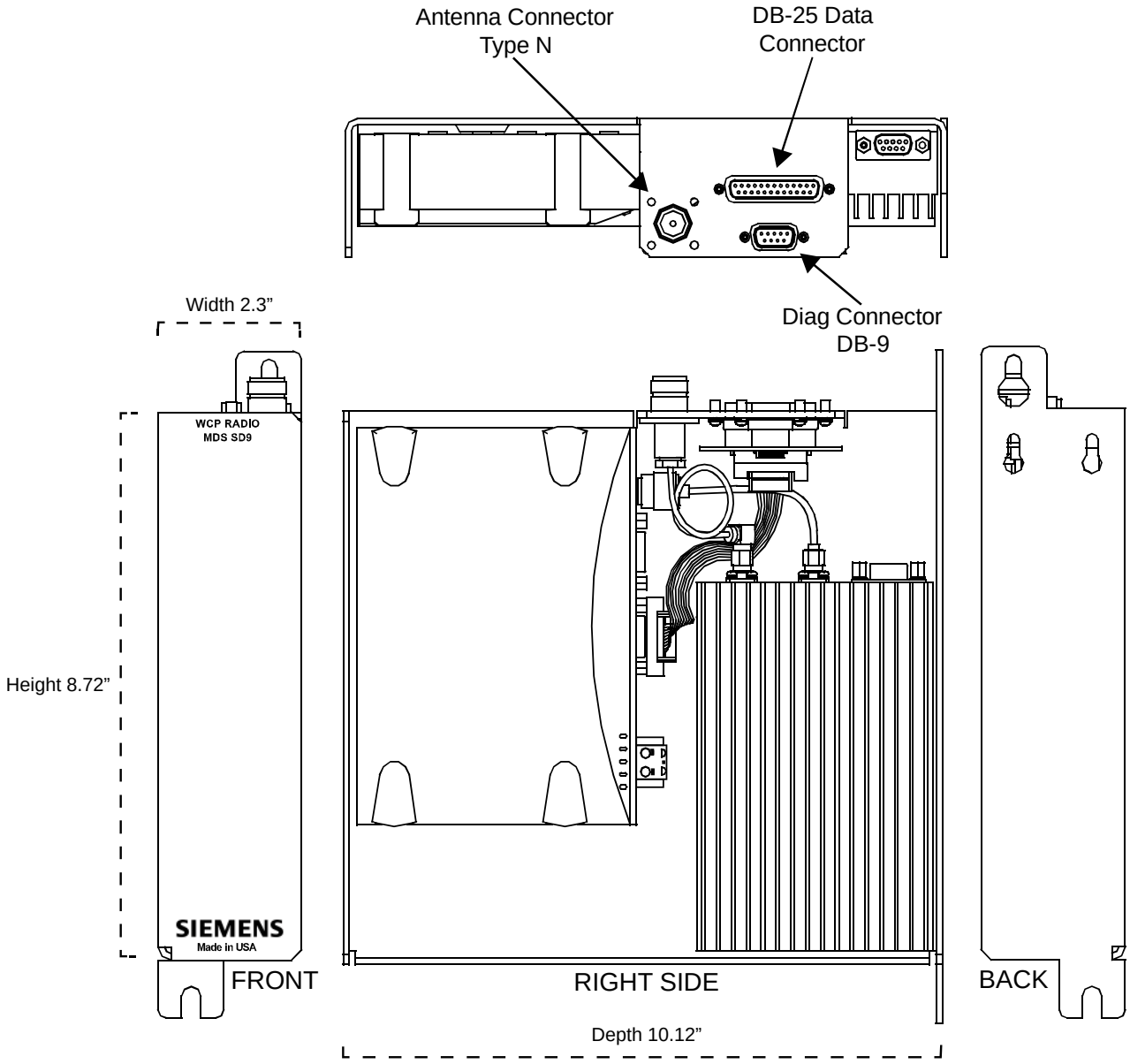

Figure 3-3 SD9 Radio Connectors

CAUTION

DO NOT KEY THE WCP RADIO MODULE USING THE RADIO DIAGNOSTIC CONNECTOR WITH THE RF AMPLIFIER ATTACHED. DAMAGE TO THE AMPLIFIER WILL OCCUR.

3.4.2 Ritron DTX 9650 Radio

The Ritron DTX 9650 Radio is equipped with three connectors that are used during WCP installation (see Figure 3-4). These connectors include a polarized DC power connector on the radio, a DB-9 power and logic connector on the amplifier, an N-type antenna connector, and a 25-pin D-type data connector. The pin assignments for the 25-pin connector and the DB-9 connector are described in the following paragraphs.

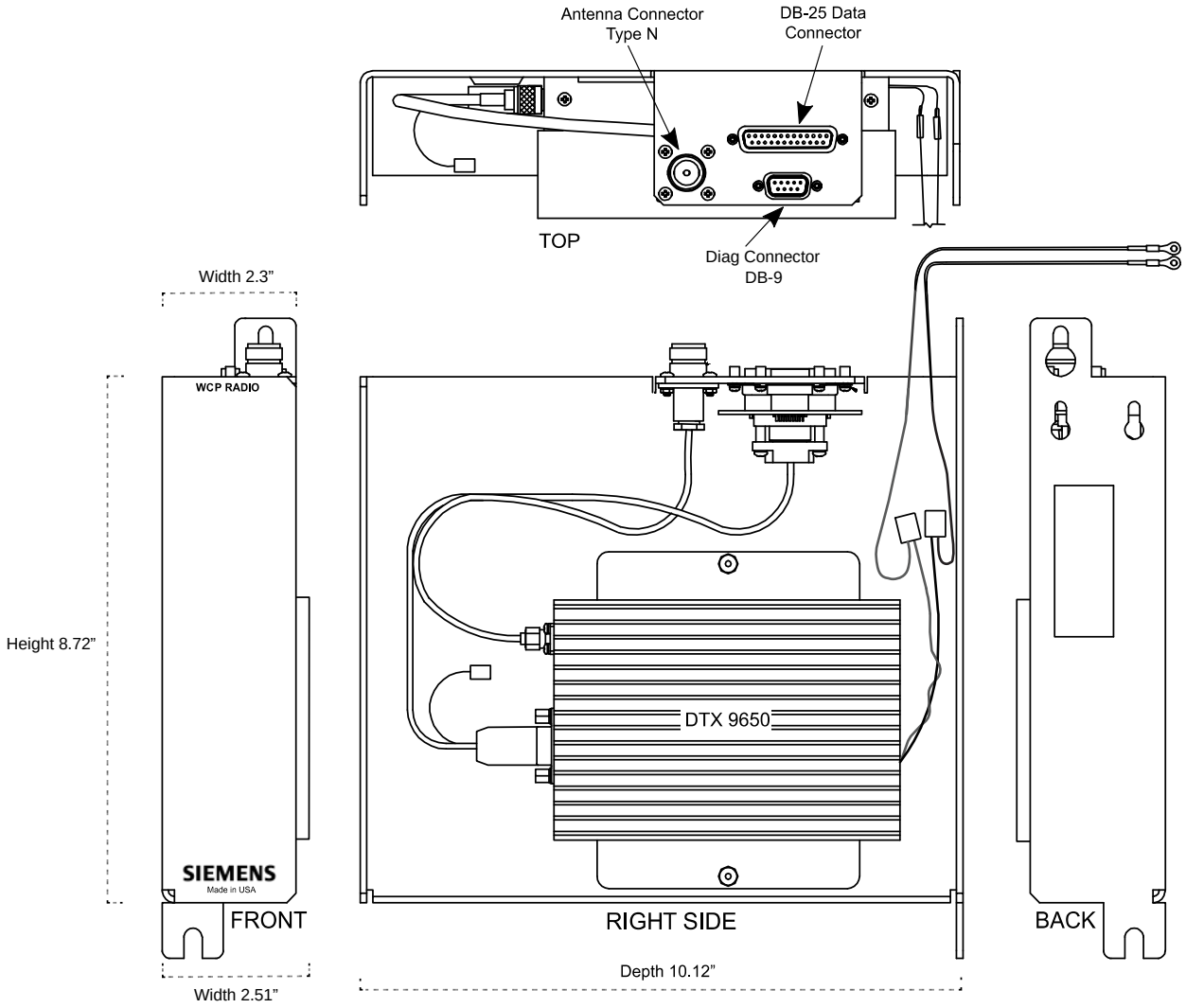

Figure 3-4 Ritron DTX 9650 Radio Connectors

3.4.2.1 25-Pin Male D-Type Connector Pin Assignments

Table 3-5 25-Pin Male D-Type Connector Pin Assignments

Pin	Function
1	Protective Ground
7	Signal Ground
9	Transmit Audio Input. Connects to the audio output of the WCP CPU II.
11	Receive Audio Output. Connects to the audio input of the WCP CPU II. Output impedance is 600Ω, and the level is factory set. Use pin 7 for the modem's return lead
16	PTT – Push To Talk. This pin is used to key radio with an active-low signal of 0VDC
21	RSSI – Received Signal Strength Indication.

3.4.2.2 9-Pin D-Type Data Connector Pin Assignments for Amp Connection (SD9 Only)

Table 3-6 9-Pin D-Type Data Connector Pin Assignments

Pin	Function
1	PTT TTL
4	B+ (Battery Positive)
5	B+ (Battery Positive)
6	Signal Ground
7	TTL Return
8	N- (Battery Negative)
9	N- (Battery Negative)

3.4.2.3 A26678 Power/Data Cable Assembly

The Siemens Rail Automation A26678 Power Cable Assembly provides the necessary power and signal connections for the WCP Radio. Use of any other cables may cause damage to the radio. Figure 3-5 details the cable assembly for the A26678 cable used with the SD9 Radio and Figure 3-6 provides the connection and pin out information for A26678.

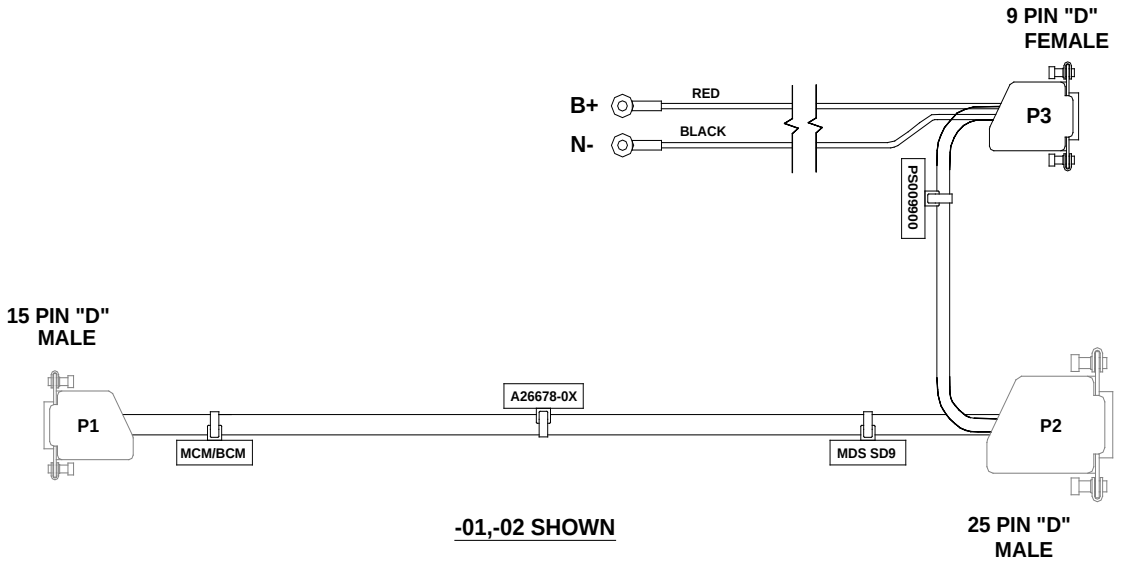

Figure 3-5 A26678 Power/Data Cable Assembly

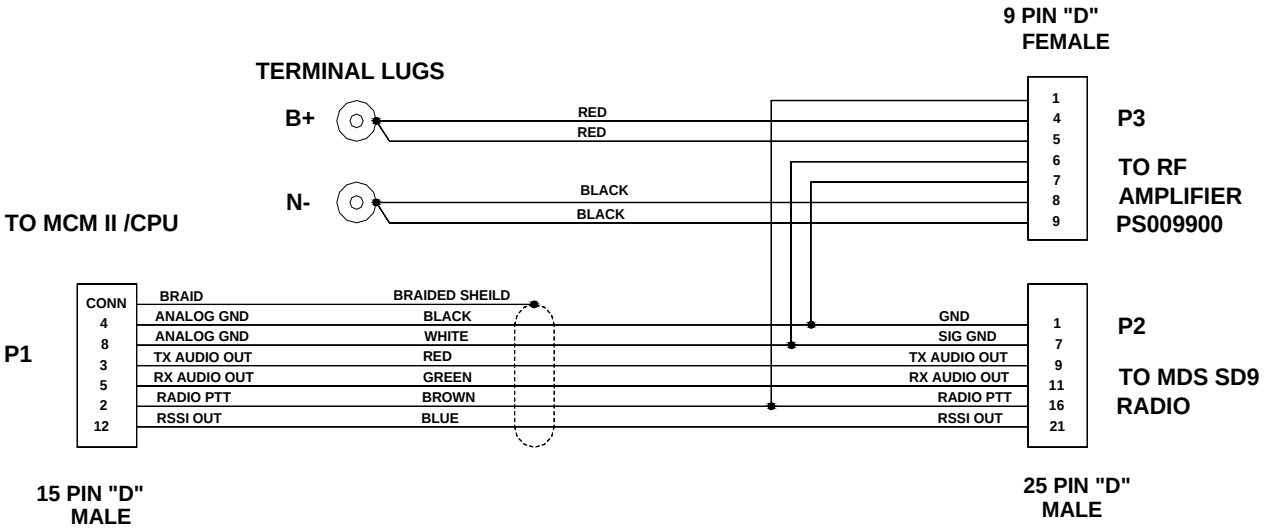

Figure 3-6 A26678 Power/Data Cable Connection and Pin Out

3.4.2.4 A26791 Power/Data Cable Assembly

The Siemens Rail Automation A26791 Power Cable Assembly provides the necessary power and signal connections for the DTX 9650 Radio. Use of any other cables may cause damage to the radio. Figure 3-7 details the cable assembly and the connection and pin out information.

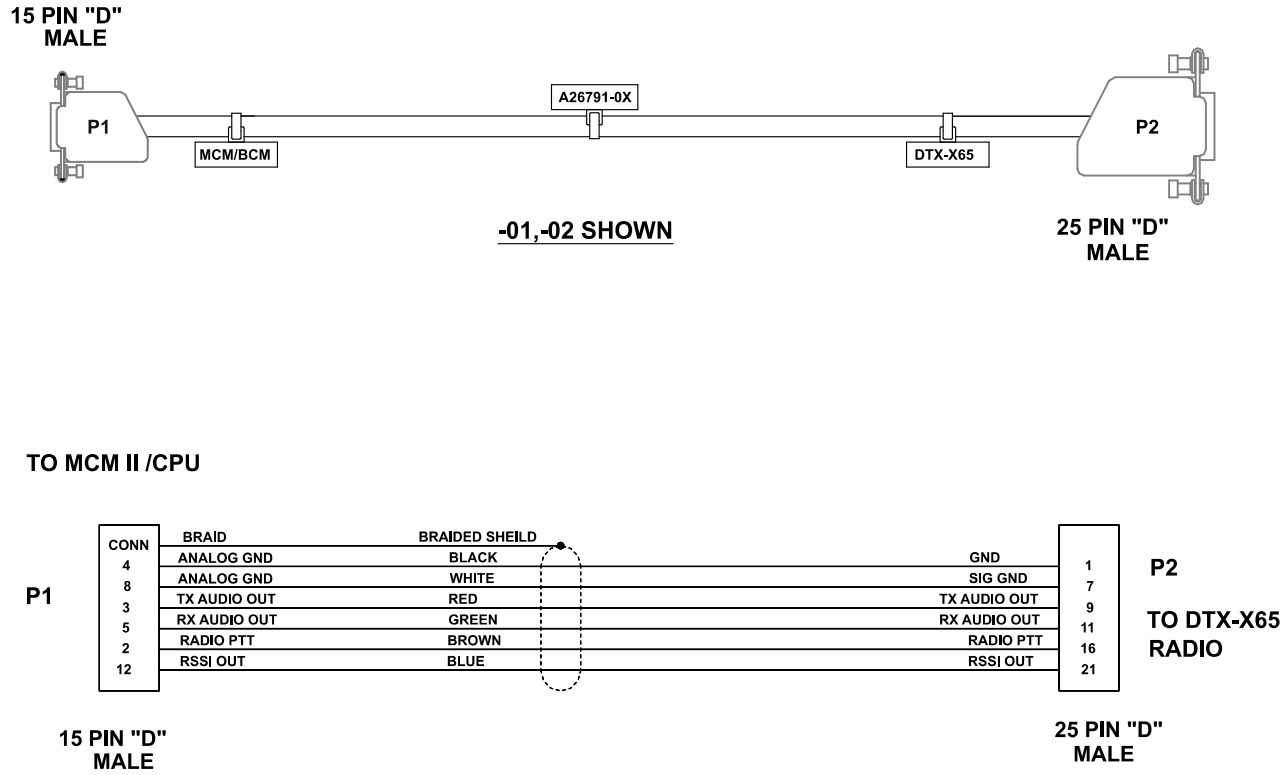

Figure 3-7 A26791 Power/Data Cable Connection and Pin Out

SECTION IV - INSTALLATION

4.0 INSTALLATION

4.1 GENERAL

The main components of the A53411 WCP can be either wall-mounted or mounted on a standard GRS Style B relay rack as shown in Figure 4-1. The modules are secured at the top by a teardrop arrangement and at the bottom by a retaining bolt**.**

NOTE

NOTE

Installation information for the A53470 MCP Cab Radio is covered in MCP Cab Radio Manual Siemens Rail Automation Document Number: COM-00-09-08.

The WCP radio is equipped with a bracket to permit mounting in a relay rack. Alternatively, it can be mounted horizontally using a standard bracket.

4.2 POWER

4.2.1 WCP CPU II, A53105

The WCP radio requires a DC/DC converter such as the Siemens Rail Automation A53106, or a separate battery system from the signal battery.

NOTE

NOTE

The transmit current (10 Amperes) requires use of number 10 AWG or larger wire to ensure that significant voltage drop does not occur when the transmitter is keyed.

4.2.2 DC/DC Converter, A53106

This unit is designed to supply a constant output voltage to the WCP radio with a fluctuating input voltage.

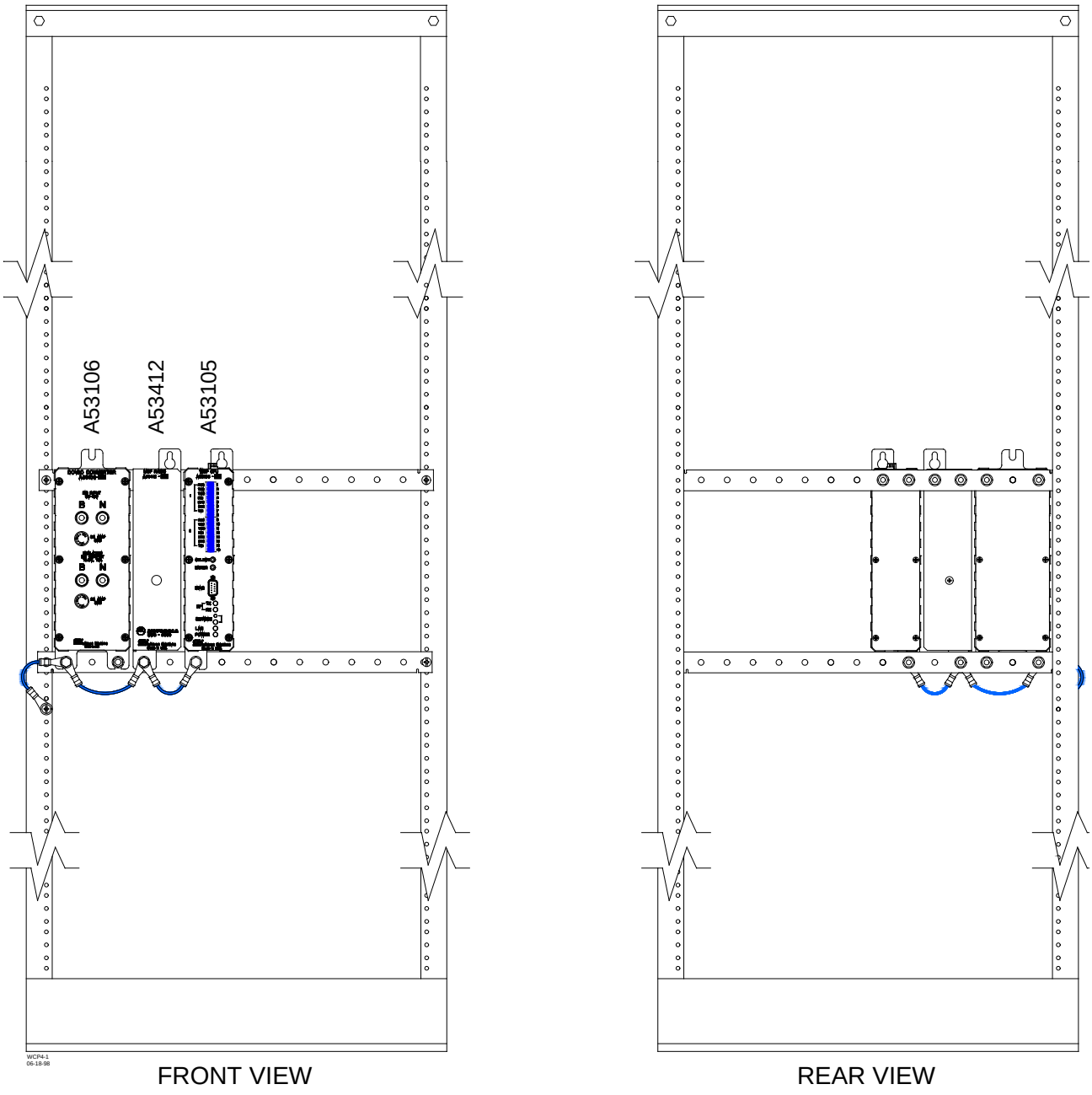

Figure 4-1 Typical WCP Rack Installation

CAUTION

DO NOT INSTALL PRIMARY SURGE PROTECTION, OTHER THAN ARRESTERS AND EQUALIZERS, ON THE INPUT TO THE DC/DC CONVERTER AS THE ADDED INDUCTANCE MAY CAUSE THE UNIT TO WORK ERRATICALLY AT LOW INPUT VOLTAGES.

NOTE

At low input voltages, instantaneous current can exceed 25A, and it is therefore extremely important to ensure tight connections and adequate wire gauge (minimum #10 AWG).

4.2.3 Grounding and Surge Protection

Siemens Rail Automation recommends that a surge panel such as R/Link™ Surge Suppression Panel, 43030, or equivalent, be used to provide surge and lightning protection to the modules (see Figure 5-3). The panel is equipped with separate surge suppressors and equalizers for the radio and the remainder of the code equipment and also provides combination circuit breakers/on-off switches for each path. Generic grounding and surge protection recommendations for the WCP Radio are provided in Appendix D.

4.3 EQUIPMENT INTERCONNECT CABLING

Once the WCP equipment is installed, connect the equipment as described in the following paragraphs.

4.3.1 WCP Basic Cabling

The equipment cabling for a basic WCP installation is shown in Figure 4-2. All necessary information is provided on the diagram and in Table 4-1. The cable numbers listed in the left column of Table 4-1 correspond to the cable numbers (e.g. # 3 and #4 Customer Battery Lines) appearing on Figure 4-2.

Table 4-1 WCP CPU II Interconnect Cable Description

Cable #	Part Number	Where Used	Termination
1	See Appendix E	WCP Radio to Antenna	Male N to male N
2	9000-26678-000X	53106 to RF Amp	Dual-lead, DC-power cable with Ring Lugs to DB-9 connector (Part of 26678 Cable)
3	Customer supplied	43030 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
4	Customer supplied	43030 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
5	Customer supplied	53106 to 53105	16/18 AWG insulated ring lug to black stripped and tinned
6	Customer supplied	53106 to 53105	16/18 AWG insulated ring lug to red stripped and tinned
7	9000-26678-000X	53105 to SD9 Data Interface Connector	Male 25-pin D to male 15-pin D (Part of 26678 Cable)
8	See Figures 4-5 thru 4-8	53105 to 50636	See Figures 4-5 thru 4-8
9	Z715-09038-0008	53105	8-pin WAGO®
10	Belden 8461	53105	Dual-lead stripped (see paragraph 4.4)
11	Customer supplied	53106 to SD9 Radio Power Plug (#13)	16/18 AWG insulated ring lug to black stripped and tinned
12	Customer supplied	53106 to SD9 Radio Power Plug (#13)	16/18 AWG insulated ring lug to red stripped and tinned
13	Part of 53412	SD9 Radio Power Plug	2 terminal Phoenix compression power plug
14	9000-26678-000X	RF Amplifier Power Plug	(Part of 26678 Power/Data Cable)
15	9000-26791-000X	Radio Data Cable 53105 to Ritron	See Figure 4-6

4.4 ECHELON® LAN CABLE RECOMMENDATIONS

- Level 4 stranded, 18 AWG twisted pair (shielded or unshielded)
- DC Resistance: 18.0 ohms per 1000 feet (304.8 meters) @ 68 °F (20 °C) (per conductor)
- DC Resistance Unbalance: 5% maximum
- Impedance: 100 ohms ± 15% (1.0 to 20.0 MHz)
- Attenuation: 5.5 dB/1000 feet (304.8 meters) @ 68 °F (20 °C) maximum (1.0 MHz)
- Pair Mutual capacitance: 17 pF/foot (30.48 centimeters) maximum
- Pair-to-ground capacitance unbalance: 1 pF/foot (30.48 centimeters) maximum

NOTE

NOTE

Refer to the Echelon® Configuration Handbook (Siemens Document Number COM-00-07-09) for Echelon® wiring and termination requirements.

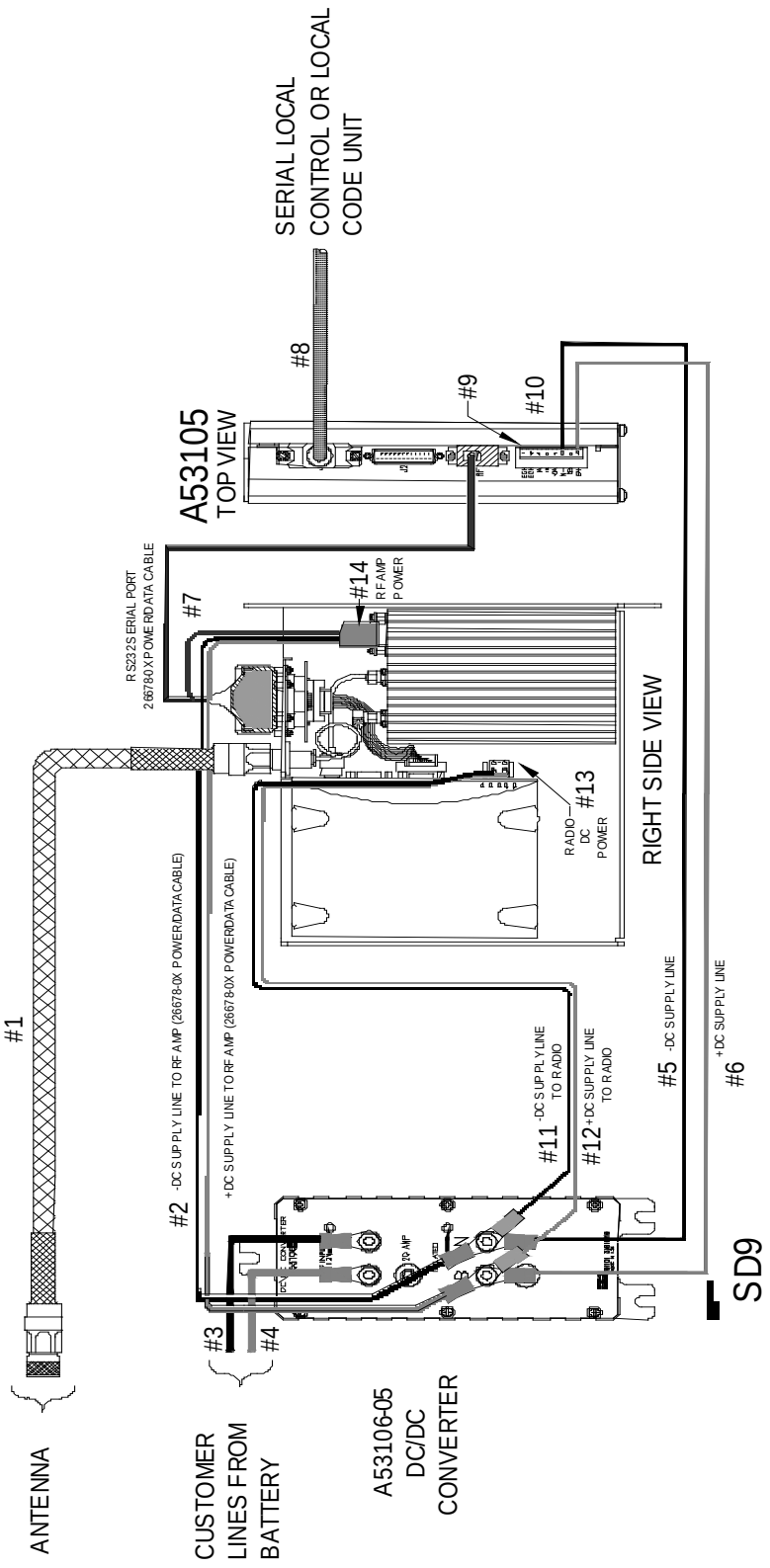

Figure 4-2 WCP Typical Interconnect Diagram (SD9 Radio)

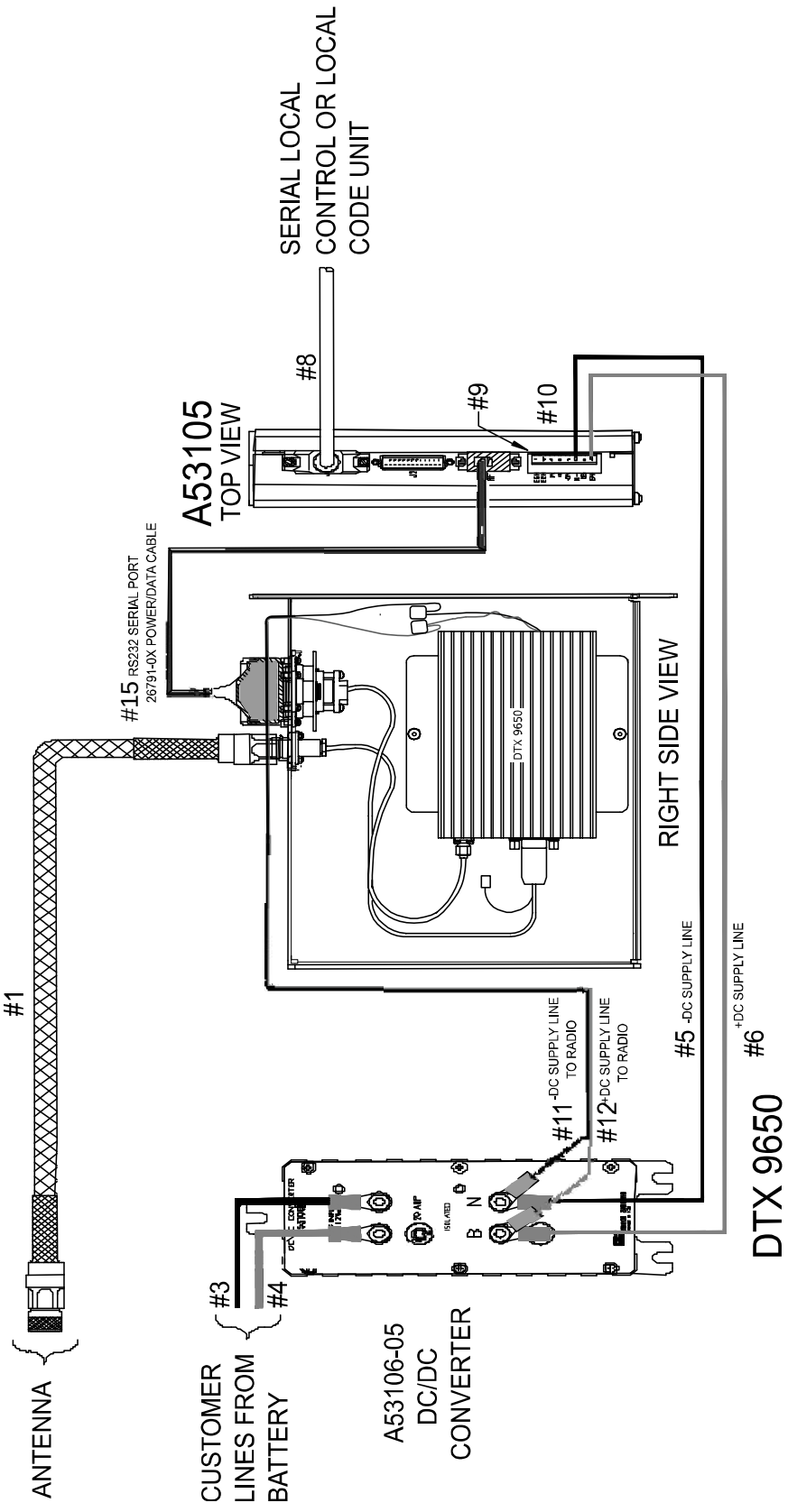

Figure 4-3 WCP Typical Interconnect Diagram (DTX 9650)

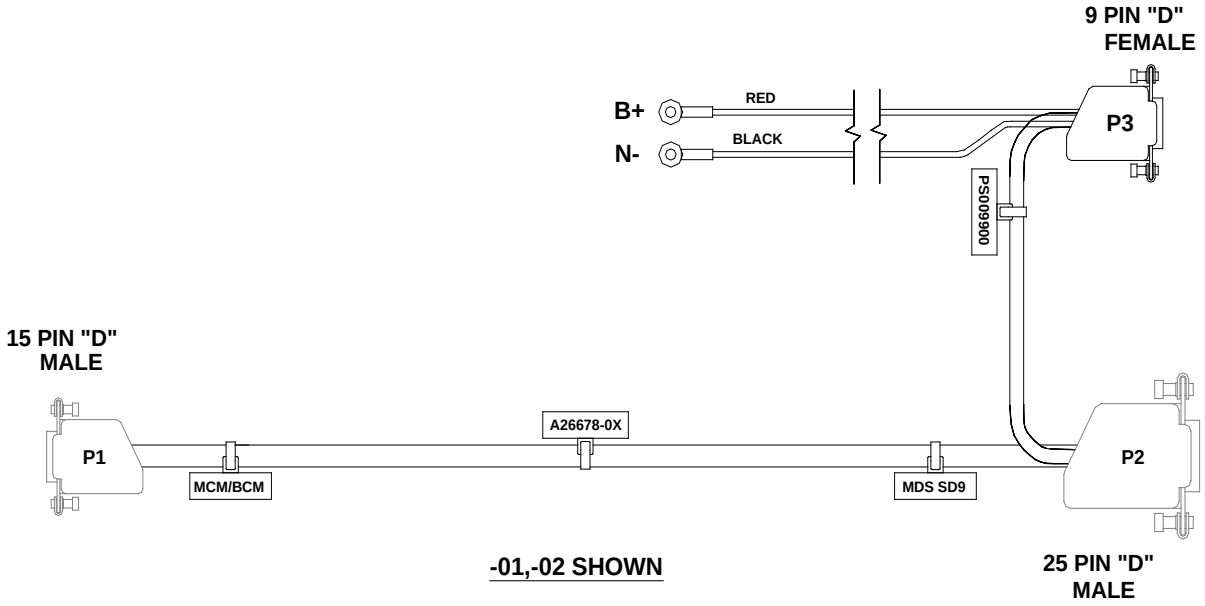

Figure 4-4 A26678 MDS Radio Cable

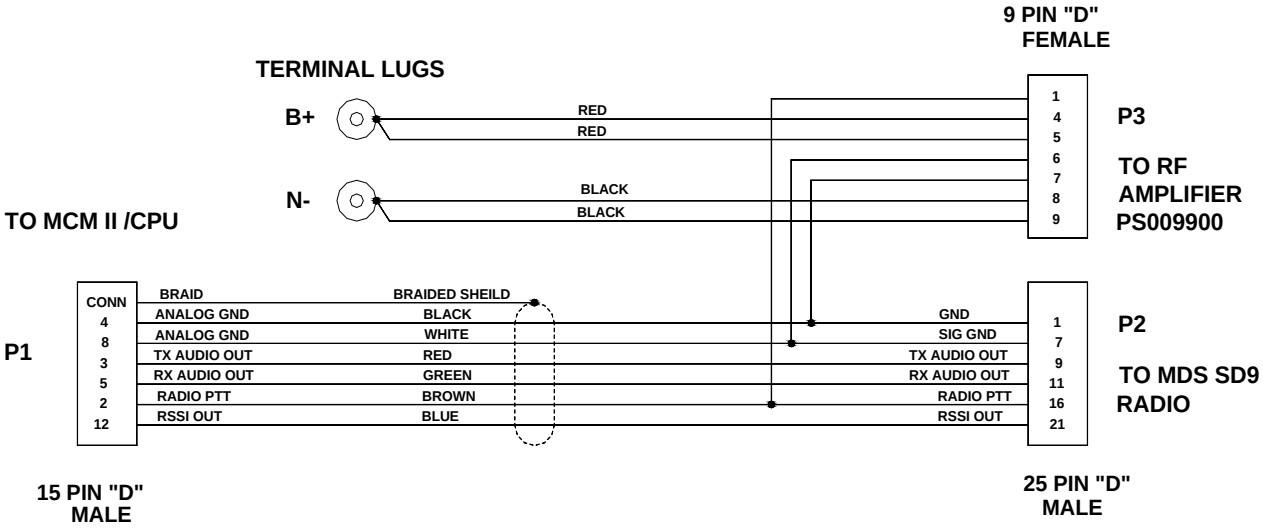

Figure 4-5 A26678 MDS Radio Cable Connection & Pin-out

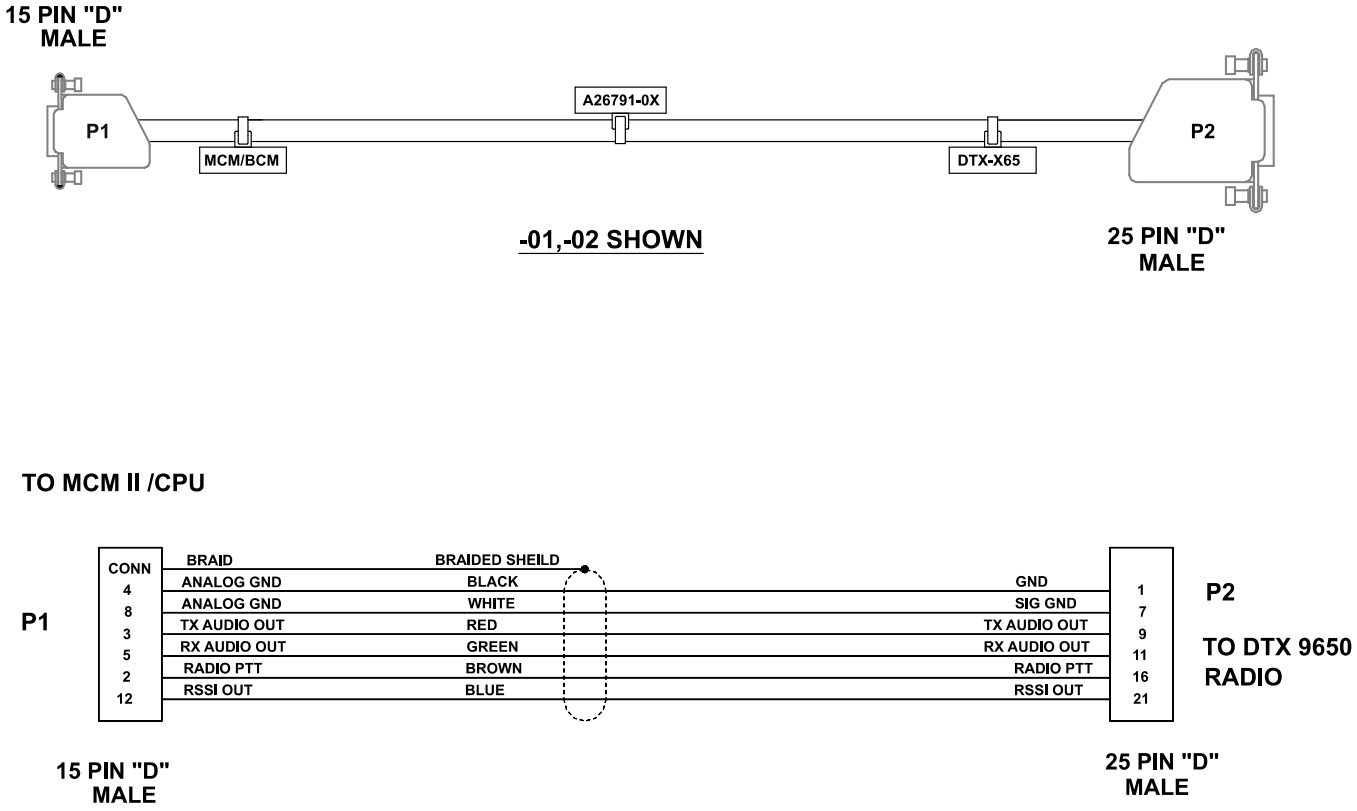

Figure 4-6 A26791 Radio Data Cable to Ritron Radio Connection & Pin-out

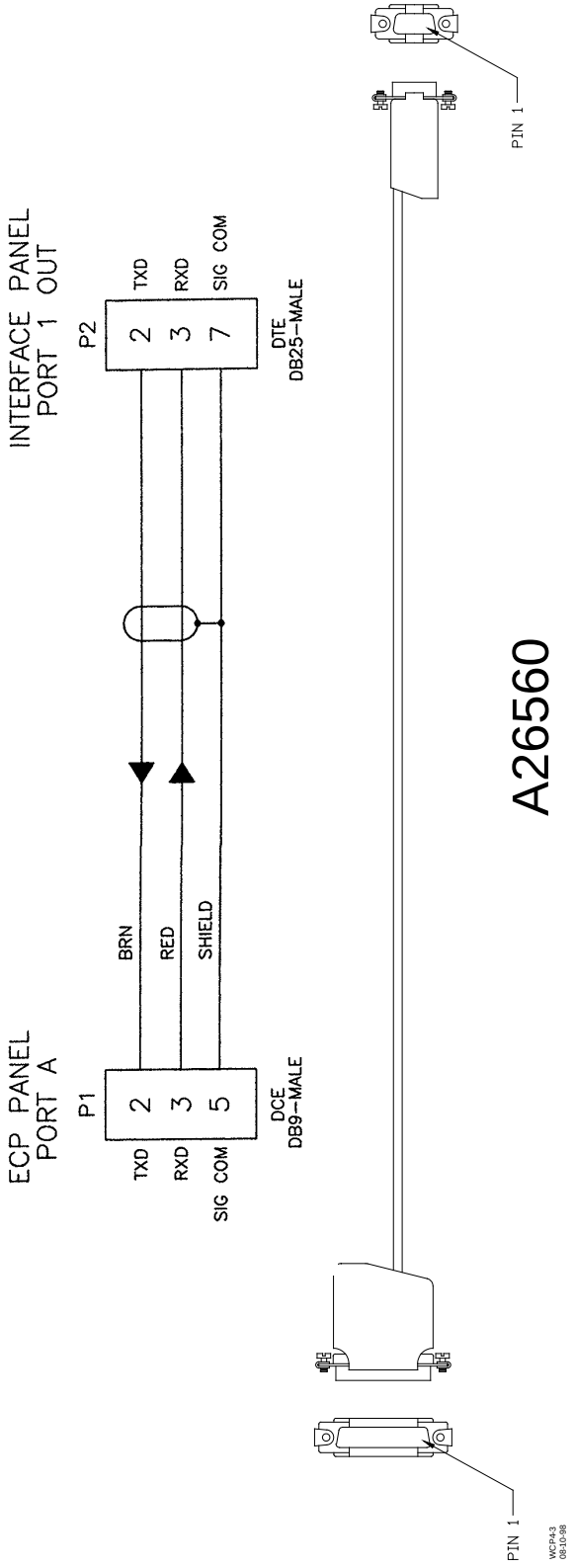
INTERFACE PANEL
PORT 1 OUT
P2
2
3
7
TXD
RXD
SIG COM
DTE
DB25-MALE
ECP PANEL
PORT A
P1
2
3
5
TXD
RXD
SIG COM
DCE
DB9-MALE
BRN
RED
SHIELD
PIN 1
PIN 1
A26560
WCP43
08-10-98

Figure 4-7 A26560 Cable Assy, WCP to MCP Local Control Panel

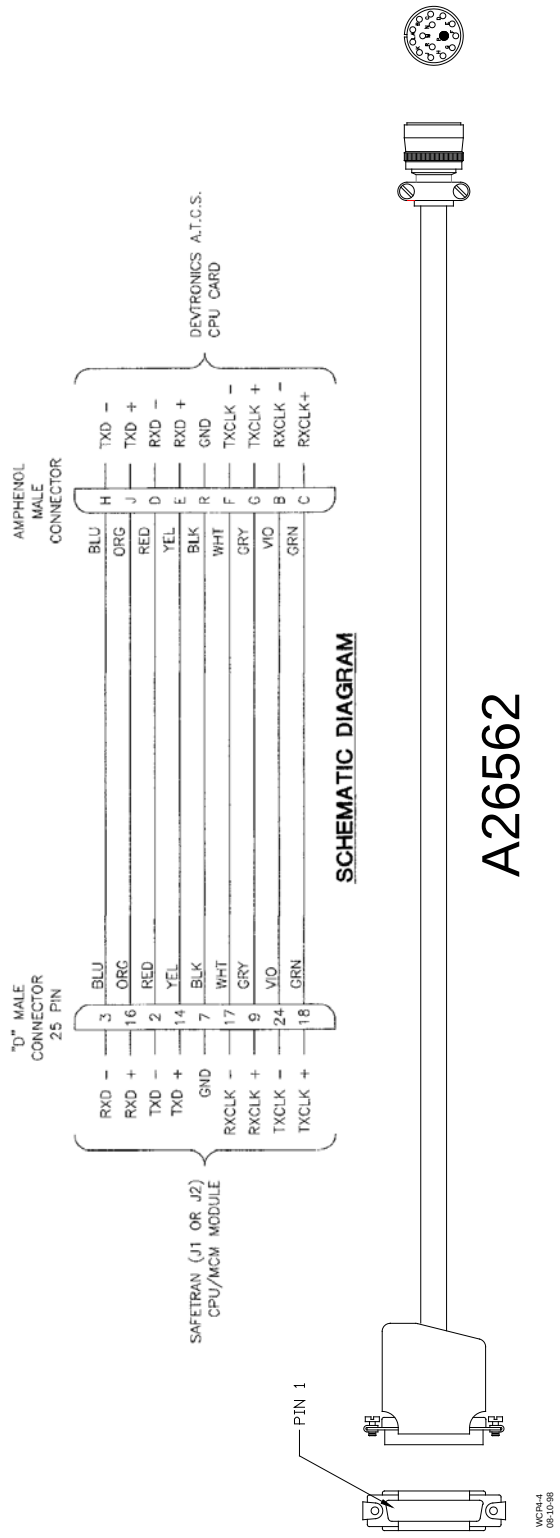

Figure 4-8 A26562 Cable Assy, WCP to Devtronics ATCS CPU Card

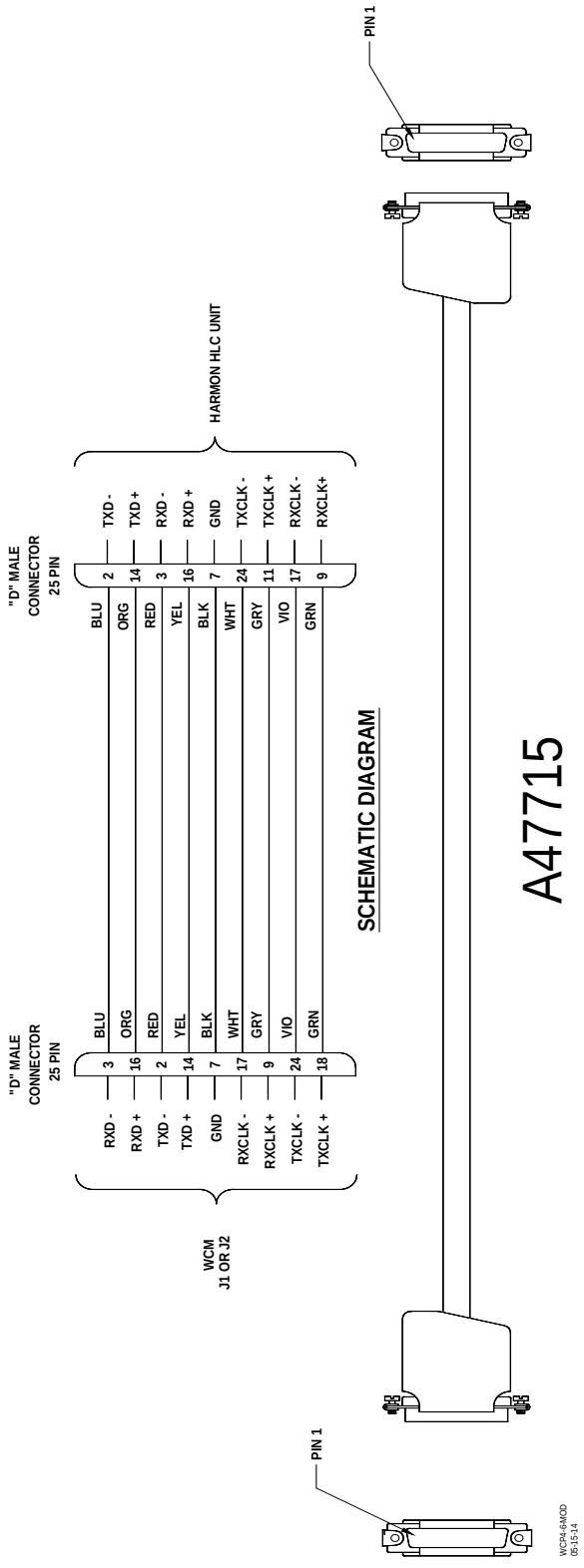

Figure 4-9 A47715 Cable Assy, to Harmon HLC Unit

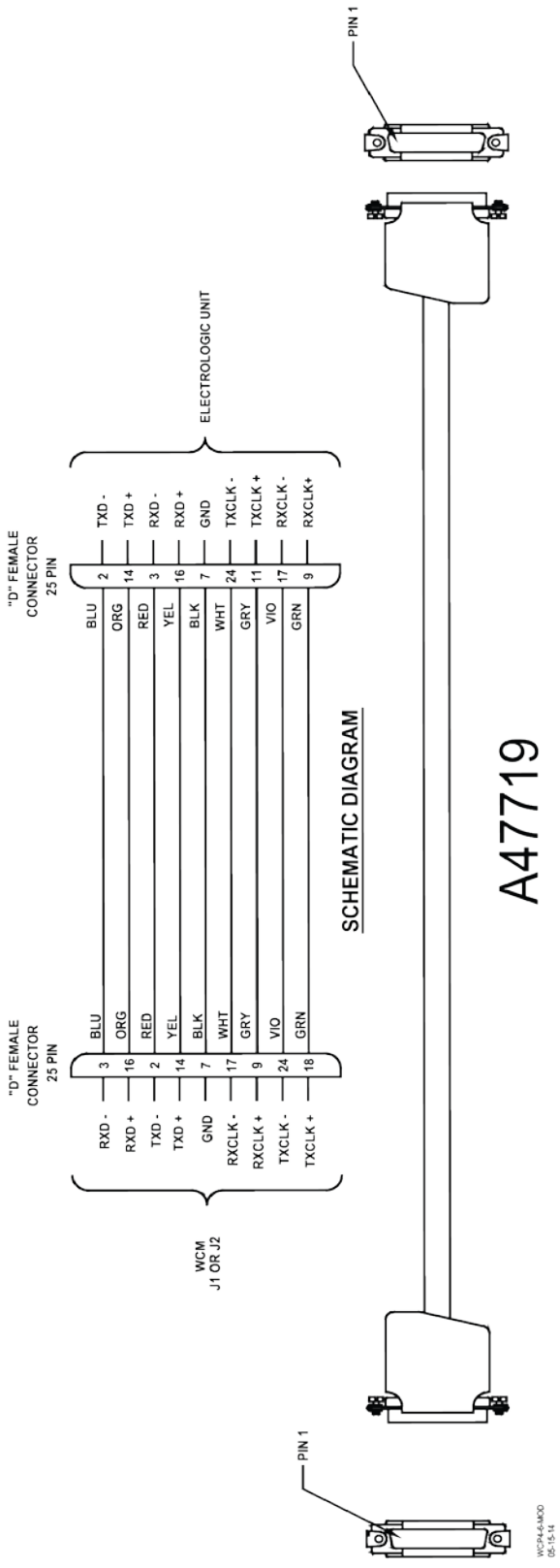

Figure 4-10 A47719 Cable Assy, to Electrologic Unit

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SECTION V - WCP OPTIONS

5.0 WCP OPTIONS

5.1 GENERAL

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

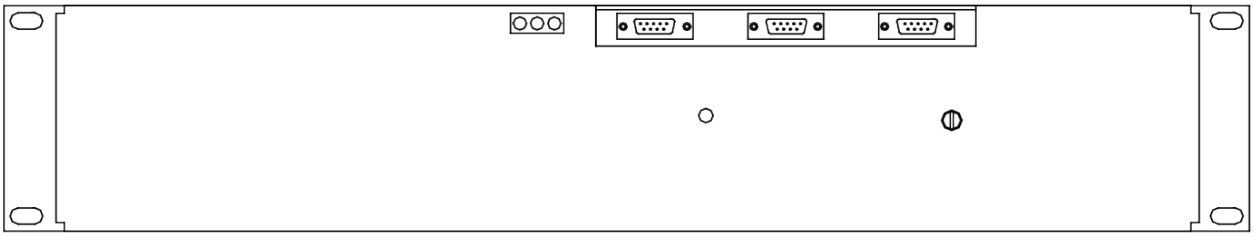
5.2 BASIC CONFIGURATION OPTIONS

The basic configuration options available for the WCP are provided in the WCP Basic Configuration Chart, located in Figure 1-2, Section I. To order, specify the basic WCP part number (53411) plus the applicable dash numbers. Refer to the Ordering Information in Section I.

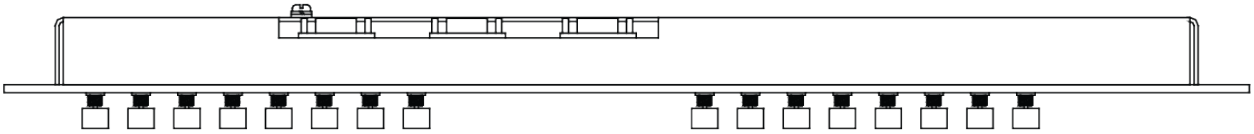
5.2.1 Option Installation

A typical rack-mount options configuration is shown in Figure 5-5. The equipment cabling for a typical installation employing a surge panel and a local control panel is shown in Figure 5-6. All necessary interconnect information is provided in Table 5-2.

BACK PANEL



TOP VIEW



FRONT PANEL

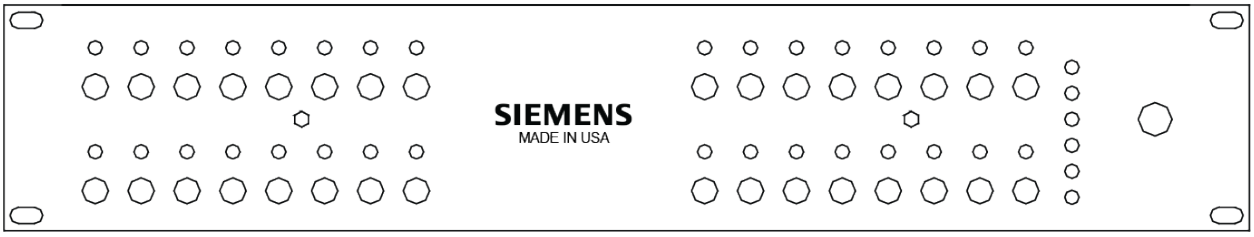


Figure 5-1 Local Control Panel

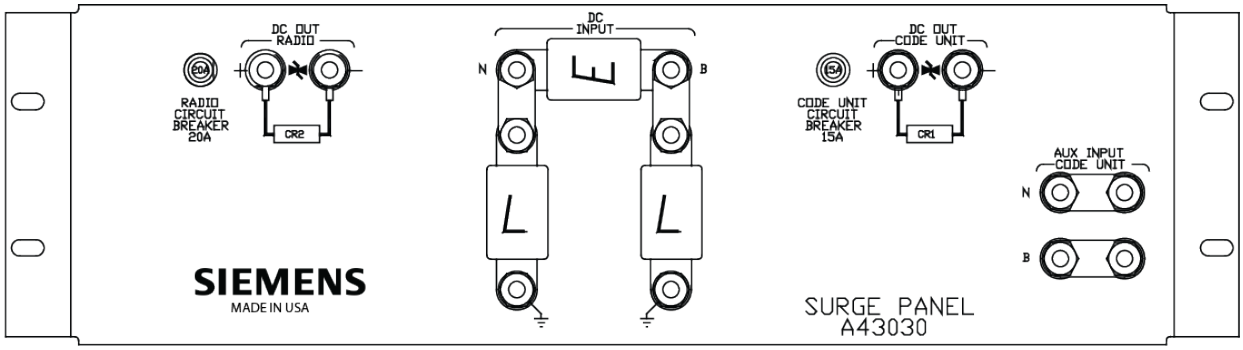


Figure 5-2 Surge Panel

Table 5-1 WCP Cable Options

Cable #	Part Number	Where Used	Termination
1	See Appendix E	WCP Radio to Antenna	Male N to male N
2	9000-26678-000X	53106 to RF Amp	Dual-lead, DC-power cable with Ring Lugs to DB-9 connector (Part of 26678 Cable)
3	Customer supplied	43030 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
4	Customer supplied	43030 to battery	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
5	Customer supplied	53106 to 53105	16/18 AWG insulated ring lug to black stripped and tinned
6	Customer supplied	53106 to 53105	16/18 AWG insulated ring lug to red stripped and tinned
7	9000-26678-000X	53105 to SD9 Data Interface Connector	Male 25-pin D (radio), Male 15-pin D (53105), Female DB-9 RF Amp (Part of 26678 Cable)
8	See Section 5.5.5	53105 to 50636	See Figures 4-5 thru 4-8
9	Z715-09038-0008	53105	8-pin WAGO® Power/Echelon/I/O Connector
10	Customer supplied	43030 to 50636	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
11	Customer supplied	43030 to 50636	10/12 AWG insulated ring lug to 10/12 AWG insulated ring lug
12	Customer supplied	43030 to 53122	10/12 AWG insulated ring lug to black stripped and tinned
13	Customer supplied	53106 to 53122	10/12 AWG insulated ring lug to red stripped and tinned
14	Customer supplied	43030 to battery	10/12 AWG insulated ring lug to red stripped and tinned
15	Customer supplied	43030 to battery	10/12 AWG insulated ring lug to black stripped and tinned
16	Customer supplied	53105	Belden 8461 Dual-lead stripped (see paragraph 4.4)
17	Customer supplied	53106 to SD9 Radio Power Plug (#13)	16/18 AWG insulated ring lug to black stripped and tinned
18	Customer supplied	53106 to SD9 Radio Power Plug (#13)	16/18 AWG insulated ring lug to red stripped and tinned
19	Part of 53412	SD9 Radio Power Plug	2 terminal Phoenix compression power plug
20	9000-26678-000X	RF Amplifier Power Plug	DB-9 (Part of 26678 Power/Data Cable)
21	9000-26791-000X	Radio Data Cable 53105 to Ritron	See Figure 5-5

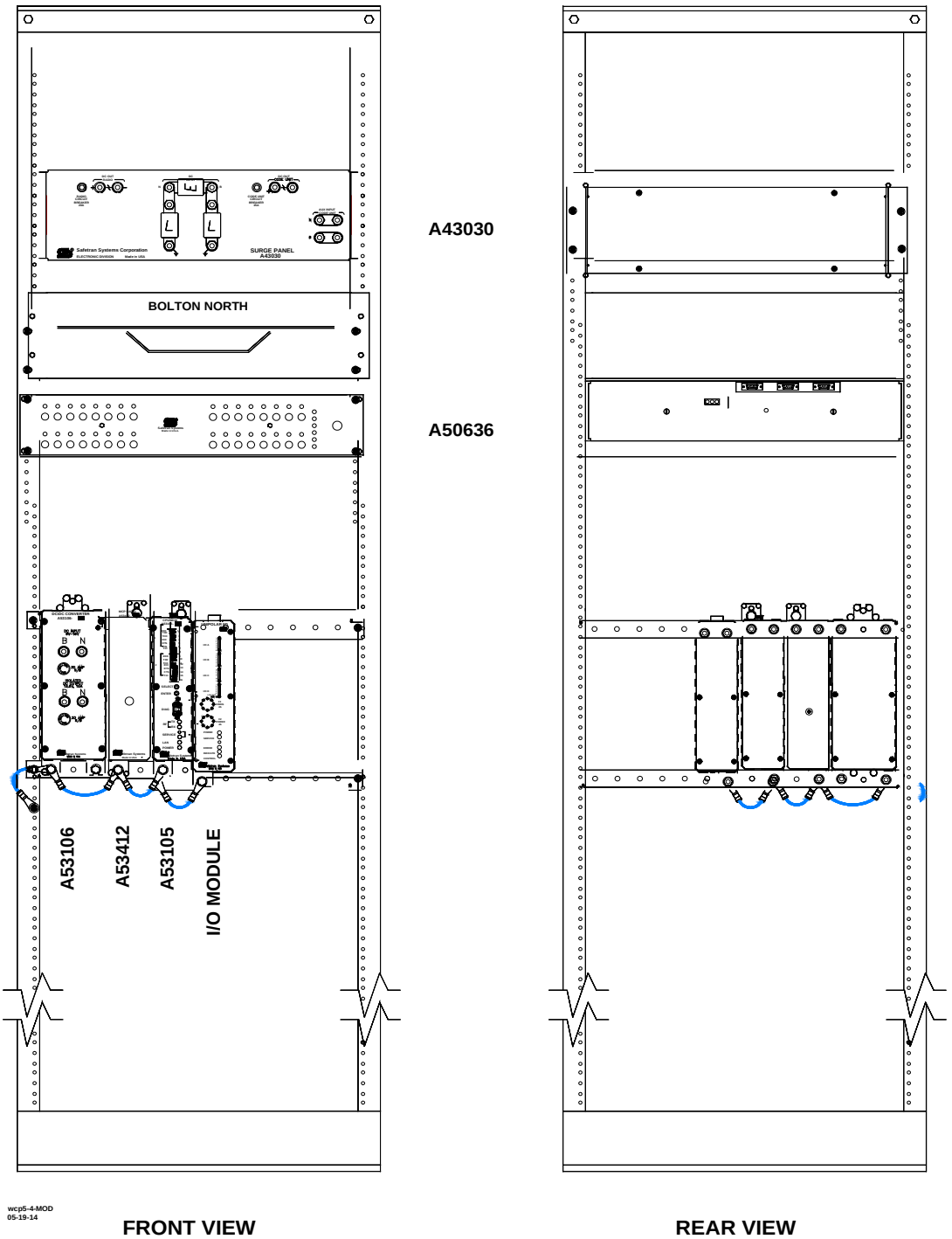


Figure 5-3 WCP Field Rack Installation Options

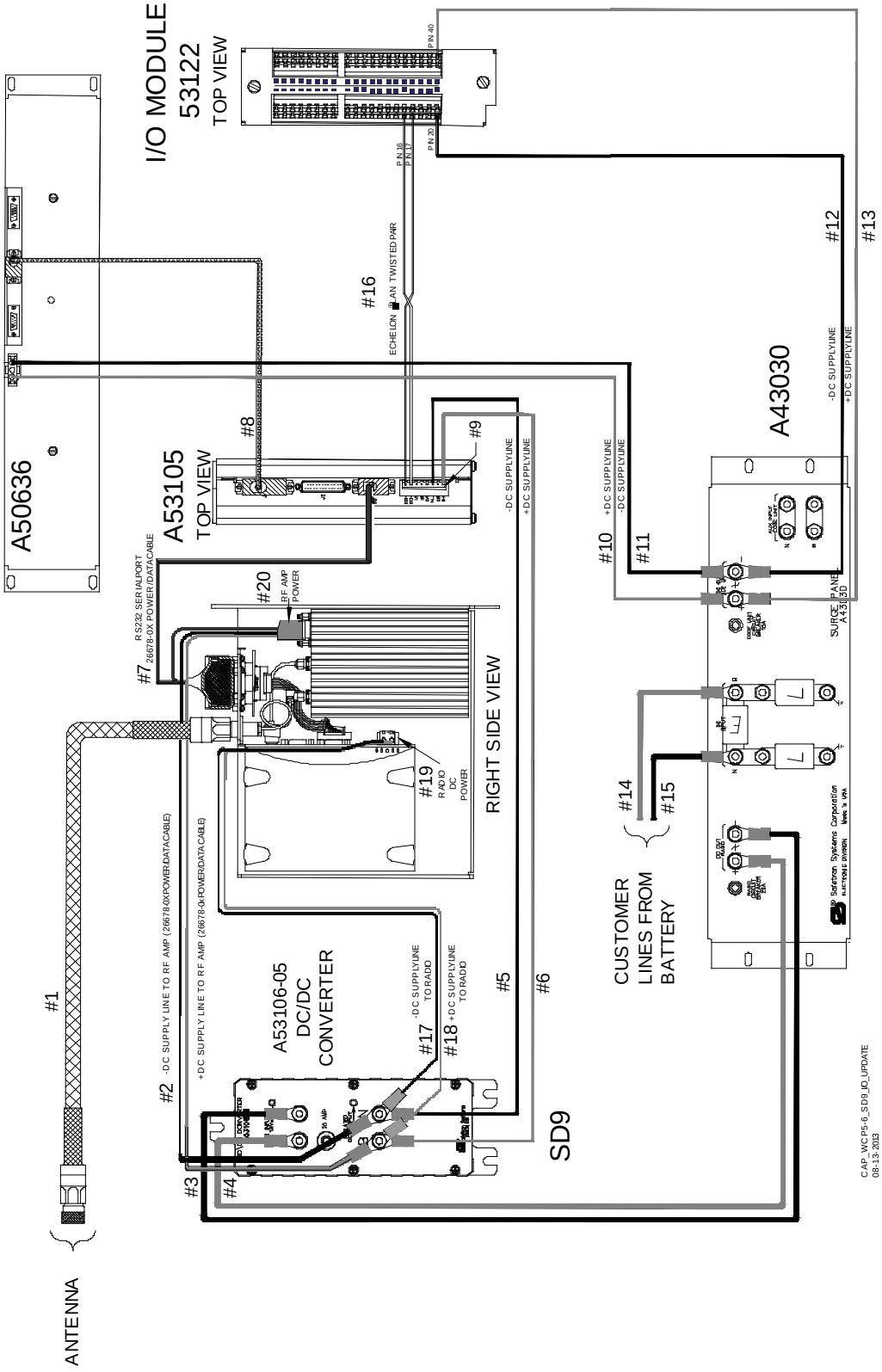


Figure 5-4 WCP Options Interconnection Diagram (SD9 Radio)

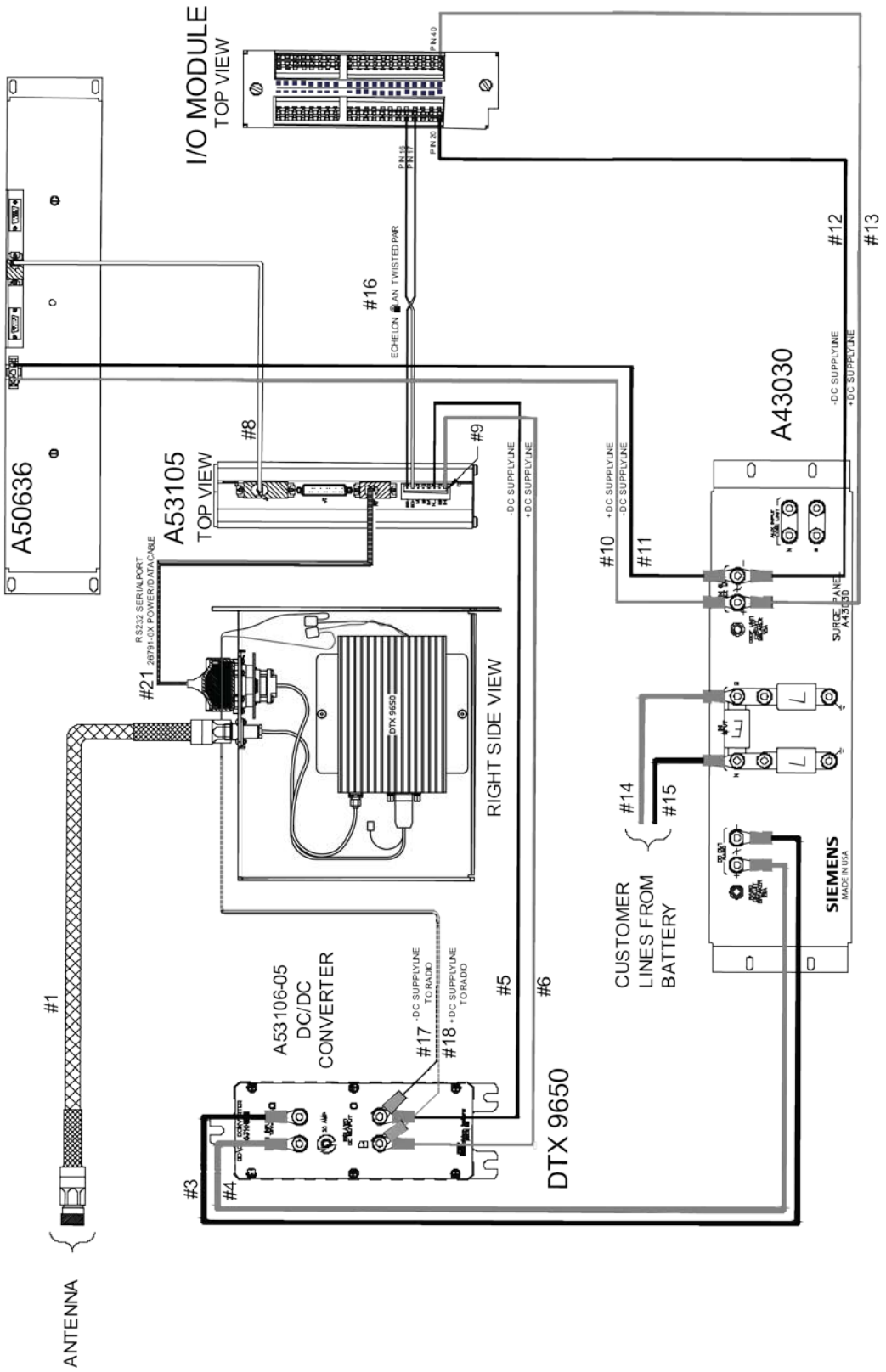


Figure 5-5 WCP Interconnection Diagram (DTX 9650 Radio)

5.3 PERIPHERAL EQUIPMENT

5.3.1 I/O Modules

Bipolar I/O modules 9000-53101-00XX, Unipolar I/O modules 9000-53102-00XX and Relay Output modules 9000-53102-0XXX are used with the WCP.

5.3.2 MCP Interface Panel

The various MCP Interface Panel configuration options available for use with the WCP are provided in Figure 5-8. To order, specify the basic MCP Interface Panel part number (9000-47585) plus the applicable dash numbers.

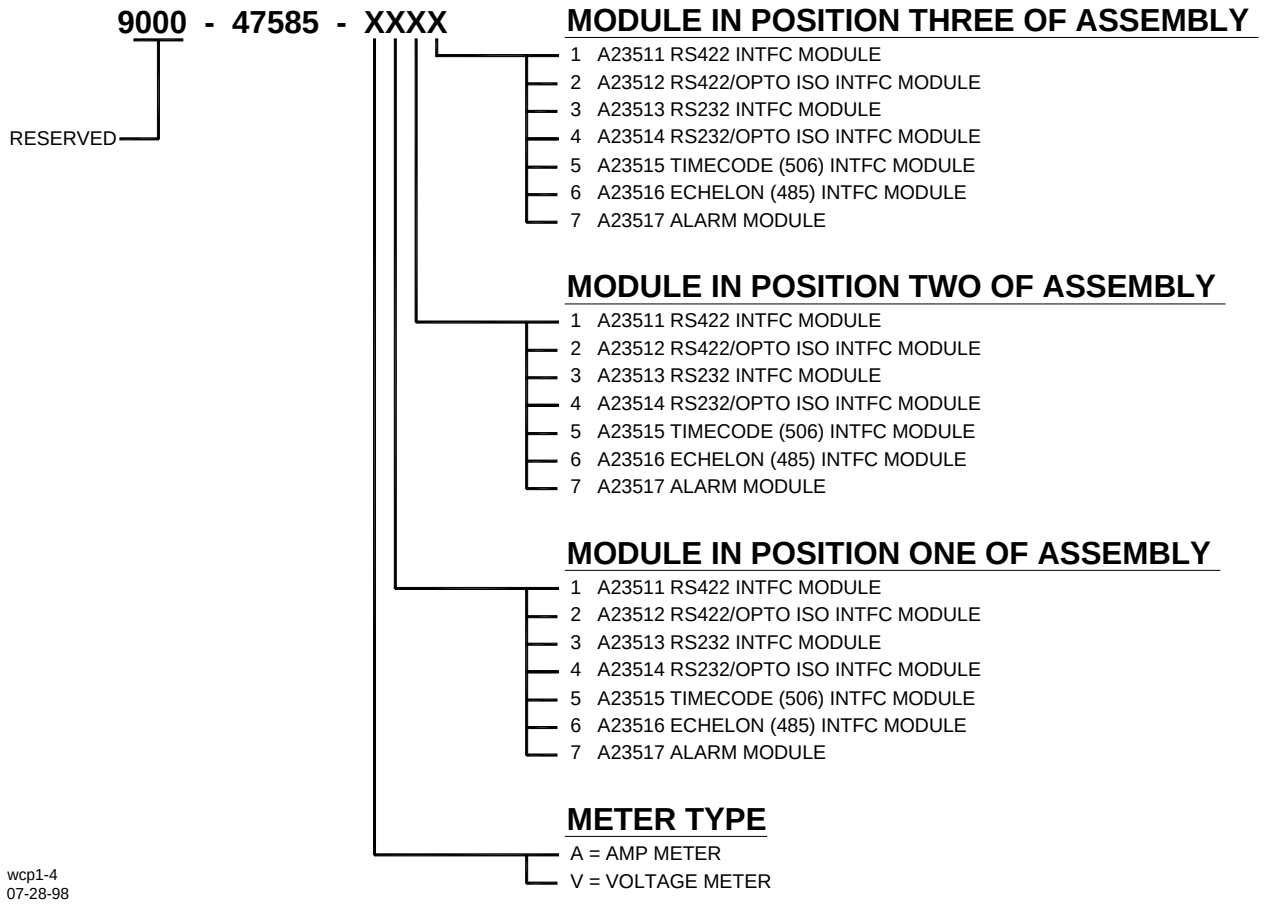


Figure 5-6 MCP Interface Panel Configuration Options

5.3.3 Interconnection Cables

The peripheral interconnection cables used with the WCP are provided in Figure 5-9.

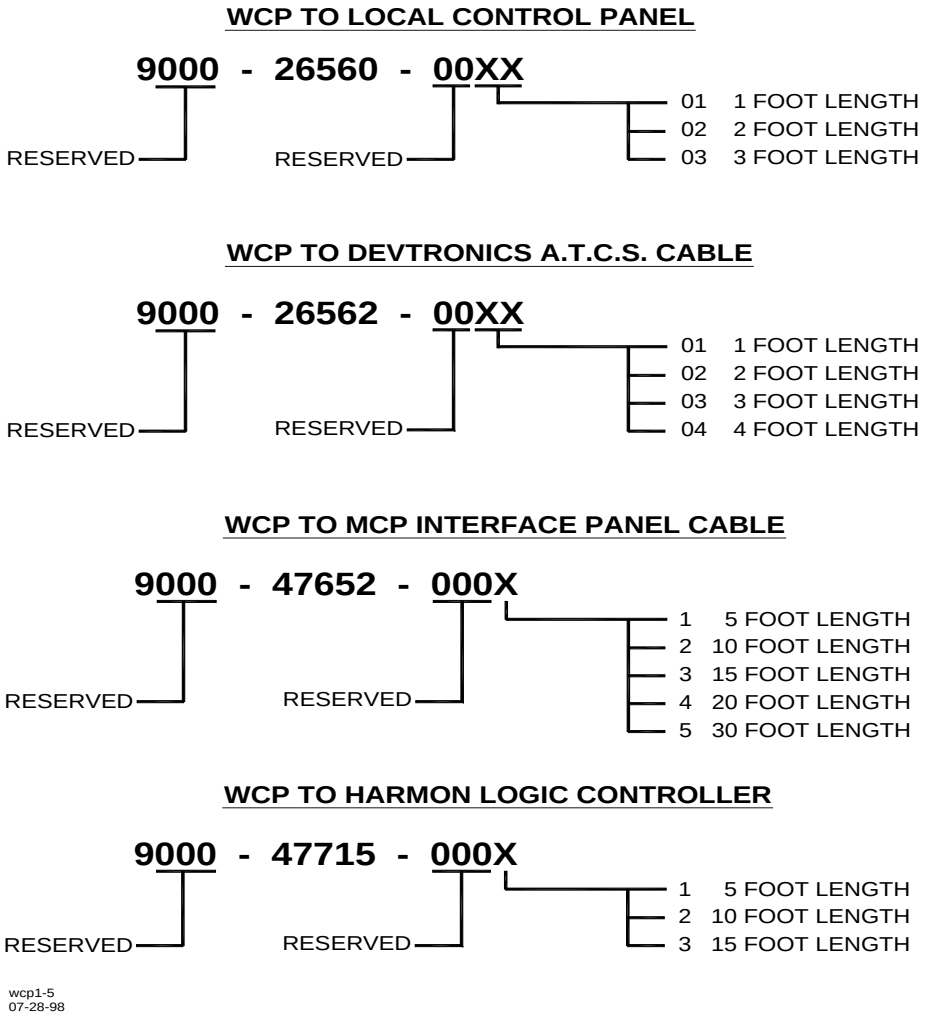


Figure 5-7 Peripheral Interconnection Cables

SECTION VI - CONFIGURATION AND ALIGNMENT

6.0 CONFIGURATION AND ALIGNMENT

6.1 INTRODUCTION

WCP Radio configuration data identifies the WCP Radio with a specific location and establishes its communications, I/O, and ancillary function parameters. WCP Radio alignment sets the operational parameters of the MDS™ SD9 data and the DTX 9650 radio.

6.2 CONFIGURATION

Ordinarily, initial setup and routine maintenance tasks consist of making changes to the site configuration (codeplug) and storing the data permanently in the Wayside Communications Package Central Processing Unit II (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 FEPCC address, client port assignments, system timers, hardware configuration 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 6.3).
2. Using the configuration editor in MCM II Configuration Utility (9VB26) and uploading the complete modified codeplug information (see paragraph 6.3). This is the recommended method.
3. Patching the codeplug data one byte at a time in the online terminal mode of MCM II Configuration Utility. 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 MCM II configuration/online utility, all codeplug 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 codeplug files for the WCP CPU II. This allows codeplug files for each WCP to be saved with a unique file name. In addition, one or more 'default' codeplug files may be generated and saved to a disk. The advantage to this method is that commonly-used configurations may be conveniently stored and later used by the MCM II Configuration Utility to configure new units as they are installed.

The MCM II Configuration Utility contains a database that may be updated with new releases of the executive firmware.

NOTE

NOTE

Codeplug files (filename.XCM) created for earlier versions of the WCP CPU may be used with the WCP CPU II, and vice versa.

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

6.2.1 EEPROM Memory Structure

All user data and executable programs within the WCP CPU II are stored in a 256kb block of on-board flash EEPROM memory. The memory sections of the WCP's on-board flash EEPROM are described in the following paragraphs.

6.2.1.1 Boot Code

Boot Code refers to the bootstrap program that runs 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.

6.2.1.2 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.

6.2.1.3 Codeplug

The codeplug 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 codeplug. See Appendix C for details.

NOTE

NOTE

The term “codeplug” is also used for the same configuration data storage function in the associated MDS SD9 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 05-3316A01, Rev E).

6.2.1.4 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 Siemens Rail Automation utility for creating and compiling ladder logic files that is separate from the module configuration utility.

6.2.1.5 Executive

The executive program is the “operating system” for the WCP CPU II and is field upgradable. Included in the executive firmware is all the input and output port handlers, diagnostics, and display functions.

6.3 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 6-2). 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.)

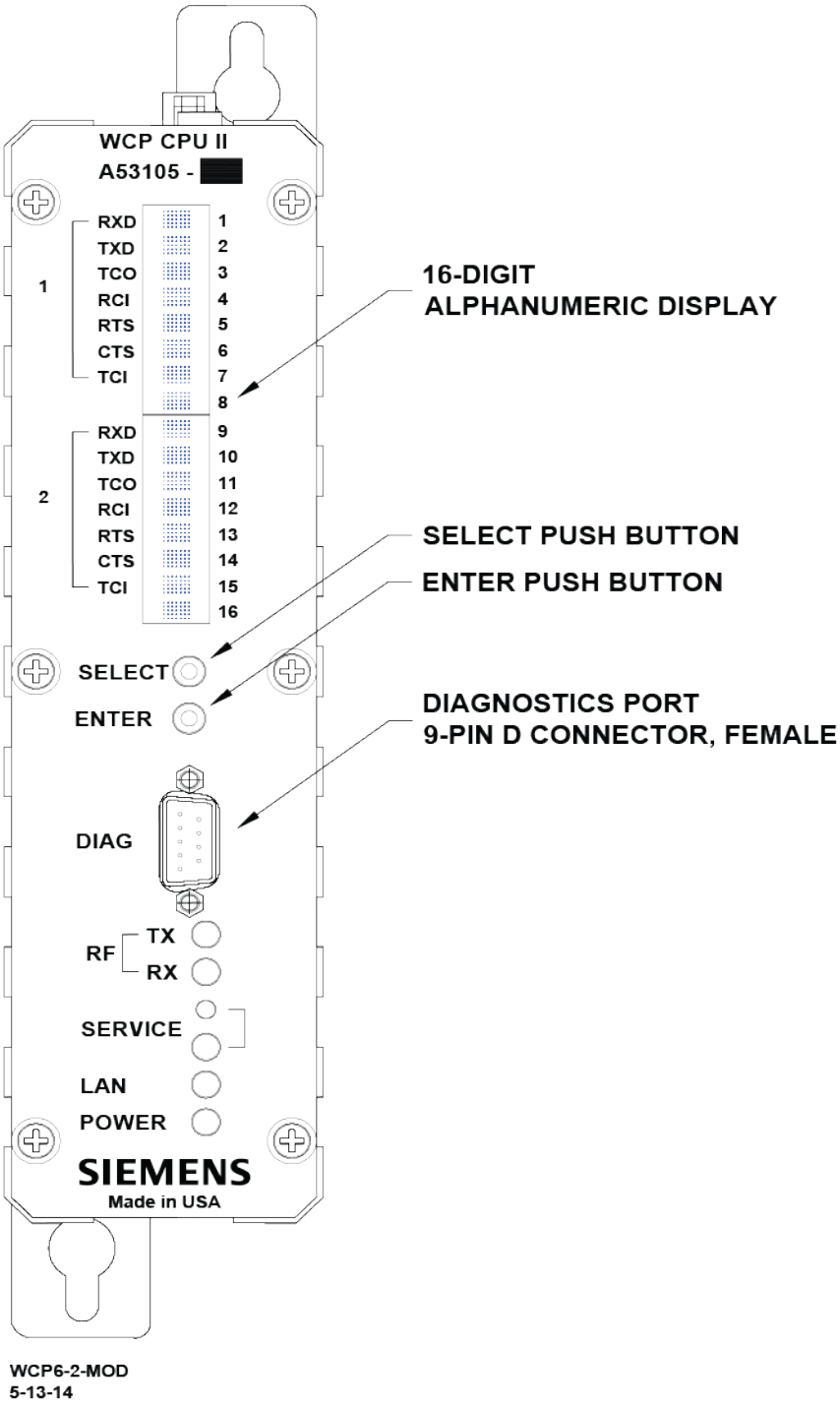


Figure 6-1 WCP CPU II Front Panel

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 contain subfunctions that allow the user to change and/or monitor code-plug data. The subfunctions accessible from each function are identified in the following paragraphs and displayed graphically in Figure 6-3.

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.

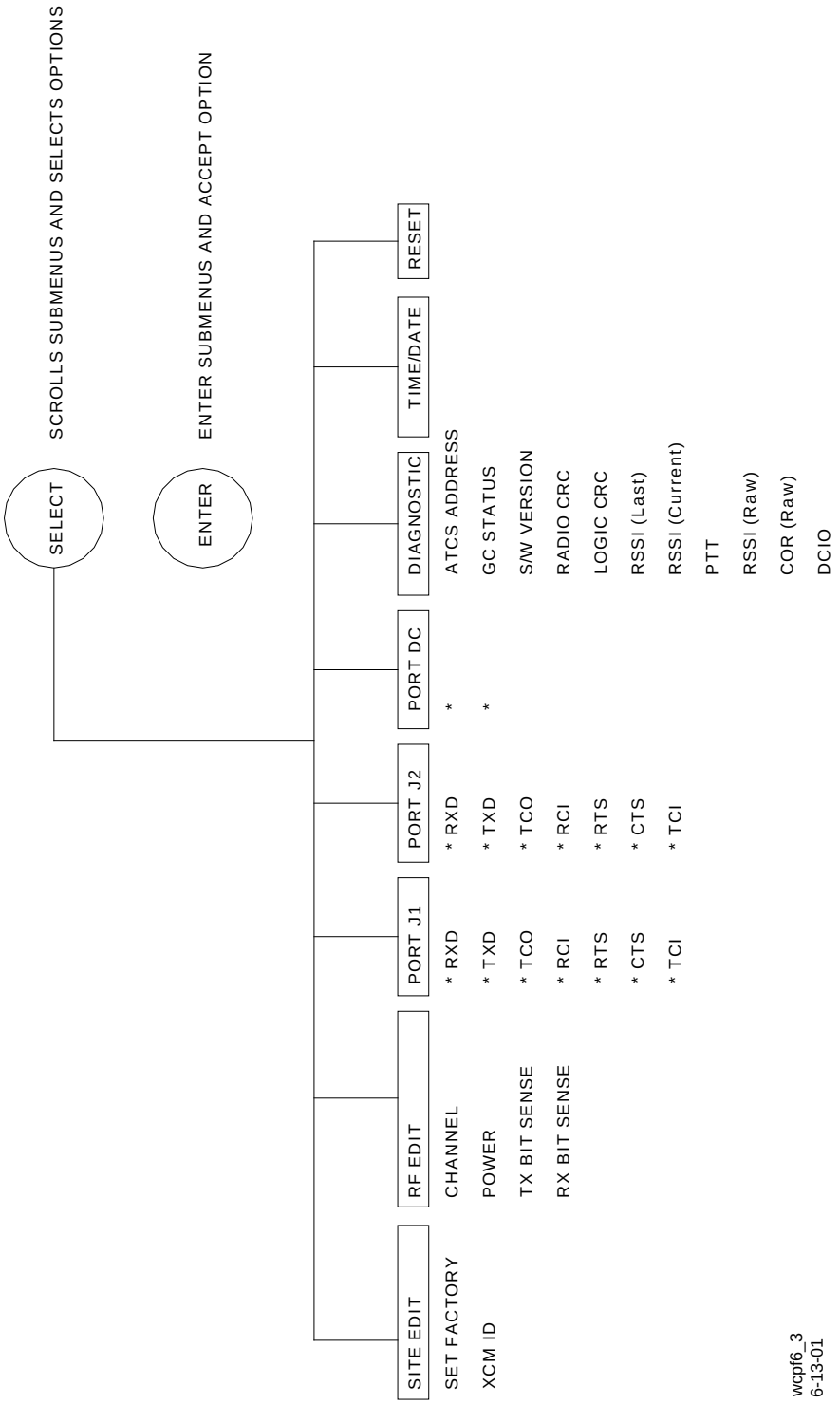
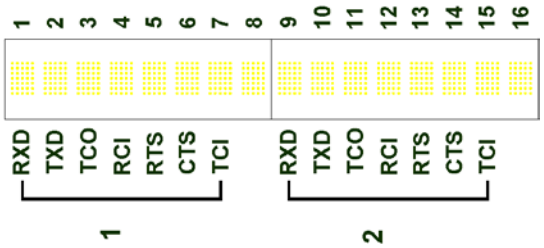


Figure 6-2 WCP CPU II Functional Menu Structure

6.3.1 Alphanumeric Display

The Alphanumeric Display is divided into two sections as shown in Figure 6-2. The seven most significant bits of each section are identified by an acronym as shown at right.



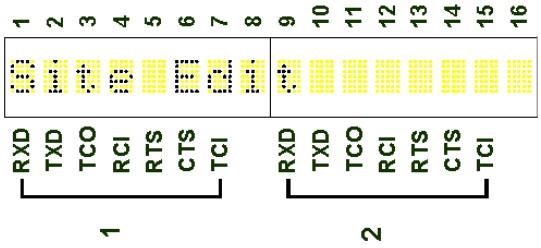
The acronyms in section 1 have no relevance at this time. The acronyms in section 2 correspond to and identify the relevant serial bits of WCP CPU II ports J1 and J2 and the local, opto-isolated I/O of the power connector J4. The definitions for these acronyms are listed in Table 6-1.

Table 6-1 Alphanumeric Display Acronyms

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

6.3.2 Site Edit

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



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

Table 6-2 Site Edit Subfunctions

Subfunction Display	Item/Value Range	Description
Set	**Default CP**	Default codeplug setting
XCM id: (1)	**Enable**	Use 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

6.3.3 RF Edit

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

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

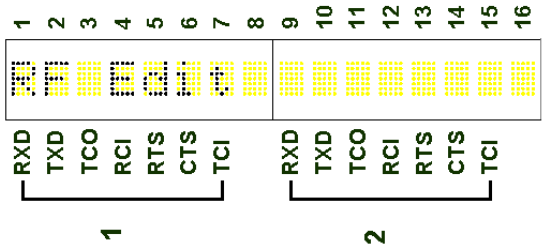


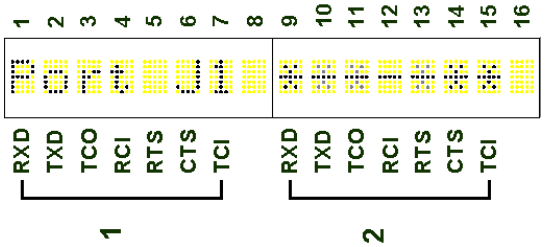
Table 6-3 RF Edit Subfunctions

Subfunction Display	Item/Value Range	Description
Chan:	**1-6**	Selects radio channel
Power:	**Auto**	Refer to paragraph 6.4
	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

6.3.4 Port J1

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

The subfunctions listed in Table 6-4 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 (*****).



6.3.5 Port J2

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

Subfunctions corresponding to those listed in Table 6-4 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 (*****).

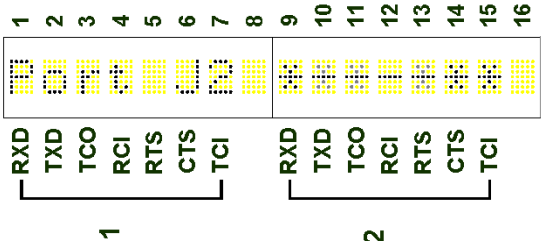


Table 6-4 Port J1 Subfunctions

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	
	ASYNC	
	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** **ASYNC**	Clock sync mode.
Poll = # See Note below.	**0 – 127**	Module polling address
Max Poll	**0 – 127**	Sets poll range

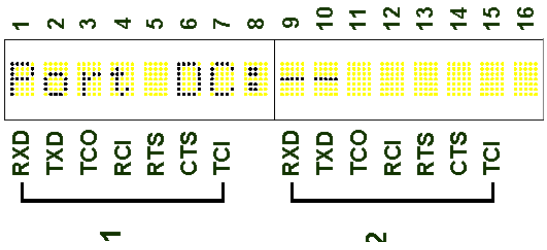
NOTE

Subfunction default display is dependent on current Codeplug parameters.

6.3.6 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.



6.3.7 Diagnostics

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

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

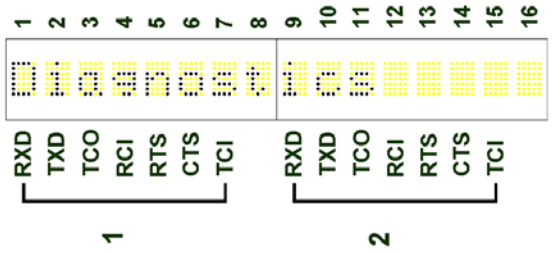


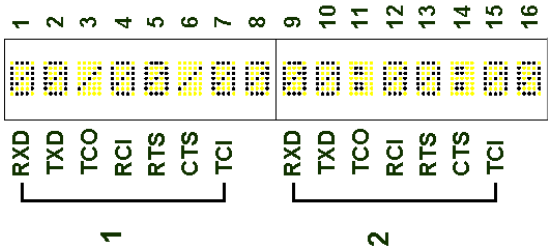
Table 6-5 Diagnostic Subfunctions

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 V01.17.47**	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** **HH**	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.

6.3.8 Date and Time

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

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



6.3.9 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 6-6 lists the tests performed.

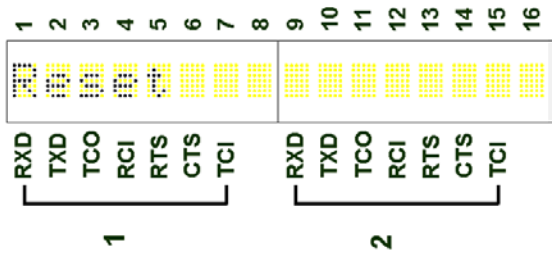


Table 6-6 WCP CPU II Self Tests

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
**HDLC PORT 0 **	**OK /FAILED**	Verifies the client ports via an internal loopback test of the TX and RX data paths
**HDLC PORT 1 **	**OK /FAILED**	Verifies the client ports via an internal loopback test of the TX and RX data paths
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.

6.4 WCP CPU II CONFIGURATION PROGRAM

The WCP CPU II Configuration program (MCM II Config 1.17.47.XX.EXE) and associated files are distributed on a CD ROM or is available from the Siemens Field Support Team (Contact: 1-800-793-7233).

- The WCP CPU II Configuration Program must be installed on a computer with a serial port. For computers without a serial port, use a USB-to-Serial adapter. Not all adapters will work for all computers. A suggested adapter is the Cables Unlimited USB-2920, USB 2.0 to Serial DB-9 Adapter.

6.4.1 Installation

To install the MCM Configuration program proceed as follows:

1. Insert the installation CD to the CD Drive.
2. Make a folder on the drive where CD Files will reside.
3. Copy the files from CD to the folder.
4. Create a shortcut to the MCM II Configuration Utility onto the computer desktop.

6.4.2 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 6-4.

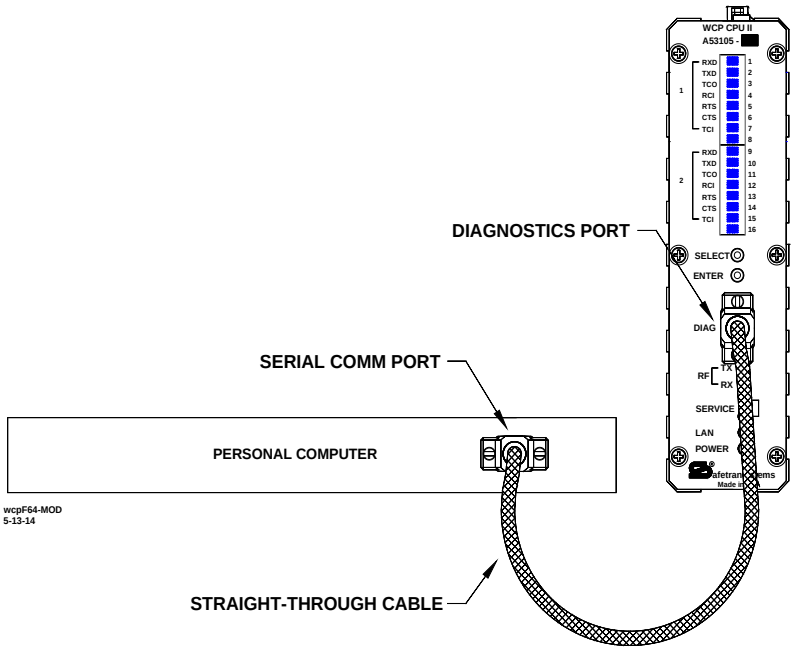


Figure 6-3 WCP CPU II to PC Interconnection Diagram

6.4.3 MCM II Configuration Utility

Start the MCM II Configuration Utility (9VB26) Editor by opening the MCM II Config 1.17.47.XX .EXE file. The name of this executable file will change per the installation CD.

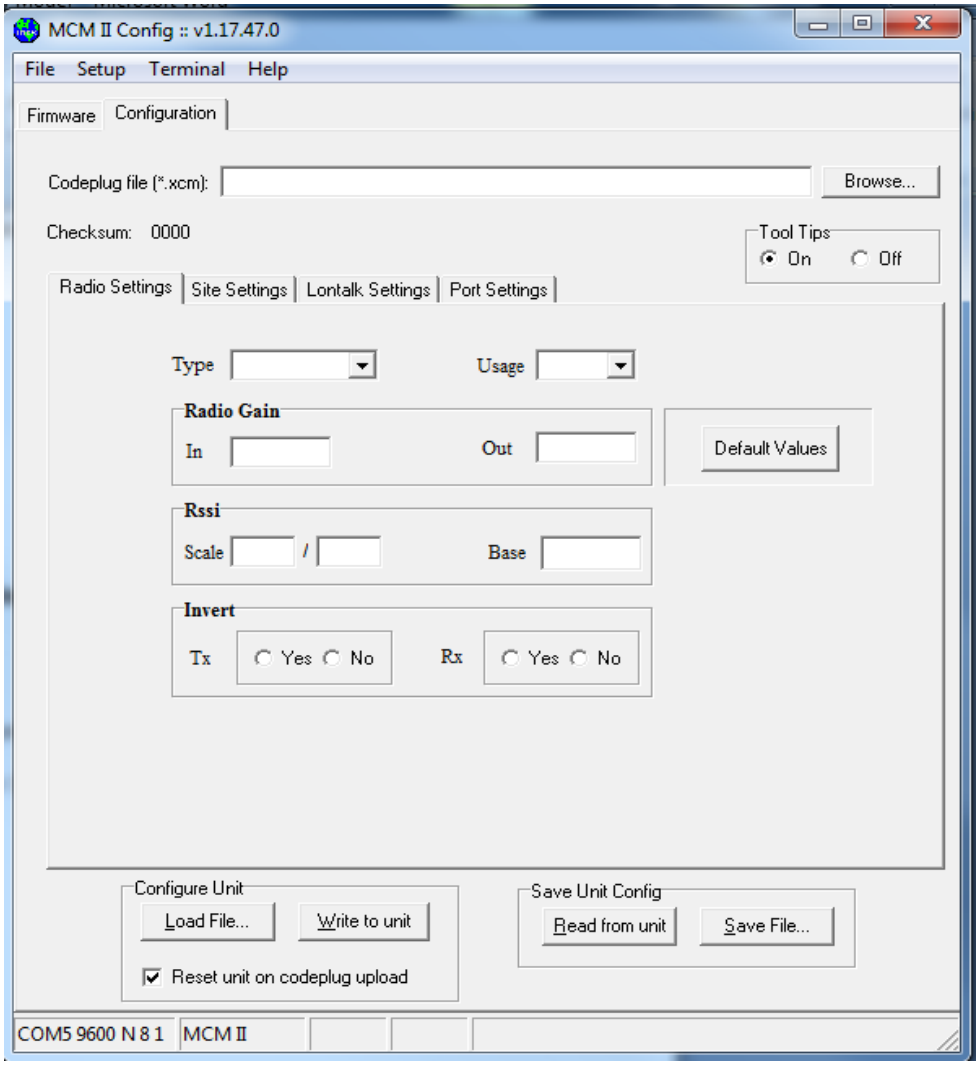


Figure 6-4 Configuration Editor Startup Screen

6.4.3.1 Accessing a Saved Code plug

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

1. Select Load File button and screen below will appear browse until you have located your code plug and open.

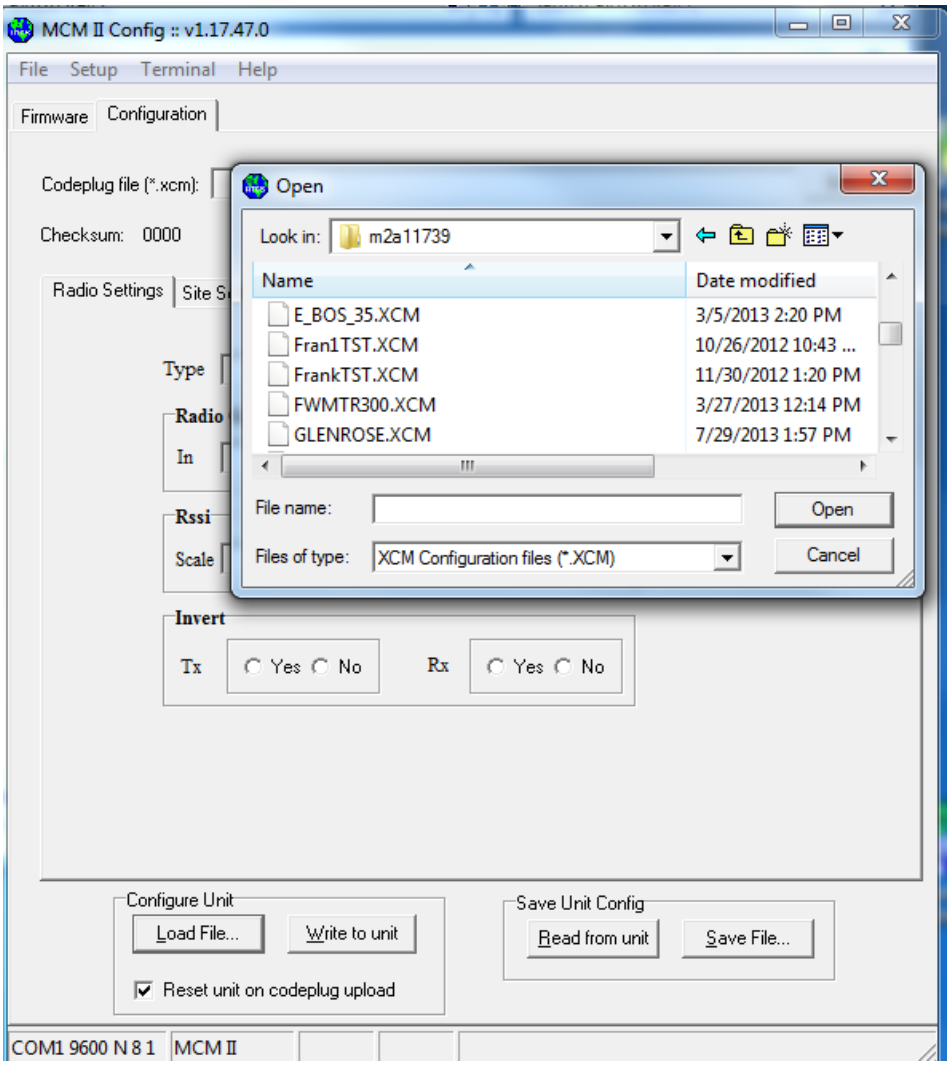
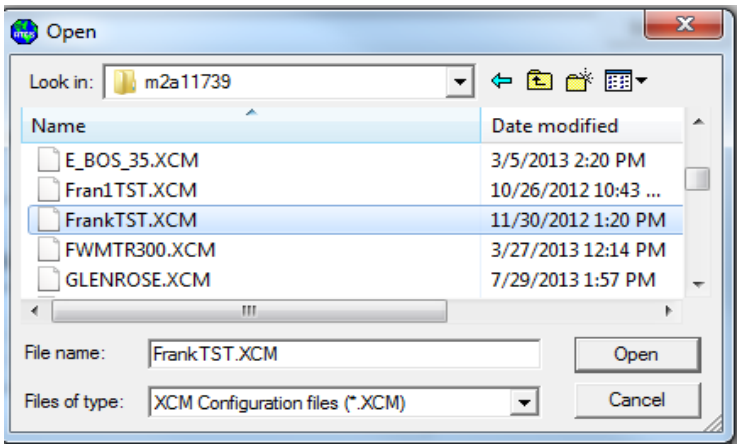


Figure 6-5 Code plug File List

2. Place the cursor on the desired codeplug file name within the list using the arrow keys.



3. Press the **OPEN** key. The selected code plug file is displayed within the Main Editor Screen, Figure 6-7. It will then display your configuration on the screen.

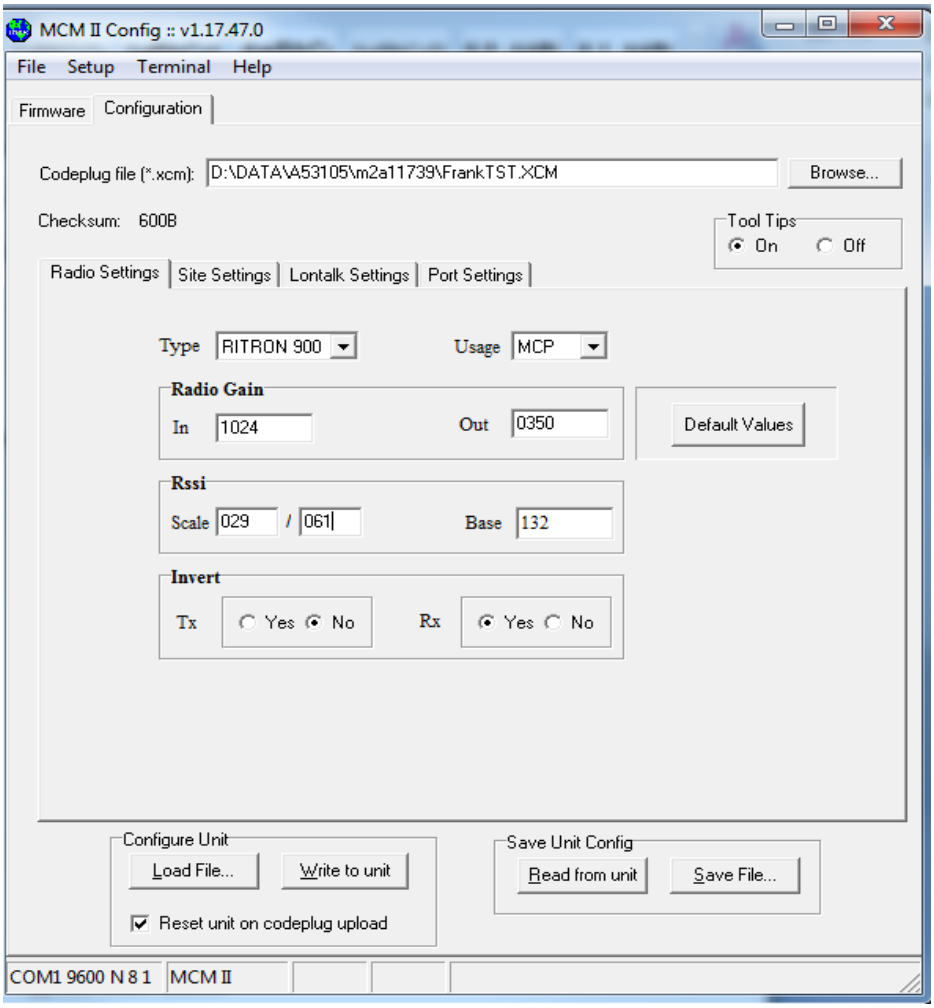


Figure 6-6 Typical Main Editor

6.4.3.2 Read WCP Code plug

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

1. Select button **"Read from Unit**" and XCM file will be downloaded on your Laptop.

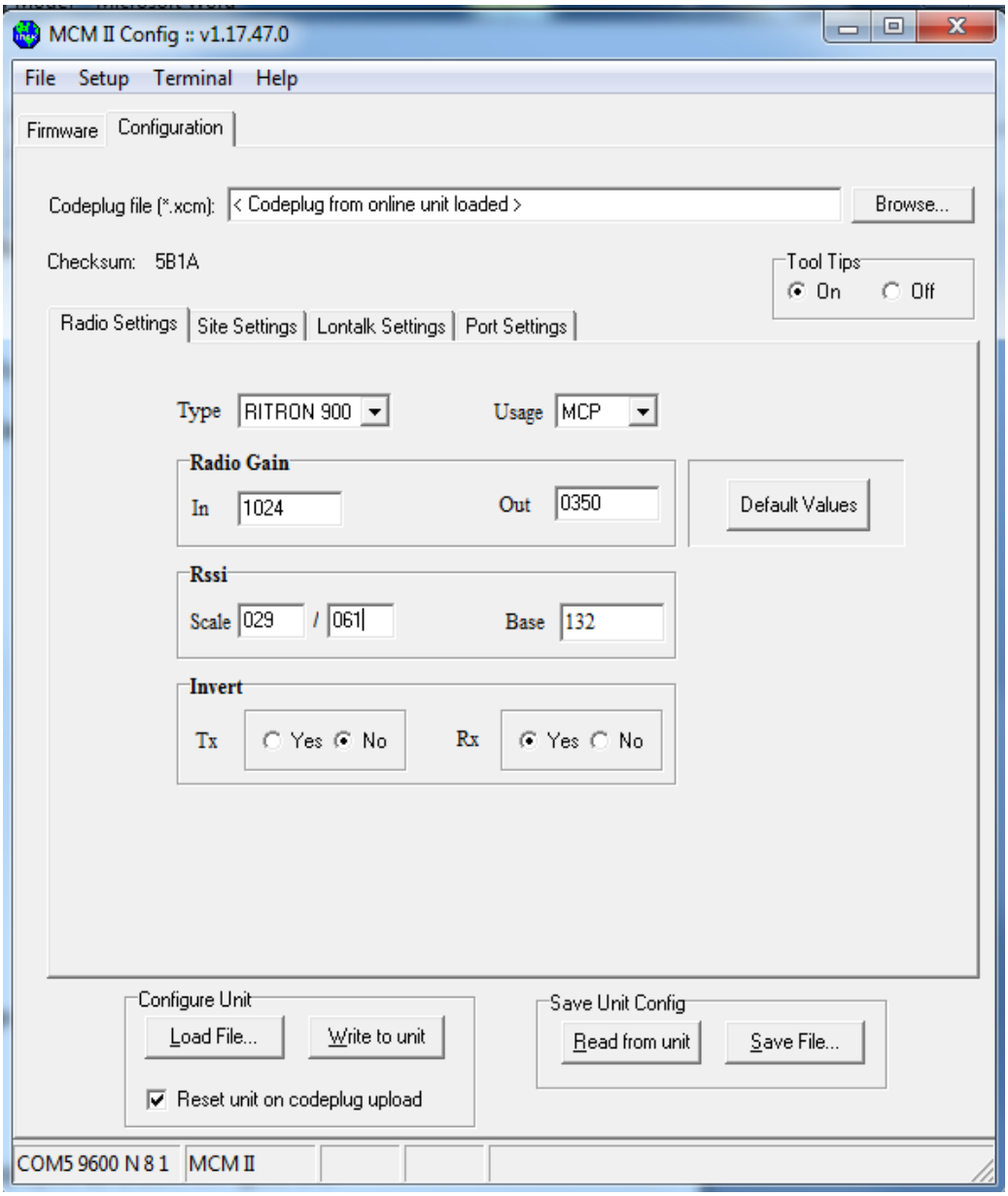


Figure 6-7 Read WCP Codeplug

2. The code plug file is read from the WCP CPU II and displayed as shown in Figure 6-9 on Terminal screen.

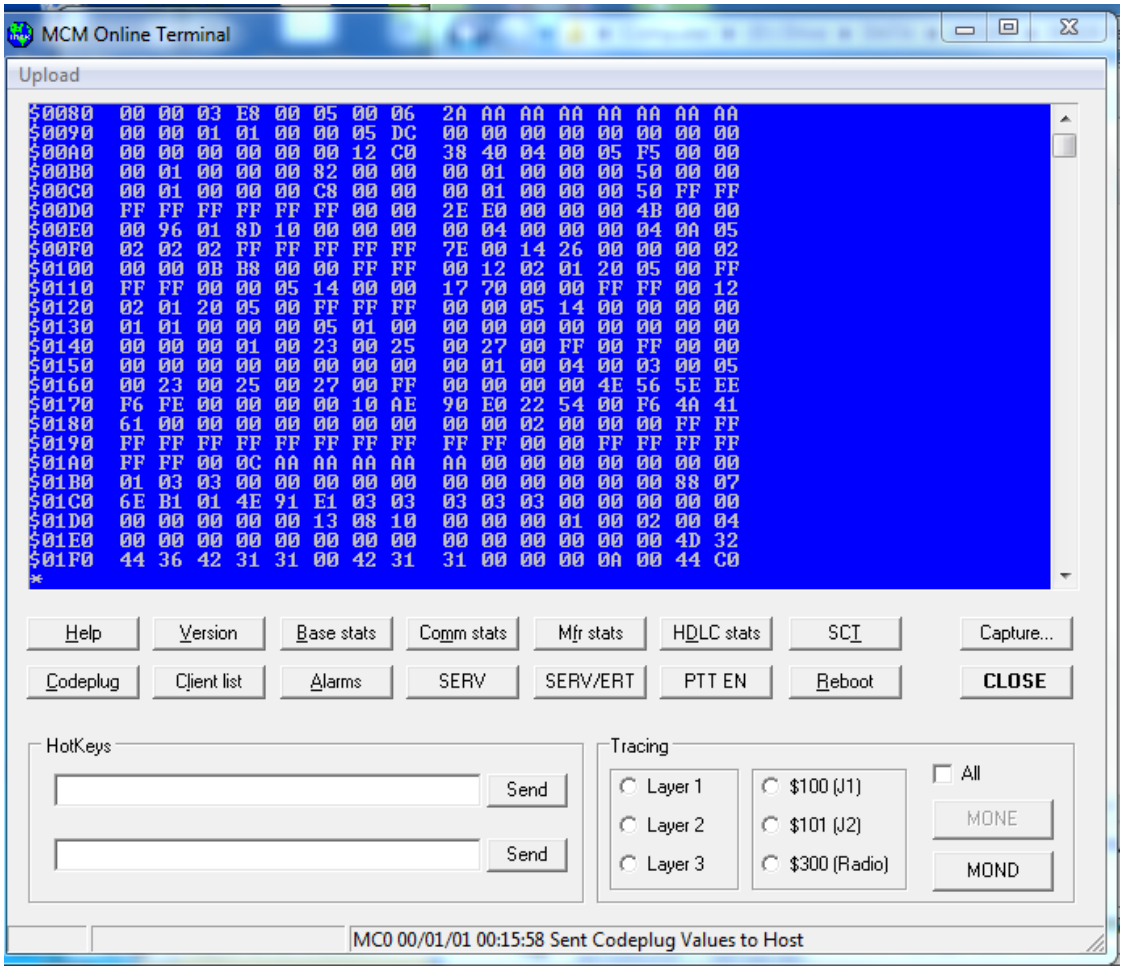


Figure 6-8 Code plug Data Read from WCP

To save the code plug you have downloaded, Select **Save File**. You will be prompted to give it a file name and then click the **Save** button on the screen.

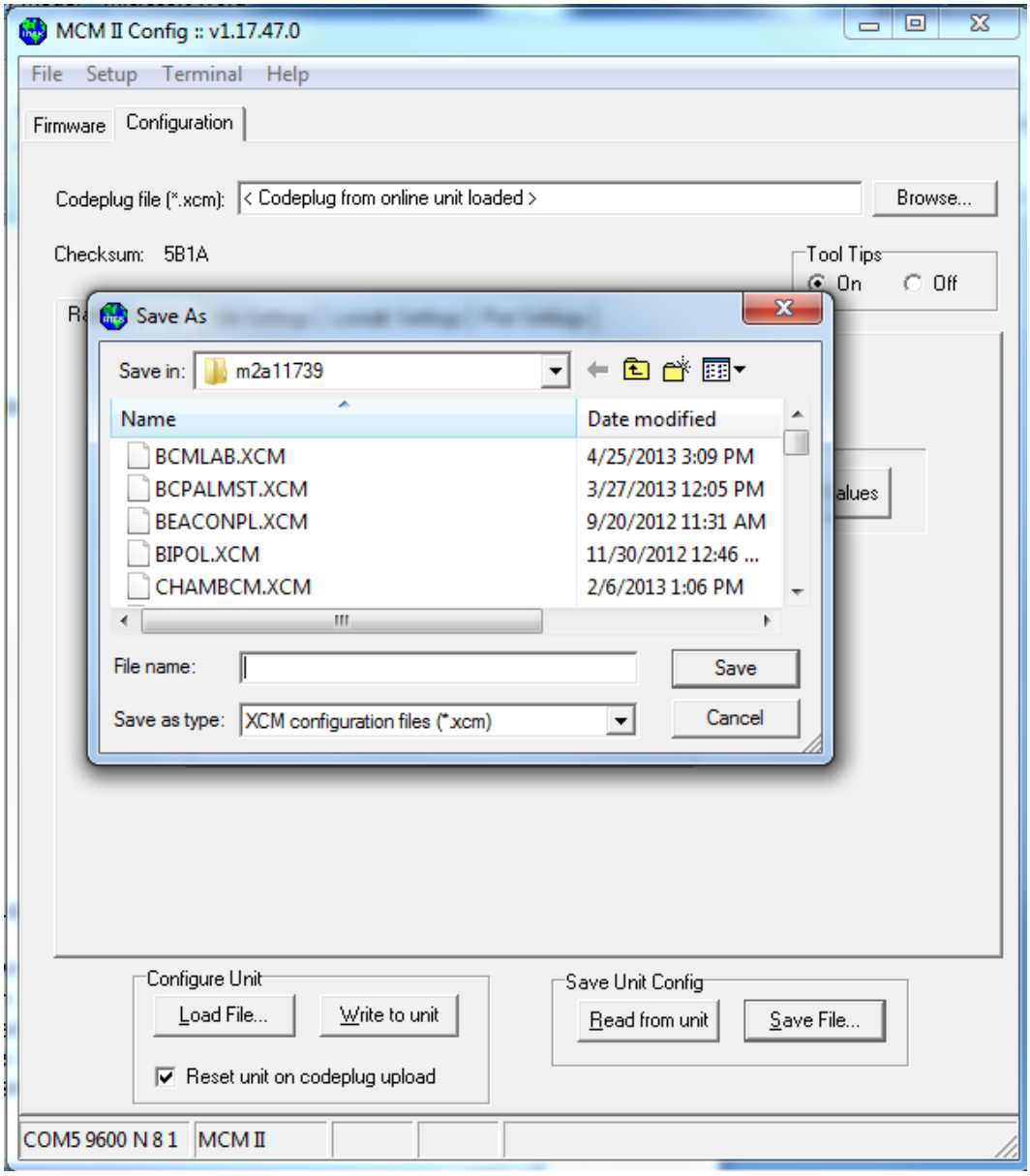


Figure 6-9 Saving File

6.4.4 Using the Main Editor Screen

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

- Radio Settings
- Site Settings
- LonTalk® Settings Network Configuration
- Port Settings

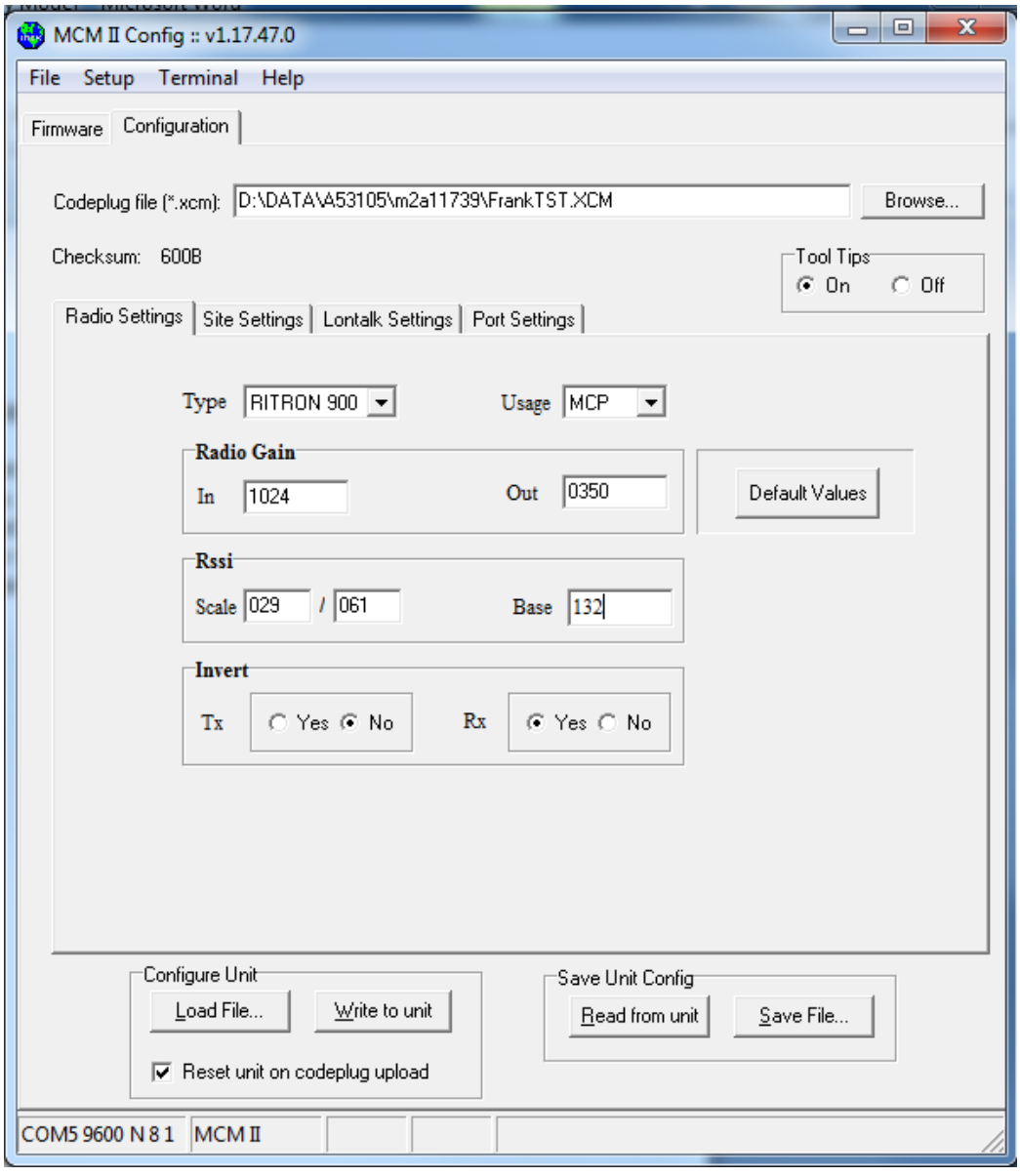


Figure 6-10 Main Editor Screen

These sections are described in the following paragraphs. The name and path for the selected file is identified at the Codeplug file (*.xcm) of the display. You can browse to select your Codeplug.

- The screen will show four tabs that contain the names of the configuration screens or functions and a **Help** menu is accessible from the menu bar at the top of the screen.
- To display a screen, select the tab you would like to view.

6.4.5 RF Settings

Under Radio settings select the radio type you have installed. This will automatically preset your radio Gains In and Out also setting your RSSI scale to proper settings for this radio. Your inverts are negotiated automatically if you are running **DSP 01.02.30** in both your MCMII and your BCMII. The only times you need to be concerned about inverts are when you are using older MCMI and BCMI.

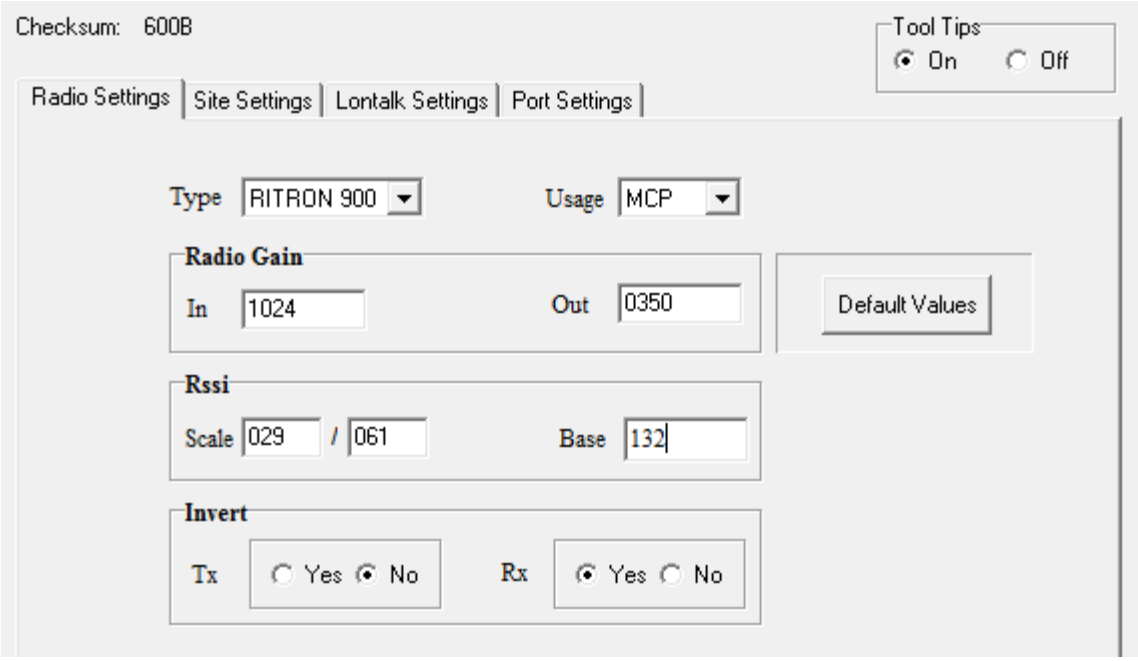


Figure 6-11 RF Settings

6.4.6 Site Settings Type RRR LLL GGG SN DD

Local is a 14 digit ATCS for WCP 7 62A AA1 AA2 A1 A1

Type 7 is for all wayside devices

RRR is your unique Railroad ID assigned by the AAR

LLL is the three digit number assigned to this particular piece of railroad Line.

GGG is the unique Group number assigned to this location.

SN is the Sub node number for the MCM it is typically going to be A1.

DD is the device number and for the MCM is typically going to be A1.

Local Address is enabled when you are using serial protocols such as Genisys polling and others. When you are using protocols that are providing the ATCS information from code unit such as VHLC's and Electro logics that are running with ATCS chips then you would disable local address.

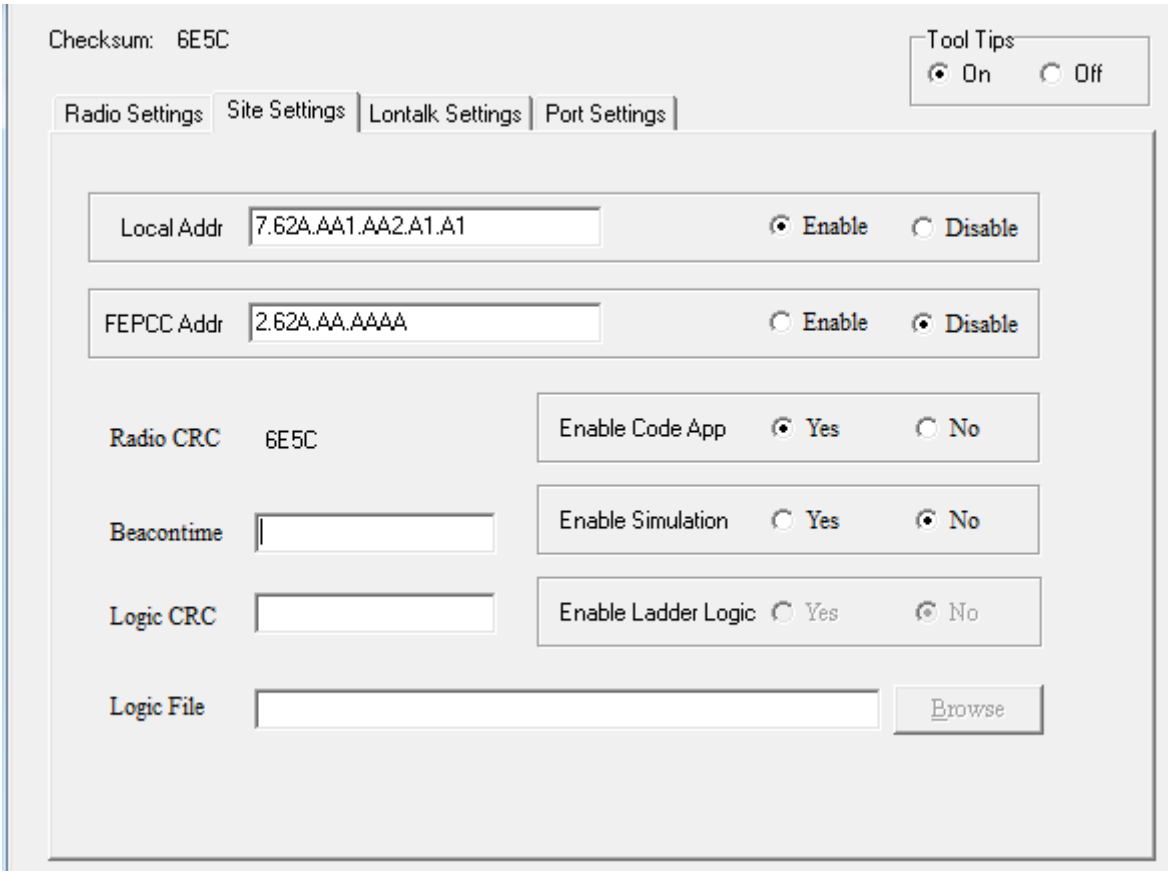
FEPCC (Front End Processor Cluster Controller) is address of OCG or Packet Switch you will be talking to. Typically disabled unless you know what it is. Through ground contact procedure the WCP will learn this address when an office device replies.

The **Code app** , **Simulation** , and **Ladder Logic** are only enabled if you are using Siemens I/O Echelon communication devices.

Beacontime is used to simulate a control point by setting a time and it will force a simulated indication into office based on the timer you set.

Logic CRC is crc of Logic file being loaded.

Logic File browse and select Logic file to be uploaded.



6.4.7 LonTalk® Network Configuration

The Lontalk Settings screen allows you to Configure Siemens Non-vital Input / Output modules

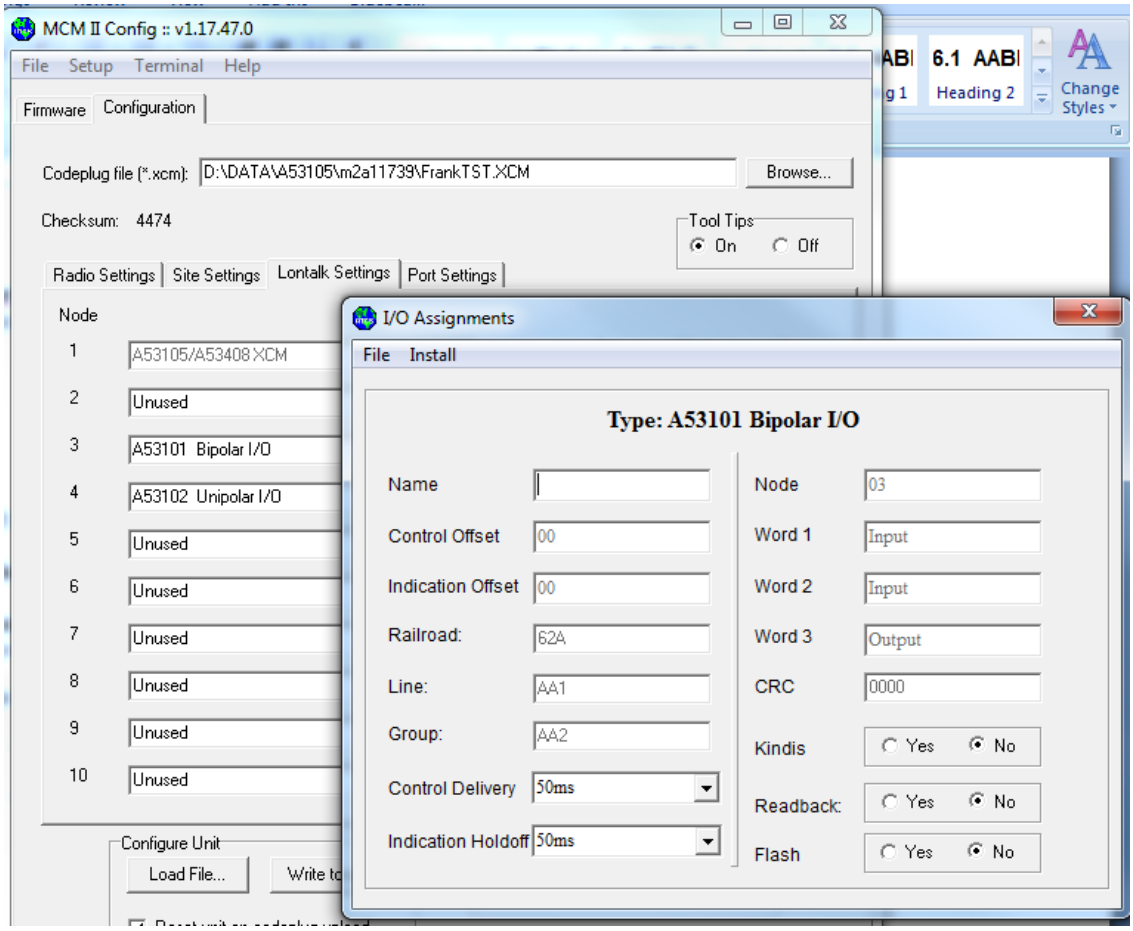


Figure 6-12 Lon Talk Configuration Screen

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

1. R/Link I/O modules selected for a node require individual configuration and installation. I/O module configuration is accomplished as follows:
   a. When you have selected your node and device, the Edit button will highlight and allow you to do configuration for module.

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.
   b. 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 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.

3) Select the **Control Delivery** field (see Figure 6-13).

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

a. Field selection range:
   50ms
   100ms
   200ms
   500ms
   1sec
   2sec
   Latch

b. Using the mouse, select appropriate Control Delivery time.
c. Select the **Indication Holdoff** field (see Figure 6-35).

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

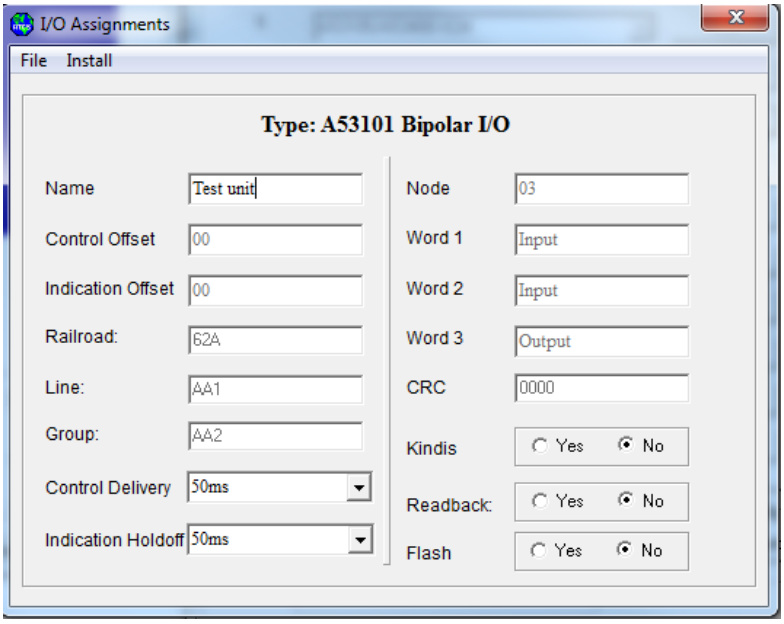


Figure 6-13 I/O Assignment Screen

When setting the words used Input for Indications and Output for Controls should be set according to your design plans.

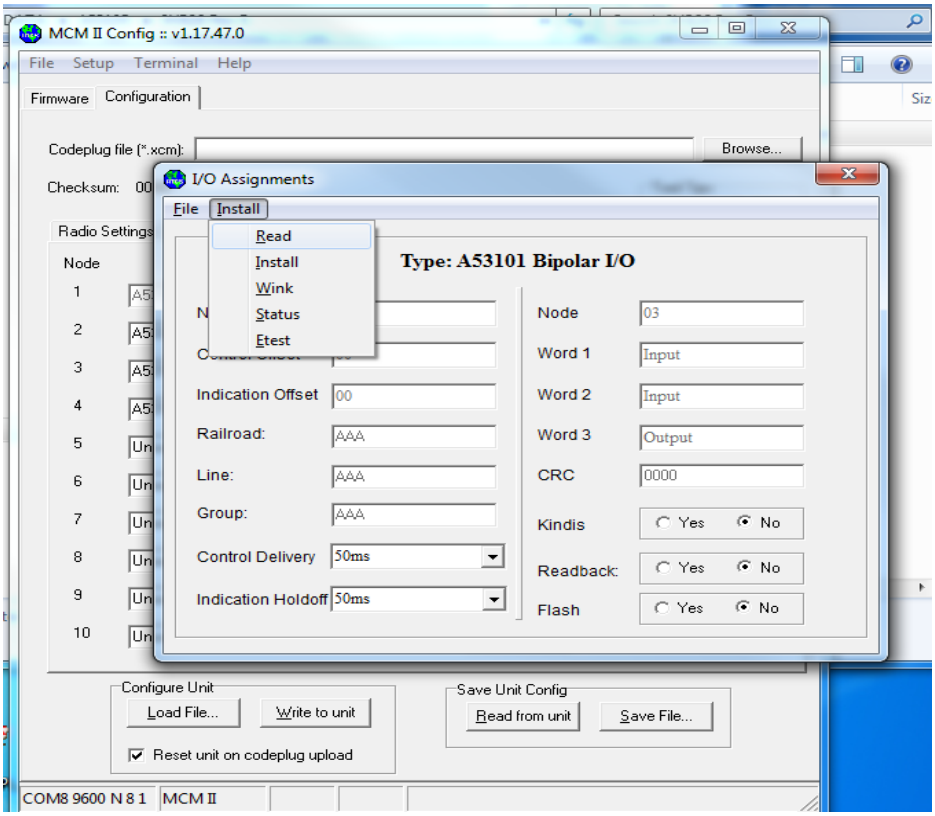


Figure 6-14 I/O Name Assignment

6.4.7.1 Install Menu

The Install drop-down menu, accessed from the I/O Edit screen, contains five entries that are described below. When the module installation process is complete, the 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 codeplug of the WCP CPU II. The 'Waiting for config data' popup box 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, the system responds with the 'Waiting for service pushbutton" pop-up 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. When the module installation process is complete, the module will restart.

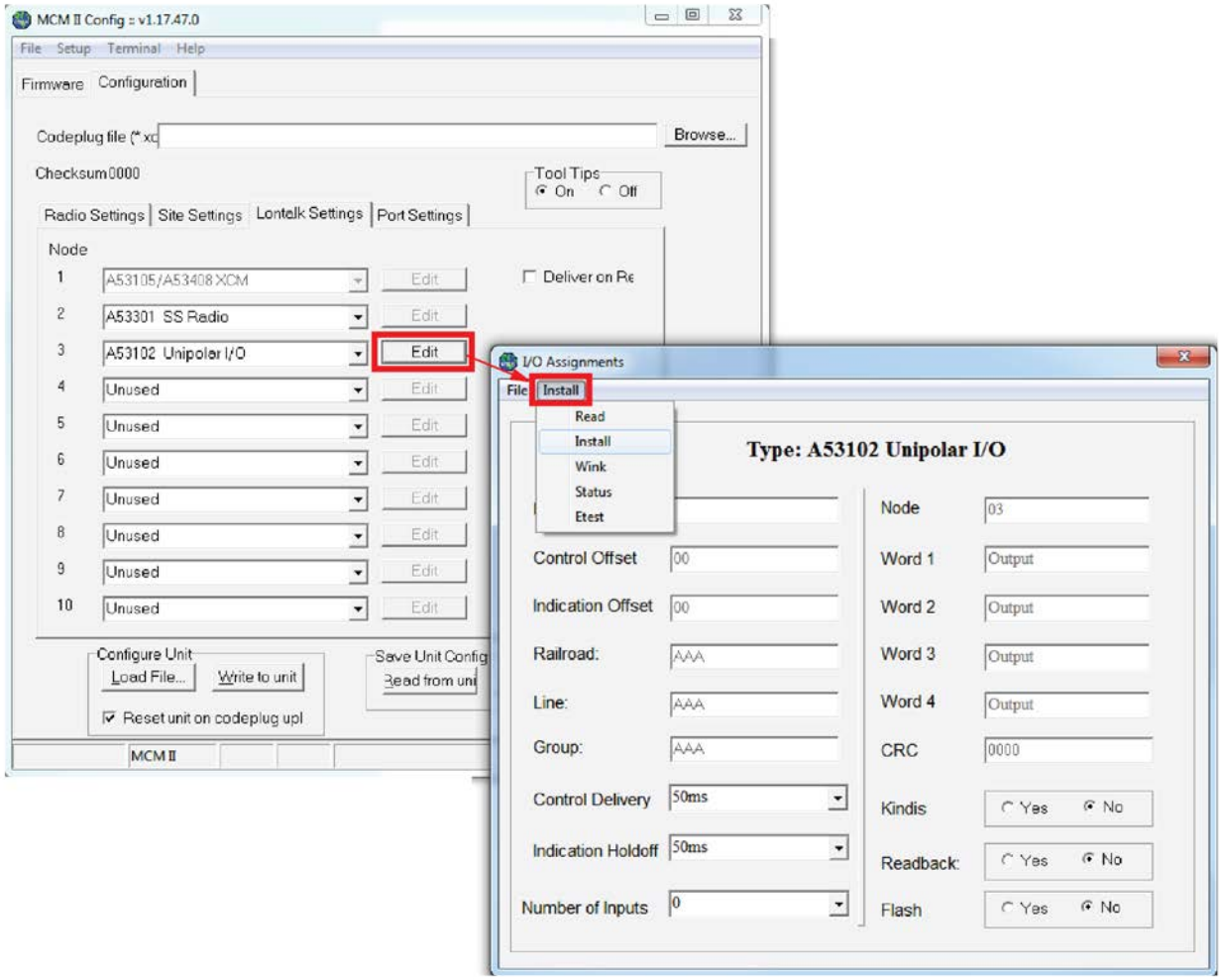


Figure 6-15 Install Menu

- **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.

6.4.7.2 Port Selection

Port selection is where you would configure your serial protocol.

J1 HDLC ADM in this example is the protocol used when talking with code devices running with ATCS chips and providing ATCS information. The Link / Max addressing not used.

J2 Geni (O) in this example is showing configured for a Genisys protocol where serial polling will be done between MCM and Code unit. The Link / Max should be set for station address of code unit also in Local address the Group number should be the same as the polling address that is set and Local address enabled.

Lon should be set for Not Used if you are not installing any Siemens I/O modules.

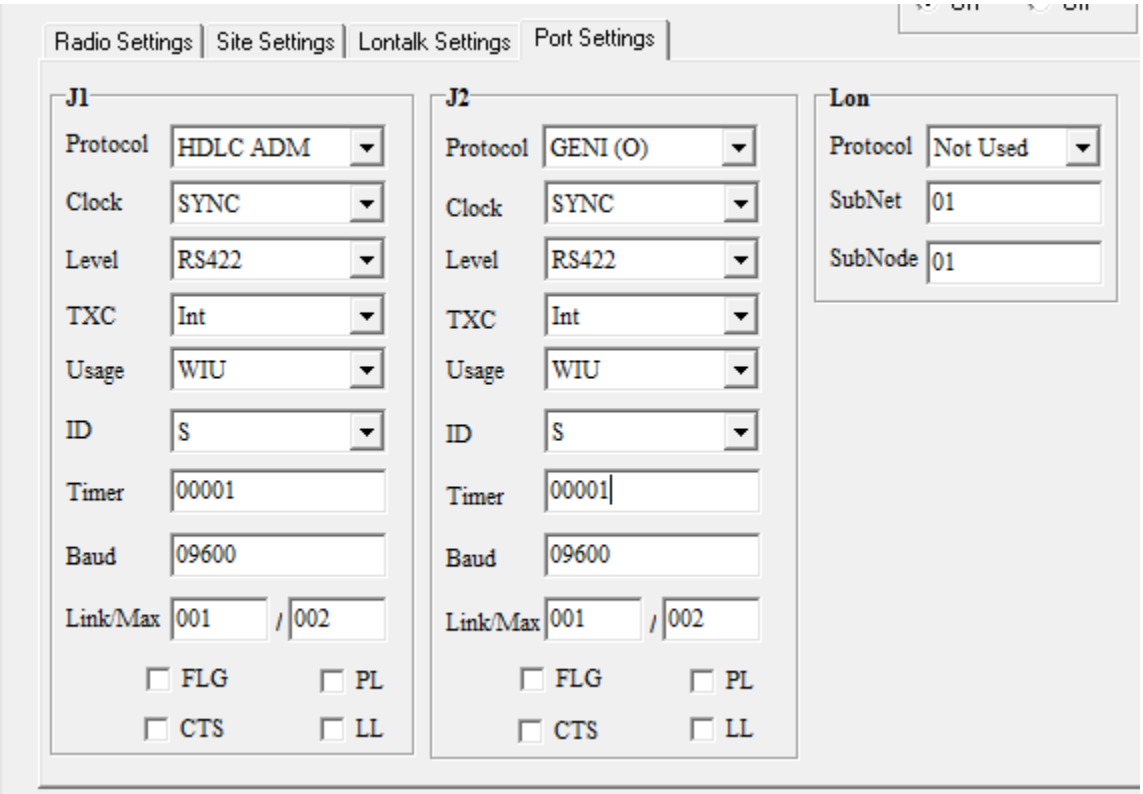


Figure 6-16 Serial Port Protocol Settings

To open the Terminal screen, select **Terminal** at top of Configuration screen. Pressing the enter key will make asterisks appear in a column on the left. This indicates the software is communicating with the MCM.

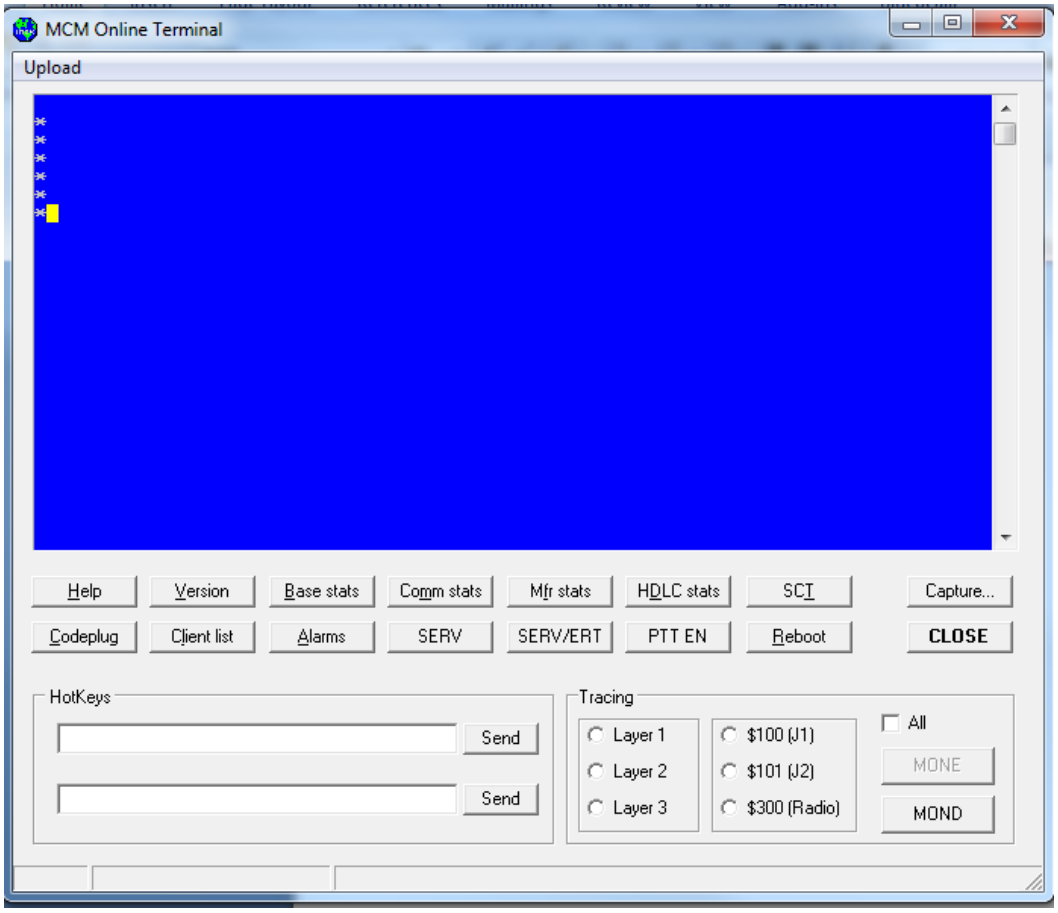


Figure 6-17 Terminal Screen

To request software information, select the **SCT** button.

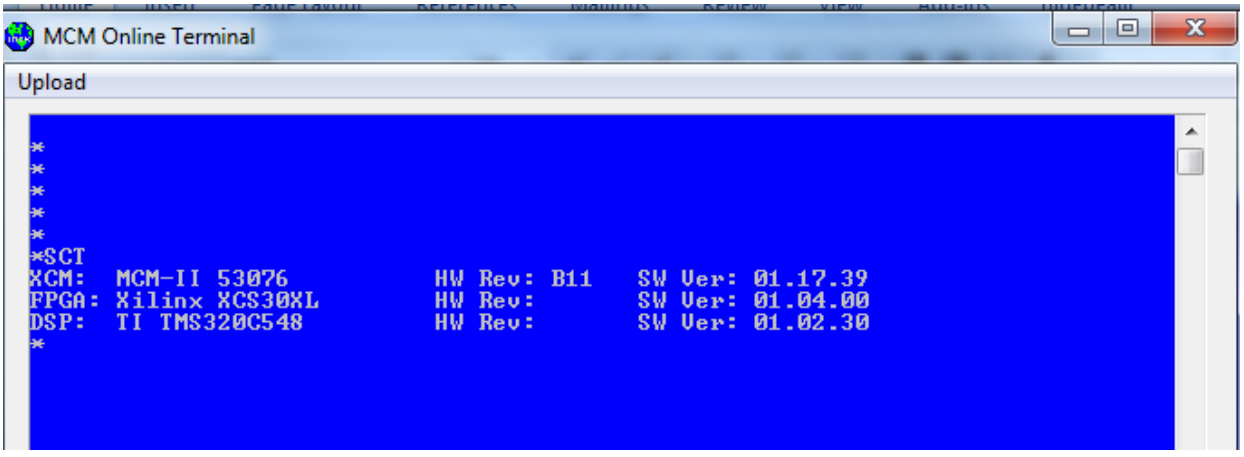


Figure 6-18 Software Information

Capturing Log file: Select the Capture button and give it a file name and then hit the Start button. The log will then capture anything that takes place if you select a layer and then the port you want to capture and hit MONE for (Monitor enable)

Layer 2 $300 will capture all RF traffic in and out of antenna.

Layer 2 $100 will capture all serial traffic in and out J1 serial port.

Layer 2 $101 will capture all serial traffic in and out J2 serial port.

Layer 1 $100 will capture all physical layer serial polling traffic in and out J1 serial port.

Layer 1 $101 will capture all physical layer serial polling traffic in and out J2 serial port.

MONE (Monitor Enabling) will enable monitoring of a port.

MOND (Monitor Disable) will disable monitoring of all ports.

Client List will display all ATCS addresses MCM is supporting.

Code plug pressing Code plug will display all code plug parameters

Alarms will display any alarms MCM detected.

SERV & SERV/ERT will take MCM out of data mode and into service mode for Error Rate Testing and code plug patching. **Note**: always make sure you have railroad before pressing these buttons.

Reboot will restart MCM.

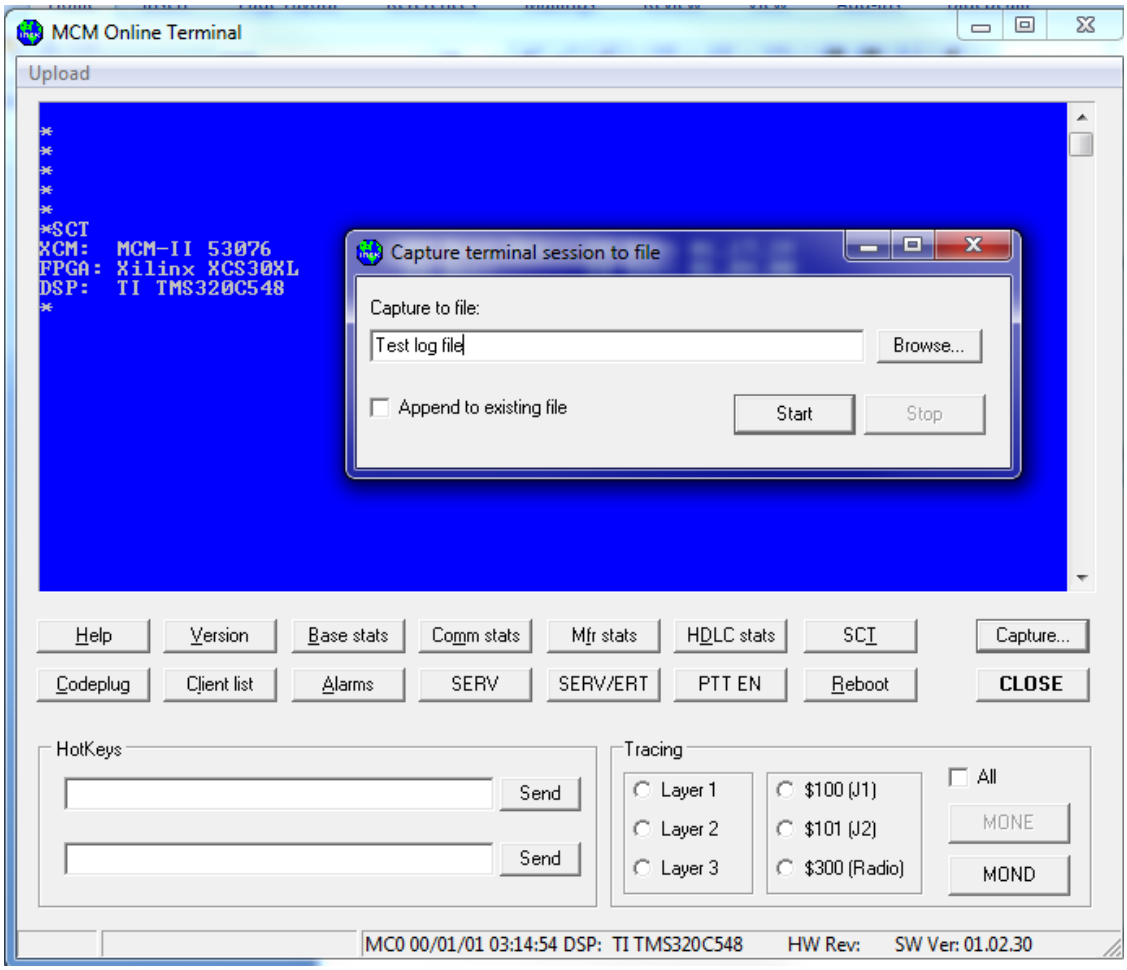


Figure 6-19 Online Terminal Screen Functions

6.4.7.3 File Menu

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

6.4.8 WCP CPU II Port Configuration

See Figure 6-20.

6.4.8.1 Serial Client Ports J1 and J2

The **J1** and **J2 Port** field selection range descriptions are presented in Table 6-7 and Figure 6-20.

Table 6-7 Client Port Field Descriptions

Field Name	Range	Description
Protocol	See Table 6-8	Serial protocol used by client. See Table 6-8
Baud	00300 to 19200 in 300 baud increments	Baud rate for specified port
Clock	SYNC and ASYNC	Specifies synchronous or asynchronous clocking
Level	RS232 and RS422	Selects RS-232 or RS-422 interface
CTS	No and Yes	Handshaking flag. If YES, the serial port uses RTS-CTS flow control.
TXC	Int and Ext	Synchronous clock only: Int sets the 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

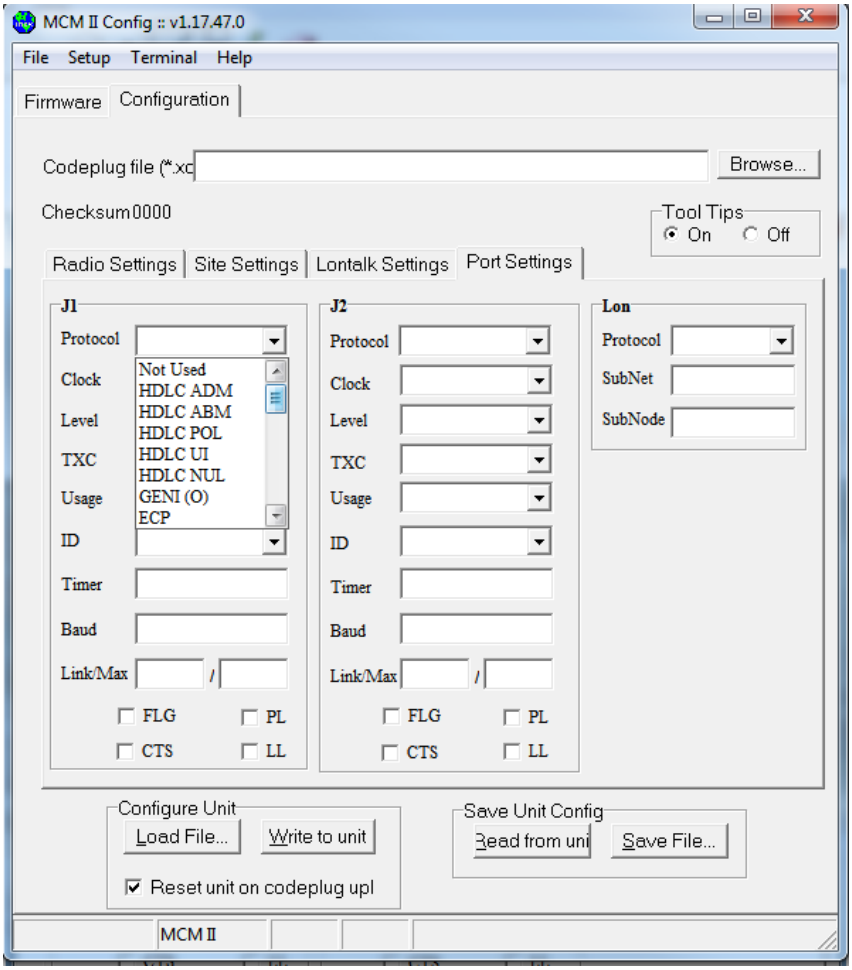


Figure 6-20 Serial Port Protocol Select

Table 6-8 Client Port Protocol Descriptions

Protocol	Description
NOT USED	No Protocol Selected - Not Used
HDLC ADM	HDLC Asynchronous Disconnect Mode
HDLC ABM	HDLC Asynchronous Balanced Mode
HDLC POL	HDLC polled operation: 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

Protocol	Description
ASYNC	Standard ASYNC port: inbound data converted to ATCS packets and outbound packets are stripped of ATCS headers
SSR	Interfaces to Siemens Rail Automation Spread Spectrum Radio linear network
SCS128	Siemens Rail Automation SCS128 office emulation. Polling range set by Link/Max fields
GENI (F)	Emulates US&S Genisys field. Used for dial backup operation
CN2000A	Canadian National proprietary (new) asynchronous field station protocol
CN2000B	Canadian National proprietary (old) asynchronous field station protocol
CN DHP	DHP2000 Series equipment
SLIP	Single Line IP Protocol
CENTRA	Centra-Code protocol
FRM RLY	Frame Relay Protocol
BGENI (O)	Genisys ATCS BCP Office interface
PPP	Point-Point Protocol
PPPMCast	Point-Point Protocol with Multicast capability
GPRS(bu)	GPRS Backup protocol
GPRSCont	GPRS Continuous protocol
ARES	ARES Protocol

6.4.8.2 IP Addressing

Six protocol assignments require IP addressing.

- These are:
  - **SLIP**
  - **FRM RLY**
  - **PPP**
  - **PPPMCast**
  - **GPRS(bu)**
  - **GPRScont**
- The **IP Address Assignments** screen, Figure 6-21, displays when the cursor is placed on one of the above protocol fields and one of the above listed assignments are selected.
- 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.

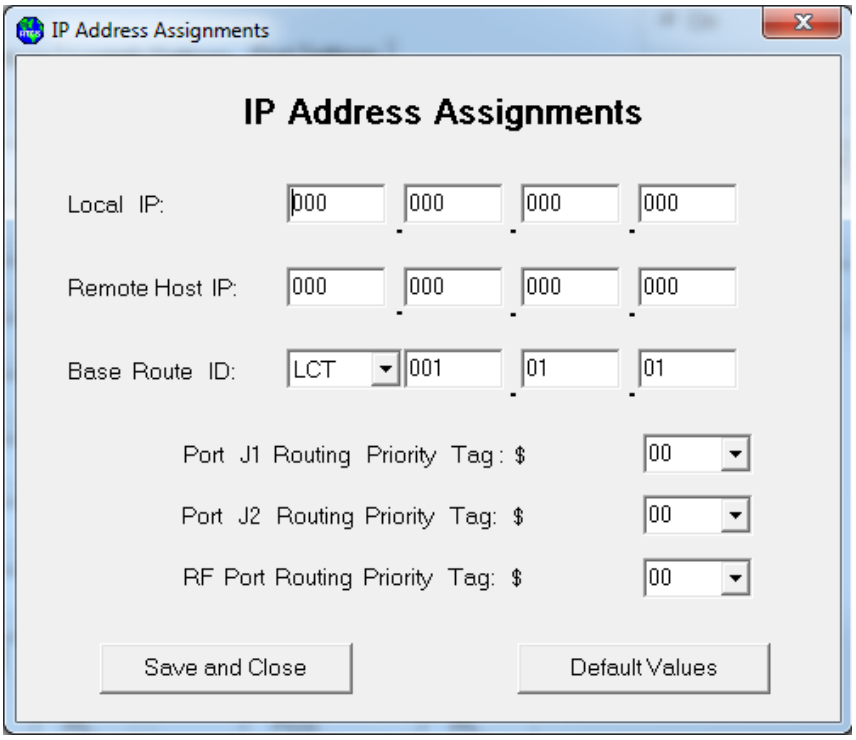


Figure 6-21 IP Address Assignments Screen

6.4.8.3 LON Port

The **Lon Port** field selection ranges are as follows (see Figure 6-22):

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

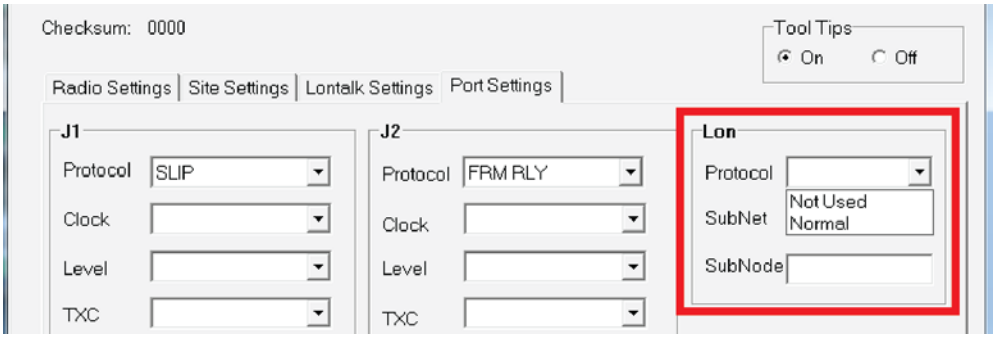


Figure 6-22 LON Enable Select

6.4.9 Instructions for Loading MCMII Software

Begin with opening Windows utility Version v1.17.47.0X.

CAUTION

BEFORE LOADING ANY SOFTWARE, MAKE SURE ALL SAFETY AND OPERATING RULES OF THE RAILROAD PERTAINING TO THE ADJUSTMENT OR MAINTENANCE OF THE SYSTEM ARE COMPLIED WITH AS THE UNIT WILL BE TEMPORARILY TAKEN OUT OF SERVICE DURING SOFTWARE UPLOAD.

Select the **Firmware** tab and select the **Browse** button on the Config file (*.ini) field.

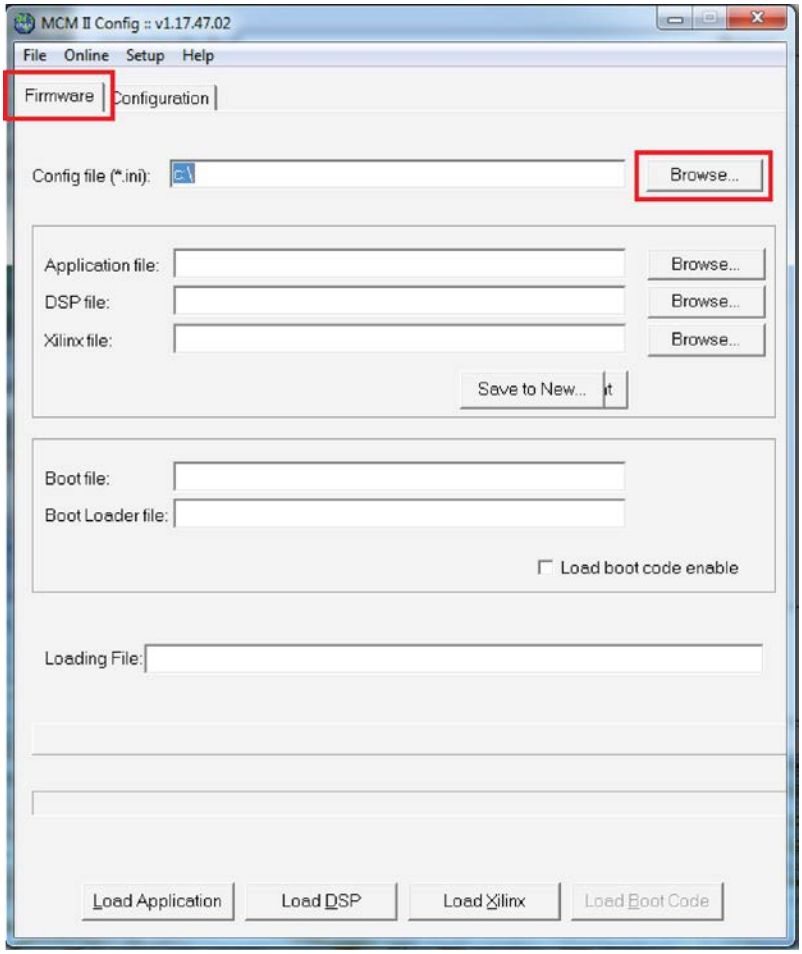


Figure 6-23 Select Firmware

Browse to the **bmbmaint** folder and select the **XCMMAINT.INI.**

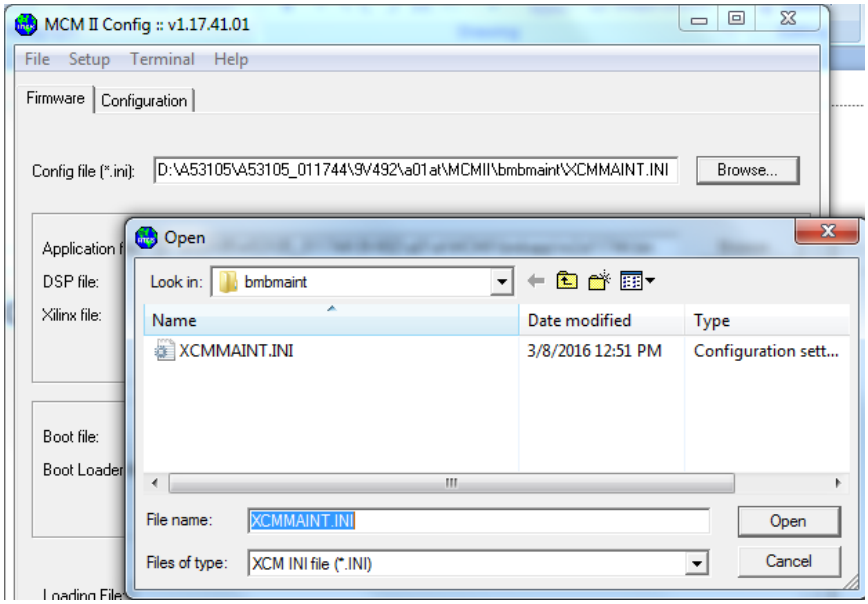


Figure 6-24 Browse for Config File

This will populate your paths for Application, DSP and Xilinx software. At the bottom of the screen (Figure 6-25) start with **Load Application**, then **Load DSP**, and finally **Load Xilinx**.

NOTE

NOTE

It is recommended to open the Terminal screen to view loading process.

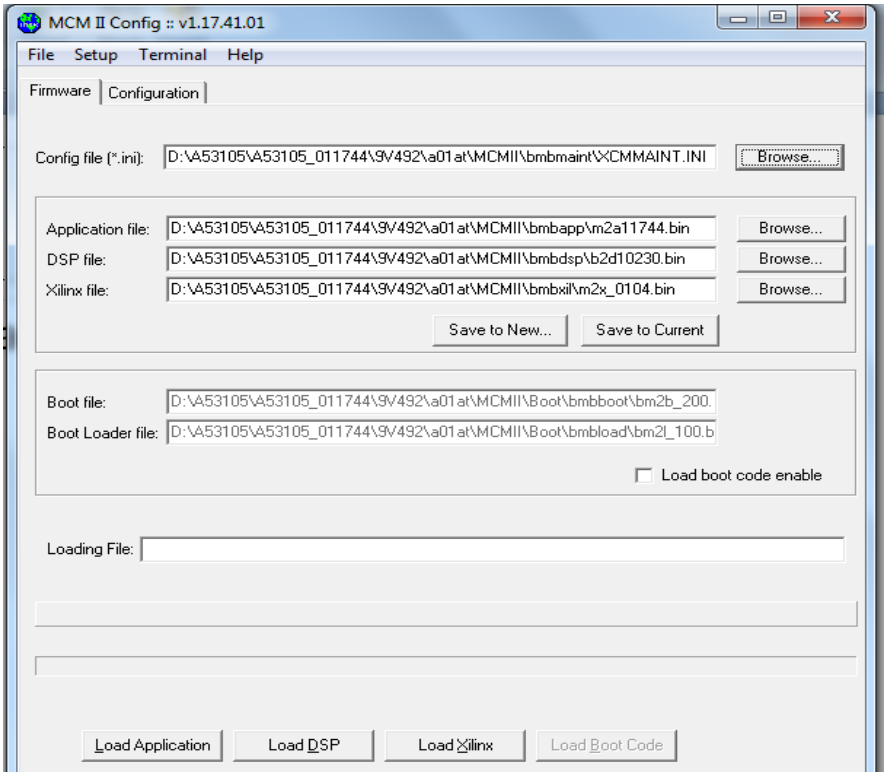


Figure 6-25 Load Options for Config File

You will be prompted with the message: **Upload file is for new hardware, cancel file update?** Select **NO.**

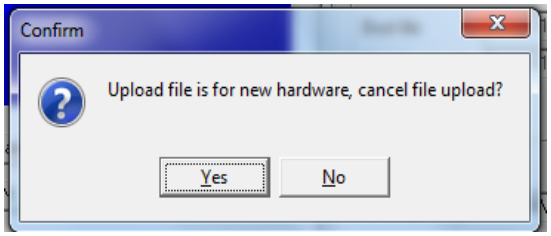


Figure 6-26 Upload File Confirmation

You will then be prompted with a message asking to load executive example m2a11744.bin. Select **Yes.**

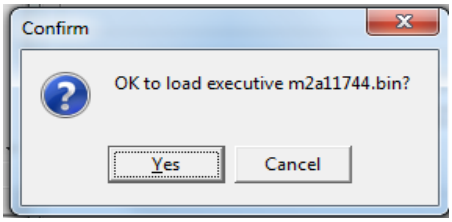


Figure 6-27 OK to Load Executive Software?

You will see on the Terminal screen that the unit has been placed in “debug” mode to load software. On the configuration screen at the bottom the percentage will count up as software is being loaded. The Application can take several minutes to load, however, the DSP and Xilinx files will load more quickly.

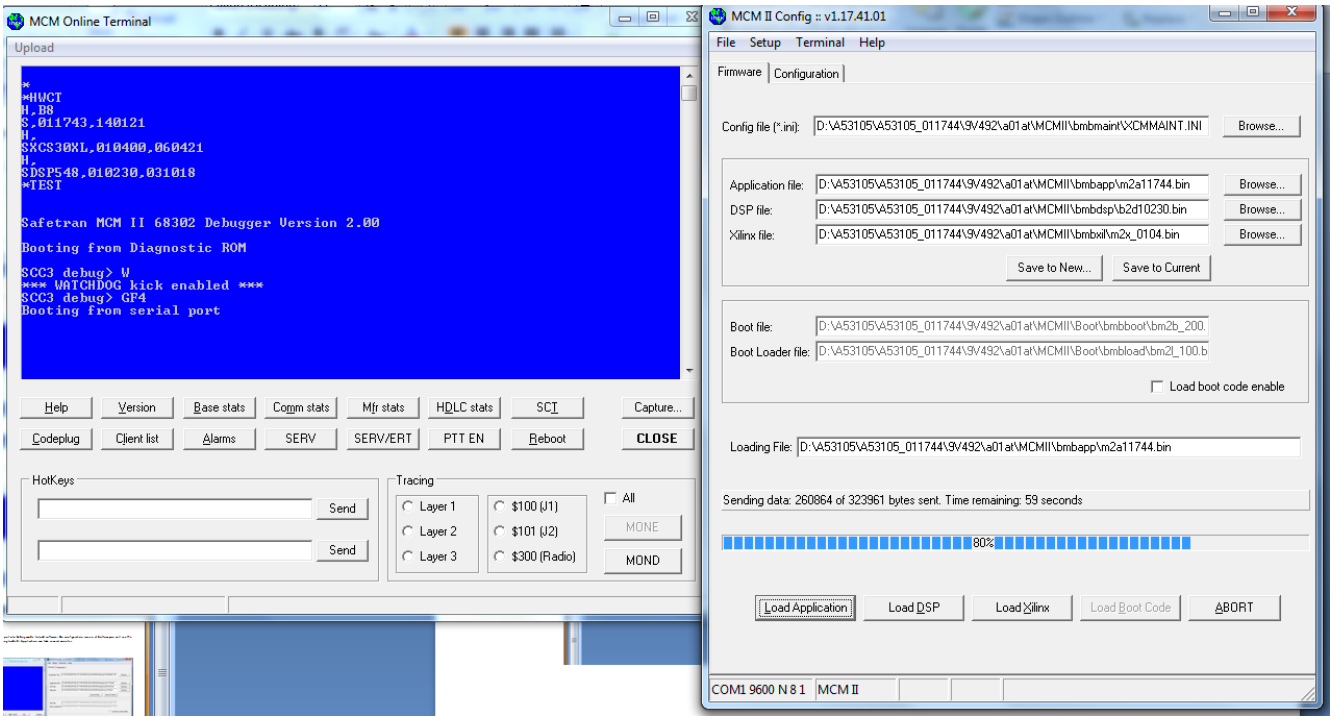


Figure 6-28 Software Load Status

When software has completed loading you will see a prompt “Firmware upgrade complete: Module will reboot” Click **OK**.

Continue with this same procedure to load DSP and Xilinx.

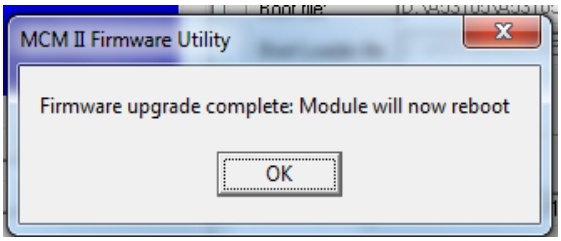


Figure 6-29 Firmware Upgrade Complete

When all software loading has been completed, verify software by selecting **SCT** button. This will display all software loaded.

- Application SW version: (01.17.44 as an example)
- FPGA Xilinx SW version (01.01.00 as an example)
- DSP SW version (01.02.30 as an example)

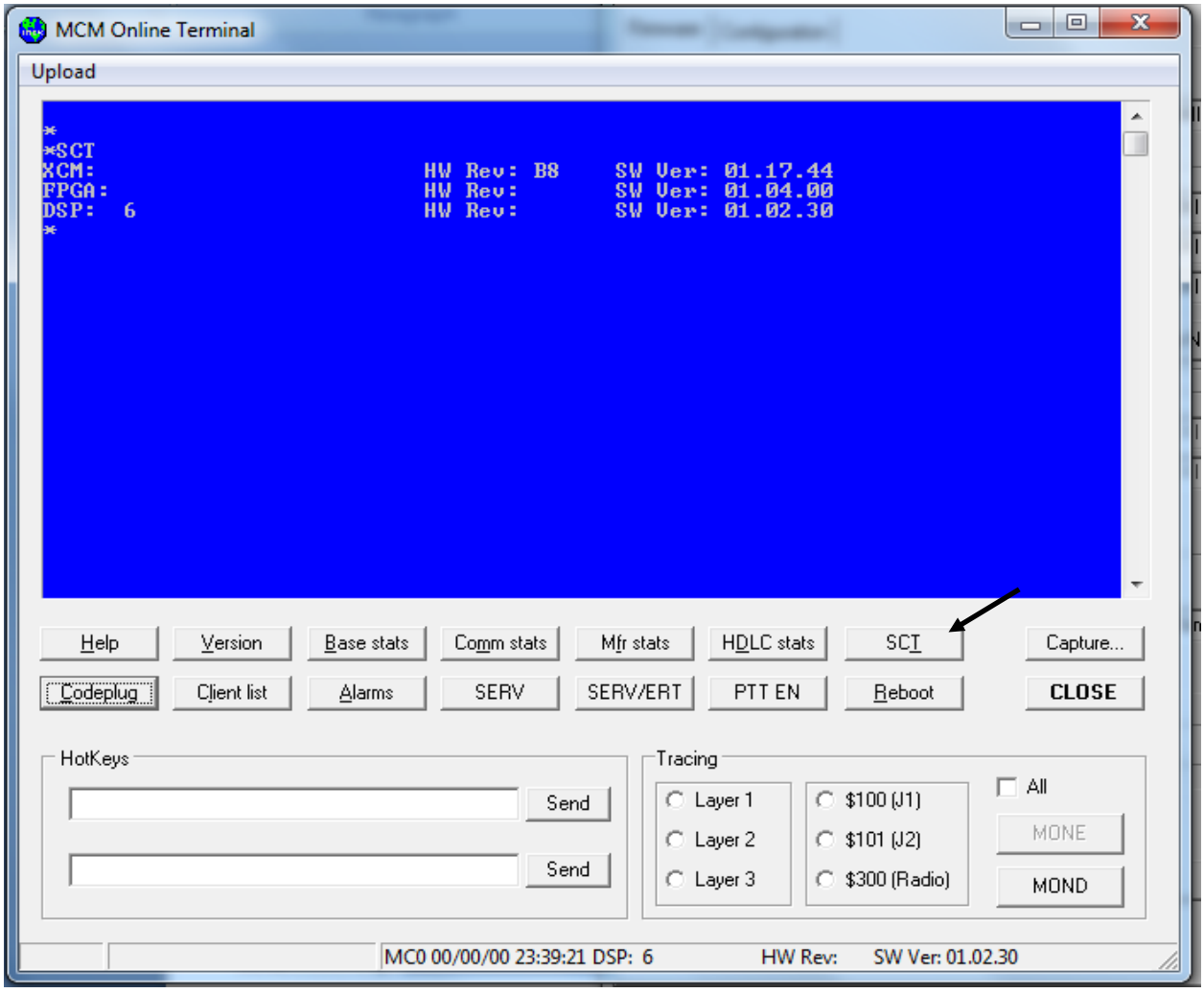
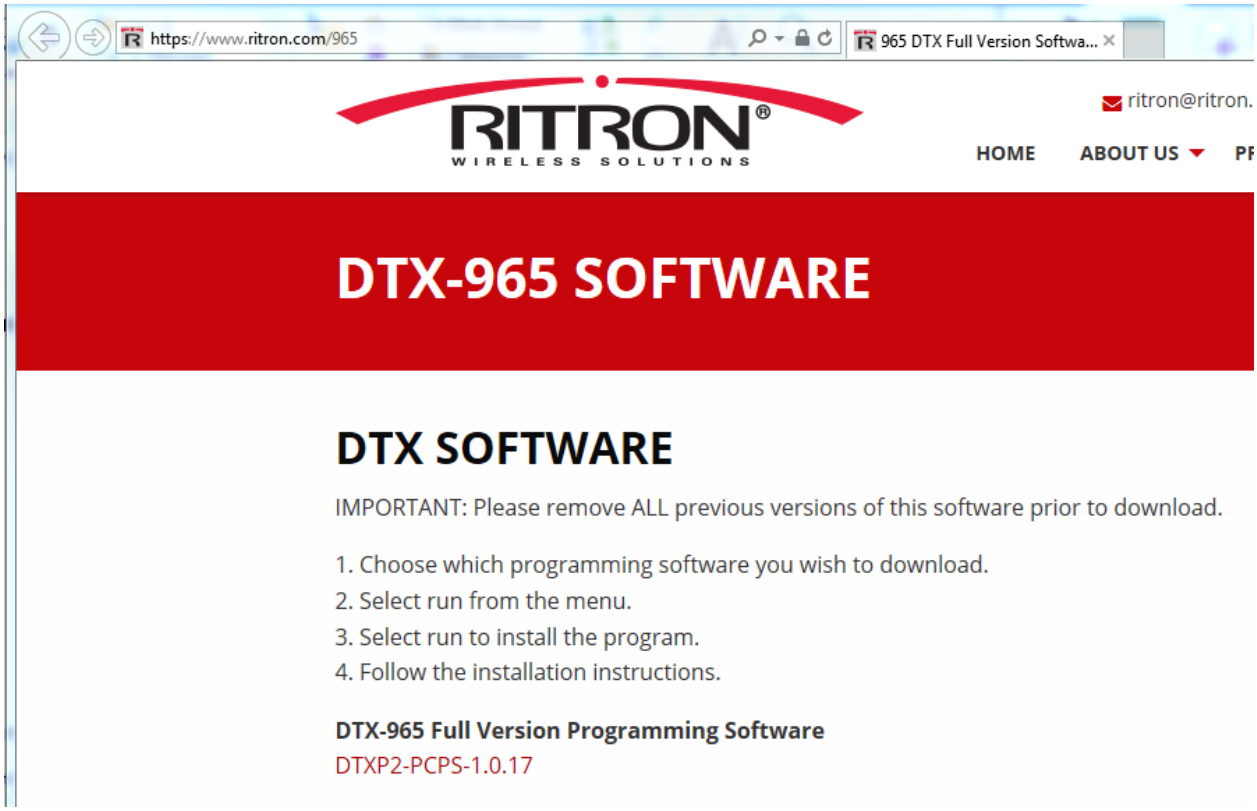


Figure 6-30 Software Loaded Example

6.4.10 Ritron Radio Proprietary Software

To download the proprietary software that can be used with the Ritron DTX-9650 radio visit:
Website: https://www.ritron.com/965
Username: dtx-965
Password: download20



The **DTXP2-PCPS-1.0.17** software will then appear for download.

SECTION VII - TROUBLESHOOTING

7.0 TROUBLESHOOTING

7.1 GENERAL

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

7.2 CODE SYSTEM APPLICATION

Initial troubleshooting involves determining the most likely location of the fault. On a code line with a number of field and base stations, it is relatively simple to locate the common denominator if more than one location is not responding. This could be a shared base station, shared wire line, or leased circuit between base stations and the office, or the office equipment. If the fault is isolated to a specific location, the following information may be helpful.

7.2.1 RF Link

ATCS code systems transmit periodic messages (about once every minute) from the field to the office. By detecting and following the flow of this traffic, the fault can quickly be localized.

RF traffic can be monitored on a laptop, or by the LED display. The TX LED lights each time the BCP transmits, while the RX LED lights each time a valid ATCS header is received.

Using the laptop, the MONE 2 $300 command monitors the data messages observed on the RF link. The MOND command halts data monitoring. The SL command reports the current radio status and frequency (channel).

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

NOTE

NOTE

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

Normal traffic on this link consists of indication, control, and recheck messages which are approximately 26 bytes in length. The RF acknowledged messages are considerably shorter at approximately 12 bytes each. Activity is present only when controls, indications, or rechecks are being sent (no polling).

7.2.2 Code System Troubleshooting

1. Verify that the location transmits at least once each minute by observing the RF TX LED indicator on the MCM front panel, or by monitoring port $300 on the DIAGNOSTIC PORT. If the LED lights, proceed to step 4.
2. Verify that the office equipment acknowledges the transmission. The RF RX LED normally flashes in response to each transmission. If the RX LED does not flash, or if the radio rejects the response, the transmission is repeated five times with a delay between transmissions of approximately 6 seconds. If the RF RX response is seen each time with no retries, the problem is not associated with the indication messages.
3. If the radio transmits at least once each minute but there is no response from the office, check the following:

a. Antenna connections and reflected power
b. Verify radio self-test alarms using the AL command. If necessary, reset the radio to repeat the self tests using the TEST command.
c. Radio power supply voltage - Verify that the voltage level does not drop during transmissions.
d. Radio output power - Verify peak transmit current (±10 Amperes) or use an RF wattmeter.
e. Radio frequency – Set internally on radio via Manufacturer's proprietary software.
f. Data inverted - Check code plug location $180. Attempt to write one of the following values: $45, $55, $65, or $75 (see appendix C).
g. Verify ATCS message format using the MONE 2 $300 command. Ensure the correct site address and code line number are used and that an indication message is being sent periodically to the proper office address.

If all above items are normal, the base station location must be monitored to determine if the problem is at the base site or along the line to the office equipment.

4. No transmissions from the field:

a. Verify that the PWR LED on the MCM front panel is lighted.
b. Verify that all self-tests are passed.
c. Attempt a manual key-up by using the front-panel switches, or by placing the radio in service mode and using the PTT command.

⚠ CAUTION

CAUTION

DO NOT KEY UP THE RADIO FROM THE RADIO DIAG PORT AS DAMAGE WILL OCCUR TO THE RF POWER AMPLIFIER.

d. Verify that the MCM has acquired its client IDs by using the CL command. Most MCMs are configured such that their ID is supplied by the attached code system.
e. Check the ground contact status (SL command). Normally, after a reset, the MCM attempts to establish ground contact with the office. If this fails, the MCM reverts to passive mode. If the ground contact status is neither active nor passive, verify the contents of code plug location $3e for the correct option.

APPENDIX A - ADVANCED TRAIN CONTROL SYSTEM

A. ADVANCED TRAIN CONTROL SYSTEM

A.1 OVERVIEW

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

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

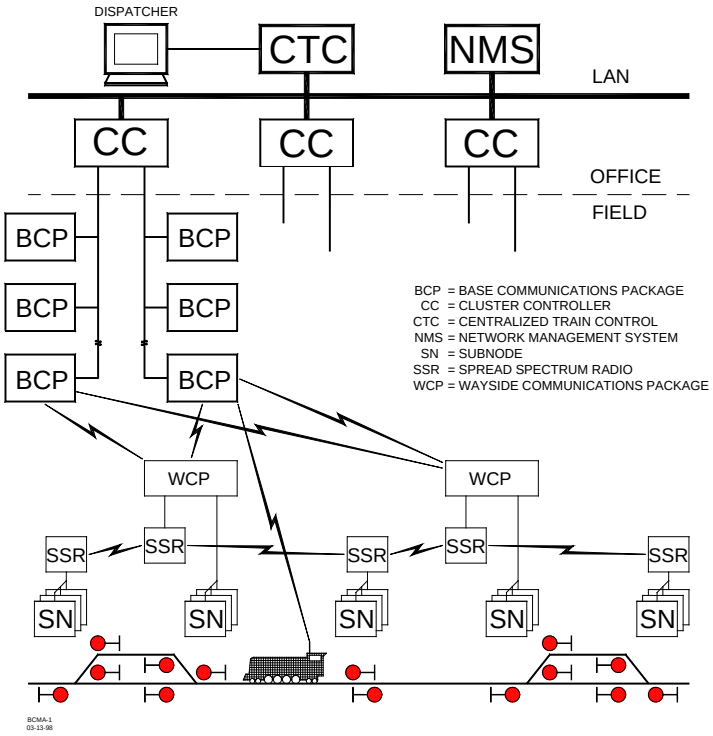


Figure A-1 Typical ATCS Network

A.2 ATCS ADDRESSING

Each ATCS datagram carries with it a destination address (i.e., the address of the equipment it is destined for), and a source address (i.e., the equipment that generated it). These addresses are constructed with slight differences for the various uses. For example, on-board equipment will have a Type 1 (locomotive) address while wayside equipment will have a Type 7 (wayside) address. A number of the various types of addresses used are described in the following paragraphs. For further information concerning ATCS addressing, refer to the following specifications:
ATCS Specification 200 (March 1993) - ATCS Protocols
ATCS Specification 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.

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 Railroad 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) Railroad	ALM	016
025	ARTC		047
026	Ashley, Drew & Northern Railway Company	AND	020
027	Ashtabula Carson & Jefferson Railroad	ACJR	235
028	Atchison, Topeka And Santa Fe Railway Company ATS	ATSF	022
029	ATCS Shared Network	ATCS	340
030	ATCS Testing & Field Evaluation	ATCR	050
031	ATCS Testing & Field Evaluation	ATCT	620
032	Atlantic & Western Railway, L P	ATW	025
033	Austin Railroad	AUNW	924
034	Austin, Todd And Ladd Railroad Company	ATLT	514
035	Baltimore And Annapolis Railroad Company	BLA	053
036	Bangor & Aroostook Railroad Company	BAR	056
037	Bath And Hammodsport Railroad Company	BH	079
038	Batten Kill Railroad Inc	BKRR	086
039	Bauxite & Northern Railway Company	BXN	084
040	Bay Colony Railroad Corporation	BCLR	082
041	Bayside Railway Co		021
042	BC HYDRO RAIL	BCE	072
043	BC RAIL LTD	BCOL	997
044	Beaufort And Morehead Railroad Company	BMH	068
045	Beech Mountain Railroad Company	BEEM	060
046	Belfast And Moosehead Lake Railroad Company	BML	087
047	Belt Railway Company Of Chicago	BRC	083
048	Belton Railroad Company	BRR	207
049	Berlin Mills Railway	BMS	073
050	Bessemer And Lake Erie Railroad Company	BLE	061

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

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

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

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

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

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

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

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

ID	CompanyName	RR Mark	ATCS
451	Thailand (Thai State Railways)		102
452	Tippecanoe Railroad Company	TIPP	753
453	Tonawanda Island Railroad Inc	TIRL	743
454	Towanda And Monroeton Shippers Lifeline, Inc.	TMSS	752
455	Transkentucky Transportation Railroad Co Inc	TTIS	773
456	Tranz Rail (Tasmania)		057
457	Trintity Railway Express		751
458	Trona Railway Company	TRC	779
459	TTCI Test Unit 1	TTCI	884
460	TTCI Test Unit 2	TTCI	885
461	TTCI Test Unit 3	TTCI	886
462	TTCI Test Unit 4	TTCI	887
463	TTCI Test Unit 5	TTCI	888
464	TTCI Test Unit 6	TTCI	889
465	Tucson, Cornelia & Gila Bend Railroad Company	TCG	783
466	Tulsa-Sapulpa Union Railway Company L L C	TSU	709
467	Turtle Creek Industrial Railroad Inc	TCKR	744
468	Tuscola And Saginaw Bay Railway Company Inc	TSBY	770
469	Union Pacific Railroad Company	UP	802
470	Union Railroad Company	URR	803
471	Union Railroad Of Oregon	UO	800
472	United South Eastern Railways Company	SE	281
473	Unity Railways Company	UNI	806
474	Upper Merion And Plymouth Railroad Company	UMP	808
475	Utah Railway Company	UTAH	811
476	Valdosta Southern Railroad	VSO	816
477	Vandalla Railroad Company	VRRC	781
478	Ventura County Railway Company	VCY	821
479	Vermont Railway Inc	VTR	817
480	Via Rail Canada Inc	VIA	818
481	Victrack (Australia)		017
482	Virginia Railway Express	VRE	023
483	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 Siemens' WCP Firmware, Version XCM4.05P, are listed in Table C-1. For additional information regarding subsequent revisions to the firmware, contact Siemens Rail Automation Customer Service.

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

NOTE

NOTE

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

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

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

Table C-1 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

D.1 GENERAL

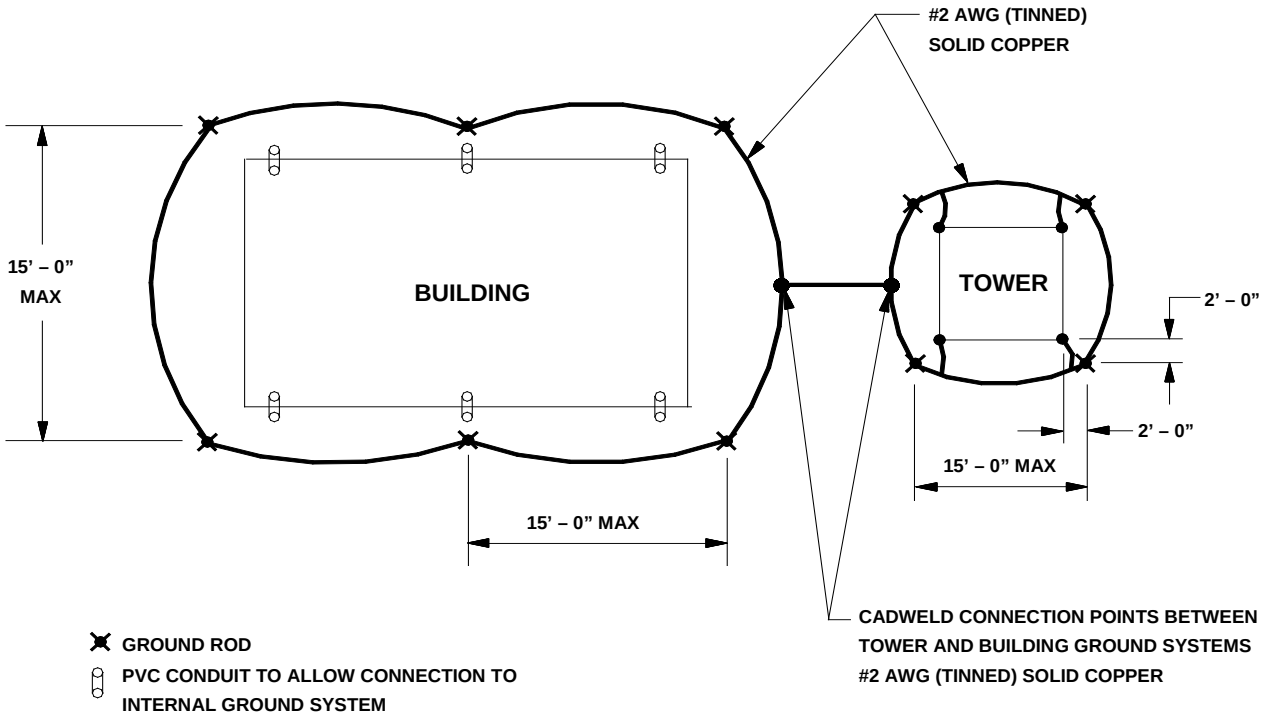
With all R-Link radio applications care should be taken to prevent ground differentials between the grounding points that can cause equipment damage. Perform the following recommendations when grounding equipment and enclosures.

D.2 EXTERNAL BUILDING GROUND

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

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

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



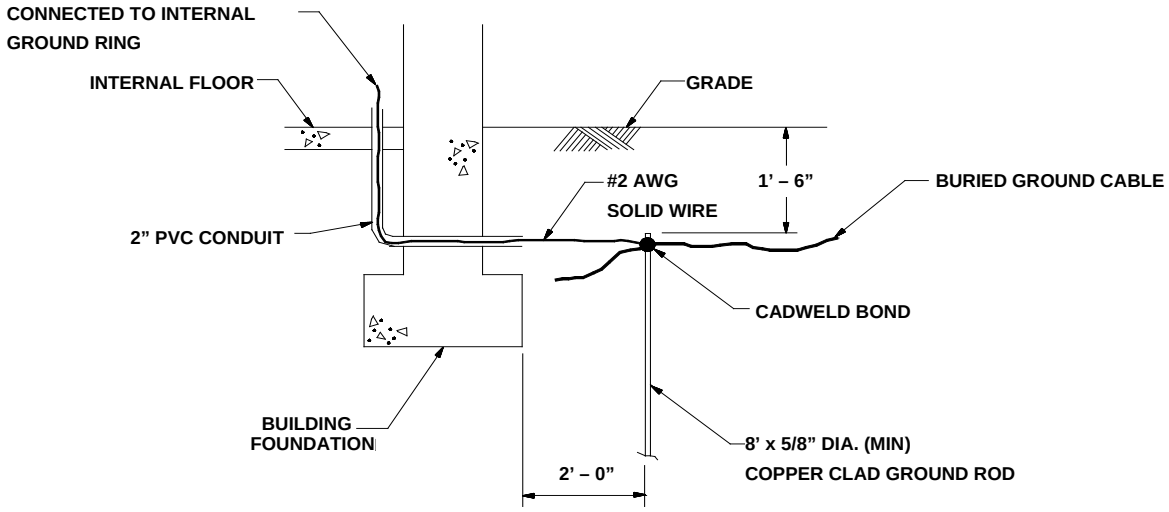


Figure D-1 Typical Ground Connections

D.3 INTERNAL BUILDING GROUND

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

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

NOTE

NOTE

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

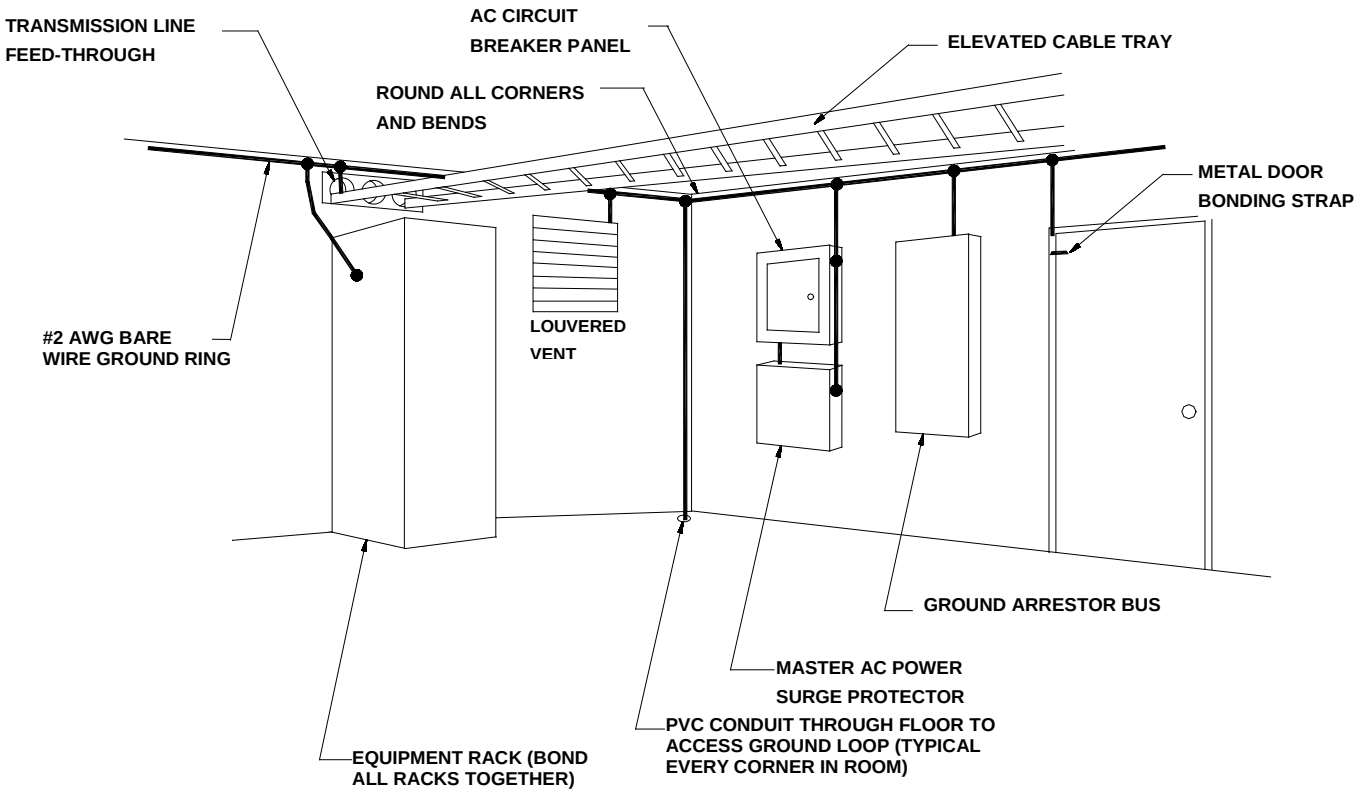


Figure D-2 Typical Internal Building Ground

D.4 ANTENNA GROUND

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

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

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

D.4.1 Antenna Ground – Roof-Mount Yagi

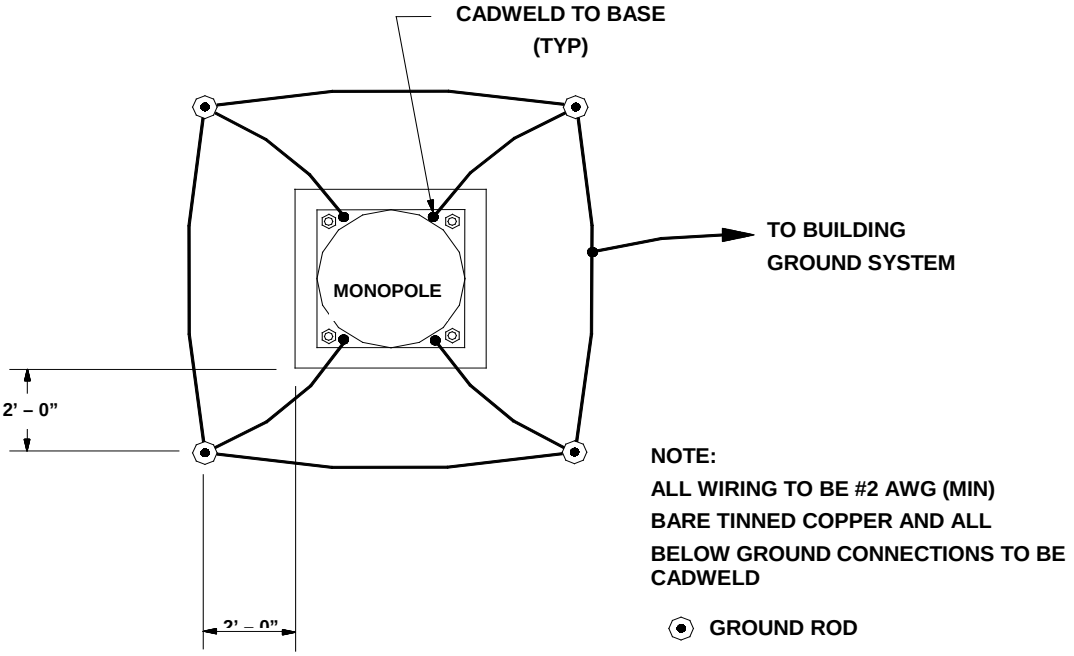
Roof-mounted Yagi antennae should have the pipe mast grounded to the outside grounding ring with a minimum #2 AWG solid copper conductor. The Heliax ground kit should be connected within 1 foot of the cable entry to the building and connected to the copper conductor. A lightning surge protector is not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

D.4.2 Antenna Ground – Towers and Poles

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

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

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



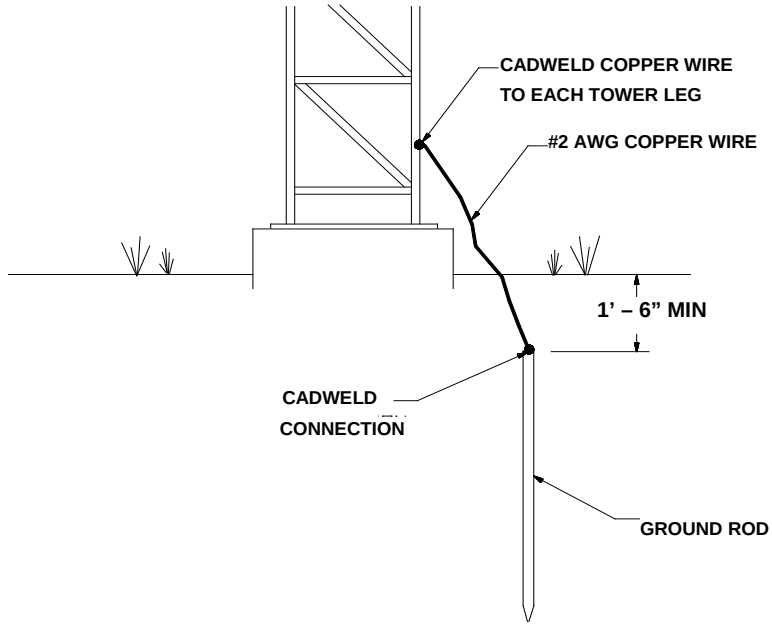


Figure D-3 Typical Tower and Pole Ground Connections

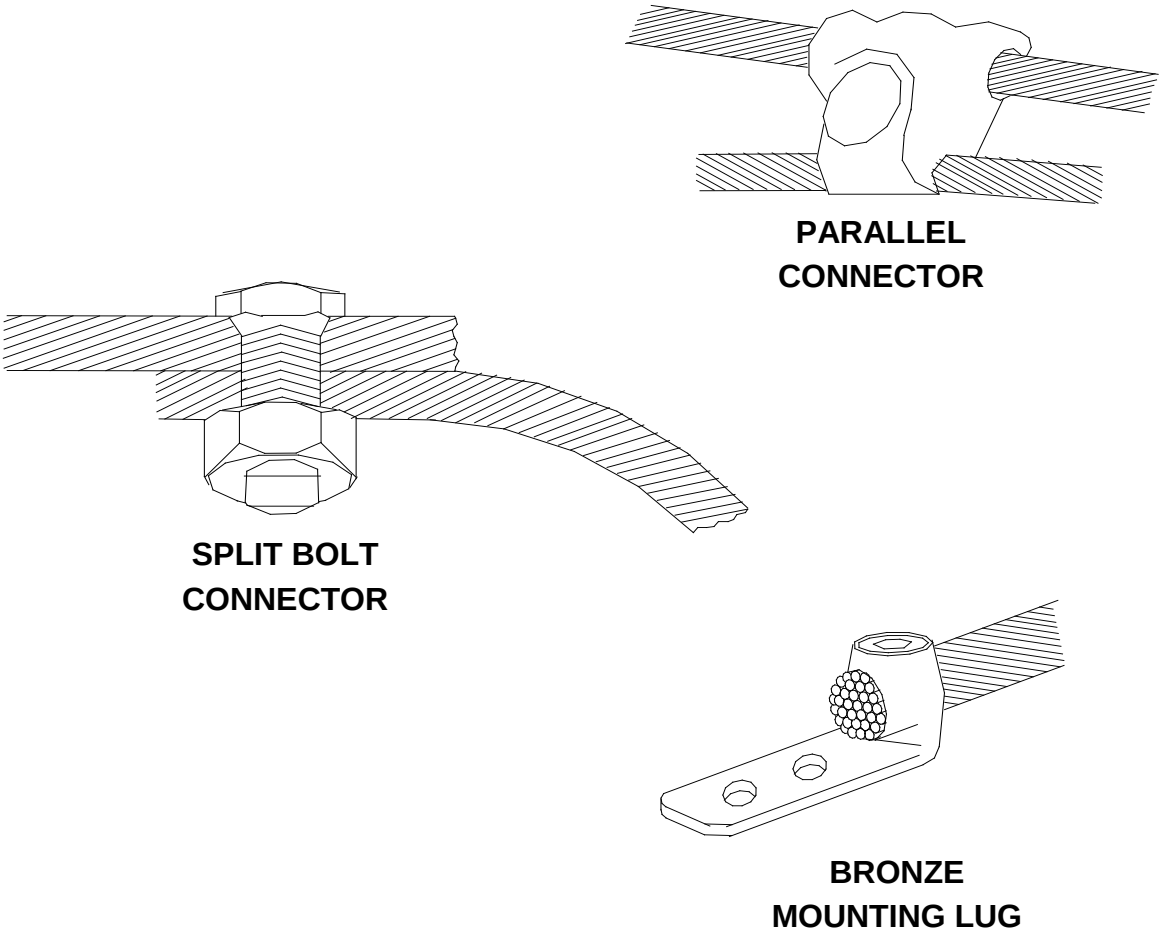


Figure D-4 Typical Connections for Grounding and Bonding

D.5 AC POWER GROUND

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

D.6 COMMUNICATIONS GROUND

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

D.7 CABLING

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

D.8 SURGE PROTECTION

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

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APPENDIX E - RF CABLE AND CONNECTOR REFERENCE DATA

E. RF CABLE AND CONNECTOR REFERENCE DATA

E.1 General

E.2 Jumper Applications

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

E.3 Connectors

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

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

E.4 Accessories (Recommended)

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

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

Table E-1 Transmission Line System Components

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

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

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

Table E-3 3/8" 50-ohm Foam Dielectric Coaxial Cable Attenuation and Average Power
(Not recommended for SSR or R-Link applications)

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

Table E-4 ½" 50-ohm Foam Dielectric Coaxial Cable Attenuation and Average Power
(Suitable for SSR or R-Link applications)

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

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

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

Table E-6 7/8" 50-ohm Foam Dielectric Coaxial Cable
(Recommended for Long Range SSR and MCP RF Data Links)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table E-15 ½" N-Connector

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

APPENDIX F - RF PROPAGATION BRIEF

F. RF PROPAGATION BRIEF

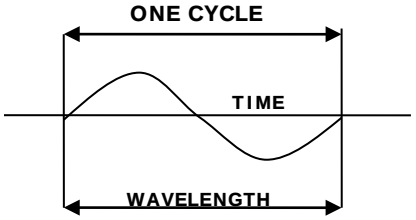
F.1 Wavelength vs Frequency

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

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

Frequency (Hz) = C / Wavelength (λ)

Wavelength (λ) = C / Frequency (Hz)



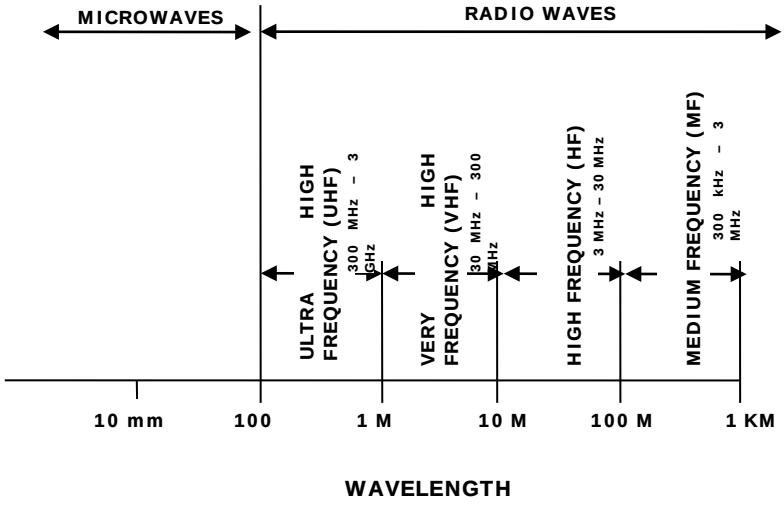
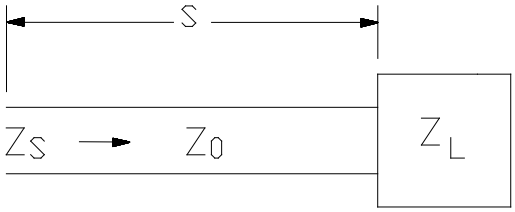


Figure F-1 Wavelength vs Frequency

F.1.1 Quarter and Half Wavelength Lines

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

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



$$Z_8 = Z_O2 / Z_L$$

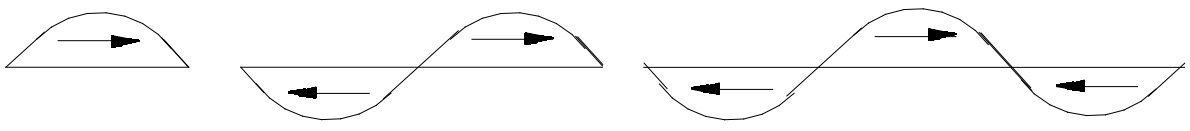
Figure F-2 Loaded Line

F.2 Current and Voltage Distributions

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

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

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



l = λ/2 *l* = λ *l* = 3/2λ

Figure F-3 Current Distribution on Resonant Dipoles

F.3 Effective Radiated Power (ERP)

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

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

ERP = transmitter output power x net gain of antenna system

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

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

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

   dBW = 10 LOG Po

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

3. Convert the ERP in dBW back to watts

   Watts = 10 dBW/10

Example:

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

ERP	=	+28.0 dBw = 631 watts

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

F.4 Resonant Antennas

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

APPENDIX G - VOLTAGE DROP TABLES

G. VOLTAGE DROP TABLES

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

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

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

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

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

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

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

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

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

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

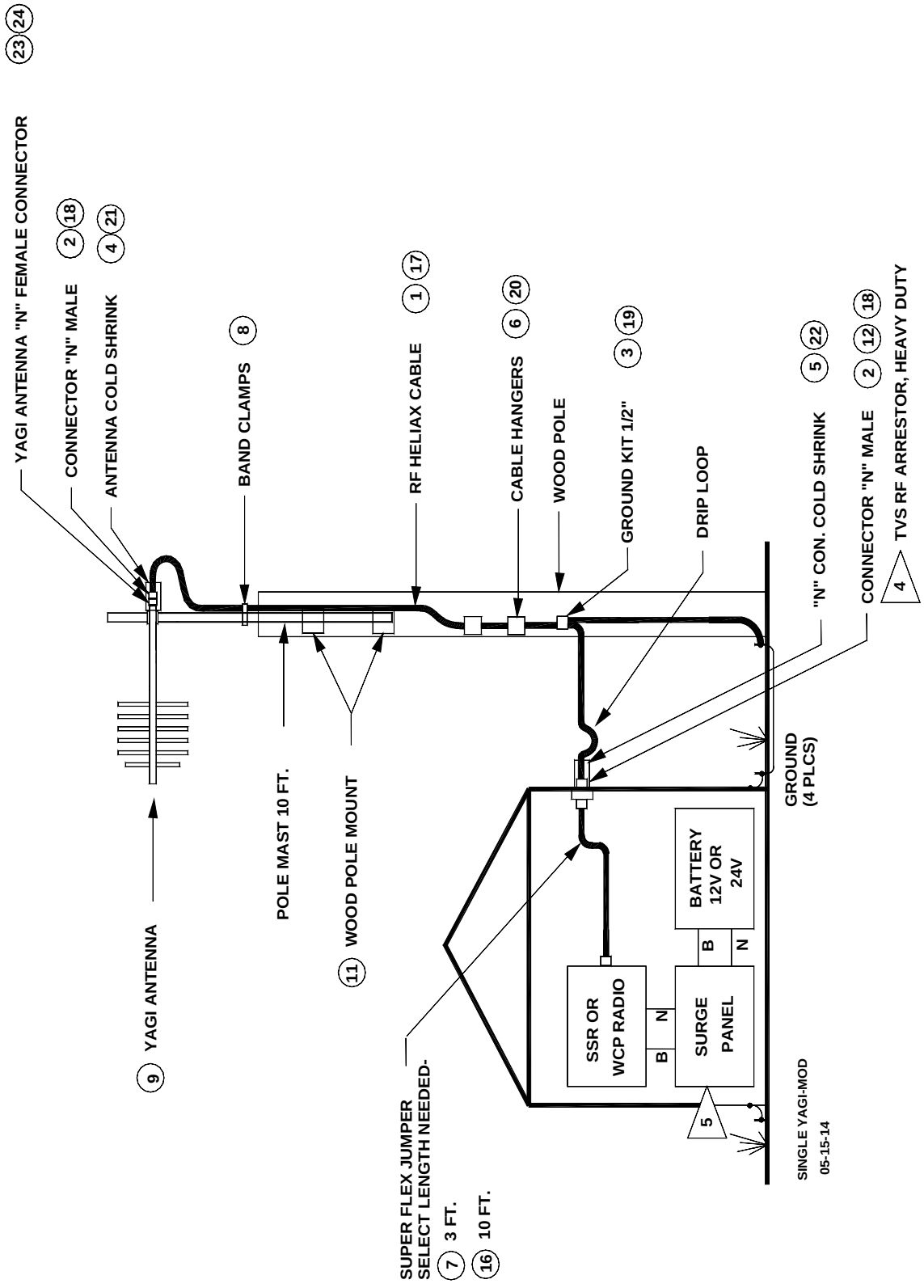
Table G-6 Conductor Sizes for 3% Voltage Drop - 32 Volts

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

APPENDIX H - SSR AND WCP RADIO POINT-TO-POINT ANTENNA SYSTEM SINGLE YAGI INSTALLATION

H. SSR AND WCP RADIO POINT-TO-POINT ANTENNA SYSTEM

H.1 Installation Drawing on the Following Page


YAGI ANTENNA "N" FEMALE CONNECTOR
23 24
CONNECTOR "N" MALE
2 18
ANTENNA COLD SHRINK
4 21
BAND CLAMPS
8
RF HELIAX CABLE
1 17
CABLE HANGERS
6 20
WOOD POLE
GROUND KIT 1/2"
3 19
DRIP LOOP
"N" CON. COLD SHRINK
5 22
CONNECTOR "N" MALE
2 12 18
4 TVS RF ARRESTOR, HEAVY DUTY
9 YAGI ANTENNA
POLE MAST 10 FT.
11 WOOD POLE MOUNT
GROUND
(4 PLCS)
BATTERY
12V OR
24V
B
N
SSR OR
WCP RADIO
B
N
SURGE
PANEL
5
SUPER FLEX JUMPER
SELECT LENGTH NEEDED-
7 3 FT.
16 10 FT.
SINGLE YAGI-MOD
05-15-14

	QTY. REQ'D. (Parts Order)	QTY. REQ'D. (-02)	QTY. REQ'D. (-01)	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	EDP NO.	MATERIAL	DATA: SPEC, REF. DES., SIZE, NOTES, VENDORS
* -		OPT.	OPT.	29	E-2	DCV FILTER	0	100VDC 2.5AMPS	CONTROL CONCEPTS
* -		OPT.	OPT.	28	A43030	SURGE PANEL	9000-43030-0001	BATTERY 36V 20A	WCP BATTERY PANEL
* -		OPT.	OPT.	27	010806-3BX	SP19-2B	Z803-00074-0000	BATTERY 32V 10A	SS RADIO BATT. PROTECTOR
* -		OPT.	OPT.	26	010805-4AX	SP18-2A	Z803-00118-0000	BATTERY 32V 5A	SS RADIO BATT. PROTECTOR
* -		OPT.	OPT.	25	40656-3	CABLE WALL THRU	Z918-00012-0000	1/2" HELIAX	WALL CABLE THRU, ANDREW
		1	-	24	L5NF	CONNECTOR N FEM.	Z709-01012-0000	7/8" HELIAX	7/8" "N" FEMALE ANDREW
		-	1	23	L4NF	CONNECTOR N FEM.	Z709-01006-0000	1/2" HELIAX	1/2" "N" FEMALE ANDREW
		2	-	22	241474-5	COLD SHRINK N	Z801-08471-0000	7/8" HELIAX	BULK-HEAD RF. ARRESTOR
		1	-	21	241548-5	COLD SHRINK ANT.	Z801-08472-0000	7/8" HELIAX	BULK-HEAD RF. ARRESTOR
		1	-	20	42396A-5	CABLE HANGERS	Z801-08473-0000	7/8" HELIAX	FOR 7/8" HELIAX 10 EA.
		1	-	19	204989-2	GND.KIT 7/8"	Z801-08470-0000	7/8" HELIAX	FOR 7/8" HELIAX ANDREW
		1	-	18	L5NM	CONNECTOR N MALE	Z709-01011-0000	7/8" HELIAX N	"N" MALE ANDREW
		FT.	-	17	LDF5-50A	7/8" HELIAX	Z935-00008-0000	7/8" HELIAX	ANDREW 7/8" RF. CABLE
* -		OPT.	OPT.	16	F4A-NMNM-10	SF. JUMPER 1/2"	Z801-08474-0010	1/2" HELIAX	SUPER FLEX JUMPER 10FT.
* -		OPT.	OPT.	15	221213	WEATHER KIT	Z801-08467-0000	TAPE AND PUTTY	WEATHER PROOF TAPE KIT
* - (4)		OPT.	OPT.	14	243394	MNT. HARDWARE	Z803-22722-0000	PANEL MOUNT	TVS ARRESTOR MNT. HDWR.
* - (4)		OPT.	OPT.	13	APT-NFNF-3	TVS RF ARRESTOR	Z803-22721-0000	"N" FEMALE	TVS RF ARRESTOR MULTI HIT
		1	1	12	IS-B50LN-C2	POLYPHASOR	Z803-22710-0000	"N" FEMALE	BULK-HEAD RF. ARRESTOR
* -		OPT.	OPT.	11	17A	WOOD POLE MNT.	Z801-08469-0000	TO PIPE-3.5 DIA.	SINCLAIR
		-	-	10	115	90 DEG. ANT. MNT.	Z801-08468-0000	TO PIPE-2.38 DIA	SINCLAIR
		1	1	9	ANT930 Y10-WRU	ANTENNA	Z913-00017-0000	YAGI "N" 10dB	YAGI (TELEWAVE)
		3	3	8	31670-2	BAND CLAMP	Z918-00013-0000	1/2" HELIAX	ANDREW (10 EA. KIT)
* -		OPT.	OPT.	7	F4A-NMNM-3	SF. JUMPER 1/2"	Z801-08460-0000	1/2" HELIAX	SUPER FLEX JUMPER 3FT.
		-	1	6	43211A	CABLE HANGERS	Z801-08459-0000	1/2" HELIAX	FOR 1/2" HELIAX 10 EA.
		-	2	5	241474-4	COLD SHRINK N	Z801-08462-0000	1/2" HELIAX	FOR N CONN. 1/2" ANDREW
		-	1	4	2415484-4	COLD SHRINK ANT.	Z801-08461-0000	1/2" HELIAX	FOR ANTENNA ANDREW
		-	1	3	204989-1	GRD. KIT 1/2"	Z801-08458-0000	1/2" HELIAX	FOR 1/2" HELIAX ANDREW
		-	2	2	L4NM	CONNECTOR N MALE	Z709-01007-0000	1/2" HELIAX	1/2" "N" MALE ANDREW
		-	FT.	1	LDF4	1/2" HELIAX	Z935-00006-0000	1/2" HELIAX	ANDREW 1/2" RF. CABLE

LIST OF MATERIALS

NOTES:

1. PARTS MARKED WITH AN ASTERISK (*) ARE OPTIONAL
2. -01 PARTS ARE USED WITH TYPICAL 1/2" COAX INSTALLATIONS.
3. -02 PARTS ARE USED WITH LONG CABLE LENGTHS USING 7/8" COAX CABLE.
4. HEAVY DUTY TVS SET, MULTI HIT OPTION. RECOMMENDED FOR HEAVY LIGHTNING AREAS. (WHEN USED REPLACES ITEM 12)
5. BATTERY FILTER DETERMINED BY APPLICATION.

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