Preliminary P3

M/A-COM
CS-7000 Control Station

Tyco Electronics
Our commitment. Your advantage.

MANUAL REVISION HISTORY

REV.	DATE	REASON FOR CHANGE
–	Apr/08	Original release.

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Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations or substitution of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.

M/A-COM recommends the buyer use only M/A-COM authorized representatives to install and service this product. The warranties provided to buyer under the terms of sale shall be null and void if this product is installed or serviced improperly and M/A-COM shall have no further obligation to the buyer for any damage caused to the product or to any person or personal property.

This product conforms to the European Union WEEE Directive 2002/96/EC. Do not dispose of this product in a public landfill. Take it to a recycling center at the end of its life.

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1 REGULATORY AND SAFETY INFORMATION

1.1 MAXIMUM PERMISSIBLE EXPOSURE LIMITS

DO NOT TRANSMIT with this Control Station and antenna when persons are within the MAXIMUM PERMISSIBLE EXPOSURE (MPE) Radius of the antenna. The MPE Radius is the minimum distance from the antenna axis that ALL persons should maintain in order to avoid RF exposure higher than the allowable MPE level set by the FCC.

> **⚠ WARNING**
>
> **FAILURE TO OBSERVE THESE LIMITS MAY ALLOW ALL PERSONS WITHIN THE MPE RADIUS TO EXPERIENCE RF RADIATION ABSORPTION, WHICH EXCEEDS THE FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE) LIMIT. IT IS THE RESPONSIBILITY OF THE CONTROL STATION OPERATOR TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS ARE OBSERVED AT ALL TIMES DURING CONTROL STATION TRANSMISSION. THE CONTROL STATION OPERATOR IS TO ENSURE THAT NO BYSTANDERS ARE WITHIN THE RADIUS LIMITS.**

1.1.1 Determining MPE Radius

THE MAXIMUM PERMISSIBLE EXPOSURE RADIUS is unique for each site and is determined during site licensing time based on the complete installation environment (i.e., Co-location, antenna type, transmit power level, etc.). Determination of the MPE distance is the responsibility of the installation licensee. Calculation of the MPE radius is required as part of the site licensing procedure with the FCC.

1.1.2 Safety Training Information

> **⚠ WARNING**
>
> **YOUR M/A-COM CONTROL STATION GENERATES RF ELECTROMAGNETIC ENERGY DURING TRANSMIT MODE. THIS CONTROL STATION IS DESIGNED FOR AND CLASSIFIED AS "OCCUPATIONAL USE ONLY" MEANING IT MUST BE USED ONLY IN THE COURSE OF EMPLOYMENT BY INDIVIDUALS AWARE OF THE HAZARDS AND THE WAYS TO MINIMIZE SUCH HAZARDS. THIS CONTROL STATION IS NOT INTENDED FOR USE BY THE "GENERAL POPULATION" IN AN UNCONTROLLED ENVIRONMENT. IT IS THE RESPONSIBILITY OF THE CONTROL STATION OPERATOR TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS DETERMINED IN THE PREVIOUS SECTION ARE OBSERVED AT ALL TIMES DURING TRANSMISSION. THE CONTROL STATION OPERATOR IS TO ENSURE THAT NO BYSTANDERS COME WITHIN THE RADIUS OF THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS.**

When licensed by the FCC, this Control Station complies with the FCC RF exposure limits when persons are beyond the MPE radius of the antenna. In addition, your M/A-COM® Control Station installation complies with the following Standards and Guidelines with regard to RF energy and electromagnetic energy levels and evaluation of such levels for exposure to humans:

FCC OET Bulletin 65 Edition 97-01 Supplement C, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

American National Standards Institute (C95.1 – 1992), IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

American National Standards Institute (C95.3 – 1992), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

CAUTION	TO ENSURE THAT YOUR EXPOSURE TO RF ELECTROMAGNETIC ENERGY IS WITHIN THE FCC ALLOWABLE LIMITS FOR OCCUPATIONAL USE, **DO NOT** OPERATE THE CONTROL STATION IN A MANNER THAT WOULD CREATE AN MPE DISTANCE IN EXCESS OF THAT ALLOWABLE BY THE FCC.

CAUTION	This equipment generates or uses radio frequency energy. Any changes or modifications to this equipment not expressly approved by M/A-COM may cause harmful interference and could void the user's authority to operate the equipment.

1.2   SAFETY SYMBOL CONVENTIONS

The following conventions are used throughout this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere violates safety standards of design, manufacture, and intended use of the product. M/A-COM, Inc. assumes no liability for the customer's failure to comply with these standards.

WARNING	**The WARNING symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING symbol until the conditions identified are fully understood or met.**

CAUTION	The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in damage to the equipment or severely degrade equipment performance.

NOTE	The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.

	The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of **E**lectro-**S**tatic **D**ischarge. Proper precautions must be taken to prevent ESD when handling circuit boards or modules.

	The electrical hazard symbol is a WARNING indicating there may be an electrical shock hazard present.

1.3 IMPORTANT SAFETY INSTRUCTIONS

- Read these instructions.

- Keep these instructions.

- Heed all warnings.

- Follow all instructions.

- Do not use this apparatus near water.

- Clean only with dry cloth.

- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.

- Only use attachments/accessories specified by the manufacturer.

- Unplug this apparatus during lightning storms or when unused for long periods of time.

- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

- **Warning**: The lightning bolt signifies an alert to the user of the presence of un-insulated "dangerous voltage" within the product's enclosure that may be of significant magnitude to constitute a risk of electric shock to persons.

- **Warning**: The exclamation point alerts the user to the presence of important operation and maintenance (service) instructions in the literature accompanying the product.

- **Outdoor Use Warning**: To reduce the risk of Fire or Electric Shock, Do Not Expose This Apparatus to Rain or Moisture.

- **Wet Location Warning**: Apparatus shall not be exposed to dripping or splashing and no objects filled with liquids, such as vases, shall be placed on the apparatus.

The CS-7000 contains no user-serviceable parts. Only authorized service personnel should open the unit. Obey all warning labels. If you do not follow these instructions you may risk electric shock, and/or damage to the equipment.

2 SPECIFICATIONS[1]

MODELS

CT-013892-001:	Control Station, Local Control, Desktop
CT-013892-002:	Control Station, Remote Control, Desktop
CT-013892-003:	Control Station, Remote Mount

FRONT PANEL CONTROLS AND FEATURES

Local Control Desktop Station:	DC Power LED, Speaker
Remote Control Desktop Station:	DC Power LED, Speaker, Station Microphone Jack, Station Volume Control, VU Meter, Intercom Switch, Remote Switch
Remote Mount Station:	DC Power LED

REAR PANEL CONNECTORS AND FEATURES

Local and Remote Models

AC Power Input:	IEC-302, Unified Power Connector/Fuse/ON-OFF Switch
Antenna Connector:	Type-N, 50 Ohm, Female
External I/O (P3):	DB-25F, I/O, Small Signal – Direct Function
Serial A (P2):	USB, 2.0 Type B, 12 Mbps, Radio Programming Port
Serial B (P6):	DB-9F, RS-232C (DCE), Serial Interface, Full Duplex, Hardware Flow Control, ASYNC and SLIP at 19.2kbps

Remote Models Only

CAN Link (J15):	2-Wire Differential, 120 ohms, V2.0B 500kbps
LINE Input (J18):	RJ-11 Tone Remote, 600 ohm, Line-Input: -30 to 0 dBm (-20 to +11 dBm Securitone level). Line-Output: 0 dBm.
Computer (J1):	RJ-45, 10/100BaseT, Ethernet, to Local PC
LAN (J6):	RJ-45, 10/100BaseT, Network, to VoIP Remote Controllers

DIMENSIONS (H x W x D):

Desktop:	3.5 x 17 x 13.1 inches (8.9 x 43.2 x 33.3 cm) excluding 1 in. (2.54 cm) rubber feet
Rack Mount:	3.5 x 17 x 13.1 inches (8.9 x 43.2 x 33.3 cm)

WEIGHT

w/o Transceiver:	18 lbs (8.2 kg)
w/Transceiver:	24 lbs (11 kg)

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[1] Specifications listed herein are intended primarily for the use of the service technician. See the appropriate Specifications Sheet for complete specifications.

AC INPUT

Maximum:	120 VAC (240VAC), 4.0 Amps (2 Amps), 400 Watts, 50/60 Hz
Transmit (typical):	120 VAC (240VAC), 2.5 Amps (1.25 Amps), 300 Watts, 50/60 Hz
Receive (typical):	120 VAC (240VAC), 1.2 Amps (0.6 Amps), 100 Watts, 50/60 Hz

ENVIRONMENTAL

Operating Temperature:	-30 to +40ºC @ 50% duty cycle -30 to +60ºC @ 20% duty cycle
Storage Temperature:	-40 to +70ºC
Standards:	MIL-STD-810F
Test Methods:	Low Pressure 500.4/2 High Temperature 501.4/1,2, Category A1 Low Temperature 502.4/1,2 Category C1 Temperature Shock 503.4/1, Categories A1 and C1 Vibration, Non-Operational 514.5/1 Category 2 Shock, Transit Drop 516.5/4 Shock, Bench Handling 516.5/6 Humidity 507.4/2 SAE-J551/15 ESD (Functional) Human Body Model

DUTY CYCLE

Receiver:	100% (per EIA-603)
Transmitter:	20 % (per EIA-603)

SPEAKER

Impedance:	12 ohms
Rated Power:	3 W RMS
Distortion:	5% at rated power from 300-3000 Hz
Buzzes/Rattles:	None
Acoustic Output::	95 dB SPL @ 3 W @ 12 inches @ 1 KHz
Acoustic Response:	± 5 dB from 300-3000 Hz

REMOTE CONTROL MODES   **(Optional)**

Tone Remote Control:	2 or 4-wire Tone Remote Control Modes: EDACS, P25, OpenSky, and Conventional.
Voice over IP:	VoIP Audio with PTT Control. Modes: EDACS, P25, OpenSky, and Conventional.
Controller Area Network:	CAN Interface, Supports up to 4 CAN-Linked peripherals Modes: OpenSky and Conventional.

TRANSCEIVER   Specifications determined by the Mobile Radio's Specifications. Refer to the applicable M5300/M7300 Mobile Radio Maintenance Manual.

REGULATORY   FCC Part-15 Class B Compliant

FCC Part 90 Compliant (refer to mobile radio manual)

Industry Canada RSS-119 (refer to mobile radio manual)

EN60950 Compliant

CSA22.2 Compliant

3   INTRODUCTION

The M/A-COM CS-7000 Control Station provides the latest in digital radio technology via the M/A-COM M5300 or M7300 mobile radio installed into the Control Station. The station may be equipped to support one or more of the following operating modes:

- OpenSky® digital operation.

- Enhanced Digital Access Communications System (EDACS®) or ProVoice™ trunked modes.

- APCO Project 25 Phase I compliant Common Air Interface (P25 CAI) trunked radio networking.

- Conventional analog mode.

The CS-7000 Control Station is typically used for voice and data dispatch communications via optional remotely-connected Desktop Controllers. Remote Desktop Controllers may be connected via any of the following remote control formats:

- Controller Area Network (CAN) link connection.

- Tone controlled line input.

- LAN-based Voice over Internet Protocol (VoIP) connection.

CAN links are generally limited to 250 feet end-to-end line length, but may utilize an optional fiber-optic-based CAN Bus Extender for increased separation between the CS-7000 and CAN-linked Desktop Controllers.   Tone Remote Controllers connect via 2-wire or 4-wire line audio connections.   VoIP requires connectivity to a Wide Area Network (WAN) or Local Area Network (LAN).

Figure 3-1: CT-013892-001 Local Control Station with Scan Head (Front View)

Figure 3-2: CT-013892-002 Local/Remote Control Station with System Head (Front View)

3.1   VOICE OPERATION

The voice path operates like a traditional dispatch radio, with a microphone to transmit (push-to-talk) and a speaker to receive. In OpenSky Trunked Protocol and P25 modes, all voice communications are transmitted in a digital mode. Systems operating in EDACS mode may employ both analog and digital voice modes, and a data mode.

3.2   OPTIONAL REMOTE CONTROL BOARD

The CS-7000 Control Station may be equipped with the optional Remote Control Board. The Remote Control Board provides the ability to remotely control the station features such as PTT (transmit), group and/or channel control, and intercom.

3.2.1   Intercom Operation

Control Stations equipped with the optional Remote Control Board are also equipped with an intercom function. The intercom function allows voice communications between the Control Station's operator and operators at Desktop Controllers connected via the CAN link, VoIP link, or Tone Remote Controllers connected to the line connector. Even when intercom is activated, incoming network radio calls are still routed to the speaker in the Desktop Controllers in receive mode (not keyed). In other words, radio calls are not muted when the Desktop Controller's intercom function is active (with the exception of the remote that is keyed and making an intercom transmission).

3.3   RELATED DOCUMENTATION

The following documents contain additional information relative to the CS-7000 Control Station. These documents may be helpful during the installation and maintenance of this equipment.

Table 3-1: Reference Documents

DOCUMENTATION	MANUAL NUMBER
CS-7000 Control Station Operator's Manual	MM-014713-001
CS-7000 Control Station Maintenance Manual	MM-014715-001
M5300 Transceiver Operator's Manual	MM-012125-001
M5300 Transceiver Quick Guide when using OpenSky Systems	MM-012997-001
M5300 Transceiver Quick Guide when using P25, EDACS, or Conventional Systems	MM-013232-001
M7300 Transceiver Operator's Manual	MM-014718-001
M7300 Transceiver Quick Guide when using OpenSky Systems	MM-014368-001
M7300 Transceiver Quick Guide when using P25, EDACS, or Conventional Systems	MM-014369-001
M5300/M7300 Software Release Notes	MS-014467-001
Site Grounding and Lightning Protection Guidelines	AE/LZT 123 4618/1

DOCUMENTATION	MANUAL NUMBER
Tower Requirements and General Specifications	LBI-39185
Antenna Specifications	LBI-38983
CAN Bus Extender	MM-009088-001

3.4 TECHNICAL ASSISTANCE

Should the CS-7000 Control Station require repair, or if you have questions or concerns about the installation of this equipment, contact M/A-COM's Technical Assistance Center (TAC) using the following telephone numbers or email address:

- U.S. and Canada: 1-800-528-7711 (toll free)
- International: 1-434-385-2400
- Fax: 1-434-455-6712
- Email: tac@tycoelectronics.com

3.5 CUSTOMER RESOURCE CENTER

Replacement parts can be ordered through M/A-COM's Customer Resource Center. To order replacement parts through the Customer Resource Center, call, fax or email our ordering system:

North America:

- Phone Number: 1-800-368-3277 (toll free)
- Fax Number: 1-800-833-7592 (toll free)
- E-mail: customerfocus@tycoelectronics.com

International:

- Asia Pacific: 1-434-455-9223
- Latin America & Middle-East: 1-434-455-9229
- Europe: 1-434-455-9219
- Fax Number: 1-434-455-6685
- E-mail: customerfocus@tycoelectronics.com

4 UNPACKING AND CHECKING EQUIPMENT

4.1 MATERIALS

The CS-7000 Control Station includes an AC Power Cord to connect it to standard AC power (120 VAC, 60 Hz). No installation kit is available, as every installation is custom. The CS-7000 is generally used in conjunction with a Desktop Controller, both of which have accessories that can be installed. Table 4-1 lists equipment top-level part numbers, and Table 4-2 lists available accessories.

NOTE	**The CS-7000 must not be powered up unless an antenna is installed and connected.** An antenna and its cabling must be purchased separately. Antennas and coaxial cables are typically customized to the installation site. Have site surveys performed to identify an appropriate antenna and antenna feed line requirements.

4.2 MATERIAL INSPECTION

CAUTION	After removal from the carton, examine the components and installation items for broken, damaged, loose or missing parts. If any are noted, contact M/A-COM's Customer Resource Center immediately to discuss and arrange for the return of the equipment to M/A-COM for replacement. Refer to Section 3.5 on page 14 for the Customer Resource Center contact information. Any unauthorized attempts to repair or modify this equipment will void the warranty and could create a safety hazard.

Upon removing items from the carton and verifying all equipment is accounted for, proceed with the installation.

WARNING	**Mounting of the CS-7000 and/or antenna in ways other than those described can adversely affect performance, violate FCC rules on RF exposure, and even damage the unit, posing a potential safety hazard.**

Table 4-1: Catalog, Description, and Part Numbers for the CS-7000 Control Station

DESCRIPTION	PART NUMBER
Control Station, Desktop Configuration, Local Control	CT-013892-001
Control Station, Desktop Configuration, Remote Control	CT-013892-002
Control Station, Remote Configuration, Remote Control	CT-013892-003

Table 4-2: Accessories for the CS-7000 Control Station

PART NUMBER	DESCRIPTION
MC-014121-001	Desktop Microphone
MAMROS0093	Antenna, 800 MHz 6-element Yagi with 8 dBd Gain
AN-025137-004	Antenna, 700 MHz 6-element Yagi with 7 dBd Gain
MAMROS0094	Antenna Mounting Kit, Universal Mount for Yagi Antennas
MAMROS0095	Cable, Coax: Antenna Jumper Kit
DSXL-MA-BF	Lightning Protection Device with DC Blocking (PolyPhaser DSXL-MA-BF), 700 to 2700 MHz, N-male to N-female connectors, elongated female connector for PolyPhaser BFN or BFD flange mount adapters.
CD-014027-001	CAN Terminator
CA-009562-0R6	Cable, CAN; 0.6 feet, Black, Right-Angle-to-Straight Connectors
CA-009562-006	Cable, CAN; 6 feet, Black, Right-Angle-to-Straight Connectors
CA-009562-030	Cable, CAN; 30 feet, Black, Right-Angle-to-Straight Connectors
CA-009562-090	Cable, CAN; 90 feet, Black, Right-Angle-to-Straight Connectors
CA-009562-250	Cable, CAN; 250 feet, Black, Right-Angle-to-Straight Connectors
CA-011344	CAN Y-Cable, Black, Right-Angle-to-Two Straight Connectors
MAA7-NSU5C	Kit, CAN Bus Extender (Includes CAN Bus Extender MD-008577 and AC Wall Power Supply.) [2 required per optical CAN link.]
TQS3385 Rev. B (min)	Radio Personality Manager (Programming Software for P25, EDACS, OpenSky)
TQS3389 Rev. A (min)	Radio Personality Manager (Programming Software for Analog Conventional and P25 Conventional)

5   INSTALLATION

<table>
<tr>
<td>⚠️
CAUTION</td>
<td>**M/A-COM recommends the buyer use only a M/A-COM authorized representative to install and service this product.** The warranties provided to the buyer under the terms of sale shall be null and void if this product is installed or serviced improperly, and M/A-COM shall have no further obligation to the buyer for any damage caused to the product or to any person or personal property.</td>
</tr>
</table>

<table>
<tr>
<td>ℹ️
NOTE</td>
<td>Prior to installation, ensure that the CS-7000 has been configured for customer usage such as channels and personality.</td>
</tr>
</table>

5.1   REQUIRED TOOLS AND EQUIPMENT

5.1.1   Tools and Shop Supplies Required to Install the CS-7000

The following is a list of tools required to complete a standard installation:

- Phillips screwdrivers, sizes #1 and #2;

- Flat head screwdrivers, sizes #1 and #2;

- Slip-jaw pliers;

- 3/8" Nut driver;

- Various fasteners; as required.

Special tools needed to construct and/or install optional cables and accessories are listed in the installation and configuration sections for the option or accessory.

5.1.2   Equipment Required for CS-7000 Configuration

The following is a list of additional equipment needed to configure the CS-7000:

- Personal Computer (PC) with an available USB communication port and running Microsoft® Windows® XP or Windows Server 2003. OpenSky programming requires a terminal application software program such as Windows HyperTerminal, and P25, EDACS, and Conventional requires the programming software listed in Table 4-2 on page 16;

- Standard USB 2.0B computer cable;

- See Table 7-1 on page 45 for a list of test equipment required to perform antenna tests procedures.

5.2   PLANNING THE CS-7000 INSTALLATION

Plan the mounting locations of all components (CS-7000, antenna, and cables) and determine the routes for all wiring and cables. Consider also the connection of desktop remotes for planning purposes. Follow all manufacturer requirements and guidelines for the location of components.

<table>
<tr>
<td>ℹ️
NOTE</td>
<td>For installations with CAN-linked Desktop Controllers which require connection through the CAN (Controller Area Network) digital interface, pay particular attention to the routing of CAN cable in the facility. It may be necessary to use plenum-rated cable for in-building installations. Refer to Section 5.9 that begins on page 27 and/or consult with TAC to identify the proper cabling.</td>
</tr>
</table>

⚠ CAUTION	All cables should be installed with a service loop at each end. During the installation, do NOT bend any cable at a severe angle near a connector. When the installation is complete, verify no cable is under any tension. Failure to do so may lead to damaged cables, causing intermittent operation, or complete equipment failure.

⚠ CAUTION	Optimal performance is based upon proper mounting techniques. An improperly installed unit may experience degradation in the quality of communication with the OpenSky network.

5.3   CS-7000 INSTALLATION

Determine the customer's preferences, if any, for location of components. Comply with these preferences insofar as they are consistent with safety, manufacturer specifications, and generally accepted professional practices.

5.3.1   Desktop Installations

The CS-7000 can be placed upon a desktop, tabletop, or another flat horizontal surface with an adequate size and weight rating. The unit's dimensions are 3.5 x 17 x 13.1 inches (8.9 x 43.2 x 33.3 cm) and it weighs approximately 24 lbs. (11 kg.).

5.3.2   Rack-Mount Installation

The CS-7000 Remote Configuration Station model CT-013892-003 is designed for mounting within a 19-inch rack-mount cabinet. Its height is two rack-units (3.5 inches). Mounting brackets are attached to the side corners near the front and rear panel of the CS-7000 at the factory.
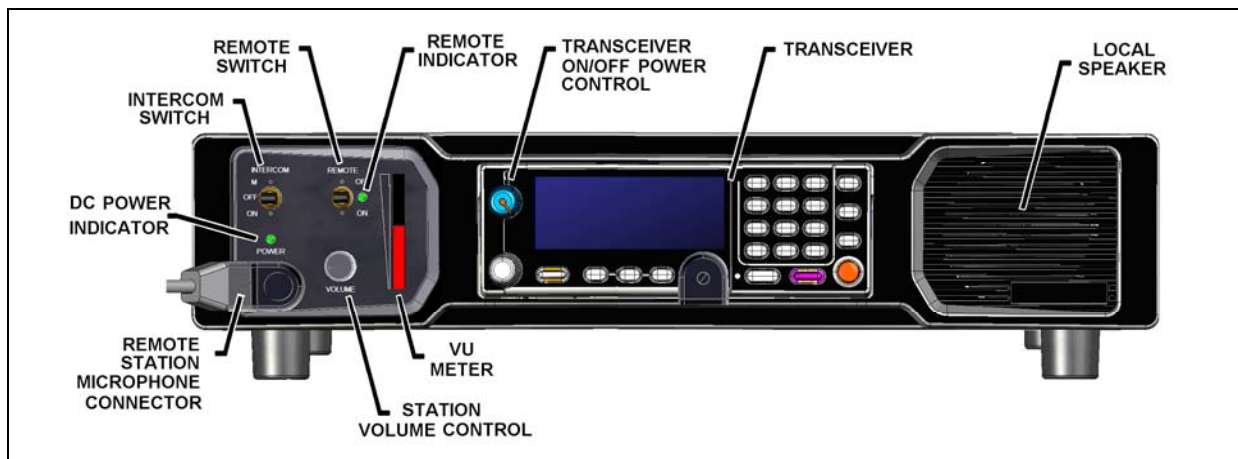
Figure 5-1: CS-7000 with Remote Control, Front View
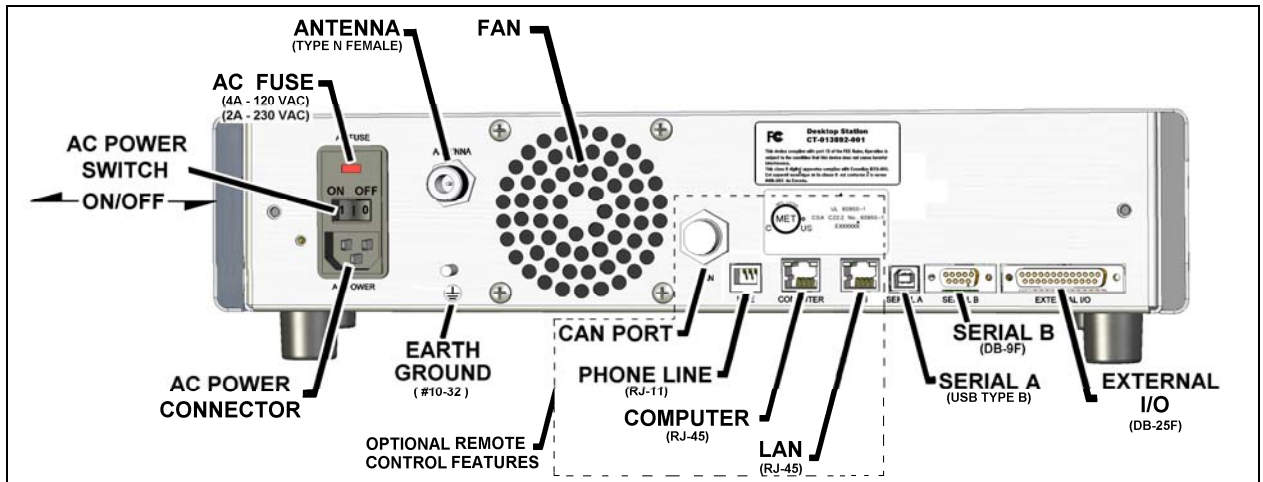
Figure 5-2: CS-7000 Rear Panel (shown with Remote Control Board installed)

⚠️ CAUTION	Never place any other equipment directly on top of the CS-7000. The case is not designed to handle the weight of other equipment.

⚠️ WARNING	**The CS-7000 must be kept away from sources of heat. Adequate ventilation must be provided to the air inlet at the rear of the unit where the fan is located and to the ventilation holes on the rear-sides of the unit.**

5.3.3   AC Power Connection

The CS-7000 only supports an AC power connection. Follow these general guidelines:

• Ensure familiarity with AC power input connection, including maintenance of the fuse; and,

• Make certain that cable routing will not damage or interfere with any existing wiring at the installation location.

In order to accommodate both U.S. and other standards, the CS-7000 can be used at voltages in the range of 110 – 120 VAC (50/60 Hz) and 220 – 240 VAC (50/60 Hz). The power cord for U.S. applications (110 – 120 VAC) is included with the CS-7000 when it ships from the factory. For other applications, the appropriate power cord must be purchased separately. The receptacle at the back of the CS-7000 is an IEC-320 C14-type connector for accepting a cord with an IEC-320 C13-type plug.

5.3.4   AC Fuse Replacement

In the event that a fuse blows in the CS-7000, disconnect AC power from the unit by unplugging the cord from the AC power source or by unplugging the cord from the IEC-320-type AC power connector on the CS-7000's rear panel, and follow this replacement procedure:

1. As shown in Figure 5-3, slip the tip of a small flat-blade screwdriver into the pry slot at the top of the AC Power Module and open the fuse assembly door.

2. Remove the fuse holder and replace the blown fuse with a new **4-amp**, 250-volt fuse.

3. Re-insert and reseat the fuse assembly until the panel snaps back into place.

4. Reconnect AC power to the unit.

STEP 1 | STEP 2
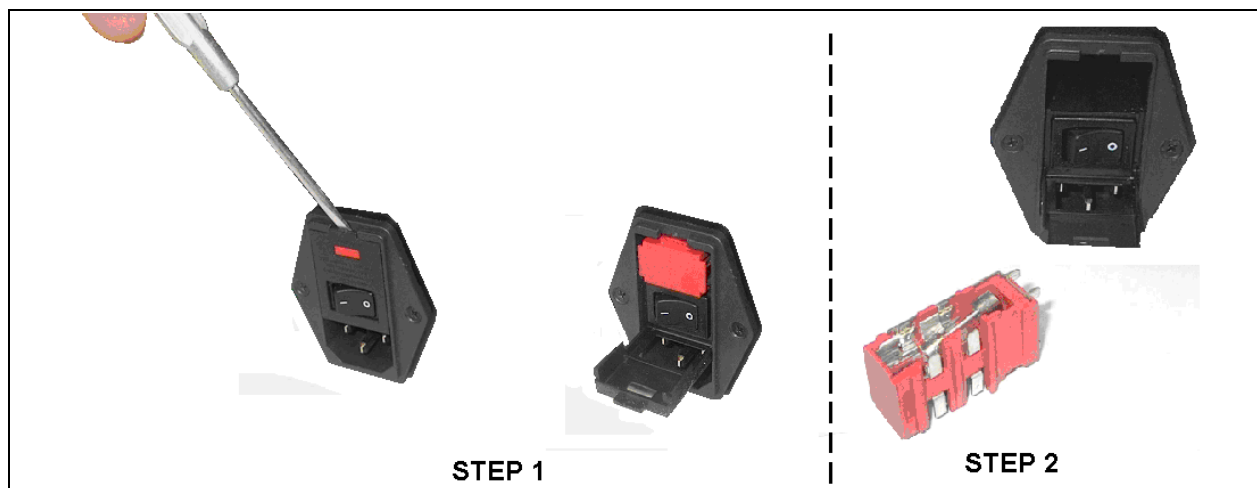
Figure 5-3: CS-7000 Fuse Replacement (Rear Panel Views)

5.4   ANTENNA INSTALLATION

Antenna installations vary greatly depending on the type of antenna mounting structure, height, and the surrounding environment.   Professional antenna installation services are highly recommended when installing and maintaining communications antenna systems.   This manual makes no attempt to provide step-by-step instructions for installing the antenna and supporting structure.   Rather, general recommendations and considerations are provided.   Further, where installation instructions provided by antenna and other related antenna equipment manufacturers differ from this manual, the manufacturer's instructions are to be followed at all times.   When in doubt, always contact the equipment manufacturer or M/A-COM Technical Assistance Center for further assistance.   Follow all national an d local building code requirements when installing antenna systems.

5.4.1   RF Safety Information

> **The antenna must be installed by a qualified antenna professional.   Improper installation of the antenna may lead to poor radio performance, and harmful exposure to RF electromagnetic energy.**

The CS-7000 antenna installation must comply with the FCC RF exposure limits as discussed in Section 1.1. Installation of the antenna for the CS-7000 is to be performed so that no person is within the distance of maximum permissible exposure limits specified in the FCC regulations. The CS-7000 must be disabled before antenna maintenance is performed.

5.4.2   General Information

M/A-COM has available several manuals that provide useful information during the installation process. General antenna installation specifications may be found in M/A-COM's Antenna Systems Manual, LBI-38983.   Tower Requirements and General Specifications may be found in the Specifications, Guidelines, and Practices Manual, LBI-39185.   And, site grounding must conform to the requirements found in the *Site Grounding and Lightning Protection Guidelines Manual*, AE/LZT 123 4618/1.

Failure to follow these instructions will void the product warranty and may expose the end user and others to excessive Radio Frequency hazards. All antennas should be installed outdoors; and where practical, at distances from personnel well beyond the minimum allowable distance.

5.4.3   Building Installation Considerations

The length of antenna cable should be kept as short as possible to minimize cable loss. Therefore, the CS-7000 should be installed within the building in a location as close to the location of the outside antenna's cable entry as reasonably possible. Remote control options (remote desktop controllers) should be utilized when the most suitable station installation location is impractical for the intended user(s) access. Consult with RF equipment installation professionals for more information.

> **NOTE**
>
> If routed through walls, plenums, or other channeling aids, the cable must be protected from excessive handling, bending, or rubbing.

5.4.4   Base Station Antennas

The rooftop-mount Yagi antennas listed in Table 4-2 (on page 16) are recommended. Side-mounting onto a building with other types of directional antennas is also acceptable as long as proper line-of-sight alignment can be achieved.

For best performance, the antenna should be placed as far away as practical from any other antennas or structures, and high enough to clear the line-of-sight of major obstructions.

> **CAUTION**
>
> Ensure that feed lines, lightning protection devices, coaxial jumpers and any other inline RF devices meet frequency and RF power requirements for the specific installation.

5.4.5   Transmission Lines

Many different RF coaxial cable types can be used for the antenna connection as long as the utilized cable meets the following minimum requirements. Cable loss, length of cable, antenna type used, etc., are issues to consider when selecting the type of cable needed. Minimum cable specifications are:

- 50 ohm nominal impedance;
- Minimal RF Loss at frequency range;
- 1.5:1 VSWR (typical);
- 3 dB/100 feet cable loss (maximum); and,
- Weatherproof construction.

> **CAUTION**
>
> **Always hand-tighten RF connectors**. Do not tighten RF connectors with tools unless recommended by the connector manufacturer. The use of a torque wrench is acceptable when the manufacturer of the connector has specified a torque value.

5.4.5.1   Minimum Transmission Line Bending Radius

When Heliax, Superflex, or another similar transmission line is used, always adhere to the minimum bending requirements provided by the manufacturer (refer to Table 5-1).

Table 5-1: Minimum Bend Radius Values for RF Transmission Lines

CABLE SIZE	TYPE	PART NUMBER	MINIMUM-BEND RADIUS
Andrews Corp.			
1/4 inch	Superflex	FSJ1-50A	1 inch (25 mm)
1/2 inch	Superflex	FSJ4-50B	1.25 inches (32 mm)
1/2 inch	Heliax	LDF4-50A	5.0 inches (125 mm)
7/8 inch	Heliax	LDF5-50A	10 inches (250 mm)
1-1/4 inch	Heliax	LDF6-50	15 inches (380 mm)
1-5/8 inch	Heliax	LDF7-50A	20 inches (510 mm)
1/4 inch	Superflexible	SCF14-50J	1 inch (25 mm)
RFS Cablewave Corp.			
1/2 inch	Superflexible	SCF12-50J	1.25 inches (32 mm)
1/2 inch	Hardline	LCF12-50J	5.0 inches (125 mm)
7/8 inch	Hardline	LCF78-50J	10 inches (250 mm)
1-1/4 inch	Hardline	LCF114-50J	15 inches (380 mm)
1-5/8 inch	Hardline	LCF158-50J	20 inches (510 mm)

5.4.6   Tower Installations

While most Control Station antenna installations are building and roof mounted, occasionally Control Stations are installed at sites with towers. Always observe all safety instructions and ensure a safe and proper antenna installation by following all tower manufacturers' recommendations. In addition to local building codes, the most current revision of industry standard TIA/EIA-222: *Structural Standards for Steel Antenna Towers and Antenna Supporting Structures* must be adhered to during tower and antenna installations.

5.5   GROUNDING AND LIGHTNING PROTECTION

Proper grounding is necessary, not only for correct functionality and maximum performance, but also for minimizing damage that may occur from lightning strikes and personnel safety.

Assuming the facility where the CS-7000 Control Station is installed is protected properly from lightning strikes on the AC power line, the station is still susceptible to damage from lightning through the RF antenna port, LAN and phone line inputs. The CS-7000 Control Station does not include an integrated lightning-protection device at the antenna port, so it is recommended to install an external lightning protection device. Lightning-protection devices are only effective if the connections are made as their design intended. Follow the manufacturer's mounting instructions to ensure a properly grounded unit.

A #10 grounding stud is located at the rear of the CS-7000 Control Station. For safety purposes, connect it to a suitable earth ground per instructions in the M/A-COM *Site Grounding and Lightning Protection Guidelines Manual*, AE/LZT 123 4618/1.

5.6   BACKUP POWER SOURCES

Due to the great advancements in the industry's backup power resources, the CS-7000 Control Station does not provide connections for backup AC or DC power resources. Rather, it is recommended to utilize commonly available resources discussed in the following sub-sections.

5.6.1   Uninterruptible Power Supplies

It is recommended when a backup AC power source is required for a CS-7000 Control Station installation to use an Uninterruptible Power Supply (UPS) system. These systems can vary greatly in price, size, and run time. Well engineered UPS systems monitor the commercial AC power mains for harmful changes in the power being supplied. Some UPS systems run in "hot standby" mode providing even greater protection to the equipment connected to the UPS.

5.6.2   Gas/Propane Generators

Generators may be used when the AC power mains are expected to be down for extended periods of time. However, generators can occasionally produce unwanted fluctuations and power surges that can potentially damage the power supply in electronic devices. If generators are used, it is strongly recommended also use a UPS inline between the generator and CS-7000 Control Station as an added layer of protection from potentially damaging changes in generator power.

5.6.3   Hydrogen Power Systems

Many alternative power products are available in today's marketplace. Hydrogen power systems are quickly becoming the main and backup power source of choice for some customers. Hydrogen power systems are inherent to high reliability with few moving parts, require lower capital costs than combustion engine generators, and typically have lower life cycle costs than combustion engine generators. They are environmentally friendly, produce no toxins, can be installed indoors or outdoors, typically have a smaller footprint and weight than combustion engine generators, and silent running (no noise pollution). Hydrogen fuel and replacement tanks are commonly available in most all locations.

5.7   CONNECTING VoIP DESKTOP REMOTE CONTROLLERS

The CS-7000 Control Station Remote Controller Board provides VoIP and control capability to the Control Station. When equipped with the Remote Controller Board, the rear panel of the Control Station is equipped with a standard RJ-45 Ethernet *LAN* jack. This jack provides standard Internet Protocol (IP) based connectivity.

5.7.1   Setting Up the LAN Port for VoIP Connectivity

1. Connect an Ethernet cable from a LAN or WAN system to the *LAN* connection on the rear panel of the CS-7000 Control Station.

2. Follow the setup instructions in APPENDIX A to configure the Control Station for VoIP connectivity.

5.7.2   Setting Up VoIP Desktop Remotes

1. Follow the setup instructions in APPENDIX B to configure IDA model 24-66, and other VoIP remotes to operate with the CS-7000 Control Station.

5.8 CONNECTING TONE REMOTE CONTROLLERS

The CS-7000 Control Station Remote Control Board also has a RJ-11 *LINE* input connector for Tone Remote Control applications.

Two-wire describes a single pair of dedicated metallic wires in the form of discrete 600 ohm telephone-grade wire provided by a customer, 600 ohm dry (quiet line only) telephone-grade line provided by a telephone company, or the multiplexed equivalent provided by customer owned equipment. This type of circuit will support the bi-directional transmission of audio signals in the nominal 300 to 3000 Hz frequency range.

Four-wire describes two pair of (usually) multiplexed dedicated telephone-grade circuits with one pair going each way. Each pair will support uni-directional transmission of audio signals in the nominal 300 to 3000 Hz frequency range. One pair is usually designated as the SEND pair while the other is designated as the RECEIVE pair. These circuits may be obtained for voice applications.

5.8.1 Standard Tone Signaling

In tone remote applications, Tone Remote Controllers send specific audio tones at pre-defined levels down the line where the station assigns the decoded tones to control various functions of the Control Station. The Control Station may be programmed to allow control of the following functions:

- Repeater Enable (disable)

- Channel Guard Decode Enable (disable)

- Channel Guard Monitor

- Transmit Frequency Selection

- Receive Frequency Selection

- Scan

- Receiver Selection (Auxiliary Receiver selection)

- Auxiliary Output Enable (disable) (Auxiliary Control)

Signaling from a Tone Remote control unit consists of a high level **Secur-it** tone, followed by the appropriate medium level function tone, followed by a hold tone if the transmitter is keyed. The tone control sequence is shown in Figure 5-4.

The Secur-it tone is a +10 dB, 2175 Hz tone that is present for 125 milliseconds. The Secur-it tone is followed by a 40 millisecond, 0 dB Function tone. The Function tone may be followed by a 2175 Hz Hold tone at -20 dB level for as long as the PTT is pressed.

5.8.2 Dual Function Tone Signaling

Signaling from a Dual-Function Tone Remote control unit consists of a high level **Secur-it** tone, followed by the appropriate one or two medium level function tones, followed by a hold tone if the transmitter is keyed. The tone control sequence is shown in Figure 5-4.
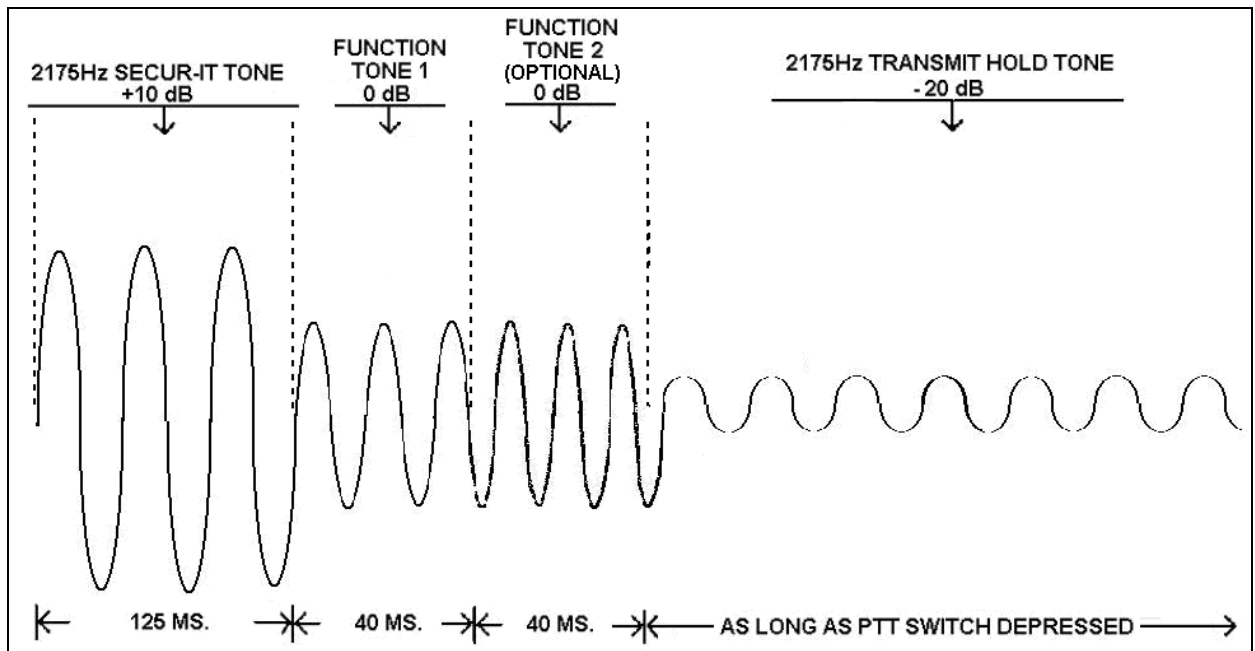
The Secur-it tone is a +10 dB, 2175 Hz tone that is present for 125 milliseconds. The Secur-it tone is followed by one or two 40 millisecond, 0 dB Function tones. The Function tones may be followed by a 2175 Hz Hold tone at -20 dB level for as long as the PTT is pressed.

Figure 5-4: Tone Remote Control Signaling

The frequency of the Function tone determines the function selected by a tone remote control unit. Function tones range from 1050 Hz to 2050 Hz, and are spaced 100 Hz apart.

Table 5-2: Typical* Tone Functionality for Tone Remote Control Signaling

| TONE (Hz)	FUNCTION	TONE (Hz)	FUNCTION
2175	SECUR-IT / TX Hold	1550	Channel Guard Decode or Repeater Enable
2050	RX Channel Guard Disable (Reset by PTT)	1450	Channel Guard Decode OFF or Repeater Disable
1950	TX Group/Freq. No. 1	1350	TX Group/Freq. No. 3 or Aux. Function 1 ON
1850	TX Group/Freq. No. 2	1250	TX Group/Freq. No. 4 or Aux. Function 1 OFF
1750	TX Group/Freq. No 1 or Receiver No. 1	1150	Repeater Enable**
1650	TX Group/Freq. No 2 or Receiver No. 2	1050	Repeater Disable** or Scan Simultaneous Monitor

NOTE: Use of tones below 1050 Hz may degrade system performance due to low frequency noise components on telephone-grade wire connections.

*   The functionality listed for each tone is typical, however may differ for some installations.
**   Repeater Enable and Repeater and disable are 1150 Hz and 1050 Hz only when Channel Guard ON/OFF is present.

5.8.3   Connecting One Tone Remote Controller

Line loading characteristics of the LINE input of the Control Station must be properly setup. If only one TRC is connected, the CS-7000 Control Station and the TRC are both considered line terminating end points. Both devices must have their line impedance set to the low impedance (600-ohm) state for proper termination. This line interface configuration is illustrated in the following figure:
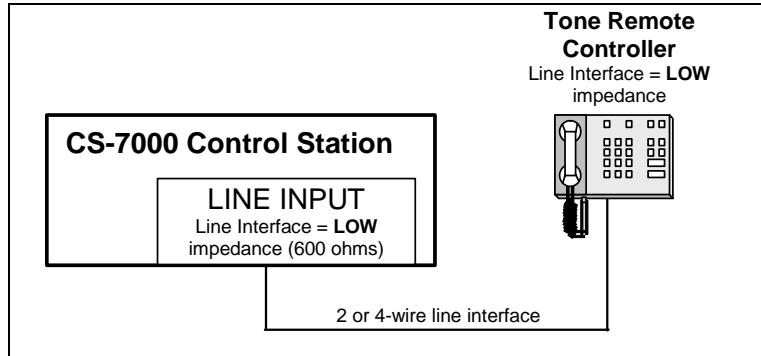
Figure 5-5: Line Input Configured as an Endpoint and Interfaced to One TRC

Refer to Section 6.4 for instructions on configuring the Control Station Line Inputs. Consult installation instructions for the Tone Remote Controller for configuration instructions.

5.8.4   Connecting More-than-One Tone Remote Controllers

The following figure illustrates the CS-7000 Control Station at the end of a "chain" of paralleled TRCs. In this configuration, the Control Station and the TRC that is furthest away from the Control Station in physical cable distance must have their line impedance set to the low impedance (600 ohm) state for proper termination. All other TRCs must be set to the high impedance state.
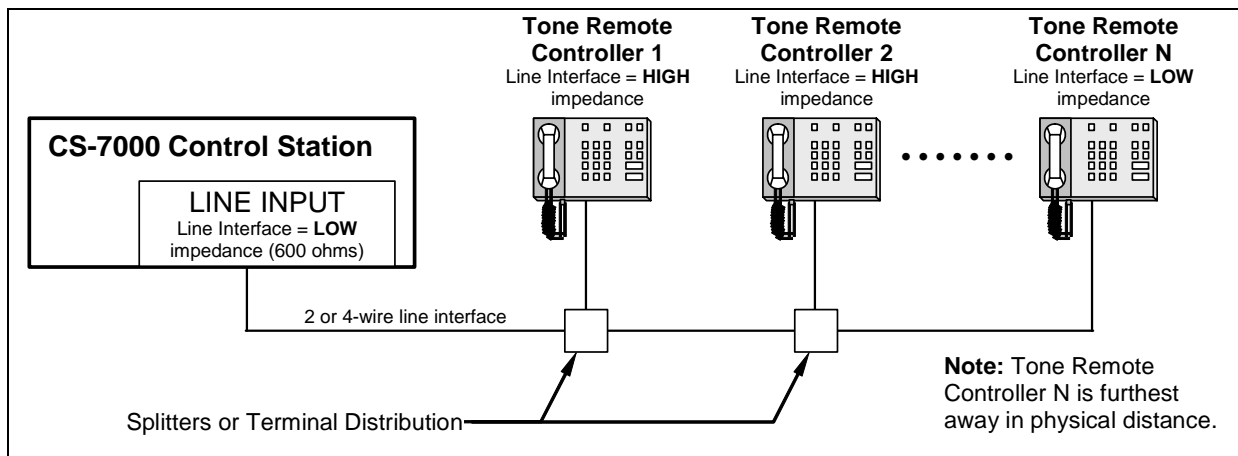
Figure 5-6: Configured as an Endpoint and Interfaced to Multiple Paralleled TRCs

The next figure illustrates the CS-7000 Control Station in the middle of a "chain" of TRCs. In this configuration, the two TRCs furthest away from each other in physical cable distance must have their line impedance set to the low impedance (600-ohm) state for proper termination. The Control Station and all other paralleled TRCs must be set to the high impedance state.
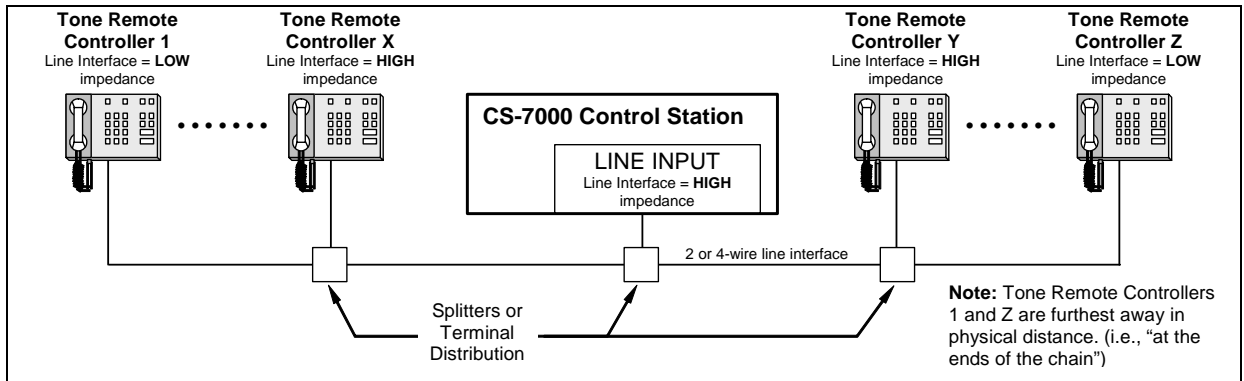
Figure 5-7: Control Station in the Middle of a Chain and Interfaced to Multiple Paralleled TRCs

5.8.4.1 LINE Input Connector

A variety of Tone Remote Controllers (TRCs) can be interfaced to the CS-7000 Control Station. The model supported by M/A-COM is IDA 24-66. The information presented in the following subsections describes how hardware connections are made to these units, although the manufacturer's instructions included with the unit provide the ultimate guidelines. Other TRCs typically follow these installation approaches.

> ⚠️ **CAUTION**
>
> In all 4-wire TRC installations, connect the Control Station RX audio lines to TRC TX audio lines, and connect the Control Station TX audio lines to TRC RX audio lines. Line misconnections will cause control failures to the Control Station.

Table 5-3 describes the pins of the CS-7000 Control Station's RJ-11 modular jack used for 2-wire and 4-wire line connections. If both 2- and 4-wire connections are available at the TRC, the customer is free to choose either connection as the CS-7000 Control Station is factory set for 4-wire operation, 4-wire is recommended, though not required.

Table 5-3: LINE Input Pin-Out
(RJ-11 Modular Jack Labeled "LINE")

RJ-11 PIN	SIGNAL
1	(No Connection)
2	4-Wire +RX IN
3	2-Wire +TX OUT/RX IN
4	2-Wire -TX OUT/RX IN
5	4-Wire -RX IN
6	(No Connection)

5.9 CONNECTING CAN –LINKED REMOTE CONTROLLERS

5.9.1 General Information

Each CS-7000 remote model may be installed using the Controller Area Network (CAN) connection. The CS-7000 is considered a CAN device, and each CAN-linked desk set in the installation is also considered a CAN device. Because CAN devices do not have internal terminators, the CAN link must be terminated at both ends via a CAN terminator.

Typically, CAN-linked Desktop Controllers and other devices have two (2) CAN ports to support "daisy-chaining" of multiple Desktop Controllers, or other CAN devices. The M5300 or M7300 mobile radio installed into the CS-7000 has two can ports on the rear of the mobile radio. Because CAN devices do not have internal terminators, the CAN link must be terminated at both ends via a CAN terminator. A terminator should always be installed on the second CAN port on the rear of the mobile radio (refer to Figure 5-8 and Figure 5-9) unless a Y-cable is used on the rear of the CS-7000 Control Station (refer to Figure 5-10). In this case, the CAN terminator on the rear of the mobile radio should be removed and the furthest CAN device on each side of the Y-cable must be terminated.

NOTE	Figure 5-8 through Figure 5-10 assumes the total CAN link connections are less than 250 feet in length. If the total connection length must exceed 250 feet, use the optional fiber-optic-based CAN Bus Extender to extend the CAN link beyond this normal 250-foot limit. Refer to Section 5.9.3 for additional information.

To make CAN connections, visually align the 3-pin male connectors of the cable to the 3-pin female connectors on each unit. Connect by pushing and twisting the outer housing of the cable connector until a click is sensed. Do not use excessive force when twisting.
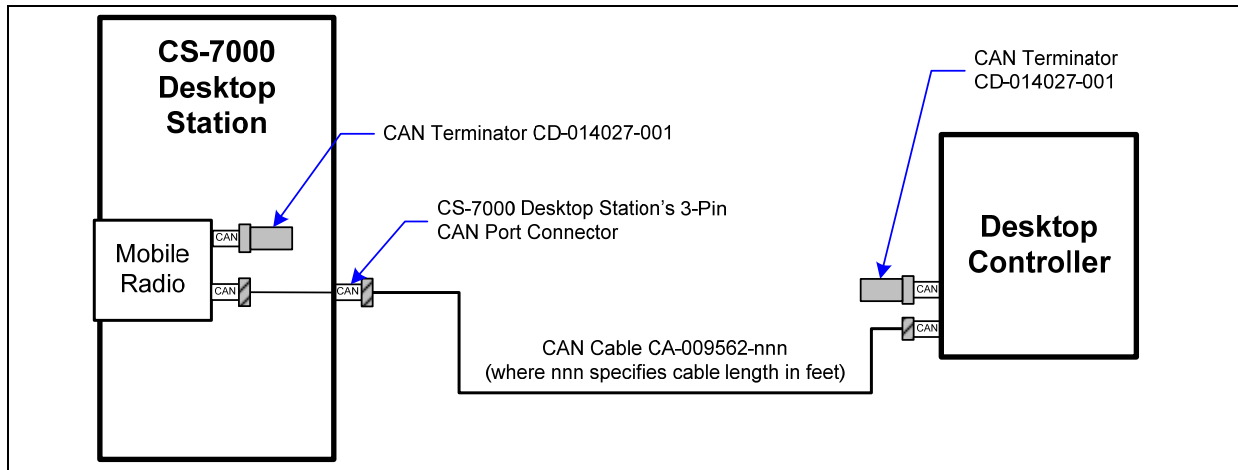
Figure 5-8: Connecting a CAN-linked Desktop Controller

NOTE	A CAN link **must** be terminated properly at both ends of a CAN link. The CS-7000 has an internal CAN terminator on the second radio CAN port. A terminator must be used on the CAN Desktop Controller furthest from the Control Station as shown in Figures Figure 5-8 and Figure 5-9.
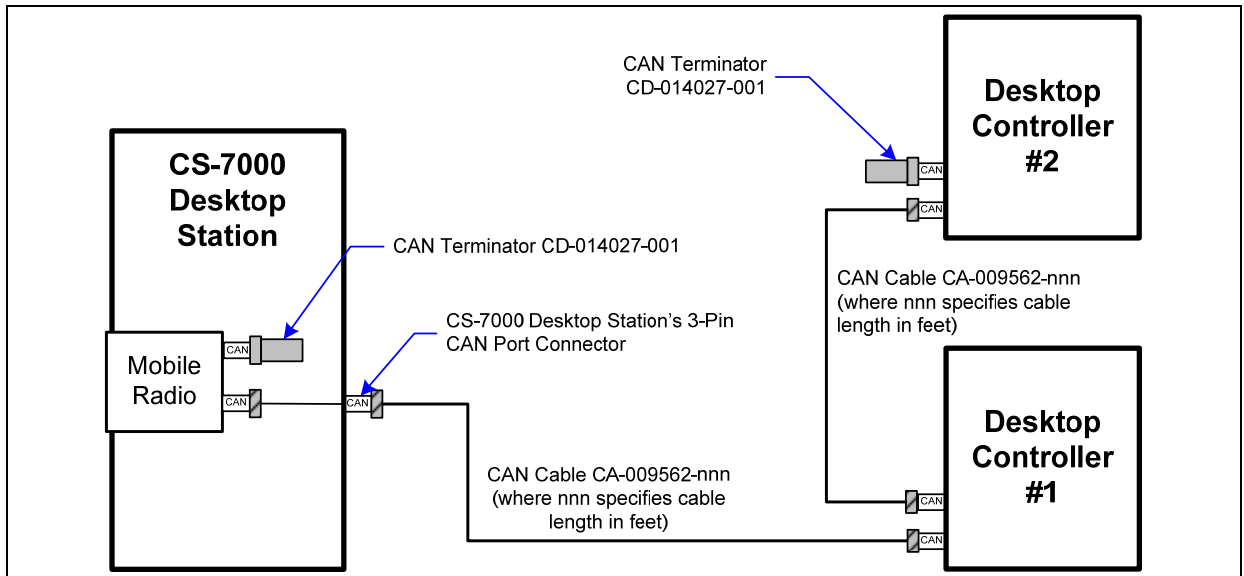
Figure 5-9: Connecting Two or More CAN-Linked Desktop Controllers

> **NOTE**
>
> A CAN link **must** be terminated properly at both ends. The CS-7000 has an internal CAN terminator on the second radio CAN port which **must** be removed when using a CAN Y-Cable at the Control Station. A terminator must be used on the CAN Desktop Controller furthest from the Control Station on each leg of the Y-Cable (refer to Figure 5-10).
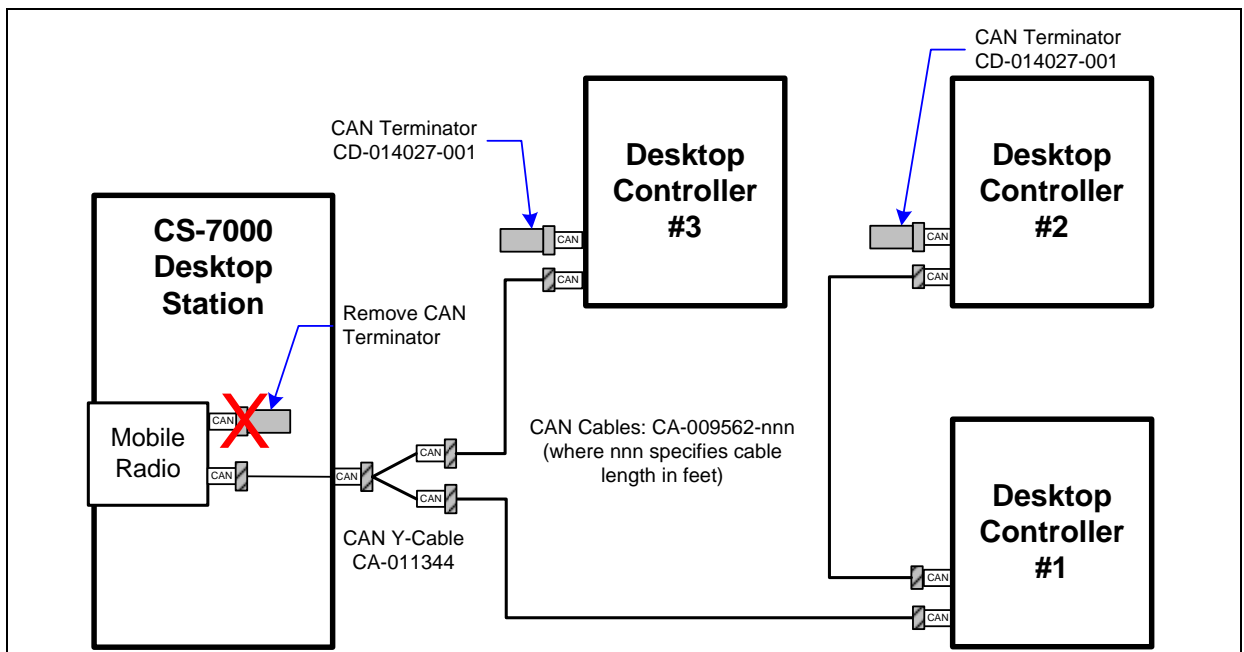
Figure 5-10: Connecting a CAN Y-Cable at the Control Station

5.9.2   CAN-Linked Desktop Controller Connections

The Desktop Controller has two CAN ports on its rear panel to support "daisy-chaining" of multiple CAN devices.   When CAN-linked Desktop Controller is in the middle of a daisy chain, two separate CAN cables connect to the Y-cable (optional, not supplied). When the CAN-linked Desktop Controller is at the

end of a chain of devices, one CAN port connects to the previous CAN device and the other port must be terminated with a CAN Terminator (part number CD-014027-001).

5.9.2.1   Collocated Installations

For installations where the CAN-linked Desktop Controller is near the same location as the CS-7000 and no routing of cables into walls or through plenums is required, a standard CAN cable can be used. For cables whose connectors can be routed without the fear of being damaged in routing (e.g., cables do <u>not</u> need to be snaked through holes), the molded CAN cables are preferred, part number CA-009562-nnn. See Table 4-2 on page 16 for specific cable part numbers. The "nnn" suffix specifies cable length in feet.

If cable connectors might get snagged or damaged during routing, but a non-plenum-rated cable can be used, it is recommended that spooled Belden cable part number 1800B (or equivalent) be purchased separately. However, a CA-009562-nnn CAN cable must also be purchased, as its molded connectors must be spliced to both ends of the spooled Belden #1800B cable. Recommended splicing instructions are presented on page 31.
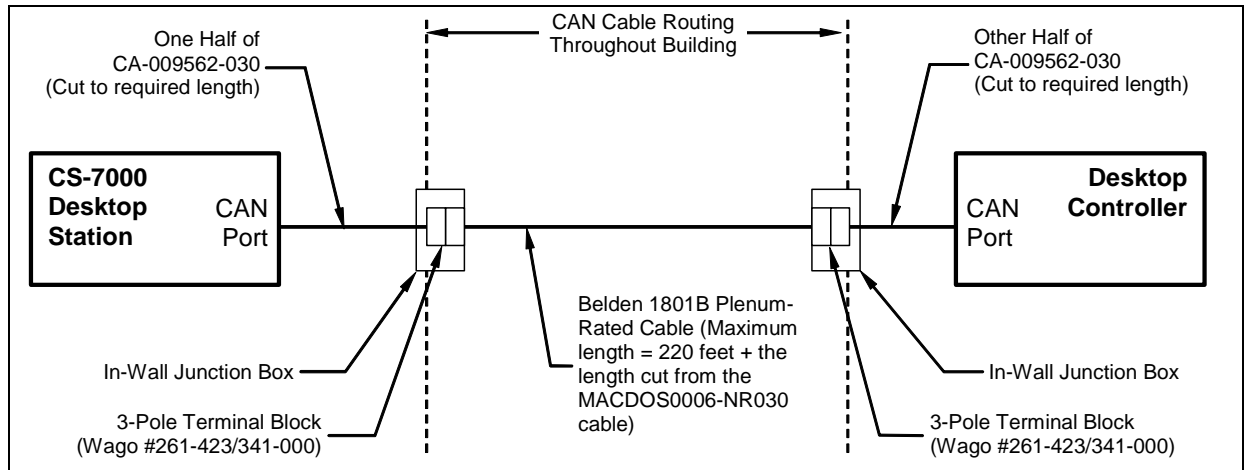
5.9.2.2   In-Wall/Plenum CAN Cable Installations

5.9.2.2.1 Cable Requirements and Routing

As described in the previous section, various lengths of molded CAN cables are available. The standard molded CAN cable, part number CA-009562-030, is for general use. However, for in-building applications, this cable does not meet certain safety agency codes for routing through walls and plenums. For this reason, a plenum-rated cable, Belden cable part number 1801B (or equivalent), can be purchased separately, by the spool. This cable is recommended for in-wall/plenum CAN cable installations because of its properties of impedance, shielding, flexibility, and resistance to flame. In-wall/plenum routing faces the rigors of "snaking" and pulling of the cable. These actions can damage installed connectors. Therefore, a procedure for routing raw cable through the walls and mating connections reliably is necessary.

Figure 5-11 illustrates the general concept for connecting the CS-7000 Control Station to the CAN-linked Desktop Controller via in-wall/plenum CAN cabling. Follow these requirements:

- Materials (e.g., junction boxes, cabling, etc) must meet all building codes.

- The in-wall/plenum cable must be a plenum-rated, shielded, twisted-wire pair of 22-AWG. Belden part number 1801B cable (or equivalent) is recommended. If the utilized cable does not meet building codes, it must be dressed or placed inside a conduit (not provided), or some other installation method must be employed so that it does meet building codes.

- Total physical length of a CAN link, including any amount of cable daisy-chained through multiple CAN devices **cannot exceed 250 feet (76.2 meters)**. This maximum length assumes the optional fiber-optic-based CAN Bus Extenders are not employed; see Section 5.9.3 for additional information.

The standard (non-plenum) CAN cable, part number CA-009562-030 for example, is spliced to the plenum cable using 3-position terminal blocks placed inside junction boxes. Plenum-rated cable is needed for in-wall/plenum routing, but the standard cable, as long as it isn't routed through a wall or concealed ducting, is acceptable for connections to the wall. The standard cable is needed because its solder-type molded connectors do not accommodate customary in-field installation.

Figure 5-11: Connecting In-Wall/Plenum CAN Cable Connections

5.9.2.2.2 Installation Materials

The following materials are required:

- 3-Pole 2-Conductor Terminal Blocks, WAGO part number 261-423/341-000, or equiv. (2 required);

- Junction boxes (2 required); and,

- Assorted tools for routing cable through walls/plenums and mounting junction boxes.

5.9.2.2.3 Splicing CAN Cables

The following procedure is recommended for splicing plenum-rated cable to the standard CAN cable:

1. Cut the standard CAN cable (part number CA-009562-030) approximately in half.

2. If not already, power-off both the CS-7000 and the other CAN devices. Both units should remain off until after the cable installation is complete.

3. Connect each end of the cut CAN cable to the CS-7000 and the Desktop Controller CAN port.

4. Using the cut ends of the cable, determine acceptable locations for wall junction boxes and mount the two junction boxes using an approved method.

5. Route the cables into the junction boxes and anchor according to building codes.

6. Cut off any excess cable length, allowing at least one foot (0.3 meters) for splicing and servicing. The total amount of cable removed from both halves is an amount that can be added to the 220 feet of plenum cable, if needed. For example, if 10 feet of excess length is cut from the standard 30-foot CAN cable, the plenum cable is allowed to be as long as 230 feet. In any case, do not exceed 250 feet (76.2 meters) of total CAN cable length.

7. Measure out an amount of spooled plenum cable needed to reach the two junction box splice points and route it through the building walls, plenums, etc. using approved methods.

8. Route the cable's ends into the junction boxes and anchor according to building codes.

9. Cut off any excess cable length, allowing a foot or so of length for splicing.

10. With a 14-AWG wire stripper, strip off 3/4-inch of the cable's outer jacket and remove any shield foil. *This dimension is critical, as too much unexposed lead length can have an adverse effect on performance.* Ensure no damage was done to the individual wires.

11. With a 22-AWG wire stripper, strip off 5/16-inch of insulation from each individual wire in the shielded pair. The third wire in the cable is the shield ground wire—do not cut it. See Figure 5-12.
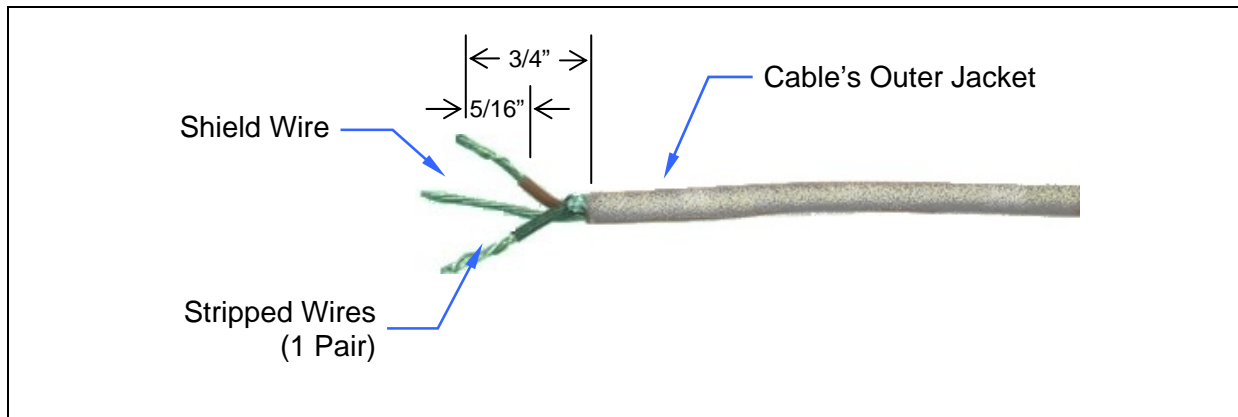
Figure 5-12: Dimensions for Stripping 2-Wire (with Shield) CAN Cables

12. At both ends of the spooled plenum cable, simultaneously insert the red and black wires into two poles of the terminal block by simultaneously pushing two adjacent buttons down with a large #2 flathead screwdriver, and guiding the bare end of the wire into the side openings of the terminal block. Next, release pressure on the buttons while ensuring the bare wires are visible entering the block's clamping mechanisms. See Figure 5-13. The order of wires in the terminal block housing does not matter, but the red and black wires must be next to each other. Consistency between the two blocks is recommended.
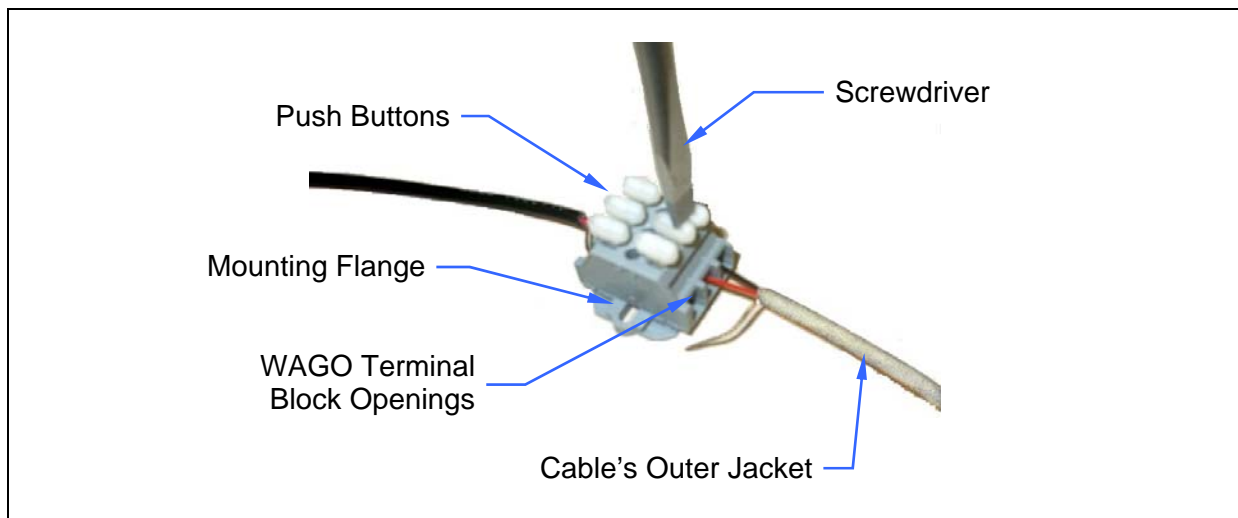
Figure 5-13: 3-Position Terminal Strip Connections

13. Insert the bare shield wire into the third pole of the terminals block by pushing the button down with the screwdriver, guiding the wire into the opening, and releasing pressure on the button.

14. Strip and connect the CS-7000 and the CAN-linked Control Station's standard CAN cable wires to the terminal blocks so matching wire colors on each half of the standard CAN cable will be electrically connected.

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15. Finish the installation by pushing the terminal block into the junction boxes and covering the boxes appropriately. Alternatively, the terminal blocks may be secured with small screws (not supplied) at the mounting flanges.

5.9.3 Connecting a CAN Bus Extender (Fiber Optic Cable Installations)

The optional fiber-optic-based CAN Bus Extenders must be employed in any connection exceeding 250 feet. When using CAN Bus Extenders to connect a CAN-linked Desktop Controller to the CS-7000, one extender must be co-located with, and connected directly to, the CS-7000. Another CAN Bus Extender must be co-located with, and connected directly to, the CAN-linked Desktop Controller. For installation-related information, refer to publication number MM-009088-001.

5.10 CONNECTING DEVICES TO THE EXTERNAL I/O

A 25-pin D-sub miniature (DB-25F) connector is located on the rear panel of the CS-7000 Control Station. This connector is an interconnection-point for various connections to the station such as auxiliary audio inputs, external PTT, etc.

5.10.1 Local and Remote Speaker – Jumper Configuration

A series of jumpers are located on the Local and Remote (PLUS Board) Control Station interface boards for configuring internal and external speaker operation. Nomenclatures and functional use of each jumper is the same for both boards. Refer to Table 5-4 for jumper configurations.

Table 5-4: Interface Board Jumper Configurations

JUMPER	FUNCTION	JUMPER BETWEEN	
		Pins 1 to 2	Pins 2 to 3
JP4	Speaker Select	Internal Speaker	External Speaker
JP7	Station Speaker 2	Single-Ended	Balanced

* Default position.

5.10.2 External I/O Connector (P3) Pinout

Table 5-6 and Table 5-6 defines the pinout for the External I/O port on the Local and Remote (PLUS Board) Control Stations.

Table 5-5: Local Control Station - External I/O Port (P3) Wiring Interconnections

J3 PIN #	FUNCTIONALITY	PORT	PINOUT
1	External Microphone High #1 (Pair to Pin 14)	Input	
2	Hookswitch (Input)	Input	
3	External Microphone High # 2 (Pair to Pin 15)	Input	
4	No Connection		
5	Fused A+ from Station PSU, 1.1 Amp Maximum (Paralleled with Pin 17)	Output	
6	No Connection		
7	Chassis Ground		**LOCAL STATION PINOUT**
8	External Logic Input 2	Input	P3
9	No Connection		1 —< EXT_MIC_HI_1
10	Low Level Receiver Audio Output High 1 (Pair to Pin 23)	Output	14 —< EXT_MIC_LO_1
11	Low Level Receiver Audio Output High 2 (Pair to Pin 24)	Output	2 —< CU_HKSW 15 —< EXT_MIC_LO_2 3 —< EXT_MIC_HI_2
12	Internal Speaker (See Jumper Chart)	Input/Output	16 —< EXT_PTT
13	External Speaker Output (See Jumper Chart)	Output	4 – NC 17 —→ FUSED_DESK_A+ 5
14	External Microphone Low # 1 (Pair to Pin 1)	Input	18 — NC 6 — NC
15	External Microphone Low # 2 (Pair to Pin 3)	Input	19 —< CHASSIS GND 7 —< CHASSIS GND
16	External Microphone PTT	Input	20 —→ OC_OUT2
17	Fused A+ from Station PSU, 1.1 Amp Maximum (Paralleled with Pin 5)	Output	8 —< TTL_IN2 21 — NC
18	No Connection		9 — NC
19	Chassis Ground		22 —< EXTERNAL_MUTE
20	OUT2 (Open Collector)	Output	10 —→ RX_AUD_HI_1 23 —< RX_AUD_LO_1
21	No Connection		11 —→ RX_AUD_HI_2 24 —< RX_AUD_LO_2
22	External Mute Control (Input)	Output	12 —→ STATION_SPKR_1
23	Low Level Receiver Audio Output Low 1 (Pair to Pin 10)	Output	25 —→ STATION_SPKR_2 13 —→ AC_EXT_SPKR_1
24	Low Level Receiver Audio Output Low 2 (Pair to Pin 11)	Output	DB25F
25	Internal Speaker Output (+) (See Jumper Chart)	Output	

Table 5-6: Remote Control Station - External I/O Port (P3) Wiring Interconnections

J3 PIN #	FUNCTIONALITY	PORT	PINOUT
1	Auxiliary Microphone Hi (Input)	Input	
2	Hookswitch (Input)	Input	
3	Auxiliary Audio (Input)	Input	
4	No Connection		
5	Fused A+ from Station PSU, 1.1 Amp Maximum (Paralleled with Pin 17)	Output	
6	Auxiliary Input 2 (Logic Input)	Input	
7	Chassis Ground		
8	External Logic Input 2	Input	
9	Plus Board > Auxiliary Output 2 (Logic Output)	Output	
10	Low Level Receiver and/or Station Audio Output 1	Output	
11	Low Level Receiver and/or Station Audio Output 2	Output	
12	Internal Speaker Output (–) (See Jumper Chart)	Input/ Output	
13	External Speaker Output (See Jumper Chart)	Output	
14	Microphone 1 Audio Ground	Input	
15	Audio Ground for Mic 2 (Input)	Input	
16	External Microphone PTT	Input	
17	Fused A+ from Station PSU, 1.1 Amp Maximum (Paralleled with Pin 5)	Output	
18	Auxiliary Input 1 (Logic Input)	Input	
19	Chassis Ground		
20	Receiver Carrier Operated Relay (COR) Output		
21	Auxiliary Output 1 (Logic Output)	Output	
22	Auxiliary Mute (Input)	Output	
23	Analog Ground		
24	Analog Ground		
25	Internal Speaker Output (+) (See Jumper Chart)	Output	

REMOTE STATION PINOUT

P3

1 → AUX_MIC_HI
14 ← ANALOG GROUND
2 → AUX_HKSW
15 ← ANALOG GROUND
3 → AUX_AUDIO_IN
16 → AUX_PTT-
4 → NC
17 ← FUSED_DESK_A+
5
18 → PLUS_BD_AUX1_IN-
6 → PLUS_BD_AUX2_IN-
19 ← CHASSIS GND
7 ← CHASSIS GND
20 ← AUX_OC_OUT2
8 → TTL_IN2
21 ← PLUS_BD_AUX1_OUT
9 ← PLUS_BD_AUX2_OUT
22 → AUX_MUTE-
10 ← AUX_AUDIO_OUT_1
23 ← ANALOG GROUND
11 ← AUX_AUDIO_OUT_2
24 ← ANALOG GROUND
12 ← STATION_SPKR_1
25 ← STATION_SPKR_2
13 ← AC_EXT_SPKR_1

DB25F

6 INITIAL SETUP

6.1 CONTROL STATION POWER-UP PROCEDURE

After installing the CS-7000 Control Station and associated accessories per Section 5 and any instructions supplied with the accessories, the station is now ready to power-up. Perform the following procedures:

1. Connect AC power to the CS-7000. See Section 5.3.3 on page 19 for details.

2. Turn on the CS-7000 via the power switch on its rear panel.

3. Verify power is applied to the CS-7000 by checking for an illuminated green LED on the left-front panel of the CS-7000.

4. If the optional CAN Bus Extender is employed, connect its "wall cube" power supply to an appropriate AC power source and then connect the supply's 24-volt DC cable to the extender's DC power input jack.

5. If using a Desktop Remote Controller, follow the instructions supplied with the controller and power-up the unit.

NOTE	If using a third-party Tone Remote Controller (TRC), follow manufacturer's instructions regarding TRC power up.

6.2 LOCAL CONTROL STATION SETUP AND ALIGNMENT

Local control CS-7000 Control Stations require no additional setup or alignment since the station is not connected to remote controllers. If the Control Station being setup is a local only station, no further setup and alignment is required; proceed to Section 7 and perform operational testing.

Stations equipped with the optional remote control board require setup and alignment to meet specific customer needs. The VoIP, CAN, and Tone Remote applications each provide uniquely definable features that must be setup, aligned, and tested per instructions in the following sub-sections.

6.3 VoIP (LAN) Setup and Alignment

This section provides a basic step-by-step installation procedure for the VoIP. Detailed information on adjusting the Control Station VoIP audio levels can be found in section 4.0 Adjustment Procedures.

1. The system should initially be set up and tested on the bench. Use only one remote at first. Additional remotes can be added later.

2. Connect the TCP/IP Ethernet connection to LAN connector on the back of the Control Station. If the connection being used is also to be shared with an existing computer, the computer can be connected to the COMPUTER Ethernet connector on the back of the Control Station. This allows the station VoIP and the computer to share one network cable.

3. Connect a 24-66 VoIP remote to the network. The Control Station will configure the remote with the appropriate profile.

4. Receive audio from the base station radio should now be heard at the remote.

5. Press PTT on the remote. The remote should key the base station radio reliably.

6. The remote should also be able to control radio functions such as change channels or systems and groups on the base station radio if the system is configured for that.

7. Program any additional remotes as required. Generally, they should be programmed the same as the first remote. See the programming procedure for the 24-66 VoIP and for the Control Station.

8. Connect additional remotes to the network. Adjust transmit and receive audio levels of the remotes as required. Audio from all remotes should be set to the same level.

6.3.1   Programming the VoIP Remote Board

All VoIP Remote board audio and configuration adjustments are accessible using a web browser directed at the IP Address that is assigned to the board.

The following will explain the adjustment procedure for the 24-66 VoIP. Most audio levels are factory preset and will, in most cases, not need adjustment. All of the audio adjustments are accessible from a computer using a web browser. The default address is 10.0.0.200 with the subnet of 255.255.255.0. The IP address and the subnet address will need to be changed to connect to your network. The user name is "admin" and the default password is "idacorp". Once you logon you should change the password to something else to protect your system. If you are configuring multiple Control Stations or 24-66 VoIP Remotes, you may need to reset the computer NIC card or restart the computer if the next 24-66 VoIP your computer is connected to does not respond. The following will explain the adjustment procedure for the 24-66 VoIP.

6.3.1.1   Programming Parameters

All of the programming and audio parameters are accessible through a WEB browser on a PC that is on the network accessing the IP Address that is assigned to the Control Station VoIP. The default IP Address is 10.0.0.200. The default account name is admin. The default password is idacorp. It is suggested that the password be changed to protect the system. Refer to the Help screens under each of the configuration parameter headers for more information on programming optio1ns.
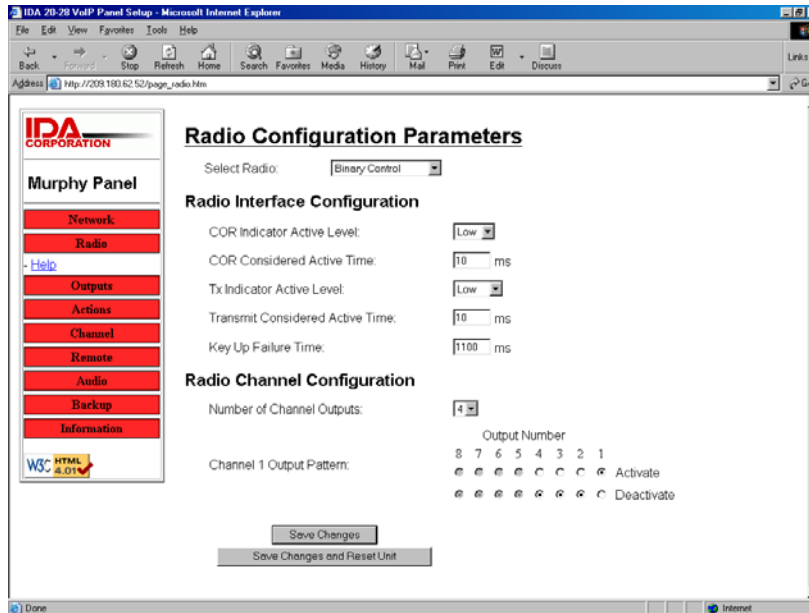
6.3.1.2   Network

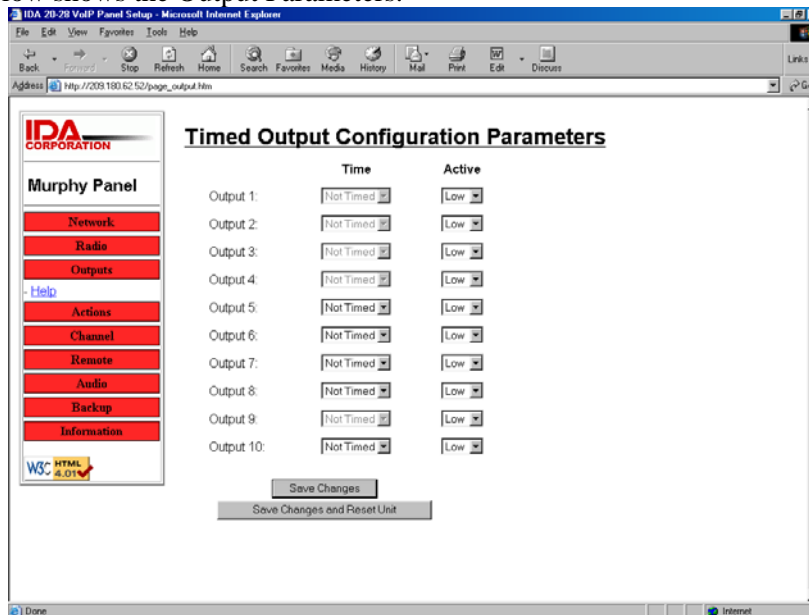The screen below shows the Network Configuration Parameters.
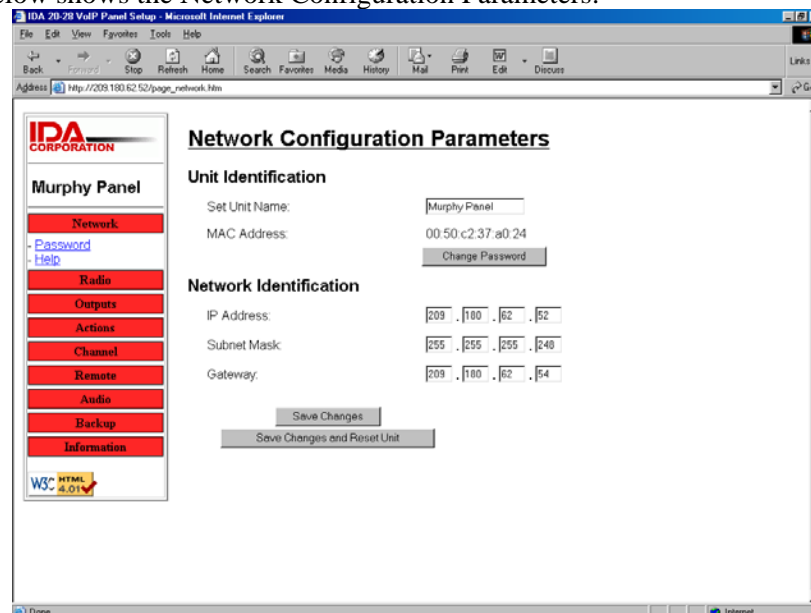
6.3.1.3   Radio

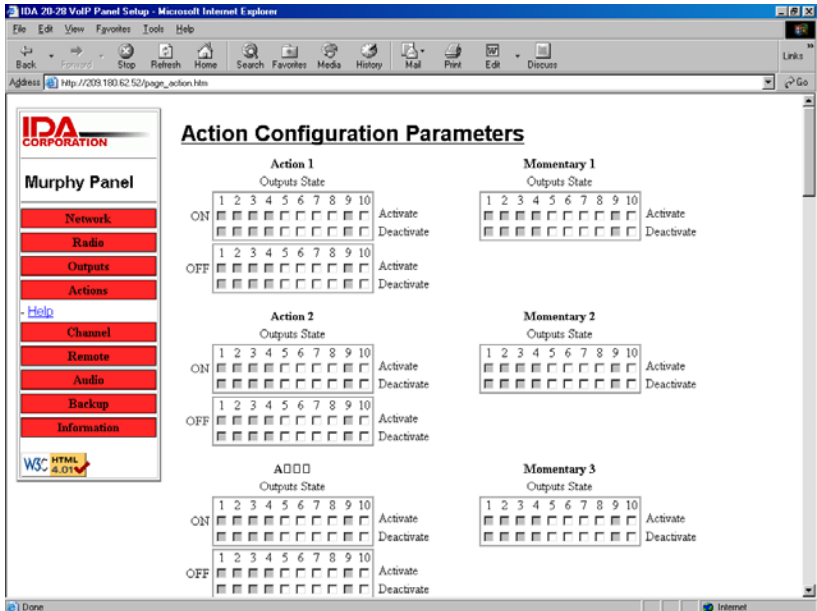The screen below shows the Radio Parameters.

6.3.1.4 Output

The screen below shows the Output Parameters.

6.3.1.5 Action

The screen below shows the Action Parameters.

6.3.1.6   Channel

The screen below shows the Channel Parameters.
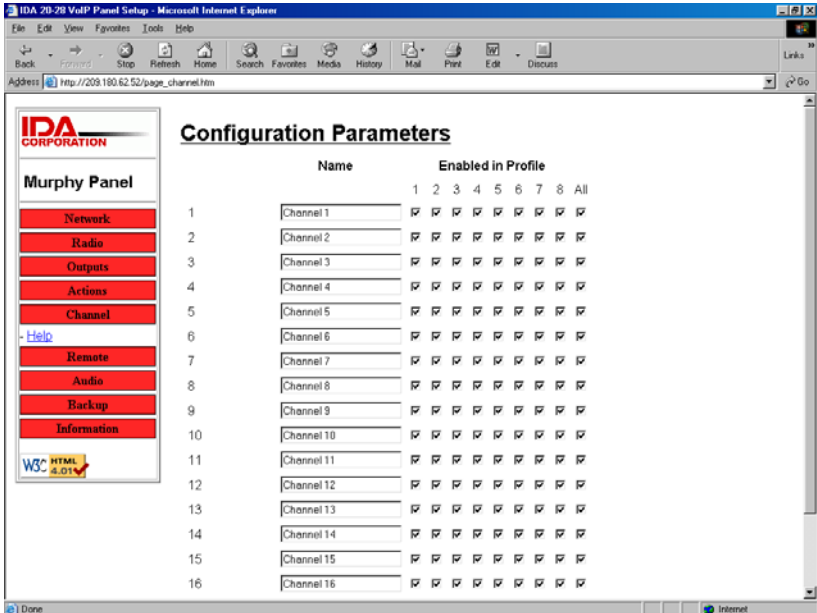
6.3.1.7   Remote Configuration

The screen below shows the Remote Configuration.
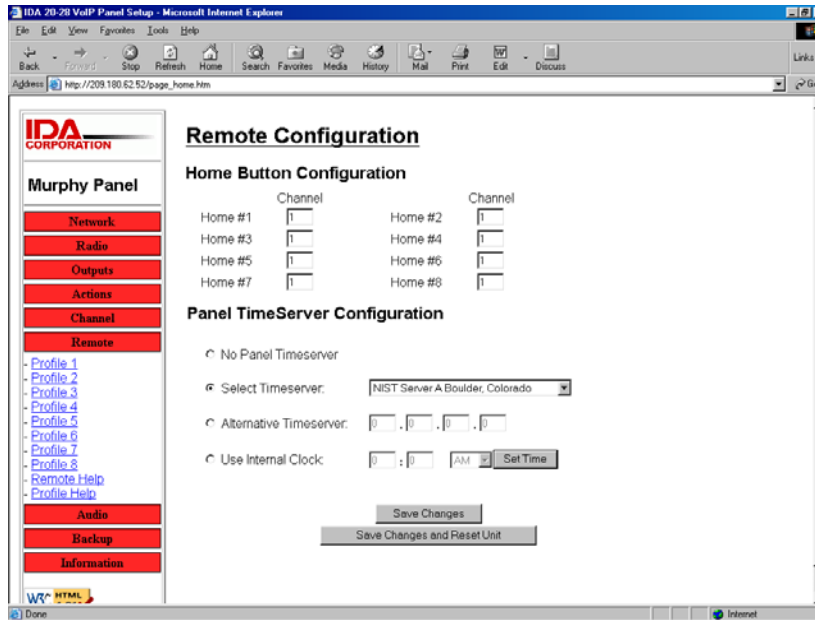
The screen below shows the Remote Button Parameters for Profile 1.
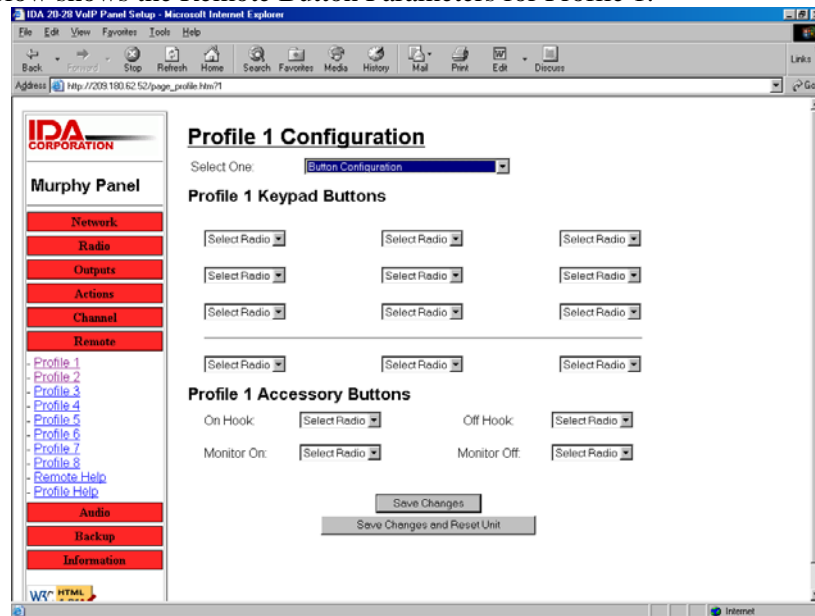
The screen below shows the Miscellaneous Configuration for profile 1.
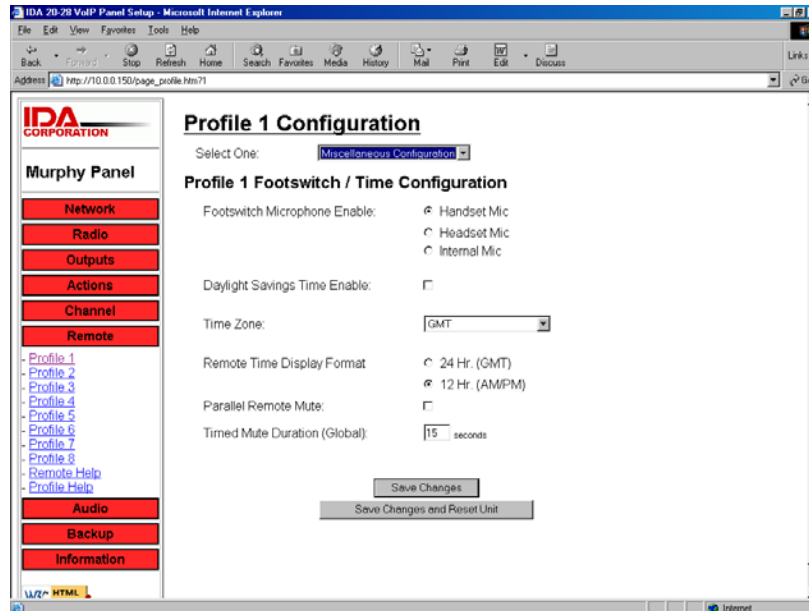
The screen below shows the Remote Tone Configuration for profile 1.
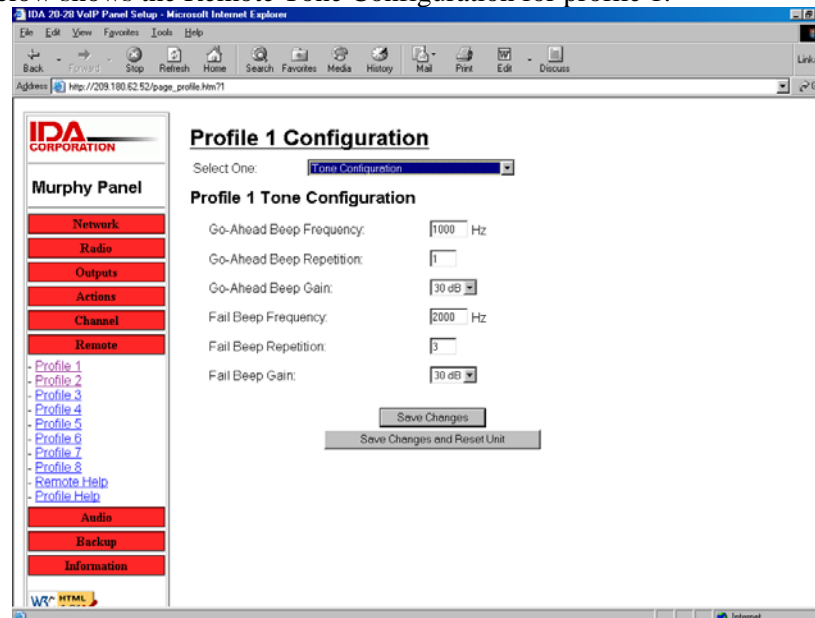
The screen below shows the Mini Console Configuration for profile 1.
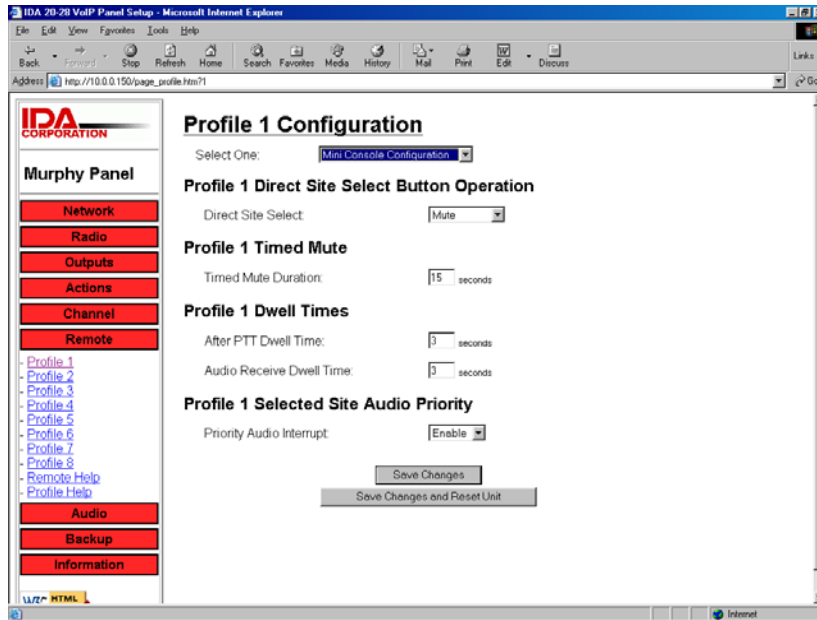
6.3.2   Audio Adjustments

6.3.2.1   Audio

The screen below shows the System Audio settings.
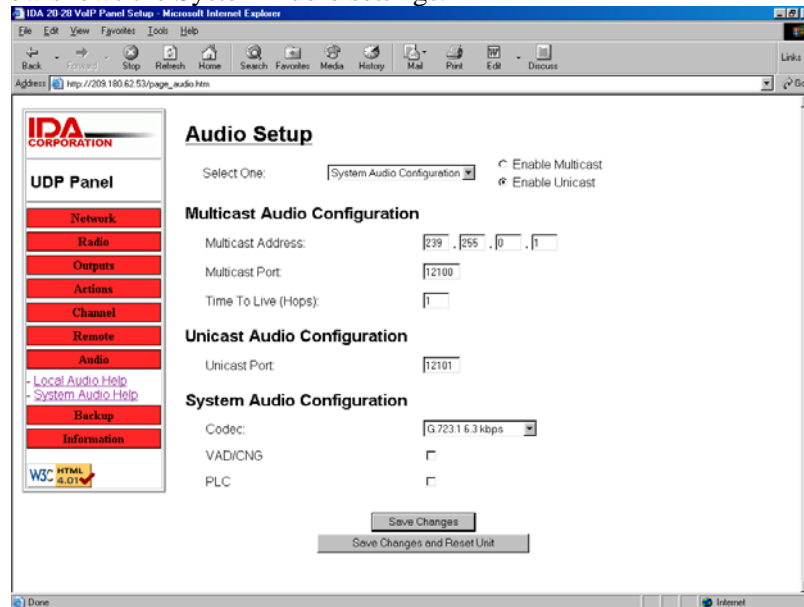
The screen below shows the Local Audio settings.
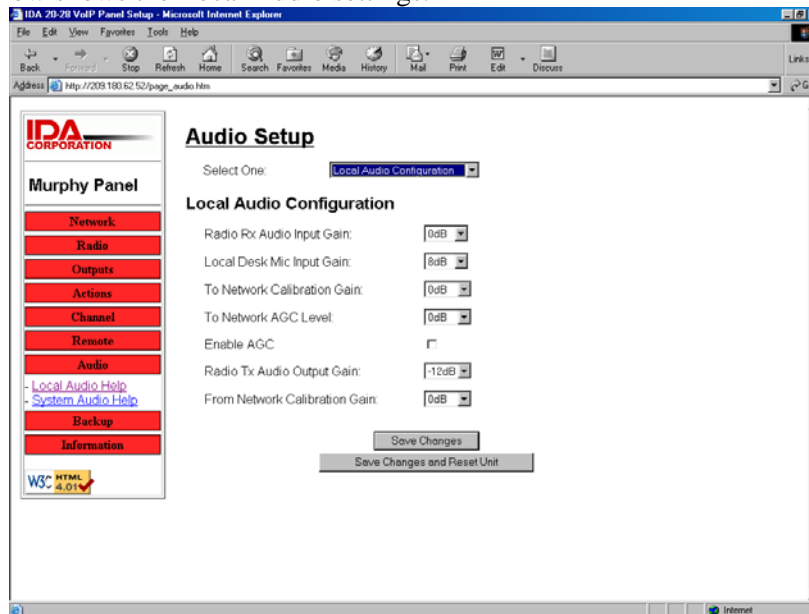
6.3.2.2   Backup

The screen below shows the Backup / Restore feature screen.
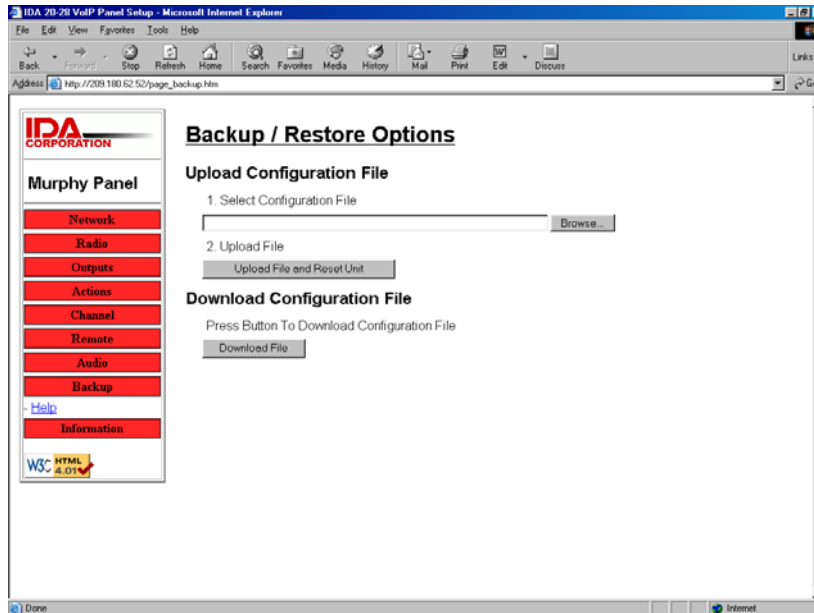
The screen below shows the Information / Status screen.
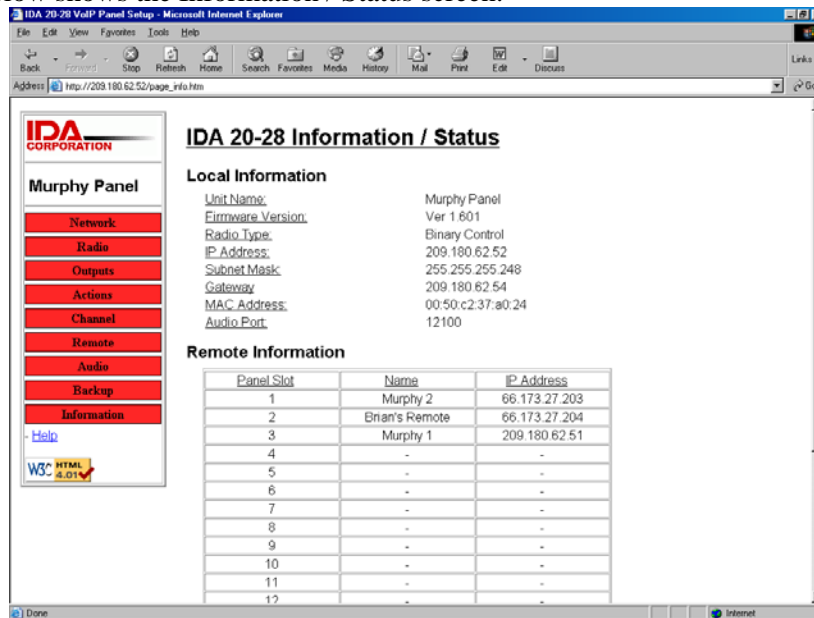
6.4   TONE REMOTE (LINE I/O) SETUP AND ALIGNMENT

TBD.

7 OPERATIONAL TESTING

This section includes test procedures to verify the performance of the Control Station and its antenna system installation. Tests must be performed by qualified service personnel with sufficient training and/or knowledge to ensure the final installation meets requirements defined by the FCC and other regulatory agencies. Final testing shall ensure that the installation meets FCC MPE requirements (refer to Section 1.1), and Maximum Effective Radiated Power (ERP) requirements (refer to Section 7.2)

7.1 SETUP AND EQUIPMENT TESTING

For EDACS, P25, and OpenSky systems, it is recommended to request the system administrator designate a talk group on the system that is pre-defined for equipment testing during installation and maintenance. This will minimize interference on a user's active talk group. It is also recommended, where possible, to assign a specific RF channel at the site(s) for the equipment test group; this aide the installers and technicians by always knowing the specific RF frequency to monitor during testing. Conventional systems may be left no choice but to test on an active user channel. Is all cases, techniques should be employed to minimize transmit time during testing.

Setup also includes setting the CS-7000 Control Station transmitter power output level to meet the station authorization's Maximum ERP (refer to Section 7.2). After determining the transmitter value for Maximum ERP, there are three (3) test procedures included in this section which must be performed:

- Verifying TX RF Power Output and Antenna Reflected Power.
- Verifying TX RF Frequency and Modulation (Deviation).
- Over-the-Air Final Testing.

7.1.1 REQUIRED TEST EQUIPMENT

Table 7-1: Required Test Equipment

TEST EQUIPMENT	MODEL / PART NUMBER & DESCRIPTION
Peak Power Wattmeter	• Bird Electronic Corp. Model 4314B (or equivalent) with Type-N female connectors at input and output ports.
Wattmeter Slug	• Bird Electronic Corp. Element 50E, 50 watts, 400 – 1000 MHz (or equivalent).
Service Monitor	• Capable of measuring EDACS, P25 and OpenSky frequency and modulation characteristics.
RF Coaxial Jumper Cable	• Low loss 50-Ohm Coaxial Cable with Type-N male connectors, approximately three (3) feet in length. This cable **must** have a VSWR below 1.2:1 within the RF pass band.
Audio Tone Generator	• Audio tone generator capable of generating a 1000 Hz test tone.

7.2   MAXIMUM EFFECTIVE RADIATED POWER

The FCC and other similar regulatory agencies define during station authorization (licensing) the maximum Effective Radiated Power that may be radiated from the antenna. ERP can be determined by subtracting feed line losses and adding antenna gain to the transmitter output power.

Once determined, the transmitter's RF output power must be aligned not to exceed the pre-determined maximum transmitter power to meet ERP requirements.

7.2.1   <u>Determining Maximum Transmitter Power that Meets ERP Requirement</u>

Antenna gains are expressed relative to a dipole (dBd) or relative to a theoretical Isotropic antenna (dBi). Antenna gains expressed as dBi are 2.14 dB greater than the dBd value for the same antenna (e.g. 6 dBd equals 8.14 dBi). ERP values should also be expressed relative to dipoles or Isotropic antennas, *EDRP* for dipoles and *EIRP* for Isotropic antennas.

Therefore, when antenna gain is expressed as dBi, and EDRP is required, 2.14 dB is subtracted in Part 2.b. of the equation shown below. If antenna gain is expressed as dBd, and EIRP is required, 2.14 dB is added in Part 2.b. of the equation below. If both antenna gain and ERP values are expressed the same, Part 2.b. of the equation is simply skipped.

Example:

If a site requires a maximum of **50 Watts EDRP** using an **8.14 dBi gain antenna,** and **3 dB feed line loss**, then the following equation applies:

1. Convert the ERP value from Watts to decibels (dBm): $\mathbf{EDRP_{Watts} = 10Log(1000 * EDRP)\ dBm}$

$$\mathbf{50\ Watts\ EDRP = 10Log(1000 * 50)}$$

$$\mathbf{50\ Watts\ EDRP = 47.0\ dBm}$$

2. Sum the antenna gains, feed line losses and dBi or dBd correction factor:

   a. Subtract the antenna gain from the ERP value: **47.0 dBm – 8.14 dBi = 38.86 dBm**

   b. Add or subtract 2.14 dB, if required: $\mathbf{38.86\ dBm + 2.14\ dB^2 = 41.0\ dBm}$
      (see above, paragraph two)

   c. Add the overall feed line losses[3]:   **41.0 dBm** + 3 dB = **44.0 dBm**

3. Convert from dBm to Watts: **Maximum Transmitter $\mathbf{P_{OUT}}$ (Watts) = InvLog(dBm-30)/10**

$$\mathbf{Maximum\ Transmitter\ P_{OUT}\ (Watts) = InvLog(44.0 – 30)/10}$$

$$\mathbf{Maximum\ Transmitter\ P_{OUT}\ (Watts) = 25\ Watts}$$

Therefore; for a Control Station installation with an antenna gain of 8.14 dBi, and a feed line loss of 3 dB, and an EDRP requirement of 50 Watts, the transmitter power output must be set to 25 Watts.

7.2.1.1   For OpenSky Mode of Operation

The transmit RF power level is set by the following:

1. Connect a PC running a Terminal program (19,200kbs, 8-N-1) to the terminal port on the radio.

---

[2] Only add or subtract 2.15 dB if the antenna rating (dBi or dBd) differs from the ERP requirement (EIRP or EDRP).

[3] When calculating feed line loss, be sure to include the RF losses presented by coaxial jumpers, lightning protection equipment, the main feed line and any other in-line devices.

2. To set the RF power output to meet the ERP requirement determined in Section 7.2.1, send the command <at*****> followed by the dBm value of the desired output power (e.g. 25 Watts = 44 dBm = <at*****44>). (Refer to the mobile radio's Software Release Notes MS-014467-001 for further setup and programming information.)

3. Send command <at&w3> to save the changed power setting.

4. Success of this setting may be verified while performing Section 7.3.

7.2.1.2   For P25, EDACS, or Conventional Mode of Operation

1. Use the appropriate Radio Personality Manager (RPM) software listed in the accessories Table 4-2 to read and set the transmit RF power level to the ERP requirement determined in Section 7.2.1.

2. Verify success of this setting while performing Section 7.3.

7.3   VERIFYING TX RF FORWARD AND REFLECTED POWER

After installation of the Control Station is complete, it is required to verify the CS-7000 Control Station's forward RF power output and the antenna system's reflected RF power.

Perform the following tests:

1. Make sure the CS-7000 Control Station is powered down (*Off*).

2. Disconnect the RF coaxial antenna cable from the rear of the station and connect it to the wattmeter's output connector.

3. Connect a coaxial jumper cable between the CS-7000 antenna port and the wattmeter input connector.

NOTE	A peak-power reading RF wattmeter equivalent to the wattmeter specified in Table 7-1 must be used. Do **not** use an average or RMS-responding wattmeter.

4. Power-up the CS-7000 Control Station and select the group/channel for performing equipment testing (refer to Section 7.1).

5. Position the wattmeter's slug to measure forward RF output power. Rotate it if necessary. The arrow on the face of the slug must point away from the CS-7000 and towards the antenna for forward power measurements.

6. Set the wattmeter to measure peak RF power.

7. Key the CS-7000's transmitter and measure the forward and reflected power; unkey the transmitter when complete. The forward power should be within the required level to meet ERP requirements determined in Section 7.2.

NOTE	Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

8. **If forward and reflected power measurements are within the expected ranges (forward power equal or less than the required wattage to meet ERP settings from Section 7.2, and reflected power no more than 10% of measured forward power),** record the measured results in the appropriate space on the data collection form near the end of this manual.

⚠️ **CAUTION**

IF reflected power is greater than 10% of measured forward power, **DO NOT** attempt corrections to the RF output power level to meet ERP values until the high reflected power measurement is corrected.

If the reflected power measurement is greater than 10% of measured forward power, check/verify all RF connections, and measure the RF output power again. If problems persist check the following:

a. Re-check the measurements with a different wattmeter, slug, and jumper cable.

b. Verify the antenna is consistent with the specified frequency range of the CS-7000. For example, if the CS-7000 is configured for operations in an 800 MHz system, it must be connected to an 800 MHz-capable antenna.

c. Temporarily bypass any lightning protection or other devices installed inline with the antenna and recheck forward and reflected power.

If problems persist, contact M/A-COM's Technical Assistance Center for assistance. TAC contact information is listed on page 14.

If the measured forward power is outside the expected ranges, and the measured reflected power is no more than 10% of measured forward power, return to Section 7.2.1.1 or Section 7.2.1.2 and reprogram the RF power setting as necessary. If the necessary software change to obtain the expected RF power level is more than ± 2dB from the expected range, further investigation may be required.

9. When testing is complete, turn *Off* the AC power to the Control Station.

10. Disconnect the coaxial cable jumper and wattmeter.

11. Re-attach the antenna coaxial cable directly to the Control Station's antenna port.

12. Turn *On* the AC power to the Control Station.

⚠️ **WARNING**

To prevent RF leakage and ensure peak performance, make sure the RF connectors are tight, but do not over tighten so connector damage will not occur.

⚠️ **WARNING**

Improper antenna and/or antenna cable installation may lead not only to poor CS-7000 performance but also to harmful exposure of RF electromagnetic energy.

7.4   VERIFYING TX RF FREQUENCY

After verifying forward and reflected power per Section 7.3, verify the CS-7000 Control Station's transmitter frequency. It is recommended to have the system administrator designate a talk group on the system that is pre-defined for test use.

The following frequency test should be performed over-the-air using the station's antenna while monitoring the transmitter's pre-programmed RF frequency:

1. Power-up the CS-7000 Control Station and select the group/channel for performing equipment testing (refer to Section 7.1).

2. Setup the service monitor as required for measuring TX frequency of over-the-air transmissions.

3. Key up the CS-7000 transmitter and measure TX frequency; unkey the transmitter when complete.

4. **If the frequency reading is within the expected ranges,** record the measured results in the appropriate space on the data collection form near the end of this manual.

   If the frequency reading is not within the expected ranges, try the following:

   a. Verify the test instrument settings and calibration date.

   b. Recheck the measurement with another test instrument.

   If problems persist, contact M/A-COM's Technical Assistance Center for assistance. TAC contact information is listed on page 14.

7.5   VERIFYING TX MODULATION

Verify the TX modulation over-the-air using the station's antenna while monitoring the transmitter's pre-programmed RF frequency. Procedures for measuring modulation vary slightly between analog and digitally modulated transmitters. Perform the following procedure as it applies to the specific mode of operation for the CS-7000 Control Station under test:

7.5.1   Digital Modulation Modes (EDACS, P25, and OpenSky)

> **NOTE**
>
> The following modulation test is intended to verify the maximum deviation level of the digitally modulated RF carrier for regulatory purposes and does not address the resulting analog audio levels. If the Control Station's analog levels heard at the receiving station's speaker during transmit appear incorrect while performing this test, refer to the Installation section of this manual and other equipment manufacturer's manuals to set the resulting analog audio levels.

1. Make sure the antenna is connected to the CS-7000 Control Station.

2. Power-up the CS-7000 Control Station and select the group/channel for performing equipment testing (refer to Section 7.1).

3. Setup the service monitor as required for measuring TX modulation of over-the-air transmissions.

4. Key up the CS-7000's transmitter and measure TX modulation; unkey the transmitter when complete.

5. **If the digital modulation reading is within the expected ranges,** record the measured results in the appropriate space on the data collection form near the end of this manual.

   If the digital modulation reading is not within the expected ranges, try the following:

   c. Verify the test instrument settings and calibration date.

   d. Recheck the measurement with another test instrument.

   If problems persist, contact M/A-COM's Technical Assistance Center for assistance. TAC contact information is listed on page 14.

7.5.2   Analog Modulation Modes

1. Power-up the CS-7000 Control Station and select the group/channel for performing equipment testing (refer to Section 7.1).

2. Setup the service monitor as required for measuring TX modulation of over-the-air.

3. Connect a tone generator to the microphone input of the transmitter, set to 1000 Hz @ 1Vrms. Alternately connect a microphone to the Control Station's microphone connector.

4. Key up the CS-7000 transmitter and measure TX modulation using the test tone or by talking into the microphone. Unkey the transmitter when complete.

5. **If the modulation reading is within the expected ranges,** record the measured results in the appropriate space on the data collection form near the end of this manual.

   If the modulation reading is not within the expected ranges, try the following:

   e. Verify the test instrument settings and calibration date.

   f. Recheck the measurement with another test instrument.

   If problems persist, contact M/A-COM's Technical Assistance Center for assistance. TAC contact information is listed on page 14.

7.5.2.1 Desktop Remote Controllers on Systems Using Analog Modes

1. If one or more Tone, VoIP, or CAN Remote Controllers are connected to the CS-7000 Control Station, it is recommended to repeat Section 7.5.2 steps 3 thru 5 while modulating the each Desktop Remote Controller connected to the Control Station.

2. **If the modulation reading is within the expected ranges,** perform the test for each Remote Controller connected to the CS-7000 Control Station.

   If the modulation reading is not within the expected ranges, verify setup of each remote per the instructions supplied in the appendices of this manual, or the manufacturer's instructions supplied with the Remote Controller.

8   COMPLETING THE INSTALLATION

Review and follow guidelines presented in this list before considering the installation complete:

- Verify all electrical connections are connected properly and the associated connector attachment hardware is tight. Pay special attention to all RF antenna cables, chassis ground cabling, and AC power cords.

- Verify all fuses are correctly installed and properly rated.

- Verify all electrical cables and wiring are tied, stowed, and protected so they are out of the way of casual contact, away from sources of extreme heat, and wire chafing cannot occur. Pay special attention to all RF antenna cables and AC power cords.

- Verify all related mechanical hardware is mounted securely and all respective mounting hardware is tight.

- Remove all tools and unused hardware from installation area(s).

- Verify the test performance data has been recorded on the data collection form found in APPENDIX C of this manual.

8.1   FINAL OVER-THE-AIR TESTING

If not already performed during setup and testing, it is recommended to perform live over-the-air testing on the customer's active group/channel from the Control Station's local microphone, and from each Desktop Remote Controller connected to the Control Station.

Installation of the CS-7000 is now complete!

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**APPENDIX A
CONFIGURING VoIP REMOTE CONTROLLERS**

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A.1   IDA MODEL 24-66 VOIP REMOTE CONTROLLER SETUP

A.1.1 Adjustment Procedures

The following will explain the adjustment procedure for the 24-66 VoIP. Most audio levels are factory preset and will, in most cases, not need adjustment. All of the network settings, profile settings, and audio adjustment are accessible from a computer using a web browser. The default address is 10.0.0.200 with the subnet of 255.255.255.0. The user name is "admin" and the default password is "idacorp". Before you connect your computer to the 24-66 VoIP make sure the computers NIC is set to the same IP address range and local subnet as the 24-66 VoIP. Connect your computer directly to the 24-66 VoIP and use your web browser to access the logon screen. Once you logon you should configure the network settings to the IP address, the subnet address, and gateway address that will be used to connect to your network, also change the password to something else to protect your system. Select the "Save Changes" button before you continue.

A.1.1.1   Logon Screen Example
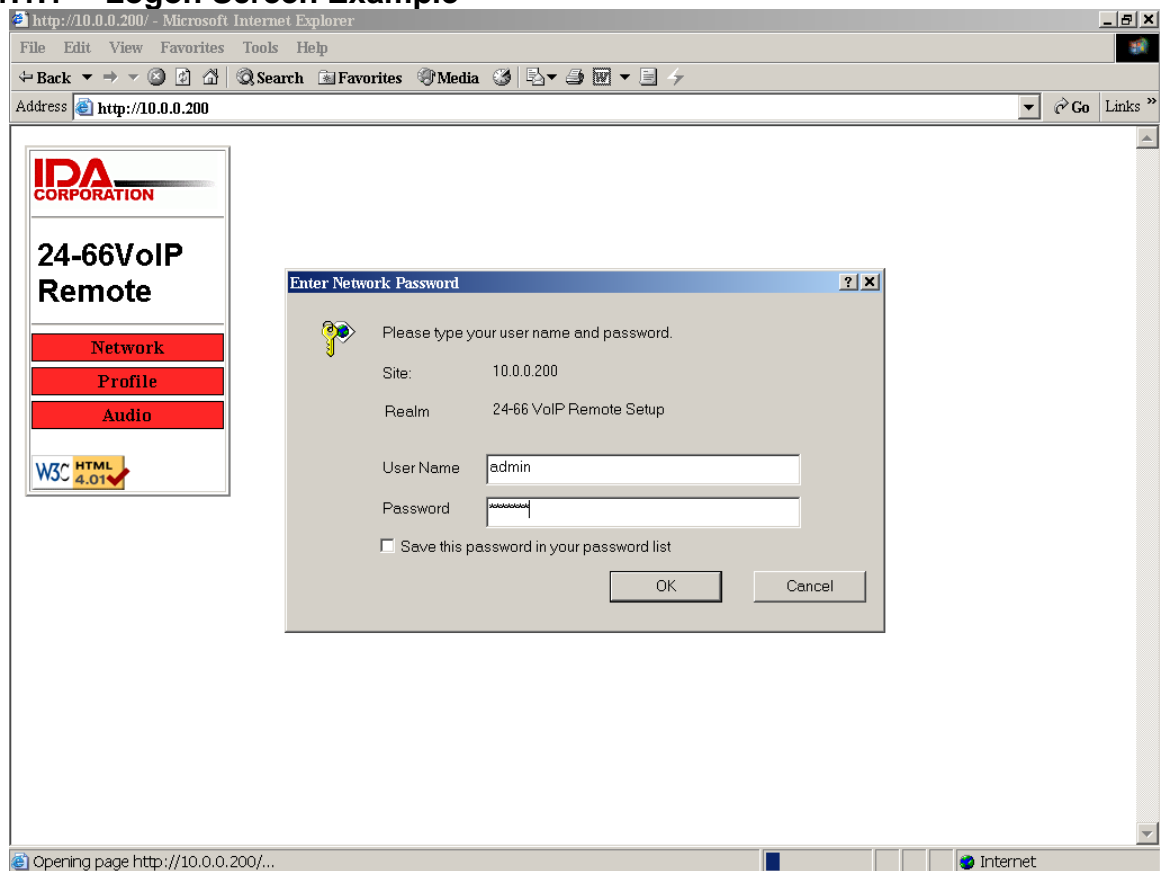
Next configure the profile settings, enter the IP address of the Control Station VoIP panel that the 24-66 VoIP remote will connect to and select one of the eight profiles. Select the "Save Changes and Reset Unit" button. After resetting, the 24-66 VoIP network and profile changes will take affect. If you are configuring multiple 24-66 VoIP Remotes, you may need to reset the computer NIC card or restart the computer if the next 24-66 VoIP your computer is connected to does not respond. If you have the 24-66 VoIP Mini Console there will not be a profile menu but a site menu will be in its place so skip to the next page.

24-66 VoIP Remote Profile screen example
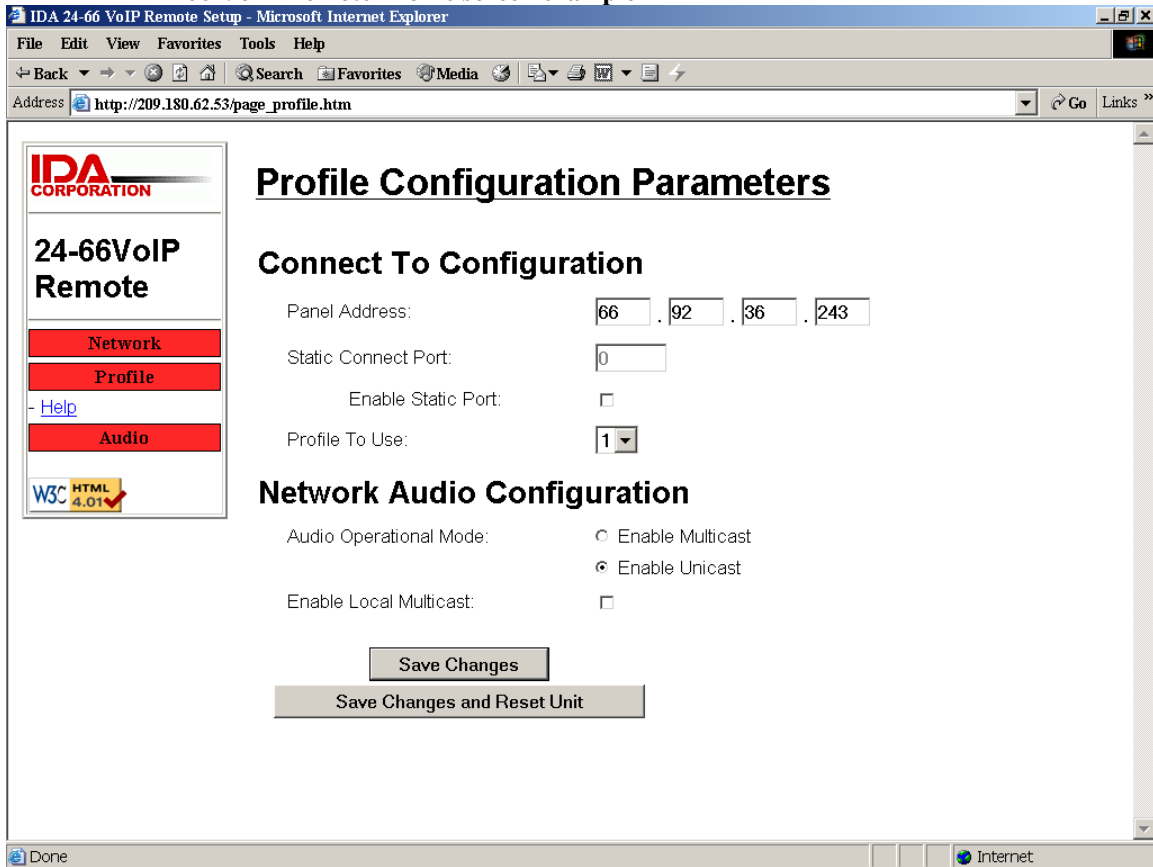
Next, configure the site settings. Enter the IP address of each Control Station VoIP panel the 24-66 VoIP Mini-Console will connect to, and select one of the eight profiles. Select the "Save Changes and Reset Unit" button. After resetting, the 24-66 VoIP network and profile changes will take affect. If you are configuring multiple 24-66 VoIP Remotes, you may need to reset the computer NIC card or restart the computer if the next 24-66 VoIP your computer is connected to does not respond.

A.1.1.2 24-66 VoIP Mini Console Site Screen Example
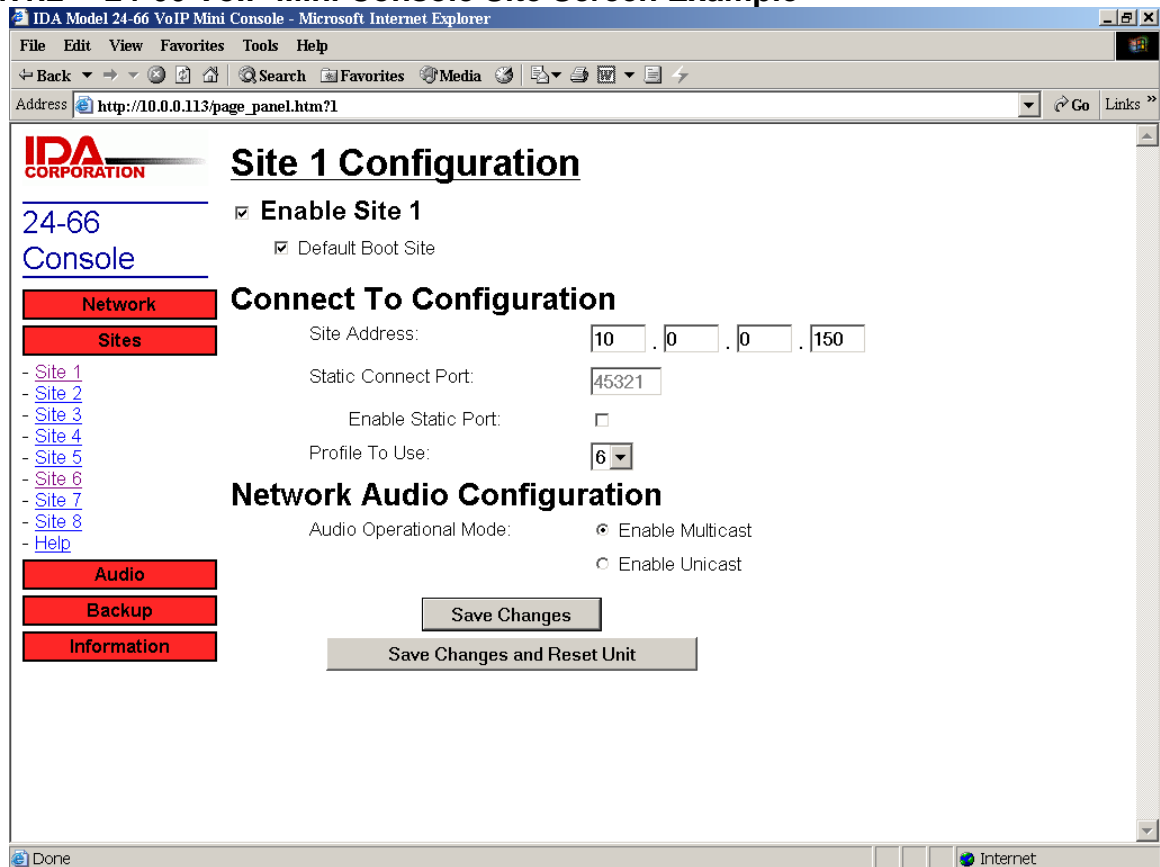
A.1.1.3 Handset/Desk Microphone to Ethernet Level

The handset or desk microphone audio level is adjusted via a web browser. The level can be adjusted from -4db to 36db in 2db steps.

A.1.1.4 Desk Microphone Output Sensitivity

The audio output level of the desk microphone can be adjusted through a hole in the bottom of the desk microphone. A small jeweler's flat blade screwdriver will be needed. The adjustment may need to be made depending upon background noise in the environment where the 24-66 VoIP is located and also upon the user of the desk microphone and how close and/or loud the user speaks.

A.1.1.5 Internal Microphone to Ethernet Level

The internal microphone audio level is adjusted via a web browser. The level can be adjusted from -4db to 36db in 2db steps.

A.1.1.6 Headset Microphone to Ethernet Level

The Headset microphone audio level is adjusted via a web browser. The level can be adjusted from -4db to 36db in 2db steps.

A.1.1.7 Speaker Level

The internal speaker audio level is adjusted via a web browser. The level can be adjusted from -24db to 0db in 6db steps.

While connected to the system and receiving audio from the highest-level source, adjust the level so that audio in the speaker is a comfortable listening level. Do not turn it up too high since this will cause distortion and clipping. The audio should not exceed 3.45 Vrms at the speaker terminals.

A.1.1.8   Handset Earpiece Level

The handset earpiece audio level is adjusted via a web browser. The level can be adjusted from -24db to 0db in 6db steps.

The handset earpiece, headset earpiece, and the base speaker are all controlled by the volume control. It may be necessary in certain noisy environments to increase the level to the earpiece. While in the noisy environment and receiving audio from the source with the least level coming in, adjust for a comfortable listening level with the volume control potentiometer at maximum.

A.1.1.9   Headset Earpiece Level

The headset earpiece audio level is adjusted via a web browser. The level can be adjusted from -24db to 0db in 6db steps.

The headset earpiece, handset earpiece, and the base speaker are all controlled by the volume control. It may be necessary in certain noisy environments to increase the level to the earpiece. While in the noisy environment and receiving audio from the source with the least level coming in, adjust for a comfortable listening level with the volume control potentiometer at maximum.

APPENDIX B
INSTALLATION CHECKLIST

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B.1   INSTALLATION DATA SHEET FOR CS-7000 CONTROL STATION

Fill out all information as they apply to the CS-7000 Desktop installation. Items in **bold** must be filled-in and a copy given to the equipment owner.

CUSTOMER INFORMATION

Licensee Name: _____

FCC License ID/Call Sign: _____

Customer Contact (Name):   _____

Site Address: _____

                                                          _____

Site Name: _____

Site Latitude (Deg., Min., Sec.):   _____

Site Longitude (Deg., Min., Sec.):   _____

INSTALLER INFORMATION

Company's Name: _____

Installer's Name(s):   _____

                                                          _____

Test Technician's Name: _____

Test Equipment Used: _____

                                                          _____

                                                          _____

                                                          _____

EQUIPMENT/INSTALLATION INFORMATION

CS-7000 Model Number: _____

CS-7000 Serial Number: _____

Antenna Manufacturer and Model: _____

Antenna Gain: _____ dBi   dBd   (circle one)

Combined Feed line losses: _____ dB

Max ERP (per station authorization) _____ Watts (refer to Section 7.2)

Maximum Transmitter Power Output to meet ERP requirement: _____   Watts (refer to Section 7.2)

TRANSMITTER MEASUREMENTS (Per FCC rules 47CFR90.215 or similar)

TX RF Power out (Forward):   _____ Watts (refer to Section 7.3)

TX RF Power out (Reflected):   _____ Watts (refer to Section 7.3)

Transmitter Frequency: _____ MHz (refer to Section 7.4)

Transmitter Modulation (Deviation):   _____ kHz (refer to Section 7.4)

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WARRANTY

A. M/A-COM, Inc. (hereinafter "Seller") warrants to the original purchaser for use (hereinafter "Buyer") that Equipment manufactured by or for the Seller shall be free from defects in material and workmanship, and shall conform to its published specifications. With respect to all non-M/A-COM Equipment, Seller gives no warranty, and only the warranty, if any, given by the manufacturer shall apply. Rechargeable batteries are excluded from this warranty but are warranted under a separate Rechargeable Battery Warranty (ECR-7048).

B. Seller's obligations set forth in Paragraph C below shall apply only to failures to meet the above warranties occurring within the following periods of time from date of sale to the Buyer and are conditioned on Buyer's giving written notice to Seller within thirty (30) days of such occurrence:

 1. for fuses and non-rechargeable batteries, operable on arrival only.

 2. for parts and accessories (except as noted in B.1) sold by Seller's Service Parts Operation, ninety (90) days.

 3. for P7200, P7100^{IP}, P5400, P5300, P5200, P5100, P3300, PANTHER™ 405P and 605P, M7300, M7200 (including V-TAC), M7100 ^{IP}, M5300 and M3300 radios, two (2) years, effective 10/01/2007.

 4. for all other equipment of Seller's manufacture, one (1) year.

C. If any Equipment fails to meet the foregoing warranties, Seller shall correct the failure at its option (i) by repairing any defective or damaged part or parts thereof, (ii) by making available at Seller's factory any necessary repaired or replacement parts, or (iii) by replacing the failed Equipment with equivalent new or refurbished Equipment. Any repaired or replacement part furnished hereunder shall be warranted for the remainder of the warranty period of the Equipment in which it is installed. Where such failure cannot be corrected by Seller's reasonable efforts, the parties will negotiate an equitable adjustment in price. Labor to perform warranty service will be provided at no charge during the warranty period only for the Equipment covered under Paragraph B.3 and B.4. To be eligible for no-charge labor, service must be performed at a M/A-COM factory, by an Authorized Service Center (ASC) or other Servicer approved for these purposes either at its place of business during normal business hours, for mobile or personal equipment, or at the Buyer's location, for fixed location equipment. Service on fixed location equipment more than thirty (30) miles from the Service Center or other approved Servicer's place of business will include a charge for transportation.

D. Seller's obligations under Paragraph C shall not apply to any Equipment, or part thereof, which (i) has been modified or otherwise altered other than pursuant to Seller's written instructions or written approval or, (ii) is normally consumed in operation or, (iii) has a normal life inherently shorter than the warranty periods specified in Paragraph B, or (iv) is not properly stored, installed, used, maintained or repaired, or, (v) has been subjected to any other kind of misuse or detrimental exposure, or has been involved in an accident.

E. The preceding paragraphs set forth the exclusive remedies for claims based upon defects in or nonconformity of the Equipment, whether the claim is in contract, warranty, tort (including negligence), strict liability or otherwise, and however instituted. Upon the expiration of the warranty period, all such liability shall terminate. The foregoing warranties are exclusive and in lieu of all other warranties, whether oral, written, expressed, implied or statutory. NO IMPLIED OR STATUTORY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR EXEMPLARY DAMAGES.

This warranty applies only within the United States.

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