NCS-C251E
Expansion Unit
INSTRUCTION MANUAL

Rev E

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collcomm inc

Revision History			
Rev	**Description**	**Date**	**Approved**
A	B Model	10/23/08	CIF
B	C Model	08/01/09	CIF
C	Formatting Corrections	10/24/10	CIF
D	D Model	02/27/13	CIF
E	E Model	1/3/14	JFP

FACTORY INSTALLED OPTION IDENTIFICATION TABLE

The Serial Number Label located on the bottom of the unit indicates which Options are installed according to the following chart:

Option	Multicast	Sidetone
M0		
M1	X	
M2		X
M3	X	X

UNIT CONFIGURATION

Model Number:

NCS-C251EM0 ☐ **NCS-C251EM1** ☐ **NCS-C251EM2** ☐ **NCS-C251EM3** ☐

Serial Number: _____

Microphone Configuration

If a microphone was ordered with this unit, it has been factory setup for the supplied microphone identified below.
(To change microphone setup, see page 8; otherwise it is configured for DEFAULT.)

NCS-E217 ☐ **NCS-E219** ☐ **NCS-E302** ☐ **NCS-E303** ☐

NCS-E305 ☐ **NCS-E326** ☐ **NCS-E411** ☐ **Other:** _____ ☐

Audio Busy Detection Mode

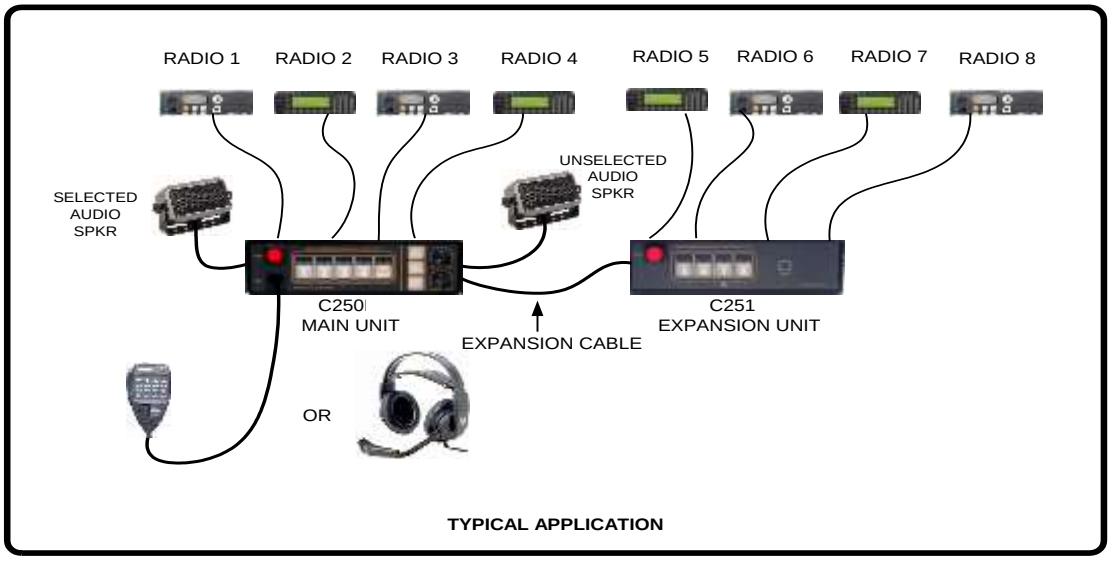
Unless specified, the unit comes from the factory with each RAD Port (RAD5 – RAD8) configured for COR. The following ports checked below have been set for VOX:

RAD1 ☐ **RAD2** ☐ **RAD3** ☐ **RAD4** ☐

Table of Contents

1.0 Introduction

The C251E adds four additional radio connections to the NCS-C250E. All functions are controlled by the NCS-C250E Main Unit except selection of Radios 5 through 8. These radios are selected on the front panel of the NCS-C251E Expansion Unit.



TYPICAL APPLICATION

2.0 Safety Information

The C251E is an electrical device requiring appropriate safety measures during installation and operation. The following safety precautions should be observed:

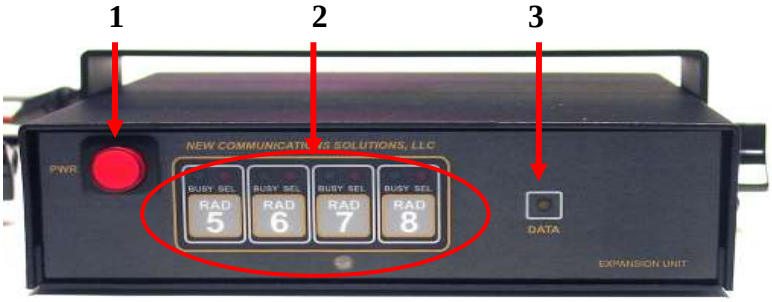
- When connecting the unit to a DC power source, a minimum wire size of 18 AWG should be used. When using in a mobile environment, automotive grade wire should be used.
- Do not route cables or wires through areas that may cause the insulation to be worn resulting in shorting of the wires to ground or to each other.
- Do not place your ears in close proximity to the local speakers or PA speaker at high volume settings. Your hearing could be impaired as a result.
- Do not attempt to operate this equipment while driving a vehicle. For safety, pull over to the side of the road when making adjustments.
- **NEVER** connect this device to an AC voltage source. Death or injury could occur and/or the unit can be badly damaged. Connect this device only to a DC power source with a voltage output of 12-15 volts and a current capability of at least 2A.

3.0 Accessory Kit

An Accessory Kit and Mounting Bracket are packed with the C251E. The following items are included in the Kit:

Item	Qty	Description
Power Cable, DC	1	10 foot cable for connecting C251E to DC power source.
Expansion Cable	1	Connects the C251E Expansion Unit to the Main C250E.
Shunts, Black	10	Used to determine COR & polarity
Mounting Feet	4	Used for table-top installation.
Clamp, Power Connector	1	Used to clamp the C251E power pigtail connector to the DC Power Cable.
Knobs, Mounting Bracket	2	Used to attach Mounting Bracket to NCS-C251E

4.0 Front Panel Controls and Indicators



Item	Description
1	Power Switch with Red LED Indicator- Latching
2	Radio Select Switches with Red Selected and Green Busy Indicators.
3	DATA light flashes during communication between the C250E and the C251E.

5.0 Power Supply

5.1 Power Requirements

The NCS-C251E will operate with any 9-16 VDC power supply capable of providing at least 2A continuous.

5.2 Power Connection

Power is supplied to the pigtail on the rear of the unit. The connector is an Anderson Powerpole PP-15. As part of the accessory kit, a 10 foot power cable is supplied with a mating connector attached. Connect the power cable to a 9-16 VDC source capable of supplying at least 2A. Additional connectors are available from Powerwerx (web site: http://www.powerwerx.com, telephone: 714-570-3303)

5.3 Polarity

Power cable polarity is: Red = +, Black = - (or chassis).

5.4 Fusing

The power supply line is internally protected against overload with a PTC Resettable Fuse. If an overload occurs, the fuse will open. It will automatically re-close when the power is removed from the unit. This is not a replaceable or serviceable item.

5.5 Using an AC Power Supply

The C251E can be operated from any well-regulated 9-16 VDC power supply capable of delivering a minimum of 2 Amperes. Voltages higher than 16V may result in damage to the circuitry.

5.6 Power Cable Clamp

The Power Cable Clamp is used to keep the Power Cable from separating from the Power Pigtail in Mobile use.

6.0 Microphone Setup

6.1 Internal Setup

Microphones are not connected directly to the NCS-C251E Expansion Unit so no jumper setup is required.

6.2 Rear Panel Microphone Connections

Do not use the rear panel Microphone Connector on the NCS-C251E Expansion Unit.

7.0 COR/VOX Setup

The NCS-C251E is available with a COR feature. This feature causes the Busy Lights and the Repeater function to be controlled by digital Busy signals from the radios. The sense of the busy signals from the radios is selectable either "High = Busy" or "Low = Busy". Unless identified on Page 2 of this manual, all Radio Ports (R1=R5, R2=R6, R3=R7, R4=R8) are set for COR.

7.1 COR Logic Level

The COR feature uses a logic level input from the radios to illuminate the Busy lights and to operate the Repeater function. The Busy signals from the radios are on Pin 8 of the modular Radio connectors. Signal levels from the radios are:

Low: < 1.0 VDC
High: > 1.5 VDC

NOTE: When utilizing the COR feature, receive input levels should be set using audio voltage measurements to 200mVp-p - 300mVp-p for each radio.

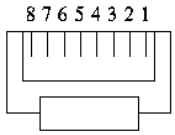


Figure 1:
End view of RJ45 Plug

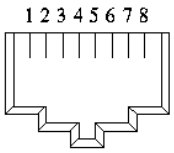
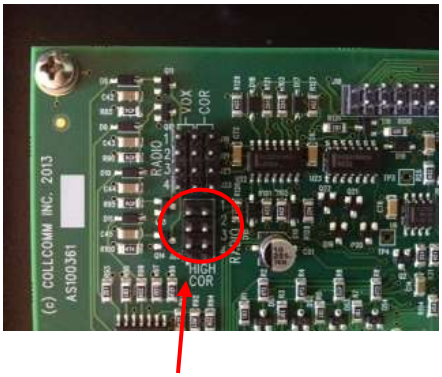


Figure 2:
Looking into an RJ45 Jack

RAD1-RAD4 Modular Radio Connector - Pin 8 is the COR Signal Line.

7.2 COR Polarity

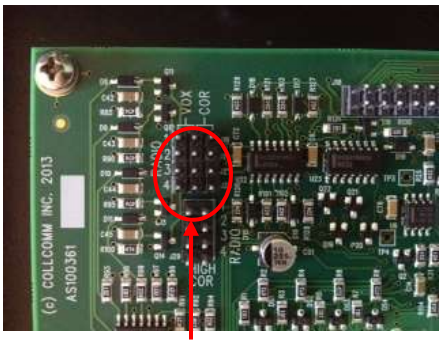
The sense of the Radios' Busy signals can be individually selected using the jumper block shown below. Absence of a jumper means that a "Low" signal indicates "Busy". The presence of a shunt on the jumper block means that a "High" signal indicates "Busy".



Add Jumper for "High" Busy signal. Do Not Add Jumper for "Low" Busy signal.

7.3 VOX Enable

To enable VOX on one or more Radio Ports (R1=R5, R2=R6, R3=R7, R4=R8), install a shunt on the respective VOX pins on the front of the main PC Board.



Move Jumper from COR side to VOX side for corresponding radio.

8.0 Rear Panel Connections

RAD5 RAD6 RAD7 RAD8

These RAD Numbers correspond to the Front Panel Buttons on the C251E Expansion Unit.

<table>
<tr><th>NAME</th><th>PINOUT</th><th>NOTES</th></tr>
<tr><td>MIC

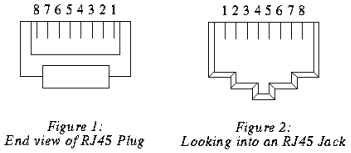
RJ45 Connector on Rear Panel</td><td> 

Figure 1:
End view of RJ45 Plug
Figure 2:
Looking into an RJ45 Jack</td><td>DO NOT USE</td></tr>
<tr><td>RAD5-RAD8

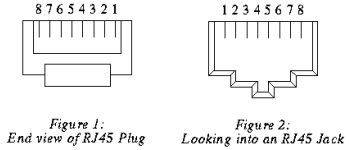
RJ45 Connectors on Rear Panel (Marked RAD1-RAD4)</td><td> 

Figure 1:
End view of RJ45 Plug
Figure 2:
Looking into an RJ45 Jack

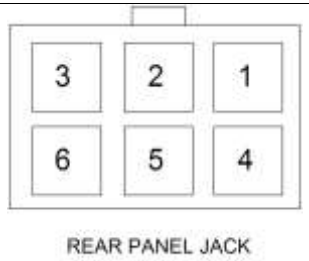
<table><tr><th>Pin</th><th>Signal</th><th>Note</th></tr><tr><td>1</td><td>Transmit Audio</td><td>To Radio Mic Input</td></tr><tr><td>2</td><td>Transmit Audio Common</td><td>To Radio Mic Input Common or Gnd</td></tr><tr><td>3</td><td>PTT</td><td>To Radio PTT Input</td></tr><tr><td>4</td><td>GND</td><td>Signal Ground</td></tr><tr><td>5</td><td>Receive Audio</td><td>From Radio Audio (Speaker) Output</td></tr><tr><td>6</td><td>GND</td><td>Signal Ground</td></tr><tr><td>7</td><td>Hookswitch</td><td>Out to Radio</td></tr><tr><td>8</td><td>COR</td><td>In from Radio</td></tr></table></td><td>Refer to Section 10.0 for cable information.</td></tr>
</table>

<table>
<tr><th>NAME</th><th>PINOUT</th><th>NOTES</th></tr>
<tr>
<td>EXPANSION

13 Pin DIN Connector on Rear Panel</td>
<td> 
<table>
<tr><th>Pin</th><th>Signal</th><th>Note</th></tr>
<tr><td>1</td><td>MIC_MIX</td><td>Microphone Mixer</td></tr>
<tr><td>2</td><td>GND</td><td>Signal Ground</td></tr>
<tr><td>3</td><td>PTT</td><td>Low = True (In/Out)</td></tr>
<tr><td>4</td><td>SLAVE_MIXER</td><td>Input Low=True</td></tr>
<tr><td>5</td><td>UNSEL_MIX</td><td>Unselected Radios Mixer</td></tr>
<tr><td>6</td><td>SEL_MIX</td><td>Selected Radio Mixer</td></tr>
<tr><td>7</td><td>EXT_MUTE</td><td>Output; External Mute Logic Level</td></tr>
<tr><td>8</td><td>PAD</td><td>Spare/Factory Use</td></tr>
<tr><td>9</td><td>GND</td><td>Signal Ground</td></tr>
<tr><td>10</td><td>RX_RS232</td><td>Serial Data In</td></tr>
<tr><td>11</td><td>TX_RS232</td><td>Serial Data Out</td></tr>
<tr><td>12</td><td>SLAVE</td><td>Input; Low = True</td></tr>
<tr><td>13</td><td>GND</td><td>Signal Ground</td></tr>
</table></td>
<td>Used for special functions. Must be enabled by firmware or special cables. <u>CAUTION:</u> Pin functions vary; Consult factory before connecting anything to this connector.</td>
</tr>
<tr>
<td>EXT MUTE

RCA Phono Jack on Rear Panel</td>
<td>Center Pin - Signal
Shell - Ground

This is an open drain output that goes low when PTT is keyed, and, optionally, when any Busy Light comes on (See Section 11.2.5.3 of the C250D Manual)

Maximum Switching Capacity: 100V, 1.5A</td>
<td>This output can be used to mute external equipment such as automobile radios or can be used to turn on external equipment such as "On-the-Air" lights.</td>
</tr>
<tr>
<td>SPEAKERS</td>
<td> 

REAR PANEL JACK</td>
<td>DO NOT USE</td>
</tr>
</table>

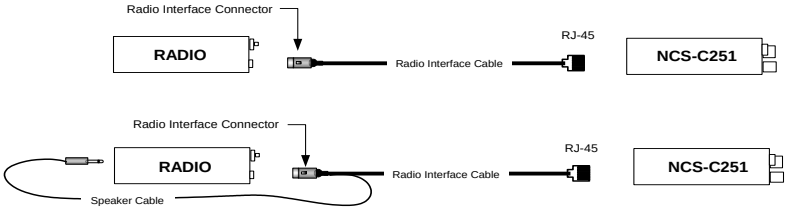
9.0 Connecting the C251E to the C250E

The C251E connects to the C250E using a NCS-C250EXP Expansion Cable connected to the Expansion connections on the two units. The end of the cable with the Yellow indicator connects to the Expansion Unit.

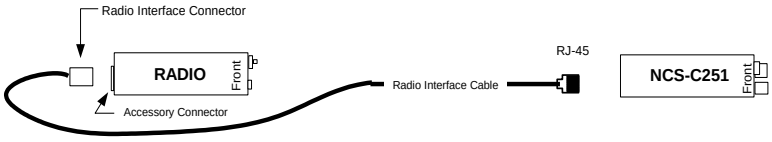
10.0 Radio Interface Cables

A Radio Interface Cable is required for each radio interfaced to the C251E. This cable contains mic audio, receive audio and PTT signals. It can be fabricated from the documentation supplied in the instruction manual or obtained from NCS. The cable consists of an RJ-45, 8 pin modular connector on one end for mating to the C251E and a radio interface connector on the other end. Un-terminated cables are also available that require the customer to attach the radio interface connector.

There are two general cable configurations. The first is for radios that have the receive audio available on the microphone connector or accessory connector and the second is for radios with a separate mic connector and speaker jack. The two configurations are shown below.



Most commercial radios have an accessory connector that usually has mic audio, receive audio and PTT connections available and usually is the preferred interface to the NCS-C251E.



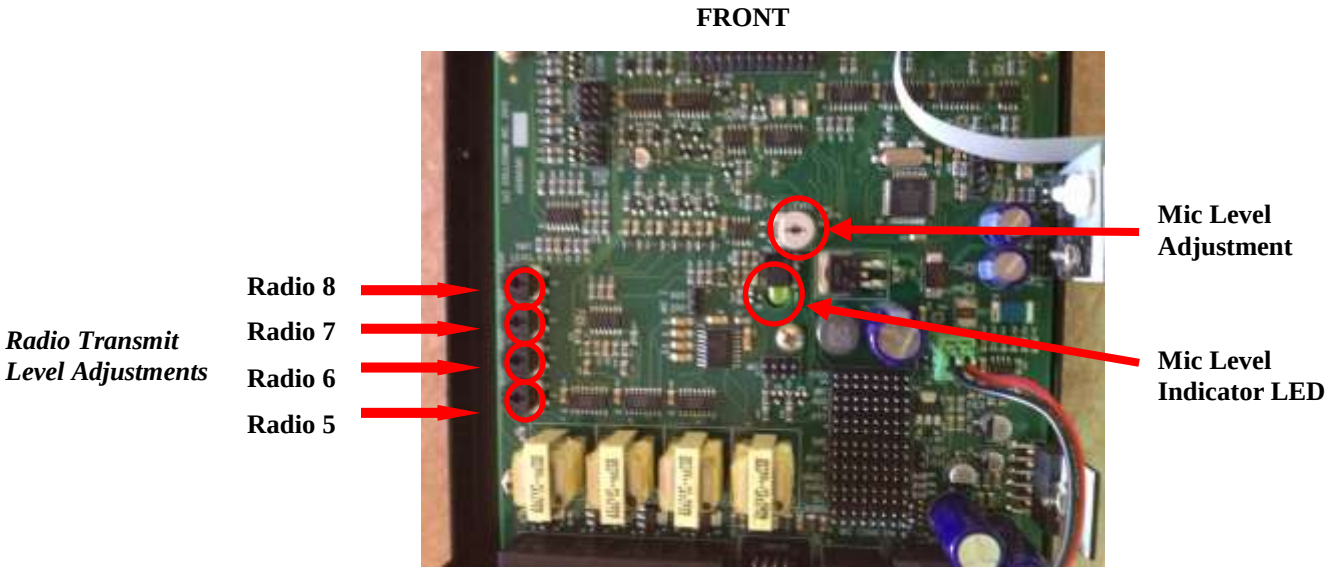
10.1 Specifying Radio Interface Cables

NCS can supply Radio Cables for nearly any radio. Standard cable length is six feet; custom lengths are available. Since there are numerous connector types for interfacing to radios, the exact radio model and connector type must be specified at the time of order. A document describing Cable Specification and Ordering is available on our website at: http://www.ncsradio.com/documents/NCS-C250Cables.pdf

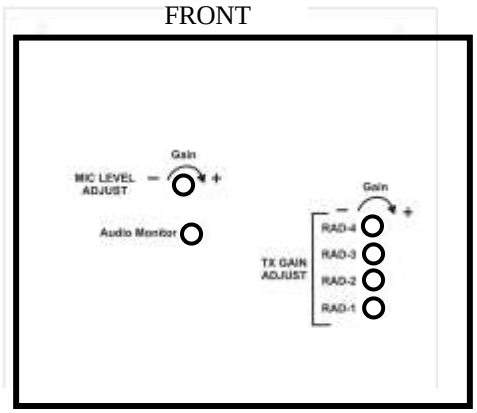
11.0 Adjustments

11.1 Transmit Audio

Transmit Adjustments can be made from inside or on the bottom of the C251E. The images below show the adjustment locations.



Adjustments Inside the C251E



Transmit Adjustments on Bottom of C251E

Transmit Audio Adjustment Procedure

i. Adjust each radio for proper operation using its standard microphone.

ii. Connect the Expansion Cable (250-EXP) between the C250E and the C251E.

iii. Connect NCS Radio Cables between the C251E and each radio.

iv. Preset the Mic Level control to minimum (clockwise from inside, counterclockwise from the bottom, of the C251E).

v. Preset all Radio level controls to midrange (clockwise from inside, counterclockwise from the bottom, of the C251E).

vi. Adjust the Mic input level as follows:

Connect the microphone to the connector on the front or rear panel of the C250E ONLY. **DO NOT USE THE REAR MIC JACK ON THE C251E**. Turn the C250E and C251E on and, while speaking into the microphone, adjust the C251E Mic Level control until the Mic Level LED lights on voice peaks. If the mic level will not adjust low enough, add an Impedance Jumper in the 600 or 200 Ohm location.

vii. Select each radio (RAD5-RAD8) in turn, press the Mic PTT, and adjust the respective output level control for proper transmitter operation.

11.2 Receive Audio

If not using the COR Option, adjust the volume control on each radio so that the Busy light on the C251E associated with that radio lights with the lowest level normal received audio. If using COR, adjust the receiver audio output in the range of 200-300mVp-p.

11.3 User Programmable Functions

The NCS-C251E has three user programmable functions. These functions are the same as those on the NCS-C250E Main Unit and are turned on or off by the attached C250E Main Unit so no user programming of the C251E Expansion Unit is possible.

This completes setup and adjustment of the C251E.

12.0 Operating the C251E

12.1 Activating the Units

With the C251E Expansion Unit connected to the C250E Main Unit using the expansion cable, turn on the two units. It doesn't matter which unit is turned on first.

The DATA indicator on the C251E will flash slowly while the C251E is trying to connect to the C250E. Once the two units are connected, the DATA light will flash faster while the C250E sends all saved setup data to the C251E. During this initial power-up sequence, all three yellow MUTE indicators on the C250E will illuminate and the AUTOMUTE indicator will blink.

After the power-up initialization, each button press on either unit will cause the DATA light to flash as the button press is shared between the two units.

12.2 Mode and Selected Radio Memory

The current Mode and the Radio Selections for all modes are automatically saved in NCS-C250E Main Unit memory so the C251E will be automatically set to the saved Mode and Radio Selection when powered off and back on.

12.3 Operating the C251E

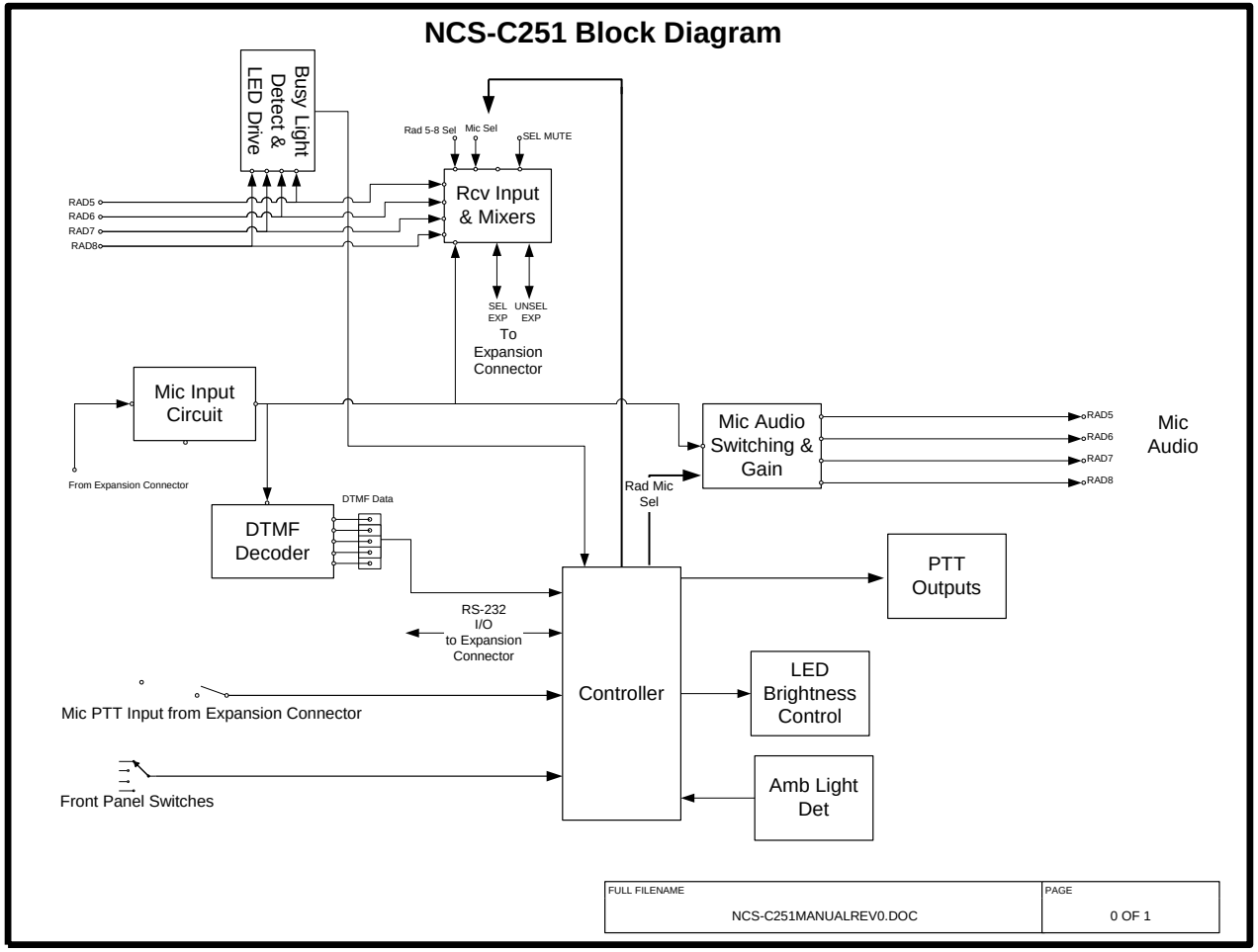
Mode setting is controlled by the NCS-C250E Main Unit. The C251E Expansion Unit will follow whatever mode the C250E is in. The front panel buttons on the C251E are used to select Radios 5 through 8.

12.4 Additional Functions

12.4.1 Watchdog Timers

Each Radio's PTT incorporates a Watchdog Timer that disables a Radio's PTT after 3 minutes of continuous transmission. To reset the Watchdog Timer and resume transmission, PTT must be released briefly. In RPT Mode, the received signal being retransmitted must stop briefly. The Watchdog Timer also resets automatically after 30 seconds even if PTT is still keyed or the received signal has not stopped. This is helpful in the event of a radio problem or other malfunction.

13.0 Block Diagram



14.0 Troubleshooting

The C251E was designed with care and uses high quality components and construction. You should not experience any operating difficulties when you follow the setup and use instructions in this manual. If you do experience problems, here is some information that may help you resolve any difficulties.

14.1 Hum

Magnetically induced hum can be caused to any modern piece of audio equipment by too close proximity to unshielded power transformers or other equipment that radiates strong AC magnetic fields. You can tell if you have this type of hum by rotating the C251E left/right, up/down and moving its position. If the hum increases and decreases, then you are experiencing magnetic coupling from an unshielded power transformer or other equipment. The C251E should be several inches away from equipment that radiates AC magnetic fields.

Another source of hum can be a ground loop. This is a situation when pieces of audio equipment that are connected together do not have their grounds well connected. This results in a voltage difference between the equipment grounds and can be a safety hazard as well as introducing electrical problems. The solution to this problem is to tie all your equipment grounds (usually case or chassis) together with a low impedance RF connection. The best choice for connecting material is a wide braid or copper strap.

14.2 Noise

Excessive noise can be caused by many factors. The C251E uses state-of-the-art low noise amplifier ICs. Nevertheless, even these components can add a bit of noise or “hiss” to an audio signal if not adjusted properly. If you seem to have excessive “hiss” type noise, review the setup and level adjustments you’ve made to the C251E. In some cases, increasing the radio’s own mic gain and decreasing the levels from the C251E may improve the noise level.

Excessive noise can also be caused by ground loops. See the previous “hum” discussion for information on eliminating ground loops.

14.3 Distortion

Distorted audio can be caused by one of two situations. The first and most common is improper adjustment of audio levels. Be sure you’ve adjusted the Radio and C251E level controls as recommended in this manual and that your radio’s mic gain control is properly adjusted. Setting the Volume Controls at too high a level can also cause distortion.

RF at the operating position can also cause distorted audio. To determine whether this is the problem, connect your transmitter to a dummy load. If the distortion disappears, then you have RF entering the interface cables. To eliminate RF problems, first make sure you have set up the jumpers and radio cables correctly. Then check that you have a good ground between all pieces of equipment and that your RF ground is low impedance.

15.0 Contacting NCS

NCS wants you to experience trouble free operation of our equipment. If you have any questions, comments or need technical help, please use the following resources:

1. Go to the web site, www.ncsradio.com: Here you will find the latest instruction manuals, any factory developed modifications and Frequently Asked Questions. Schematics for all NCS products may be found at www.ncsradio.com/schematics .

2. Email us at support@ncsradio.com: Be sure to include all pertinent information, e.g. make and model of radios, how they’re connected to the C250E, detailed description of any problems, antenna and grounding configurations, etc.

3. Telephone us toll-free at 888-883-5788: Be near your equipment and have the manuals for your radios available. We will do our best to help you using our technical expertise.

16.0 C251E Specifications

General Specifications	
Dimensions	1.8"H x 6.4"W x 7.1"D 4.6cm x 16.3cm x 18.0cm
Weight	2.0 lb (0.91kg)
Temp Range	0° to +50° C
Memory Protection	Radio Selections preserved in non-volatile memory
Power Requirements	9 to 16 VDC @ 2A typical
Automatic Mute Function	Mutes external equipment when Mic is keyed or when received signal is present (User selectable)

Front Panel	
Power On/Off	Pushbutton Switch with Red LED Indicator
Radio Select (RAD5-RAD8)	Momentary Pushbutton Switch with Green LED "Busy" Indicator and Red LED "Selected" Indicator
DATA	Yellow Indicator blinks when communicating to the Main Unit

COR Option	
Radio Connector Pin #	8
Signal Levels	**COR Logic Input from Radio:** Low: < 1.0 VDC High: > 1.5 VDC
COR Sense	Selectable Low or High

Rear Panel Connections	
Radio Interface Connectors (1-4) RAD5-RAD8	RJ-45 Modular Jack
Expansion	13 pin DIN Jack
Microphone	DO NOT USE
External Mute	RCA Phono Jack
Speakers	DO NOT USE
DC Power	Six inch dual-fused pigtail terminated in an Anderson PowerPole PP-15 connector.

Accessory Kit	
Mounting Bracket	NCS-MTG501
Mounting Bracket Hardware	Qty 2 knobs with 10-32 Threaded Studs
Spare Fuses	Qty 2 - 3A
Power Cable	10 foot, 18 AWG wire terminated with mating connector
Rubber Feet	Qty 4 Self Adhesive
Power Cable Clamp	Used to keep Power Cable from separating from Power Pigtail in Mobile use.

Hookswitch Option	
Radio Connector Pin #	7
Signal Levels	**Hookswitch Input Resistance to Ground:** On-Hook: < 1K Ohms Off-Hook: > 5K Ohms **Output Switching Resistance to Ground:** On: < 10 Ohms Off: > 1 Mohm **Max Load Imposed by Radio:** Off Voltage: < 60 V On Current: < 200mA

17.0 Warranty

Collcomm Inc. d.b.a. NCS
Limited Product Warranty

All products manufactured by Collcomm Inc. (hereafter referred to as NCS) and purchased from an authorized dealer or purchased directly from NCS will be warranted to be free from defects in material and workmanship for a period of one (1) year from the date of purchase.

NCS' liability under this warranty and the Customer's exclusive remedy is limited to repairing, servicing or adjusting, and/or replacing the defective product returned to NCS within the warranty period. Whether the defective product is repaired or replaced will be at the sole discretion of NCS. The warranty will be voided for products that have been abused, misused, or subjected to abnormal operating conditions as determined by NCS. Further, products damaged by lightning, power surges or force majeure events are not covered under this warranty.

If, in the Customer's estimation the product appears to be defective and is within the warranty period NCS should be notified as to the nature of the defect. If the product appears to be covered by the terms of the warranty, NCS will promptly communicate a return authorization number and shipping instructions to the Customer. When returning a product for repair/replacement under warranty the proof of purchase or a copy thereof must be returned with the defective product. NCS at its discretion may deny warranty in the absence of proof of purchase. Acceptable proof of purchase includes bill of sale, cancelled check or credit card receipt. Evidence of alteration of the proof of purchase document shall be reason to immediately void the terms of the warranty.

For those products returned that prove to be defective and covered under the warranty, the Customer will bear the cost of shipment for the return of the product to NCS. Collect shipments will not be accepted. NCS will bear the cost of shipment for return of the product to the Customer after repair/replacement. Mode of shipment for return to the Customer will be determined by NCS. Should examination reveal that the product is not defective, NCS will notify the Customer and request return shipping instructions and NCS will be due all shipping expenses. In the event that the examination reveals that the product is defective, but for any reason is excluded from this warranty, NCS will prepare a quotation of the cost to repair, and will communicate same to the Customer. In the latter event, NCS will be due all shipping charges incurred for return of the product to the Customer.

The Customer may attempt to repair a defective product under warranty provided authorization to do so is received from NCS Technical Support. NCS will supply replacement parts free of charge for authorized Customer repairs provided that the defective part along with the proof of purchase is submitted to NCS. NCS will pay postage and handling for replacement parts provided the above terms are met. The product warranty under these circumstances will remain in force for the life of the warranty.

EXCEPT FOR THE EXPRESS WARRANTIES STATED IN THIS WARRANTY, WHICH ARE EXCLUSIVE, NCS DISCLAIMS ALL WARRANTIES ON PRODUCTS SOLD HEREUNDER, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. UNDER NO CIRCUMSTANCE IS NCS LIABLE FOR CONSEQUENTIAL DAMAGES TO PERSON OR PROPERTY AS A RESULT OF THE USE OF ANY NCS PRODUCTS.

The Customer may have additional rights beyond those specifically outlined in this document based on individual state laws.