

NCS-3230 Multi-Rx™ INSTRUCTION MANUAL

Rev C



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Introduction

The Multi-Rx™ was designed to provide a flexible way to monitor and control the receive audio of multiple receivers. The Multi-Rx™ works with any radios including VHF/UHF scanners and transceivers and HF receivers and transceivers. The Multi-Rx™ provides selective monitoring of one to six radios while allowing the operator to position the audio from each radio at distinct locations in the audio field. Additionally, all radios can be muted (silenced) at the push of a button. Provision is included for manual or automatic control of an external digital or audio tape recorder. Any combination of the six radios can be recorded and you can even record both sides of a QSO (provided your transceiver has a “monitor” function). A unique *Spatial* mode lets you use only two speakers but gives spatial separation of the audio from each radio which is equivalent to having 6 individual speakers, one for each radio. In the *Normal* mode, receive audio can be selectively positioned left, right or center in the audio field.

The Multi-Rx™ will benefit just about any ham shack. Its flexibility and versatility make it ideal for contest stations, emergency operations, satellite stations, repeater sites, mobile communications vans and any radio communications environment.

Connecting to the NCS-3240 Multi-Switcher

For complete station control, the Multi-Rx™ was designed to connect to the NCS-3240 Multi-Switcher. The Multi-Switcher provides microphone switching for transmitters as well as other functions. When both are used together, complete transmit and receive control of multiple radios is achieved including automatic muting of all radios when transmitting. There is also the ability to mute all radios except the one being used. This feature is useful in HF setups where the operator wants to monitor the transmitted audio using a radio’s built-in “monitor” function.

NCS provides a full range of cables for connecting the Multi-Rx™ to the Multi-Switcher as well as microphone cables for most radios. Consult the NCS website or call NCS to determine the correct cables for your specific configuration.

1.0 Power Supply

1.1 Power Connector

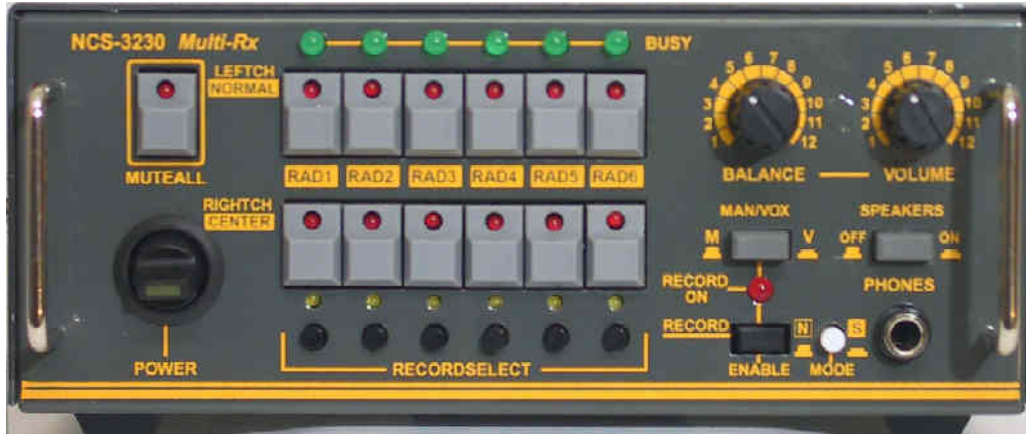
The NCS-3230 Multi-Rx™ will operate with any well-filtered 10-14 VDC power supply capable of providing at least 200mA continuous, 1A peak. The required power connector is a 2.1mm ID, 5.5mm OD coaxial power plug. One power connector is supplied in the accessory pack with the Multi-Rx™.

1.2 Polarity

The center pin of the coaxial power plug must be wired positive (+). If the plug is wired backwards, the Multi-Rx™ will not operate due to reverse polarity protection built into the unit.

CAUTION: The Multi-Rx™ was designed to work with voltages between 10-14 VDC. Voltages higher than 15V will cause an internal fuse in the Multi-Rx™ to open to protect certain components. (If the fuse opens, the unit will need to be returned to NCS for out-of-warranty repair.) Most Wall Power supplies on the market that are advertised as 12 VDC are not regulated and may put out as much as 20 VDC when not connected to a piece of equipment. The output voltage is reduced when powering equipment depending on the current drawn by the equipment and the internal resistance of the power supply. The internal resistance of the power supply varies depending on manufacturer and model number. **If you are going to use a Wall Power Supply be sure it's output voltage, when connected to the Multi-Switcher, does not exceed 14 VDC.** The NCS-1514 Wall Power Supply meets the requirements of the Multi-Rx.

2.0 Front Panel Controls and Indicators



2.1 POWER Switch

The power switch turns on all power to the Multi-Rx™. It has a yellow LED in the paddle that is illuminated when the power is on. Note that the Left and Right channel Radio Selections are maintained when the power is off.

2.2 MUTE ALL

The MUTE ALL button will mute all radios when activated. The LED in the button will blink as a reminder that all radios are muted.

2.3 Radio Select Switches

These switches are momentary pushbutton switches with LEDs. There is a row of six switches for the Left channel (LEFT CH) and a row of six switches for the Right channel (RIGHT CH). In the *Normal* mode, the top row of switches select which radio(s) will be connected to the Left speaker and the bottom row of switches select which radio(s) will be connected to the Right speaker.

In the *Spatial* mode, the top row of switches turns on the audio of the selected radio(s) in the appropriate position(s) in the sound field. The bottom row of switches produces audio centered in the sound field for selected radio(s) by sending the audio from the radio(s) equally to both the Left and Right speakers.

2.4 BUSY Lights

These green LEDs will light up when audio is present from the respective radio(s). It takes about 150mV peak from the radio(s) to activate the busy lights.

2.5 RECORD SELECT Switches and LEDs

These switches select which radio(s) will be recorded. When a switch is engaged (the “in” position), the corresponding yellow LED will light indicating which radio will be recorded. Any or all radios can be recorded simultaneously since the receive audio is mixed together inside the Multi-Rx™.

2.6 RECORD Controls

The RECORD controls consist of two pushbutton switches and one red LED. The ENABLE switch enables the recording function when pushed in. When in the “out” position, no recording can occur regardless of the settings of other controls.

With the RECORD function enabled, the MAN/VOX switch controls whether recording will be signal activated (VOX) or always on (Man). VOX operation depends on having enough audio level. The BUSY lights indicate the signal level and if they are on, there is enough audio to activate the VOX record function. There is a delay (5-10 sec) built in to the drop out time of the VOX record function so the recorder will continue to record during short pauses in the received audio.

When the record function is on and recording, the RECORD ON LED will light.

2.7 SPEAKERS Switch

This switch turns the speakers on or off. The headphone output is always active.

2.8 PHONES Jack

This jack is for use with a stereo headphone. Both channels of audio, Left and Right, are present at all times unless one of the Mute functions is activated.

2.9 BALANCE and VOLUME controls

These controls operate the same as on a consumer stereo system.

2.10 MODE Switch

This switch selects either the *Normal* or *Spatial* modes of operation. The “in” position (S) selects *Spatial* mode; the “out” position (N) selects *Normal* mode. See Section 4.2 for a description of the two modes.

3.0 Rear Panel



3.1 AUDIO IN Jacks

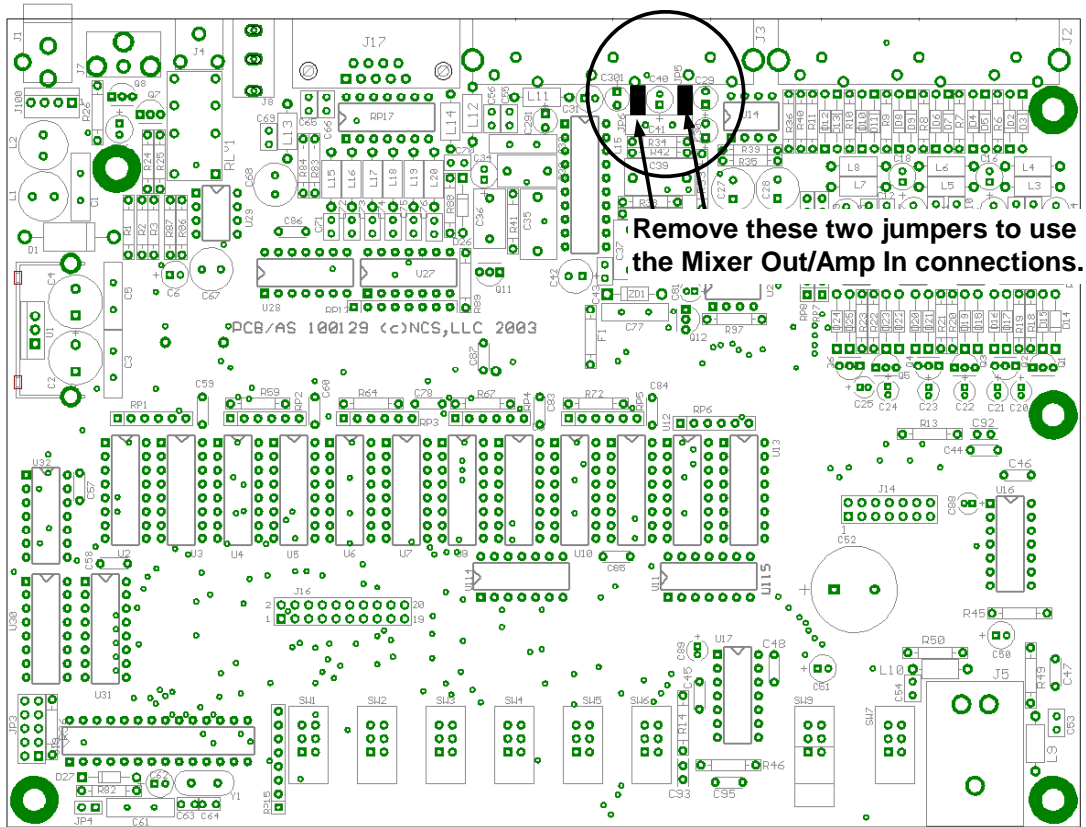
On the rear panel are six RCA phono jacks that connect the Multi-Rx™ to six different radios. These jacks are connected to the speaker output of each radio. Signal level required for activation of the front panel BUSY lights is approximately 150mV peak.

In the *Spatial* Mode, audio from radios 1-3 will appear in the sound field to the left of center; audio from radios 4-6 will appear right of center. Note the labeling of the top row "L" and the bottom row "R".

3.2 MIXER OUT/AMP IN Jacks

The MIXER OUT and AMP IN jacks can be used to connect external equipment such as equalizers, DSP filters or external audio amplifiers. Note there are two pairs of jacks, one pair for the Left channel (L) and the other for the Right channel (R). The MIXER OUT signal consists of receive audio mixed as selected by the front panel switches. These outputs are at "line" level – nominally 100-200 mV, The AMP IN signal should also be at "line" level.

To use these jacks, two jumpers must be removed (one for each channel) inside the Multi-Rx™. These internal jumpers normally connect the MIXER OUT to the AMP IN signals when the rear panel jacks are not being utilized. The following drawing shows the location of these jumpers on the Main PC Board.



Main Board showing location of Mixer Out and Amp In Jumpers

3.3 SPEAKER Jacks

These jacks are for the left and right speakers. The Multi-Rx™ was designed for use with speaker impedance in the range of 4-16 Ohms. For best results, both speakers should be the same type and impedance.

3.4 DATA Connector

The DATA connector is used for two purposes. The first is Selective Muting. There is one input line on this connector for each of the six radios. Selective Muting works in conjunction with the Mute jack to enable you to mute all radios except one when you key PTT. To use selective muting, the pin for any radio you DO NOT want to mute when transmitting, must have a low (logic "0") level (~0VDC). This can be a TTL or CMOS level or a relay or switch closure to ground. The Selective Muting pinout is shown below:

Radio	DATA connector pin
1	1
2	4
3	6
4	7
5	8
6	9
Ground	5

The Selective Muting function was designed to be compatible with the NCS-3240 Multi-Switcher™, giving you total Receive and Transmit control of your station. See the NCS website for Application notes on using the Multi-Switcher™ with the Multi-RX™.

The second function of the DATA connector is for external control of the Multi-Rx™. Using this function, an external computer can read and set the status of the front panel switches. Note that these signals are TTL/CMOS level (0 to +5VDC) and must be converted to RS232 standard levels (approx +12VDC to -12VDC) in order to connect the Multi-Rx™ to a computer.

Details of the data sent to and from the Multi-Rx™ are shown in Section 4.4.

3.5 Recorder Connections

The RECORDER jacks are used to connect an external tape or digital audio recorder to the Multi-Rx™. This function allows recording of any radio(s) using either Manual or VOX operated control.

The AUDIO jack is a mini phone jack (1/8" or 3.5mm) and is normally connected to the audio input of a recorder. The CNTRL jack is a sub-mini (1/16" or 2.5mm) jack and is used to turn the recorder on and off. This jack is isolated from ground and uses a dry relay closure so it can control nearly any recorder.

3.6 MUTE Jack

The MUTE jack is an RCA phono jack. Bringing this input low (~0VDC) causes all radios to be muted – except for any radios using Selective Muting. Normally, this connector is tied in parallel with a PTT circuit.

3.7 PWR Connector

The PWR connector is a standard coaxial jack with 2.1mm pin and 5.5mm shell dimensions.

3.8 Typical Connections

A diagram of typical connections is shown in Section 7 of this manual.

4.0 Operating with the Multi-Rx

4.1 Audio levels

Adjust the volume control on each connected receiver so that the corresponding BUSY light is activated when received audio is heard.

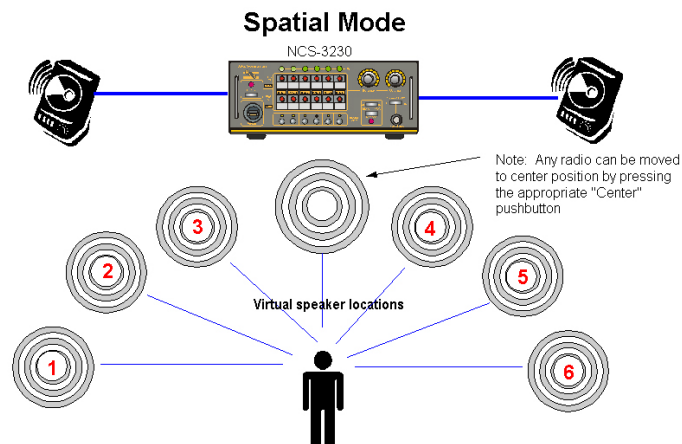
4.2 Mode Selection

4.2.1 **NORMAL** mode

Moving the MODE Switch to the “out” position selects *Normal* operation of the Multi-Rx™. In this mode, radios selected on the top row of switches will be heard on the left speaker. Radios selected on the bottom row of switches will be heard on the right speaker. Radios selected on both rows of switches will be connected to both speakers so they will be heard centered between the two speakers. The Balance control can be adjusted to compensate for the operator being closer to one speaker than the other.

4.2.2 **SPATIAL** mode

Moving the MODE Switch to the “in” position sets *Spatial* operation of the Multi-Rx™. In this mode, each radio has a pre-assigned location in the audio field as shown below:



Selecting a radio with its corresponding top row button turns on its audio in the pre-assigned location. Selecting a radio with the bottom row of buttons sends the radio's audio to both speakers equally, thus centering the audio in the sound field.

4.3 Recording Function

To configure the Multi-Rx™ for recording, connect a (tape or digital) recorder to the RECORD jacks on the rear panel and enable recording by setting the RECORD ENABLE switch to the “in” position. To record one or more radios, press the RECORD SELECT switch for the desired radio(s). For continuous recording regardless of whether there is activity or not, set the MAN/VOX switch to the Man (in) position. In the VOX position, the recorder will operate only when there is activity on the radio(s) selected for recording. The VOX circuit is keyed to the BUSY lights so if the audio is not strong enough to light the BUSY lights, then the VOX function won't turn on the recorder.

Note that you can record any radio(s) regardless of radio speaker selection or mute functions. So even if a radio is not being heard through a speaker, it can be recorded.

The red RECORD ON LED will light when actually recording. Note there is an approximately 5 second dropout delay between the time activity ceases and the recorder stops.

4.4 Computer Interfacing

The Multi-Rx™ can communicate with an external computer using serial data. When connecting to a computer, you will need to supply a TTL-to-RS232 adapter to provide the proper signal levels for computer control of the Multi-Rx™.

4.4.1 Electrical Interface

The Multi-Rx™ has a DB9 female connector on the rear panel that has the serial data transmit and receive lines. These lines are TTL/CMOS level and must be converted to RS-232 levels for use with most external computers. The serial data sent to and received from the Multi-Rx™ must be 8 bits, No Parity, 1 Stop Bit (8N1) at 1200 baud.

The serial data pinout on the Multi-Rx™ is:

Signal	DB9F DATA connector pin
RxD – TTL/CMOS level data from an external computer	3
TxD – TTL/CMOS level data to an external computer	2
Ground	5

4.4.2 Switch Status

The Multi-Rx™ always sends the status of both rows of front panel switches and the status of the MODE switch under the following conditions:

- Power Up
- Change of status of any Radio Select Switch
- Change of the Mode Switch
- Receipt of a Status Inquiry command

The status is returned as two individual 8-bit bytes. Each byte is defined as follows:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Channel 0 = Left 1 = Right	Mode Switch Status 0 = Spatial 1 = Normal (only valid with Left channel status byte)	Radio 6	Radio 5	Radio 4	Radio 3	Radio 2	Radio 1

4.4.3 Status Inquiry

To determine the current status of the front panel switches, send the following command to the Multi-Rx™ and it will respond with two data bytes containing the status as shown in 4.4.2.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	X	X	X	X	X	X

X = Don't Care

4.4.4 Set Command

To set the front panel switches, the following data is sent to the Multi-Rx™:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Channel 0 = Left 1 = Right	0	Radio 6	Radio 5	Radio 4	Radio 3	Radio 2	Radio 1

Note: 1= On, 0=Off

NOTE: The MODE switch cannot be controlled remotely.

4.5 Hum, Noise and Distortion

Your Multi-Rx™ 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.

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 Multi-Rx™ 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 Multi-Rx™ 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. You should refer to any of the Amateur Radio publications for extensive discussion of ground loops and how to eliminate them.

Noise

Excessive noise can be caused by many factors. The Multi-Rx™ 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 radios connected to the Multi-Rx.

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

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(s) volume controls as recommended in this manual.

RF in the shack 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 floating around the shack. 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. Refer to any reliable Amateur Radio publication for detailed information on RF problems and RF grounding.

5 Getting Help from 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.
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 Multi-Switcher™, 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.

6 Multi-Rx™ Specifications

Front Panel Controls and Indicators

- MUTE ALL Switch - Mutes all audio unconditionally.
- POWER Switch - Paddle Switch with Yellow Power Indicator LED
- Radio Selection Switches – Red LEDs light up when radio selected
 - *Normal Mode*
 - Top Row – Left Speaker
 - Bottom Row – Right Speaker
 - *Spatial Mode*
 - Top Row – Positions Radio(s) in Audio Field
 - Bottom Row – Centers Radio(s) in Audio Field
- BUSY Lights – Green LED(s) Flash with audio from corresponding radio(s).
- RECORD SELECT – Selects radio(s) for recording. Yellow LED indicators.
- BALANCE and VOLUME Controls – Control Left/Right speaker balance and volume of both channels.
- MAN/VOX – Controls manual or VOX operation of record function.
- RECORD ENABLE – Enables recording. When off (out), no recording can occur.
- RECORD ON LED – Lights when recorder is running.
- MODE Switch – Determines *Normal* (out) or *Spatial* (in) mode.
- SPEAKERS – Turns speakers off (out) and on (in).
- PHONES Connector – ¼ in (6.4 mm) stereo phone jack

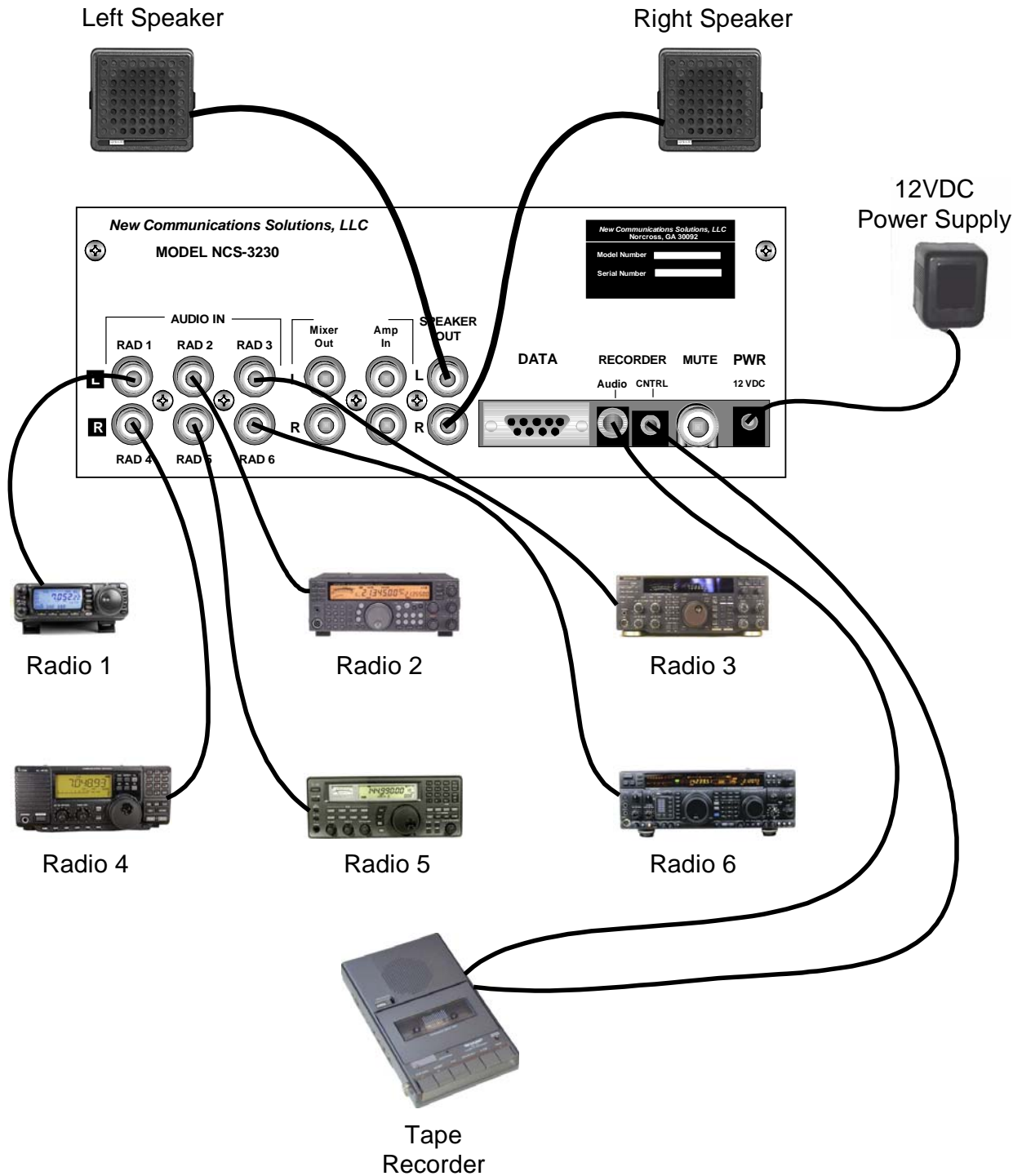
Rear Panel Connections

- AUDIO IN – Inputs from speaker jacks on radios. Approx 150mV required to light BUSY LEDs.
- MIXER OUT – Line level outputs from internal mixers for both channels.
- AMP IN – Line level input to internal audio amplifier, both channels.
- SPEAKER OUT – Connect 4-16 Ohm speakers to these jacks.
- DATA – Selective Mute Inputs and Serial Data In /Out
- RECORDER
 - AUDIO – Line level audio output to recorder.
 - CNTRL – start/stop control of recorder. Dry relay contact, isolated from ground.
- MUTE – RCA phono jack. When logic low (~0VDC) mutes all audio except those programmed as Selective Mute.
- PWR – Coaxial, 2.1mm pin, 5.5mm shell, center pin positive

Power Requirements: 12-15 VDC @ 200 mA average, 1A peak.

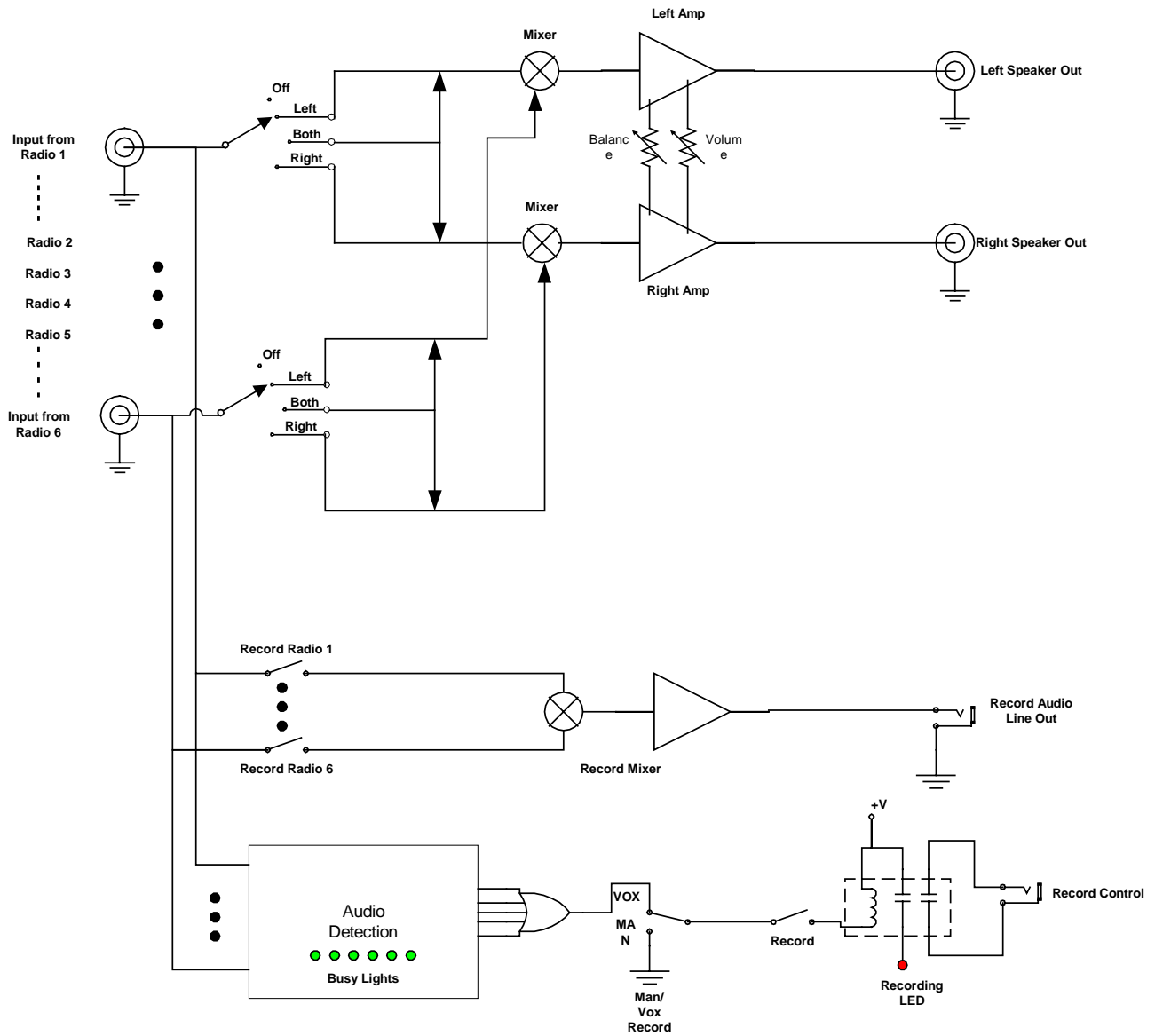
Size: Approximately 8.3 x 6.2 x 3.3 inches

7 Typical Connections

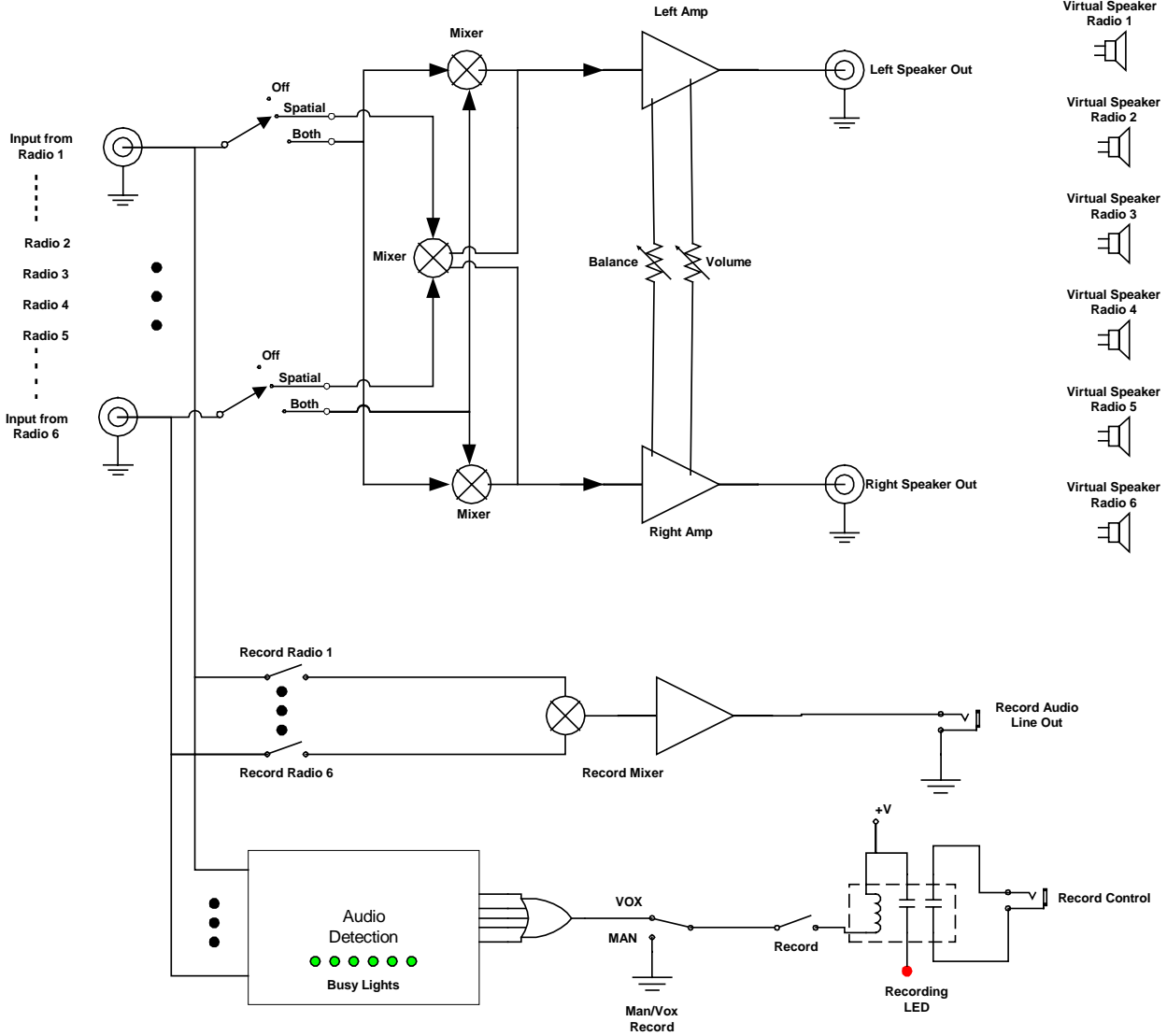


Typical Connections

Functional Block Diagram - NORMAL Audio Mode



Functional Block Diagram - SPATIAL Audio Mode



New Communications Solutions, LLC
Limited Product Warranty

All products manufactured by New Communications Solutions, LLC (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 include 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.

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