

Installation and Operation Manual

NXU-2B **Network Extension Unit**



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FEDERAL COMMUNICATIONS COMMISSION

(FCC) COMPLIANCE NOTICE:

RADIO FREQUENCY INTERFERENCE NOTICE

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

NOTICE

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CAUTION

Changes and modifications to this equipment not expressly approved by JPS Interoperability Solutions could impair proper operation of the equipment and/or could void user's warranty.

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Glossary

| <i>Glossary</i> | | |
|-----------------|-------------------------------------|---|
| COR | Carrier Operated Relay | A signal from a receiver that gives a positive indication that a carrier or signal is being received and that the receiver is unsquelled. It has the same function as Carrier Operated Squelch (COS). |
| COS | Carrier Operated Squelch | See COR. |
| DHCP | Dynamic Host Configuration Protocol | A method of automatically assigning an IP address to an Ethernet device at startup time. This method conserves IP addresses in networks where devices do not stay connected permanently. |
| DSP | Digital Signal Processor | A type of microprocessor, which is optimized for signal processing functions. |
| IP | Internet Protocol | A protocol designed to allow communications between computers on different networks. |
| LAN | Local Area Network | A group of computers and associated devices that share a common communications line, typically within a small geographic area. |
| PTT | Push-To-Talk | A control signal to a radio transmitter that controls the actual transmission of radio frequency energy over the air. Also called a keyline. |
| TCP | Transmission Control Protocol | An additional layer to the Internet Protocol, which ensures delivery of packets, sent across the network. It can handle situations such as lost packets or packets arriving out of order. |
| UDP | User Datagram Protocol | An additional layer to the Internet Protocol which does not ensure delivery of packets but which offers much lower transmission overhead than TCP. |
| VoIP | Voice over Internet Protocol | Also called Voice over Packet (VoP), a method of sending voice communications across a digital network. |
| WAN | Wide Area Network | A network, which is spread out over a wider area, such as around a city or state. It may include other public or shared networks. |



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1 General Information

1.1 Scope

This instruction manual provides the information necessary to install and operate the NXU-2B Network Extension Unit.

1.2 Description

1.2.1 NXU General

NXU stands for Network Extension Unit. NXU units connect communications equipment to a digital network using VoIP (Voice over Internet Protocol) technology. NXU units use JPS' proprietary technology, embodied in a family of hardware and software products that enable voice communications devices to be interconnected via a network across the room or around the world. VoIP is a means of digitizing voice signals and transmitting them over a digital network, such as a LAN, WAN, or even the Internet itself.

The NXU-2B is standards-compliant and therefore supports standards-compliant web browsers, including Microsoft Edge, Firefox, Chrome, Opera, and Safari. It's always best to use the most current version of any web browser.

The NXU-2B is intended for use with radio communications consoles, communications radios, and JPS products such as the ACU-1000 Interconnect Unit. This general-purpose, stand-alone device interfaces full duplex audio, one RS-232 port, and three status bits onto an Ethernet network. A pair of NXU-2Bs can form a simple system that creates a transparent communications link between the two. The NXU-2B at one end (usually the equipment end) is the *server*; the one at the other end (usually the operator end) is the *client*. The audio, RS-232, and status bits are transparently transferred between the server and the client.

Any NXU-2B can be set up as a server or as a client depending on system needs. The RS-232 interface allows for different baud rates between the server and the client.

The NXU-2B monitors its network connection and adjusts its parameters automatically to provide optimum performance under varying network conditions. Front panel indicators display the unit's status. Configuration is done through the NXU-2B's Ethernet port using a standard web browser.

Designed for years of continuous operation in mission-critical applications and remote locations, the NXU-2B has no moving parts and requires no periodic shutdown or maintenance. Startup upon power on is under 10 seconds.

1.2.2 Advantages of NXU Technology

- Enables the design of low cost, extremely flexible radio communications networks.
- Multiplexes voice audio and data over a standard Ethernet network.
- Uses existing network infrastructure eliminating the need for leased lines and microwave sites.
- Eliminates the requirement for pilot tones and other in-band signaling.
- Facilitates centralized control of a communications network from a single computer.

1.3 Network Details

The NXU-2B is a 10/100BASE-T Ethernet device and each unit has a unique Ethernet address and an RJ-45 physical interface jack. A 10/100BASE-T device operates at either 10 or 100 Mbps and interconnects to an Ethernet hub or switch using standard CAT 5 twisted pair cable, also known as UTP. The maximum cable length between an NXU-2B and its hub port is 100 meters. With the right connective equipment (recommended or supplied by JPS), the NXU-2B’s Ethernet port can be linked with virtually any LAN, WAN, or the Internet, no matter which topology or cabling system is in use.

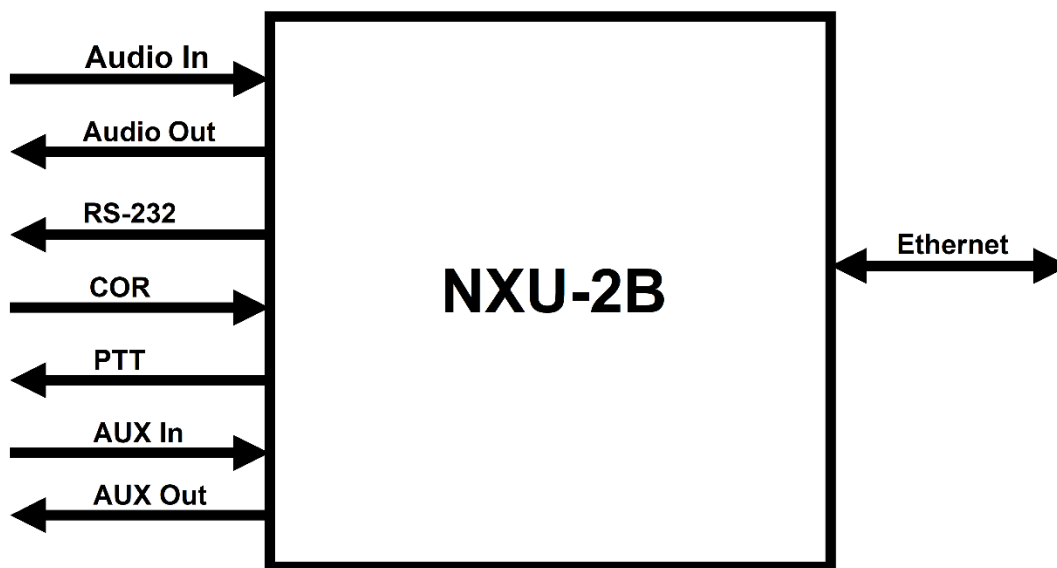


Figure 1-1 NXU-2B Basic Block Diagram

1.4 Specifications

| Table 1-1 Specifications | |
|---------------------------------|---|
| RX Audio Input | |
| Input impedance | Balanced 47k ohms, transformer coupled, 600 ohm selectable |
| Input Level | Incoming signals adjustable from -26 to +10 dBm to set 0 dBm nominal input; +15 dBm clipping. +20 dB boost configurable |
| Frequency Response | 10 Hz to 3600 Hz +/- 2dB. |
| TX Audio Output | |
| Output Impedance | Balanced 600 ohms, Transformer Coupled. |
| Output Level | Adjustable from -26 to +4 dBm, 0 dBm nominal factory default into a 600-ohm load. |
| Frequency Response | 10 Hz to 3350 Hz +/- 2dBm. |
| Distortion | 0.5% or less (excepting Vocoder). |
| COR & AUX Input | |
| Input impedance | 47k ohm pull-up to +5V. |
| Polarity | COR: Selectable active low or active high; AUX Inputs: Active low. |
| Threshold | +2.5V nominal. |
| Protection | Up To + 100 VDC. |
| PTT and AUX Output | |
| Output Type | Open drain, 47k ohm pull-up to +5V, PTT relay output selectable |
| Maximum Sink Current | 100 mA for open drain, 300 mA for PTT relay |
| Max Open Circuit Voltage | +60 VDC for open drain, +100 VDC for PTT relay |
| Serial Interface | |
| Interface Type | RS-232, Asynchronous, Full Duplex. |
| Baud Rates | 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps. |
| Connector | DB-9 Male, Standard PC/AT DCE Pinout. |
| Network Interface | |
| Interface Type | 10/100BASE-T Ethernet, 10 or 100 Mbps; RJ-45 Connector. |
| Protocols | Audio and status-UDP, RS-232- TCP. |
| Audio Vocoder | Selectable, 13, 16, 24, 32, or 64 Kbps data rate. |
| General/Environmental | |
| Programming/Configuration | Web, Telnet, or RS-232 Interface. |
| Front Panel | Power, Link Active, Channel Active, and Audio Level LEDs. |
| Rear Panel | Audio/Data (DB15 Female), Serial, Network, and Power Connectors. |
| Input Power (12 VDC Nom) | +11 to +15 VDC @ 0.5A max. Wall cube supplied operates on 100-240 VAC. |
| Power Connector | Coaxial Jack, 2.5 mm ID, 5 to 5.5 mm OD; Center Pin Positive; Reverse Polarity Protected. |
| Size and Weight | 1.36"H x 6.50"W x 6.50"L (3.45 x 16.5 x 16.5 cm). 1.2 lbs. (0.5kg). |
| Temperature | Operating: -20 to +60 degrees C. Storage: -40 to +85 degrees C. |
| Humidity | Up to 95% @ 55 degrees C. |

1.5 Equipment and Accessories Supplied

| <i>Table 1-2 Equipment and Accessories Supplied</i> | | |
|---|---|----------------|
| NXU-2B Shipping Level - JPS P/N 5190-200000 | | |
| Quantity | Item | JPS P/N |
| 1 | NXU-2B Final Assembly | 5190-201000 |
| 1 | DC Power Supply [100 to 240 VAC, 47-63 Hz to +12 VDC, 500 mA] | 1620-240061 |
| 1 | Accessory Kit | 5190-200150 |
| | | |

1.6 Optional Equipment - Not Supplied

| <i>Table 1-3 Optional Equipment - Not Supplied</i> | |
|--|----------------|
| Description | JPS P/N |
| Operation & Maintenance Manual, printed and bound Note: This manual may be downloaded from the jpsinterop.com website at no cost | 5190-200200 |
| Generic Radio Interface Cable; unterminated at radio end; 15 ft. | 5961-291115 |
| Interface cables for a very wide range of commercial radios are available for purchase. Email JPS or consult the JPS Interoperability Solutions website for a listing: <p style="text-align: center;">sales@jpsinterop.com / support@jpsinterop.com www.jpsinterop.com</p> | |

1.7 Differences Between the NXU-2B and the NXU-2A

The NXU-2B is an updated and improved redesign of the popular NXU-2A device. Tens of thousands of the NXU-2As are currently in operation, and the NXU-2B maintains compatibility with those units.

Some improvements extend beyond the incorporation of updated electronic components and are listed below:

- The pinout of the Audio/Control connector on the rear panel of the unit is different between the NXU-2A and the NXU-2B. The NXU-2B pinout has been changed to match that of other JPS products such as the ACU product family. This allows standard JPS radio cables to be used with the NXU-2B with no adapter needed. Previously an audio crossover adapter was included with the NXU-2A to allow standard JPS radio cables to be used. This adapter is not required with the NXU-2B and is not included. Please refer to Table 2-3 for the pinout of the Audio/Control connector.
- The NXU-2B uses transformer-coupled balanced audio for both input and output audio. The NXU-2A only had balanced input audio and single-ended output audio.
- The NXU-2B audio input and output levels are electronically adjustable via the web browser interface and are saved in non-volatile memory. This allows audio level adjustments without requiring the operator to be at the location where the NXU-2B is installed. The NXU-2A had rear panel mechanical potentiometers for the adjustment of audio input and output levels. This upgrade prevents any need to travel to a remote radio site if audio level optimization is desired.
- The NXU-2B uses hardware relay contacts for PTT output while the NXU-2A had a solid-state (open drain transistor) keying output. There is a jumper selectable solid-state output available on the NXU-2B as well, but the default is to use the relay for PTT. The relay allows for higher keying voltages and currents than the solid-state output.

NOTE: If replacing an existing NXU-2A with an NXU-2B, be sure to remove the adapter at the rear panel AUDIO/CONTROL connector (assuming one is being used).

This adapter is not needed when using a JPS Radio Interface Cable with an NXU-2B.

1.8 NXU-2B Overview

JPS Interoperability Solutions has four decades of experience with voice communications interoperability, fielding their first devices in 1989. Over this time the company has encountered and resolved a wide array of problems that can hamper or complicate communications when disparate devices are patched together into interoperability nets.

The NXU-2B incorporates all this experience, in the form of:

- A suite of sophisticated DSP algorithms that operate at the unit’s analog and network interfaces. allowing optimized performance with connected communications devices.
- Custom radio interface cables, designed by the JPS Systems Engineering Department, for use with well over 300 different radio makes and models.

JPS interoperability devices are also known for simplicity and ease-of-use. The NXU-2B’s browser-based Graphical User Interface is designed to make these sophisticated capabilities easily accessible when necessary, but unobtrusive when not needed.

1.8.1 Important definitions:

COR: (Carrier Operated Relay) A signal that indicates when a radio (or other type of communications device, such as an NXU-2B) is receiving a valid audio signal.

PTT: (Push-to-Talk) A control signal that tells a radio (or other communications device) to transmit the audio signal being sent to it.

Full Duplex Communication System: Users can simultaneously talk to and listen (for example, a standard telephone call).

Simplex or Half Duplex Communication System: Only one system user can be heard at a time.

Interoperability Net: Communications link consisting of disparate devices (such as radios of different types or frequencies, telephones, VoIP phones, etc.) connected together, similar to a conference call.

These definitions are essential in understanding the basic operation of an interoperability device, such as a JPS ACU Gateway or this NXU-2B. That is: If multiple communications devices are engaged in an interoperability net, whenever one device detects active COR (valid audio input), that audio, along with a PTT signal, is sent to all other devices in the net to be retransmitted. Also, if any device in an interoperability net is half duplex (such as are almost all radio systems), then all communications must be half-duplex. The NXU-2B supports full and half-duplex modes.

Among the unit’s sophisticated features are various methods for determining active COR such as VOX (Voice Operated Switching) or VMR (Voice Modulation Recognition) which are optimal or necessary for some types of devices, and adjustable audio delays to meet the timing requirements of the connected communications systems and prevent lost syllables at the start or end of a transmission.

1.8.2 Configuration

The unit is configured via its web-based GUI. There are no physical potentiometers or switches related to the analog interface configuration. See the NXU-2B manual for instructions on configuration and adjustment.

1.8.3 Basic Applications and Operation

In many applications, the NXU-2Bs operate in pairs – one unit is configured as a server while the other unit is configured as a client. The client unit is programmed to connect to the IP address of the server unit. When the network connection between the units is established, a transparent connection is created between the audio inputs and outputs of each device, as well as the complements of each control signal. When the COR signal is active on one device, audio received on that device is transported over the network and reproduced at the audio output of the second device, and its PTT output is activated. Additionally, any RS-232 data received on one device is also sent over the network and is transmitted from the RS-232 port of the second device. This is the essence of the “Network Extension Unit” name – the devices act similarly to a long cable, if you think of the associated IP network as that cable.

The NXU-2B is useful for remote radio linking (see Figure 3 below), allowing a LAN, WAN, or the Internet to be used in place of expensive leased lines.

The NXU-2B is also compatible with the extensive JPS ACU family of radio interoperability gateways; all have the capability for RoIP channels/interfaces.

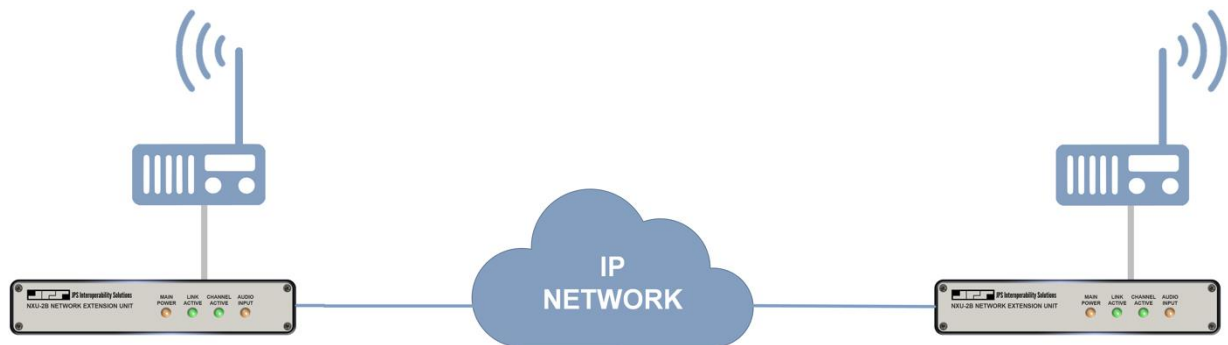


Figure 1-2 Two NXU-2Bs Enabling a Radio Repeater Function

A simple application of the NXU-2B. A pair of the devices are used to connect a pair of radio channels. Note that an Active COR (unquelched) condition on one of the radios causes its RX audio to be sent via its associated NXU-2B across the network to the other NXU-2B/radio pair. The NXU-2B on the other side of the network transforms the RX audio into TX audio, and the Active COR into Active PTT.

An RS-232 serial data stream can also be sent across the network.

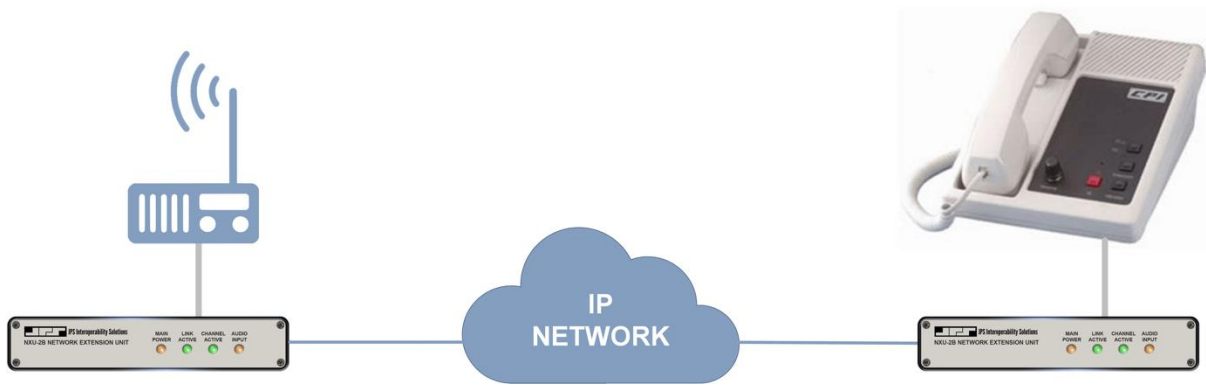


Figure 1-3 NXU-2B Pair Creates Remote Dispatch Capability Using an LE Device

A pair of NXU-2Bs connect an LE audio console device to a radio over the IP network. The basic function is similar to the radio-to-radio system, except that one radio is replaced by the LE device.

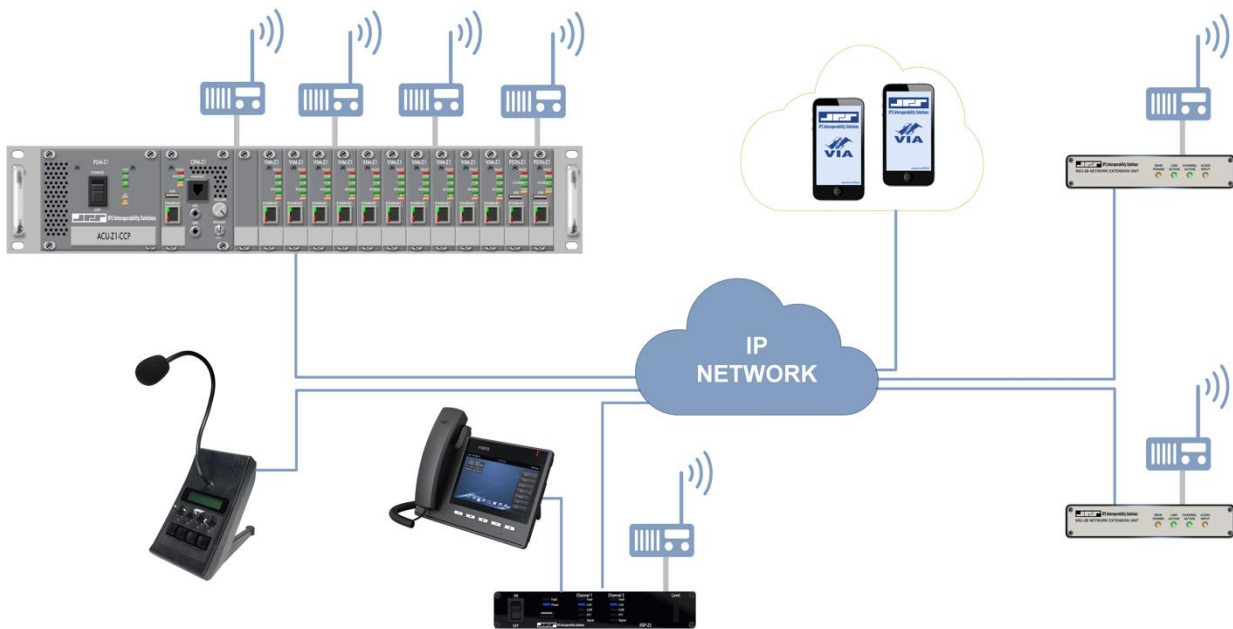


Figure 1-4 NXU-2Bs Connect Radio Channels to an ACU-Z1 Interop System

The new JPS “Z” product line of interoperability gateways also includes RoIP interfaces, and therefore the NXU-2B can be used to interface radios and other 2/4 wire devices to them. The ACU-Z1 modular gateway shown in the upper left can make up to 12 local connections using its plug-in modules. It also has the capacity to include a large number of virtual streaming channels, enabled by the NXU-2Bs at the right or the two-channel RSP-Z2 depicted in bottom center. Similarly, the new Z2 Controller (not shown) can handle a large number of virtual streaming channels. Contact JPS for more information or visit our website: www.jpsinterop.com

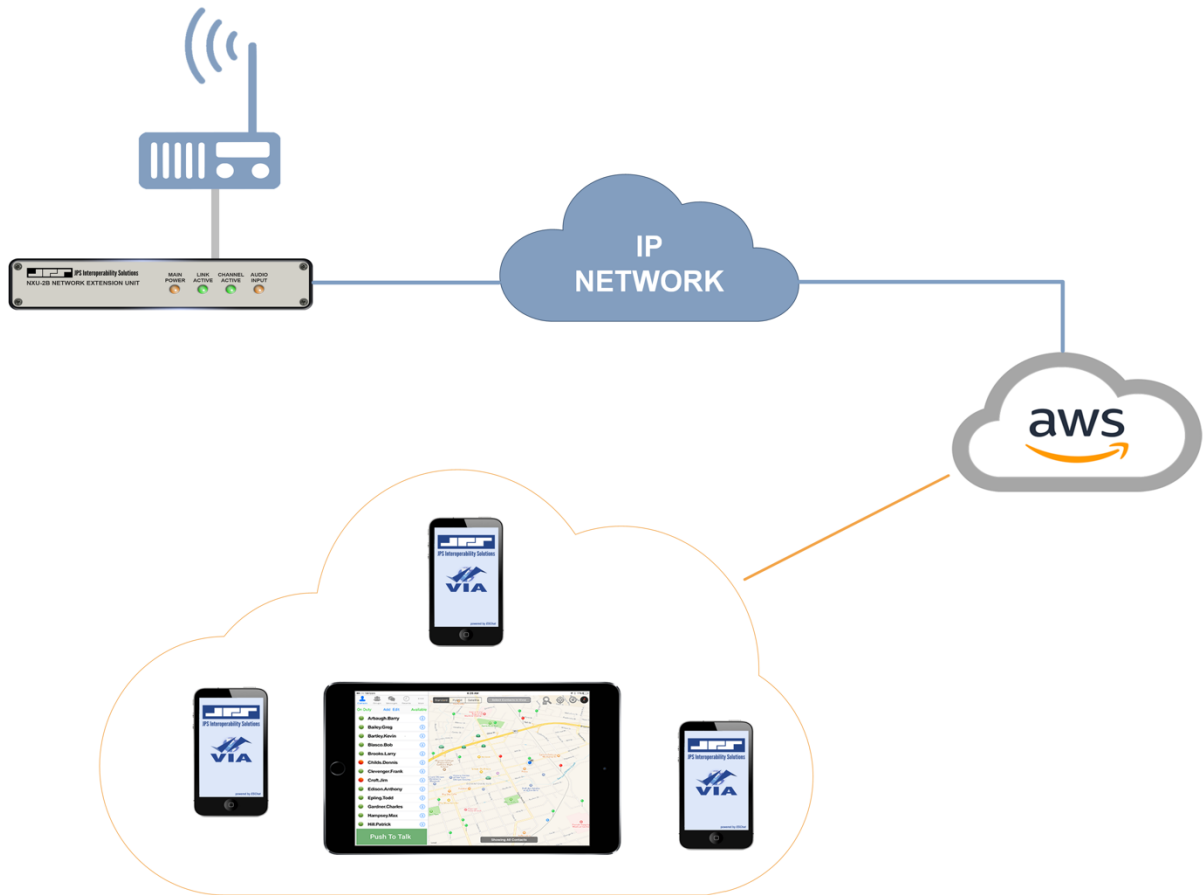


Figure 1-5 Single NXU-2B Connects a Radio Channel to a JPS VIA PTTToC Channel

Just as its predecessor the NXU-2A did, the NXU-2B can be used to connect a radio channel to a variety of Push-To-Talk over Cellular (PTToC) applications, including the JPS VIA app.



End of Section One

2 Installation

2.1 General

This section provides the instructions for unpacking, inspection, installation and set-up. Also included are directions for reshipment of damaged parts or equipment.

2.2 Unpacking and Inspection

After unpacking the unit, retain the carton and packing materials until the contents have been inspected and checked against the packing list. If there is a shortage or any evidence of damage, do not attempt to use the equipment. Contact the carrier and file a shipment damage claim. A full report of the damage should also be reported to the JPS Customer Service Department. The following information should be included in the report:

- Order Number
- Equipment Model and Serial Numbers
- Shipping Agency
- Date(s) of Shipment

The JPS Customer Service Department can be reached by phone at (919) 790-1011. Upon receipt of this information, JPS will arrange for repair or replacement of the equipment.

2.3 Reshipment of Equipment

If it is necessary to return the equipment to the manufacturer, a Returned Material Authorization (RMA) number must first be obtained from JPS, following the procedure outlined on the JPS website. This number must be noted on the outside of the packing carton and on all accompanying documents. When packing the unit for reshipment, it is best to use the original packaging for the unit; if this is not possible, make sure that adequate packing material is used to prevent excessive shocks during transport and handling.

Shipment should be made prepaid consigned to:

**JPS Interoperability Solutions
Customer Service Department
5800 Departure Drive
Raleigh, North Carolina 27616
USA**

Plainly, mark with indelible ink all mailing documents as follows:

GOODS RETURNED FOR REPAIR

Mark all sides of the package:

FRAGILE - ELECTRONIC EQUIPMENT

Inspect the package prior to shipment to be sure it is properly marked and securely wrapped.

2.4 Installation Overview

NOTE: NXU-2B installation requires knowledge of Ethernet network fundamentals as well as a basic understanding of Internet Protocol (IP). As with any network-connected device, improperly configuring and installing the NXU-2B could disrupt proper network operation. Please seek the assistance of your network administrator or other knowledgeable person if you are unsure about how your network is configured.

The following six steps are needed to properly install the NXU-2B:

1. Determine the IP address, subnet mask, and (if applicable) the gateway address for the unit. You may have to contact the network administrator for your organization to obtain this information.
2. Provide the proper primary power for the unit.
3. Interconnect the unit with the communications system via the NXU-2B's rear panel connectors. The rear panel Audio/Control jack provides the lines necessary to interface the NXU-2B to your audio equipment.
4. Configure the unit's operational parameters per Sections 3.2 through 3.5.
5. Connect the unit to your Ethernet network.
6. Optimize the input and output audio levels per Section 4.4.2.

The NXU-2B is then ready to use.

2.5 Installation Considerations

Careful attention to the following installation suggestions should result in the best unit/system performance. The unit is 1.36 inches tall, and 6.5 inches wide by 6.5 inches deep.

The NXU-2B must be installed in a structure that provides both protection from the weather and assurance of ambient temperatures between -20 and +60 degrees C. Since the unit is neither splash proof nor corrosion resistant, it must be protected from exposure to salt spray. When the unit is mounted in a cabinet with other heat-generating equipment, the use of a rack blower is suggested to keep the cabinet interior temperature rise to a minimum.

NOTE: If the NXU-2B is installed in a high RF environment such as repeater system or other transmitter site, it is recommended that all cable assemblies be individually shielded, with the shield grounded to the ground pin on the terminal block for that module. For all D-subminiature connector cable assemblies, cable shields should be connected to connector shells so that they make contact with the grounded D-subminiature connector shells on the NXU-2B.

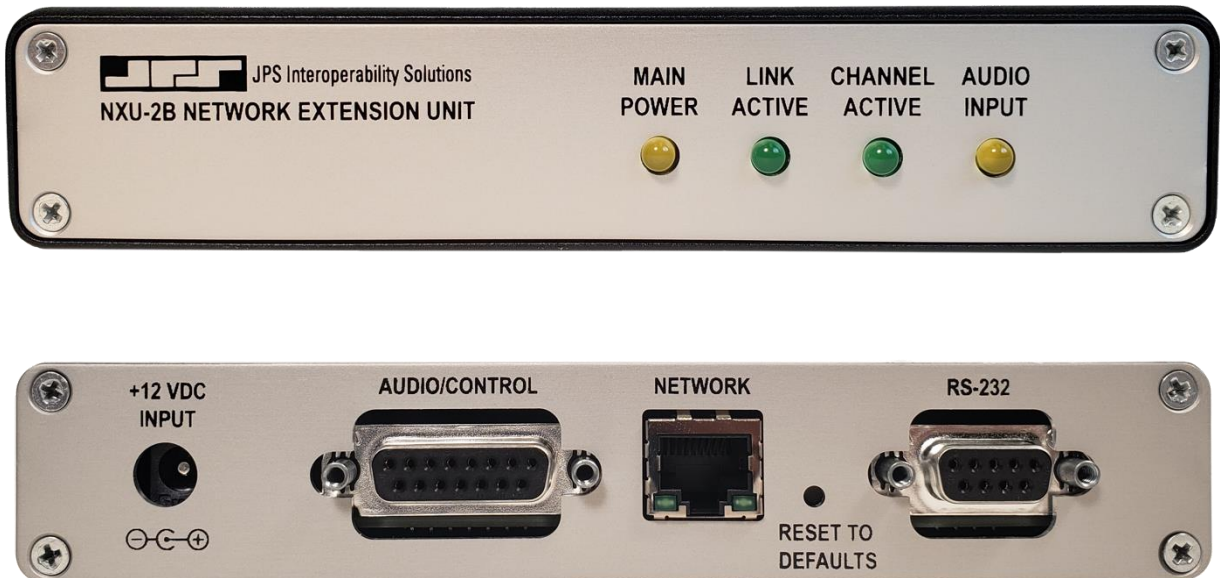


Figure 2-1 Front and Rear Views

2.5.1 Internal Jumper Configuration

The illustration below shows the NXU-2B internal PCB jumper locations. The only reason to open the unit is if the default settings are not optimal for your system. *For the majority of applications, the default jumper settings are sufficient and need not be changed.*

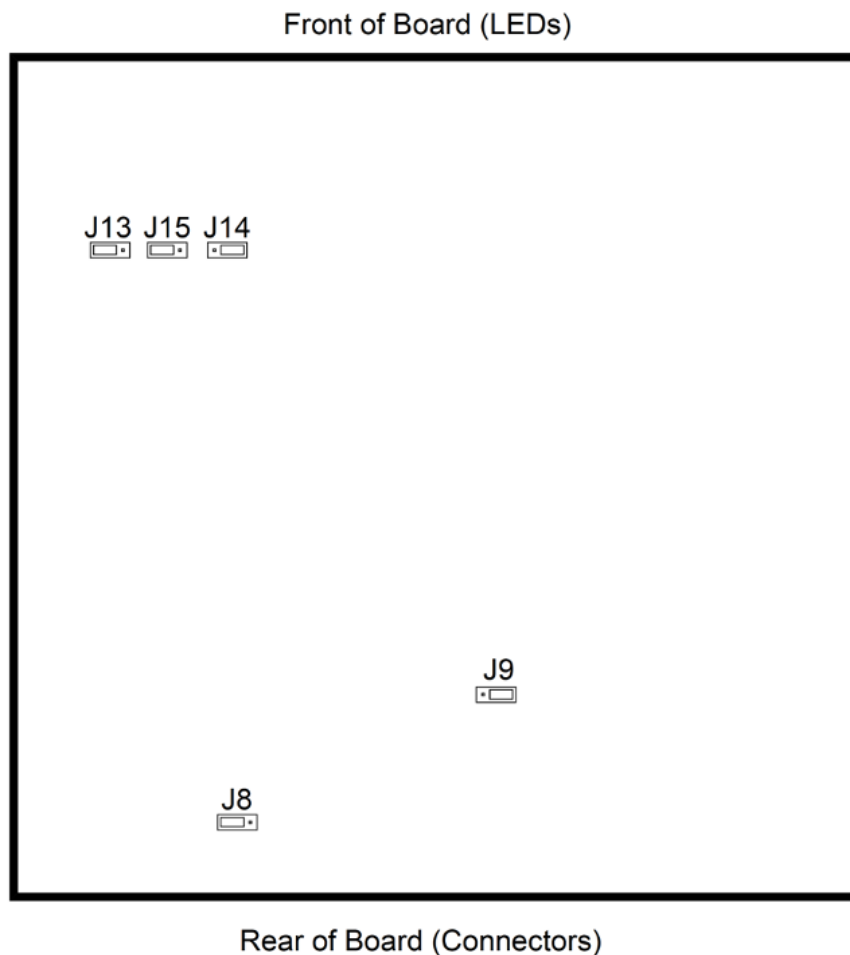


Figure 2-2 NXU-2B Internal Configuration Jumpers

| <i>Table 2-1 NXU-2B Jumper Settings [Default Settings in Bold Text]</i> | | |
|---|-----------------------|---------------------|
| Jumper and Function | Left 2 Pins | Right 2 Pins |
| J8: Audio In – Balanced/Unbalanced | Balanced | Unbalanced |
| J9: Audio In – Impedance | 600 Ohms | High Impedance |
| J13: E&M Return | Ground | AUXIN0 |
| J14: PTT Source | Transistor open drain | Relay Contact |
| J15: AUXIN0 Pin Function | AUXIN0 input | E&M Return |

2.5.2 E&M Return Selection

When the PTT source is set to use the internal relay, the user may select either an internal GROUND as the return or an external pin on the Audio/Control jack as the return. This is for E&M applications where some PTT reference other than ground may be desired. To select the internal GROUND reference place J13 (E&M Return) in the Ground position. When an alternative reference is desired place J13 in the AUXIN0 position and place J15 (AUXIN0 Pin Function) in the E&M Return position. The desired E&M return voltage may then be applied to the AUXIN0 pin on the Audio/Control jack.

2.6 Power Requirements

The NXU-2B is designed to operate from a nominal +12V DC supply. The unit will meet all of its specifications over a voltage range of +11 to +15 VDC and will be damaged by a DC source that delivers a constant (non-transient) DC voltage above this range. The DC power consumption is 500 mA maximum. The AC adapter provided with the unit meets these specifications.

The NXU-2B is a microprocessor-controlled device. As with any such equipment, a very short loss of power can cause operational problems and/or cause the unit to reset. The communications link will be inoperable during the reset period. JPS recommends the NXU-2B and associated equipment be connected to an AC power source that utilizes an uninterruptible power system (UPS). If the overall site does not have UPS capability, the NXU-2B should be plugged into a smaller UPS, such as those used for personal computer systems

2.7 Installation Checklist

| Table 2-2 Basic Installation Checklist | |
|---|---|
| Determine NXU-2B network parameters such as IP address, subnet mask, and gateway address. | You must assign these values. If you are not sure how to determine these values, see the network administrator for your organization. |
| Provide suitable power for the device. | See section 2.6 Power Requirements. |
| Configure NXU-2B parameters. | See Section 3 Configuration. |
| Adjust audio levels. | See Section 4.4.2. |

2.8 Rear Panel Connectors

Refer to Figure 2-1 for a view of the NXU-2B Rear Panel. All rear panel connectors are explained in the section that follows, starting at the left side of the panel.

2.8.1 DC Input Connector, (+12 VDC INPUT)

The NXU-2B operates on a nominal +12 VDC. The power is applied to the +12 VDC INPUT via the “Wall Cube” AC adapter provided with the unit.

2.8.2 Connection to Radio or Other Four-Wire Device (AUDIO/CONTROL)

The interface between the NXU-2B and associated radio or other audio device is made via the Audio/Control connector on the rear panel. This is a female DB-15 connector.

Note: On the NXU-2A, which the NXU-2B replaced, an *Audio Crossover Adapter* was included. This DB-15 male to DB-15 female adapter allowed the use of radio cables developed specifically for the JPS ACU-1000 Intelligent Interconnect system to be used with the NXU-2A. It provided a crossover of transmit and receive audio as well as COR and PTT control signals. *You do not need this adapter on the NXU-2B, as its audio port has been changed to match that of the ACU product family, and cables designed specifically for the ACU products will work on the NXU-2B.*

Table 2-3 NXU-2B Pinout (Audio/Control Port)

| PIN | Signal | Description |
|-----|--------------|---|
| 1 | Ground | Ground connection. |
| 2 | | Not used. |
| 3 | /AUX Out 0 | Auxiliary Output 0 - Active low. |
| 4 | /AUX In 0 | Auxiliary Input 0 - Active low. |
| 5 | Ground | Ground connection. |
| 6 | Audio Output | Balanced audio output A. |
| 7 | Ground | Ground connection. |
| 8 | Audio Input | Balanced audio input A. |
| 9 | | Not used. |
| 10 | /AUX Out 1 | Auxiliary Output 1 - Active low; general purpose. |
| 11 | /AUX In 1 | Auxiliary Input 1 - Active low; general purpose. |
| 12 | /PTT Output | Output to radio PTT, active low, relay contact to ground. |
| 13 | /COR Input | Input from radio COR, programmable active high/low. |
| 14 | Audio Output | Balanced audio output B. |
| 15 | Audio Input | Balanced audio input B. |

2.8.2.1 Audio Input

The NXU-2B audio input is 47K ohm, balanced. It can be used as an unbalanced input by grounding one half of the balanced pair and connecting the single-ended input to the remaining half. Balanced inputs and shielded cables are recommended for superior noise immunity.

The audio input will accept signal levels from -26 to $+10$ dBm. Internal circuitry is used to amplify or attenuate this input as necessary to optimize the level to the DSP. The signal level is adjusted by the “RX input level” pulldown in the web interface Configuration page. The input is set to 0 dBm when shipped. This means an audio input level of 0 dBm is expected and provides the correct level to the internal audio circuitry.

2.8.2.2 Audio Output

The audio output from the NXU-2B is a balanced 600-ohm output. The output level is adjusted by the “TX output level” pulldown in the web interface Configuration page. This output provides a 0 dBm nominal level into a 600-ohm load. The TX audio output will supply signal levels from -26 to $+4$ dBm.

2.8.2.3 COR Input

The COR input to the NXU-2B is a high impedance input and can be programmed to be active high or active low. In the active low configuration, the input is pulled up to $+5V$ DC internally through a 47K ohm resistor. In the active high configuration, the input is pulled down to ground through a 22K ohm resistor. The logic threshold is 2.5V DC nominal, and the input is protected from momentary surges up to $+100$ V DC.

2.8.2.4 AUX Inputs

The AUX inputs (AUX IN0 and AUX IN1) are high impedance inputs and are always active low. They are pulled up to $+5V$ DC internally through a 47K ohm resistor. The logic threshold is 2.5V DC nominal, and the input is protected from momentary surges up to $+100$ V DC.

2.8.2.5 PTT Output

The NXU-2B’s default PTT output is a “ground” through an E&M Relay. Additional options allow (See Section 2.5):

- That the E&M Relay Return be a pin on the Audio/Control connector.
- That an open drain transistor pulled low be used instead of the relay. This transistor can sink up to 100 mA of current and can withstand open-circuit voltages up to $+60V$ DC. In order to avoid conflicts with internal pull-up resistors on the PTT lines of some radio equipment, there is no internal pull-up resistor on the NXU-2B PTT output.

2.8.2.6 AUX Outputs

The AUX outputs from the NXU-2B (AUX OUT0 and AUX OUT1) are open drain types. They can sink up to 100 mA of current and can withstand open-circuit voltages up to $+60V$ DC. These lines are pulled up to $+5V$ DC through a 47K ohm resistor.

2.8.3 Network Connection

The NXU-2B is connected to the Ethernet network via rear panel RJ-45 connector using a standard Ethernet Patch Cable (one is included in the unit’s accessory kit).

2.8.4 Serial Port Connection, (RS-232)

The rear panel connector labeled RS-232 is a standard RS-232 DCE serial port. It is a female DB-9 connector, and can be interfaced to most PCs, typically standard DTE serial ports, using a DB-9 straight-through serial cable.

| <i>Table 2-4 J4 Serial Port Pinout</i> | |
|--|--------------------|
| J4 pin | Description |
| 2 | TX data |
| 3 | RX data |
| 5 | Ground |

2.8.4.1 Connecting Equipment and Computers to an NXU-2B

A straight-through RS-232 serial cable is used to connect the NXU-2B to a PC serial port. In order to connect the NXU-2B serial port to other serial devices you may need a DB-9 male-male null modem cable, also called a crossover cable.

RS-232 serial devices are divided into two types. Devices which provide control information are called DTE (Data Terminal Equipment) devices. Devices which accept control information are called DCE (Data Communication Equipment) devices. In the "old days" the DTE devices were terminals and computers, while the DCE devices were modems. The RS-232 standard specified that DTE devices would connect to DCE devices using a straight-through cable. If you wanted to connect two like devices (DTE to DTE or DCE to DCE) then you needed a null modem (crossover) cable. The PC is a DTE device, and the NXU-2B and ACU products are DCE devices.

That is why you need a crossover cable for connecting other DCE serial devices to an NXU-2B or an ACU gateway. The following drawing shows typical cable requirements for connecting different devices to an NXU-2B. See Figure 2-3 DTE Versus DCE Serial Cables.

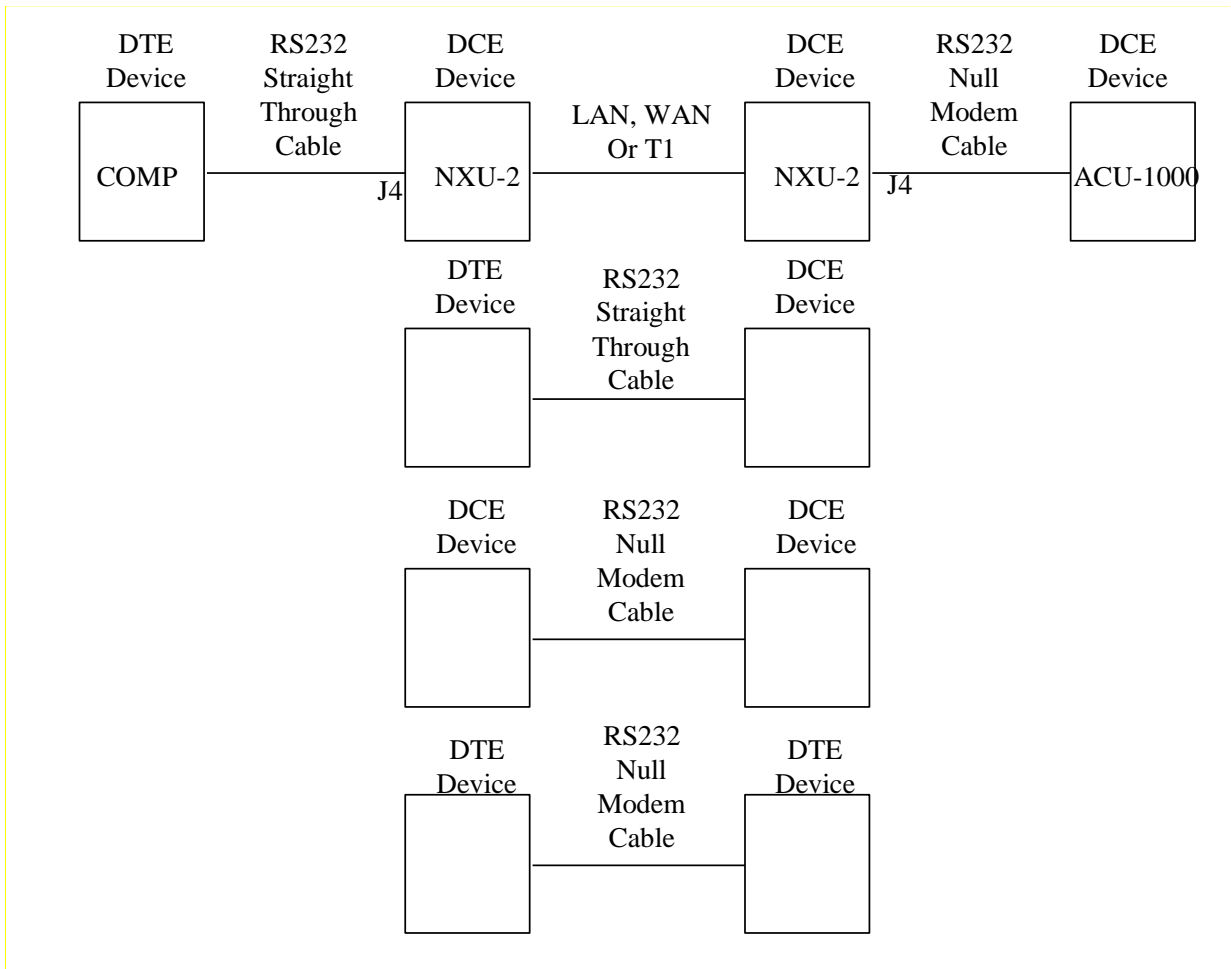


Figure 2-3 DTE Versus DCE Serial Cables



End of Section Two

3 Configuration

3.1 General

This section explains all settings and level adjustments that configure the NXU-2B. It is not necessary to remove the NXU-2B cover to configure the unit per this section.

3.2 Configuration Details

Configuring an NXU-2B or pair of NXU-2Bs requires that you allocate an IP address for each unit, and that you designate one unit as a Client and one unit as a Server (explained in subsequent paragraphs). Initial configuration can be accomplished by using a web browser (preferred) or by attaching a serial RS-232 terminal to the NXU-2B RS-232 port. Each method of configuration is discussed below. Detailed descriptions of each setting are in this chapter.

NOTE: *The NXU-2B comes from the factory configured as a Server with these default settings:*

IP Address: 192.168.1.200

Subnet Mask 255.255.255.0

Gateway IP 0.0.0.0

If the above network parameters are compatible with your network then you may attach the NXU-2B to your network and use your web browser to configure the NXU-2B as outlined in the sections that follow. Otherwise configure the computer's Ethernet port to a static IP address of 192.168.1.xxx (where xxx is a number between 2 and 199) and a subnet mask of 255.255.255.0. Then directly connect the NXU-2B to your computer via CAT-5 cable (need not be a cross-over cable, although a cross-over cable will work) and this will allow you to browse to the NXU-2B at its default IP address of 192.168.1.200.

NOTE: *To restore the factory default conditions, remove and reapply power to the unit while rear panel switch "Reset to Defaults" is depressed. When the front panel LEDs begin blinking, release the switch, and the unit will be operational using the JPS factory default parameters.*

Any previously assigned configuration changes will be lost during this process.

3.3 Configuration via Web Browser

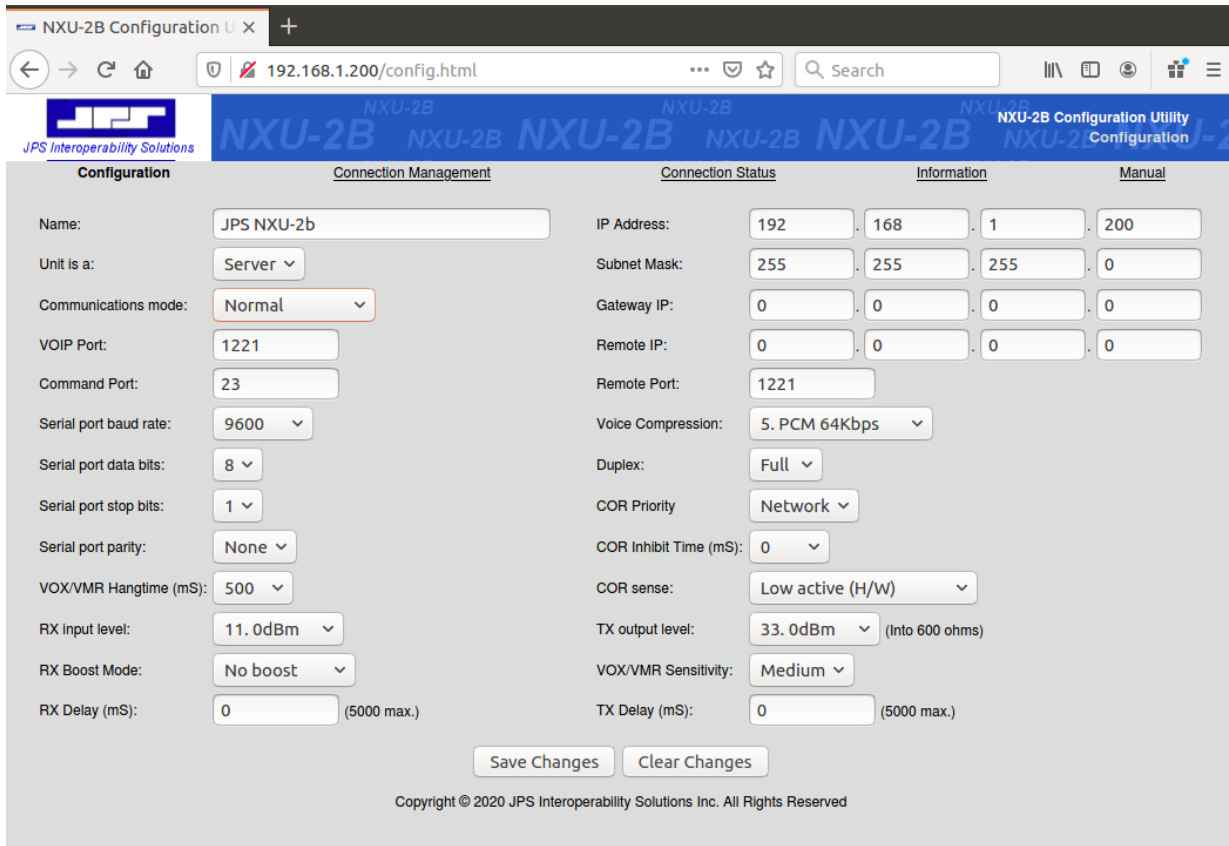


Figure 3-1 NXU-2B Configuration Page

The simplest way to configure the NXU-2B is to browse to the unit and click on **Configuration** to open the unit’s Configuration Page as shown above. Configuration parameters are set via dropdown menus, entering a number, or entering text to give the NXU-2B a specific name. No changes are enacted until the **Save Changes** button is pressed. Any changes not yet enacted can be reverted back to previous via the **Clear Changes** button.

The network-related settings are grouped mainly near the top of the Configuration Page. These will be discussed first, followed by the settings that configure the analog interface.

3.3.1 Name

This optional entry allows you to give a unique name to each NXU-2B in your system.

3.3.2 IP Address and Subnet Mask

Use these entry fields to set the desired IP Address and Subnet Mask to configure the NXU-2B for the network where it is going to be deployed.

NOTE: Be sure to write down the new IP Address so that you can remember where to access the unit on your network. Once you press Save Changes the unit will reconfigure itself.

If you have a DHCP server on your network, you may configure the NXU-2B to obtain its IP address, subnet mask, and gateway address via DHCP. Setting the NXU-2B IP address to 0.0.0.0 will cause it to attempt to contact a DHCP server on power-up.

NOTE: If DHCP is to be used, it should only be used on client NXU-2B units. The use of DHCP is not recommended for NXU-2B Server units since the IP address assigned by the DHCP server is not generally known and is subject to change.

3.3.3 Gateway IP Address

If you are using a gateway, set the gateway address (the address of your router). If on a LAN with no gateway, leave the gateway address set at the default address 0.0.0.0.

3.3.4 Unit is a (Client or Server)

Sets this NXU-2B to function either as a Client or as a Server. A Client is able to make or break connections with Servers; Servers can only accept connection requests from a Client.

3.3.5 Remote IP and Remote Port (*applicable only to Client units*)

If the NXU-2B is set as a Client, you must provide the IP address and Port of the server that it will attempt to connect to.

If you do not want the client unit to connect to a server automatically at power-up, set the Remote IP (server IP) address to 0.0.0.0

3.3.6 VoIP Port

The VoIP Port is the port used by the NXU-2B for receiving audio from the network, and defaults to 1221. Under normal circumstances, this should not be changed. The port number must range from 1 to 65535 and be different from the command port.

Note: The server port on a client unit corresponds to the VoIP port on the server unit that the client unit is going to connect to. Also, the client unit's VoIP port does not need to match the server unit's VoIP port (or client unit's server port) for the two units to communicate. The server unit will automatically determine where to send audio so the client unit receives it.

3.3.7 Command Port

The NXU-2B's Command Port is used for receiving commands via the telnet protocol or from a WAIS Controller. The value defaults to 23 and under normal circumstances should not need to be changed. The port number must range from 1 to 65535 and must not be the same as the VoIP port. Note: WAIS is an acronym for the JPS *Wide Area Interoperability System*.

3.3.8 Communications Mode

The NXU-2B has three communications modes: Normal, Connectionless, and Multicast.

The default mode is Normal; this consists of a TCP connection initiated by a client unit to a server unit for traffic to be exchanged between the two units' serial ports along with a unicast UDP channel for VoIP traffic. This is the standard mode and should be used for one-to-one unit operations.

Connectionless mode consists solely of a unicast UDP channel for VoIP traffic (along with the status bits such as PTT and COR) between the NXU-2B and another unit. No serial traffic is exchanged. This mode is reserved for special applications such as the JPS WAIS (Wide Area Interoperability System) and should not be used for day-to-day operation.

Multicast is a network routing technique that allows IP packets to be sent simultaneously from a single source to multiple destinations. Rather than sending the packet to each destination independently, the packet is sent to a multicast group identified by a single, specialized, Class D IP address. This is an IP address in the range of 224.0.0.0 to 239.255.255.255. Multicast mode on the NXU-2B consists of a multicast UDP channel for VoIP and status bit traffic. No serial traffic is exchanged. It can be used whenever more than two units wish to hear each other's audio.

To use a set of NXU-2Bs in Multicast mode, they must all be put into the same multicast group. To do this, first select a Class D IP address, port, and vocoder for use by the entire group.

Then configure each NXU-2B in the group so that:

- Its server IP address is the IP address of the multicast group
- Both its server port and VoIP port are the ports selected for the multicast group
- It's set to use the vocoder selected for the group.

Once these configuration steps are complete, packets sent by any unit in a multicast group will be received by all other units in that group.

NOTE: Please note that multicast operation is guaranteed to work only in LAN environments or private WANs where multicast-enabled routers are in use. Multicast mode will not work over the Internet because not all routers on the Internet are multicast-enabled.

3.3.9 Voice Compression

In order to send voice information over an IP network efficiently the NXU-2B uses digital signal processing algorithms to compress the voice information. Several different voice compression methods are available to support a variety of applications. For example, some compression methods work well with voice and provide a high amount of compression, but do not handle signaling tones very well. Other methods handle tones and voice but use more network bandwidth because they offer less compression. You may select the method from the following voice compression schemes that optimizes the trade-offs for your particular application:

1. GSM 13Kbps - Suitable for voice communications only. Should not be used if any tone signaling is required. Offers the greatest compression with reasonable voice quality.
2. ADPCM 16Kbps – Suitable for voice or tone signaling. Offers good voice compression, but the voice quality is lower than the other compression methods.
3. ADPCM 24Kbps – Suitable for voice or tone signaling. Offers less compression than ADPCM 16Kbps but the voice quality is higher.
4. ADPCM 32Kbps – Suitable for voice or tone signaling. Offers still less compression, but the voice quality is the best of the ADPCM compression types.
5. PCM 64Kbps – Suitable for voice or tone signaling. Offers the highest audio quality of all compression methods but provides the least compression. This is the default setting.

3.3.10 Serial Port Settings

Baud Rate options are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. The number of data bits may be set to either 7 or 8 using the DATA command, and the number of stop bits may be set to 1 or 2. The serial port parity options are odd, even, or none.

3.3.11 COR Sense (COR/VOX/VMR)

The NXU-2B has several methods to determine when to send audio data across the network. This is an important determination, because if the NXU-2B is connected to another NXU-2B/radio pair, that remote radio will be placed into TX mode and retransmit that audio.

There are several options for determining valid audio. Use of a COR signal direct from the radio (sometimes called *Hardware Cor*) is best, but this signal is not available on all radios; plus equipment other than radios may be used with the NXU-2B, so VOX and VMR options are provided. The Application Notes provided with JPS Radio Interface Cables may also specify what COR method must be used with that cable.

The options are:

- Hardware COR – Active Low. A control signal that goes low when valid audio is present. For a radio, this signal is low when the radio breaks squelch.
- Hardware Core – Active High. A control signal that goes high when valid audio is present. For a radio, this signal is high when the radio breaks squelch.

- VOX. Stands for “Voice Operated Xmit” – an NXU-2B algorithm detects the level of audio in the incoming signal and indicates “valid audio” when that level exceeds a threshold. That threshold can be modified by the VOX/VMR Sensitivity setting.
- VMR. Stands for “Voice Modulation Recognition” – an NXU-2B algorithm detects the level of human speech content in the incoming signal and indicates “valid audio” when that level exceeds a threshold. That threshold can be modified by the VOX/VMR Sensitivity setting. VMR is a good choice for noisy audio signals.

3.3.12 VOX/VMR Sensitivity

This setting applies only if COR Sense is set to either VOX or VMR. Options are Low, Medium, and High. A lower setting means that a smaller amount of audio (for VOX) or human speech content (for VMR) will be required for the incoming audio to be considered valid and transmitted over the IP network.

3.3.13 VOX/VMR Hangtime

This setting also applies only if COR Sense is set to either VOX or VMR. This is the amount of time the VOX or VMR remains active after the valid audio detection falls below the set threshold, and may be set to 500, 1000, 2000, 3000, or 4000 milliseconds. Hangtime prevents the valid audio determination from being inappropriately halted during short pauses in speech or between words.

3.3.14 RX Input Level

Use this setting to adjust the NXU-2B for proper operation with the amount of audio being applied.

Selecting a value for RX input level means that the NXU-2B expects that level as its nominal input. That is, if the NXU-2B RX Audio Input is set to 0, the unit expects, and operates best, with an input of 0dBm.

With normal audio input applied at the Audio/Control connector, the RX input level setting should be adjusted until the AUDIO INPUT indicator flashes on voice peaks (and only on the peaks).

3.3.15 RX Boost Mode

The receive input level may optionally be boosted by +20db in order to accommodate low level signal sources. Selections are “No Boost” and “Boost +20db”.

3.3.16 RX Delay

Additional delay may be provided to the receive audio path. As much as 5 seconds of delay may be introduced, specified in 1 mS increments. Upon editing the field with numeric data, the NXU-2B will round to the nearest 100mS interval. When additional delay is used, the received audio will be delayed before being sent to the network, relative to when the NXU-2B sends an “Active COR” valid audio signal, which is not delayed.

3.3.17 TX Output Level

The desired transmit output level in dBm. The unit will send any standard audio at the set level, assuming the receive audio level is set correctly on the remote unit that the NXU-2B is connected to.

3.3.18 TX Delay

Up to 5 seconds of delay may be introduced to the transmit audio path, in 1 mS increments. Upon editing the field with numeric data, the NXU-2B will round to the nearest 100mS interval. When additional delay is used, active PTT will be asserted prior to the delayed audio being presented. For example, this may delay the TX audio in LMR trunking systems to be delayed until after the “Channel Acquisition Time” and thereby preventing a loss of initial syllables.

3.3.19 Duplex

The NXU-2B allows full-duplex audio operation where audio can be received and transmitted at the same time. In some applications this is required or helpful, but in other applications this may not be desirable. For example, if the system echoes back the transmitted audio to provide sidetone monitoring the resulting audio will be slightly delayed. Listening to a delayed version of your own voice can be distracting, and in such cases it would be better to use half-duplex audio. Most radios are half-duplex.

3.3.20 COR Priority

The COR Priority determines whether the NXU-2B responds to valid audio from the network or from the associated radio, if valid audio is simultaneously presented at both interfaces.

3.3.21 COR Inhibit Time

In some applications it may be necessary to inhibit the NXU-2B’s response to the COR input (whether hardwired COR or VOX) for a brief period of time (and under certain circumstances) in order to avoid problems with the “ping pong” effect.

The “ping-pong” effect can occur when the COR output of a device is inappropriately and momentarily activated by the device when it switches out of the transmit mode. There are varieties of reasons why this can happen (including squelch tails on some radios), and it may occur with COR or VOX, but the result is the same.

To illustrate the problem, assume that there are two radios connected over a network by a pair of NXU-2Bs. An active COR at one end of the network creates an active PTT at the other end. When the COR of Radio 1 is active, Radio 2 is transmitting, and vice versa. Consider what can happen when the cessation of the TX mode causes a momentary active COR output:

Radio 1 COR becomes deactivated, so the Radio 2 switches out of the TX mode and activates its COR output momentarily. This momentary Radio 2 active COR signal causes Radio 1 to switch momentarily to TX mode, and when it quickly drops back out of the TX mode its own COR output is momentarily activated. This will once again put Radio 2 in the TX mode, causing an endlessly repeated cycle where the radios “ping-pong” back and forth and in and out the TX mode.

The COR Inhibit feature prevents this problem by ignoring any active COR input that occurs just after the NXU's TX output command is de-activated. The unit ignores the COR input (whether hardwired or VOX) only in the specified interval immediately following the inactivation of its PTT output. The COR inhibit time should be set as long as required to prevent the "ping-pong effect", but no longer, or the beginning of a valid audio signal being transferred might be lost.

3.3.22 NXU-2B Dispatch Option

This setting allows the optional WAIS Dispatch capability to be enabled. This is an extra cost option. Upon purchase, JPS will provide an authentication code which will enable the option when entered. The code will work only for the MAC address it was created for. Clicking on Enable will show the unit's MAC Address. Contact JPS for more information.

3.4 Configuration via Serial Port

The serial port may be used for configuration if it is not practical to configure the NXU-2B via a web browser, or you are more accustomed to using this method.

Connect a standard serial cable from a suitable COM port on your PC to the RS-232 connector on the NXU-2B rear panel. A standard DB-9 straight-through cable (which should work on most PCs) is included with the NXU-2B. The NXU-2B comes pre-configured with the serial port set at 9600 baud, 8 data bits, no parity, and 1 stop bit. No hardware flow control is used or needed. In order to configure the NXU-2B you will need to know which COM port you are connected to on your PC.

3.4.1 Configuration Using an RS-232 Terminal Program

If you are configuring via Serial Port, you will need a terminal program to communicate with the NXU-2B. Any suitable Windows terminal program such as PuTTY, Tera Term, or Windows Terminal may be used.

With the serial cable connected and the PC running a terminal program set to the above parameters, apply power to the NXU-2B. Wait at least 10 seconds after power up of the NXU-2B and type +++ (three plus signs) on your keyboard. You must type all 3 '+' characters within 1 second. Do not type anything else, only the 3 '+' characters. The NXU-2B should respond with 'OK'. At this point, you are in *Command Mode*, and you will be able to issue configuration commands to the NXU-2B.

NOTE: If you type the three plus signs into your terminal program and they appear on the screen, the NXU-2B is already in the COMMAND Mode.

3.4.2 Configuration Mode Command Set

Type HELP and press the ENTER key. The NXU-2B should respond with:

NXU-2B Commands:

| | | | |
|----------|---------|----------|---------|
| BAUD | BCAST | CMDPORT | CONMODE |
| CONN | COR | CORINH | DATA |
| DISC | DUPLEX | ECHO | GATEIP |
| HANGTM | HELP | MAC | MYIP |
| NAME | PARITY | PASS | PORT |
| REBOOT | SAVE | SECURITY | SRVRIP |
| SRVRPORT | STAT | STOP | SUBNET |
| TRAN | VER | VOCODER | WHAT |
| BOOST | RXDELAY | TXDELAY | RXLEVEL |
| TXLEVEL | VSENSE | | |

Type HELP followed by a command to get help on that command.

Save changes with the SAVE command.

NOTE: If you decide that you don't want to make any changes to the NXU-2B settings then you should place the NXU-2B back into the TRANSPARENT Mode. The TRAN command should be used to do this, placing the unit back into the data mode.

3.4.3 Command Summary

This is a full list of the commands available in the NXU-2B command mode. More detail is given on the following pages. You can get a one-line summary of each command by typing HELP followed by the command.

BAUD <rate> - Set the serial port baud rate

BCAST <mode> - Sets the broadcast mode (0) Normal (1) Connectionless (2) Multicast

CMDPORT <port number> - Set the port used to receive telnet and WAIS commands

CONMODE <0/1> - Places unit in CLIENT (0) or Server (1) mode

CONN <IP address> - Connect this client to a server at IP address

COR <0/1/2/3> - Sets COR active low (0), high (1), VOX (2), or VMR (3)

CORINH <time> - Set COR inhibit time to 0, 500, 1000, 2000, 3000, or 4000 ms

DATA <7/8> - Set the serial port data bits

DISC - Break this client's current connection

DUPLEX <0/1> - Select either full duplex (0) or half duplex (1) for audio

ECHO <ON/OFF> - Enables/disables character echo to console

- GATEIP <ip address> - Set gateway IP address for this unit
- HANGTM <time> - Set VOX hang time to 500, 1000, 2000, 3000, or 4000 ms
- MAC - Return the Ethernet MAC address of this unit
- MYIP <ip address> - Set the IP address of this unit
- NAME <text description> - Give this unit a name
- PARITY <O/E/N> - Set the serial port parity to Odd, Even, or None
- PASS <password> - Assign a password for web access
- PORT <port number> - Set the IP port used by this unit
- REBOOT - Restart this unit
- SAVE - Save NXU-2B settings to FLASH memory and restart
- SECURITY <security level> - Set the security level (0-255)
- SRVRIP <ip address> - Set the IP address of the NXU-2B server
- SRVRPORT <port number> - Set the port where to send VOIP traffic
- STAT - Return this client's current connection status
- STOP <1/2> - Set the serial port stop bits
- SUBNET <ip address> - Set IP subnet mask for this unit
- TRAN - Place this unit's serial port in transparent mode
- VER - Print the software version information for this unit
- VOCODER <number> - Select the voice compression method (1-5)
- WHAT - Print a description of this unit's settings
- BOOST <0/1> - Select either no boost (0) or +20 dB boost (1) on audio input
- RXDELAY <0-9999> - Set the received audio delay in milliseconds
- TXDELAY <0-9999> - Set the transmitted audio delay in milliseconds
- RXLEVEL <1-37> - Sets expected audio RX level (1-37) as follows:
1 (+10dBm) to 37 (-26dBm) in 1 dBm steps. 11 = 0dBm.
- TXLEVEL <number> - Sets desired audio RX level (1-37) as follows:
1 (-26dBm) to 37 (+10dBm) in 1 dBm steps. 27 = 0dBm.
- VSENSE <0/1/2> - set the VOX/VMR sensitivity to low (0), medium (1), or high (2)

3.4.4 Setting Unit IP Address

The first thing you should do is to set the IP address of the unit. The NXU-2B comes from the factory with a default IP address set to 192.168.1.200. Set the address by typing:

```
MYIP <IP address>
```

Where <IP address> is the IP address of the unit in dotted quad notation. All configuration commands are entered by a carriage return. In this example, if your desired IP address is 192.168.1.1 you would type MYIP 192.168.1.1 and press ENTER

3.4.5 Setting Unit Subnet Mask and Gateway Address

Now set your subnet mask using the SUBNET command. If you are using a gateway, set the gateway address (the address of your router) using the GATEIP command. If on a LAN with no gateway, leave the gateway address set at the default address 0.0.0.0.

3.4.6 Using DHCP to Assign IP Parameters

If you have a DHCP server on your network, you may configure the NXU-2B to obtain its IP address, subnet mask, and gateway address via DHCP. Setting the NXU-2B IP address to 0.0.0.0 will cause it to attempt to contact a DHCP server on power-up. NOTE: Using DHCP is not recommended for NXU-2B Server units since the IP address assigned by the DHCP server is not generally known and is subject to change. If DHCP is to be used, it should only be used on client NXU-2B units.

3.4.7 Setting VoIP Port (Optional)

The port used by the NXU-2B for receiving audio from the network which defaults to 1221. Under normal circumstances, this should not be changed. The default value may be changed, if necessary, by using the PORT command. Type PORT <port number> and press ENTER to select a new VoIP port. The port number must range from 1 to 65535 and be different from the command port.

3.4.8 Client/Server Selection

Whether the unit will be a client (a unit which can make and break connections) or a server (a unit which only accepts connections from a client) will need to be decided. This selection is made with the CONMODE command. CONMODE 0 configures the unit as a client, while CONMODE 1 configures the unit as a server. For a client unit, you also need to set the IP address and port of the corresponding server with the SRVRIP and SRVRPORT commands. For example, if a client unit is going to be connected to a server NXU-2B at address 192.168.1.10 and port 1221, then the commands must be issued:

```
SRVRIP 192.168.1.10
```

```
SRVRPORT 1221
```

On the client unit, if you do not want the client unit to connect to a server automatically at power-up then set the server IP address to 0.0.0.0 by typing SRVRIP 0.0.0.0.

Note: The server port on a client unit corresponds to the VoIP port on the server unit that the client unit is going to connect to. Also, the client unit's VoIP port does not need to match the server unit's VoIP port (or client unit's server port) for the two units to communicate. The server unit will automatically determine where to send audio so the client unit will receive it.

3.4.9 Serial Port Settings

The serial port baud rate may be set using the BAUD command. Valid baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. The number of data bits may be programmed to 7 or 8 using the DATA command, while the number of stop bits may be programmed to 1 or 2 using the STOP command. The serial port parity may be programmed to odd, even, or none by typing the PARITY command followed by O, E, or N.

3.4.10 COR and VOX Settings

The NXU-2B uses the COR (Carrier Operated Relay) or equivalent signal from your radio to determine when to send audio data across the network. When the COR input is active, audio is transferred to the other side of the network. The COR command allows you to select the polarity of the COR input. If a COR output signal is not available, you may select VOX (Voice Operated Switching). VOX operation uses the detection of an audio signal from your radio or other audio device to control the flow of audio from the NXU-2B.

Select the polarity of the COR input by using the COR command. **COR 0** selects active low COR, while **COR 1** selects active high COR sense. **COR 2** selects VOX mode. In VOX mode, no connection to the NXU-2B COR input is required, since the audio input level itself is used to determine when a signal is present. **COR 3** selects VMR (Voice Modulation Recognition) mode. In VMR mode the unit must detect speech content before a signal is determined to be present. In order to conserve network bandwidth, digital audio packets are only sent when COR is active. If using the NXU-2B in an application where the connected equipment does not support the COR line, then the COR line must either be tied to its active state (in which case audio will be sent across the network continuously) or you must select VOX or VMR mode. ***In any case, the COR, VOX, or VMR mode must be set properly since the NXU-2B uses this setting to determine when to send audio data across the network.***

3.4.11 Duplex Setting

The NXU-2B allows full-duplex audio operation. Audio can be received and transmitted at the same time. In some applications this is required, but in other applications this may not be desirable. For example, if the system echoes back the transmitted audio to provide sidetone monitoring the resulting audio will be slightly delayed. Listening to a delayed version of your own voice can be distracting, and in such cases, it would be better to use half-duplex audio. Use the DUPLEX command to set full- or half-duplex. **DUPLEX 0** selects full-duplex operation (the default) while **DUPLEX 1** selects half-duplex.

3.4.12 VOX Hang Time

When VOX mode is enabled, you may also adjust the VOX hang time. This is the amount of time the VOX remains active after the input signal falls below the VOX threshold, and may be set to 500, 1000, 2000, 3000, or 4000 milliseconds. This is useful to prevent the VOX from dropping out between words or syllables. Use the HANGTM command followed by 500, 1000, 2000, 3000, or 4000 to select the hang time. The factory default is 500 milliseconds.

3.4.13 COR Inhibit Time

In some applications it may be necessary to inhibit the NXU-2B's response to the COR input (whether hardwired COR or VOX) for a brief period of time (and under certain circumstances) in order to avoid problems with the “ping pong” effect.

The “ping-pong” effect can occur when the COR output of a device is activated momentarily by the device when it switches out of the TX mode. There are varieties of reasons why this can happen (including squelch tails on some radios), and it may occur with COR or VOX, but the result is the same.

To illustrate the problem, assume that there are two radios connected over a network by a pair of NXU-2Bs. An active COR at one end of the network creates an active PTT at the other end. When the COR of Radio 1 is active, Radio 2 is transmitting, and vice versa. Consider what can happen when the switch out of the TX mode causes a momentary active COR output:

Radio 1 COR becomes deactivated, so the Radio 2 switches out of the TX mode and activates its COR output momentarily. This momentary Radio 2 active COR signal causes Radio 1 to switch momentarily to TX mode, and when it quickly drops back out of the TX mode its own COR output is momentarily activated. This will once again put Radio 2 in the TX mode, causing an endlessly repeated cycle where the radios “ping-pong” back and forth and in and out the TX mode.

The COR Inhibit feature prevents this problem by ignoring any active COR input that occurs just after the NXU's TX output command is de-activated. The unit ignores the COR input (whether hardwired or VOX) only in the specified interval immediately following the inactivation of its PTT output. Use the CORINH command followed by 500, 1000, 2000, 3000, or 4000 to select the COR inhibit time in milliseconds. Type CORINH 0 to disable the COR inhibit feature. The COR inhibit time should be set as long as required to prevent the “ping-pong effect”, but no longer, or the beginning of a valid audio signal being transferred might be lost.

3.4.14 Voice Compression Settings

In order to send voice information over an IP network efficiently the NXU-2B uses digital signal processing algorithms to compress the voice information so that it requires less network bandwidth. The NXU-2B offers several different voice compression methods to support a variety of applications. For example, some compression methods work well with voice and provide a high amount of compression, but do not handle signaling tones very well. Other methods handle tones and voice but use more network bandwidth because they offer less compression. You may select the method from the following voice compression schemes that optimizes the trade-offs for your particular application:

- 1. GSM 13Kbps** - Suitable for voice communications only. Should not be used if any tone signaling is required. Offers the greatest compression with reasonable voice quality.
- 2. ADPCM 16Kbps** – Suitable for voice or tone signaling. Offers good voice compression, but the voice quality is lower than the other compression methods.
- 3. ADPCM 24Kbps** – Suitable for voice or tone signaling. Offers less compression than ADPCM 16Kbps but the voice quality is higher.
- 4. ADPCM 32Kbps** – Suitable for voice or tone signaling. Offers still less compression, but the voice quality is the best of the ADPCM compression types.
- 5. PCM 64Kbps** – Suitable for voice or tone signaling. Offers the highest audio quality of all compression methods but provides the least compression. This is the default setting.

You may select a compression method with the VOCODER command followed by the number of the compression method (1-5). For most applications you may leave this at the default setting.

3.4.15 Security Settings

The NXU-2B may be configured, monitored, and controlled remotely via its network interface using a web browser or a telnet client. In some instances, it may be desirable to limit access via one or both of these methods, or to selectively limit the things that may be done remotely. The SECURITY command allows various levels of security to be set in order to limit remote access. Additionally, a password may be assigned to limit access via a web browser. Refer to the chapter on Security for detailed information on setting the NXU-2B security parameters.

3.4.16 Ethernet MAC Address

The Ethernet MAC address of the NXU-2B may be read using the MAC command. When MAC is typed the 48-bit Ethernet MAC address will be printed as a sequence of two-digit hexadecimal numbers separated by dashes. No two NXU-2B units have the same MAC address, so this may be used as an electronic serial number if desired. It cannot be changed by the user.

3.4.17 Command Port

The port used by the NXU-2B for receiving commands via the telnet protocol or from a WAIS Controller. The value defaults to 23 and under normal circumstances should not need to be changed. If necessary, the command port may be changed by using the CMDPORT command. Type CMDPORT <port number> and press ENTER. The port number must range from 1 to 65535 and must be different than the VoIP port.

3.4.18 RX Input Level

The expected RX input level in dBm.

3.4.19 TX Output Level

The desired TX output level in dBm. Assumes the RX level is set correctly on the remote unit.

3.4.20 Input Level Boost +20db

The receive input level may optionally be boosted by +20db in order to accommodate low level signal sources. Provisioning via the web interface allows selecting either “No Boost” or, “Boost +20db” in the ‘RX Boost Mode’ field.

3.4.21 TX Delay

Additional delay may be provided to the transmit audio path. Via the web interface ‘TX Delay (mS)’ field, the user may introduce up to 5 seconds of delay, in specified in 1 mS increments. Upon editing the field with numeric data, the NXU-2B will round to the nearest 100mS interval. When additional delay is used, the PTT\ signal will be asserted prior to the delayed audio being presented, allowing LMR trunking systems to be accessed without audio loss.

3.4.22 RX Delay

Additional delay may be provided to the receive audio path. Via the web interface ‘RX Delay (mS)’ field, the user may introduce from 0 to 5 seconds of delay, specified in 1 mS increments. Upon editing the field with numeric data, the NXU-2B will round to the nearest 100mS interval. When additional delay is used, the received audio will be delayed before being sent to the network.

3.4.23 VMR

Voice Modulation Recognition has been added to allow interfacing with radios which do not provide a separate COR signal. VMR provides a more robust method of ‘COR Sensing’ than VOX alone. VMR mode may be selected via the web interface ‘COR Sense’ field pulldown menu. When VMR mode is chosen, the hardware COR signal is ignored, and audio content with the appropriate speech characteristics is allowed to simulate the COR signal.

3.4.24 VOX and VMR Sensitivity Adjustments

When either VOX or VMR COR sensing is selected, three levels of sensitivity adjustments are provided to allow greater flexibility. Via the web interface, “Low” sensitivity requires more signal content to recognize and simulate COR activity. “High” sensitivity requires less signal content to recognize and simulate COR activity. The default sensitivity is “Medium”.

3.4.25 Restoring Factory Defaults

The NXU-2B allows the user to restore the original factory default operating conditions. This may be useful if the unit has been incorrectly configured, and it is necessary to return to a well-defined state. To restore the factory default conditions, the power to the unit needs to be removed and restored while rear panel switch “RESET TO DEFAULTS” is depressed. When the front panel LEDs begin blinking, the switch may be released, and the unit will be operational using the JPS factory default parameters. The IP address will return to “**192.168.1.200**”, which will allow web configuration. All other previously assigned user parameters will be lost during this process.

3.5 Communications Mode

The NXU-2B has three communications modes: Normal, Connectionless, and Multicast.

The default mode is Normal; this consists of a TCP connection initiated by a client unit to a server unit for traffic to be exchanged between the two units' serial ports along with a unicast UDP channel for VoIP traffic. This is the standard mode and should be used for one-to-one unit operations.

Connectionless mode consists solely of a unicast UDP channel for VoIP traffic (along with the status bits such as PTT and COR) between the NXU-2B and another unit. No serial traffic is exchanged. This mode is reserved for special applications such as the JPS WAIS (Wide Area Interoperability System) and should not be used for day-to-day operation.

Multicast is a network routing technique that allows IP packets to be sent simultaneously from a single source to multiple destinations. Rather than sending the packet to each destination independently, the packet is sent to a multicast group identified by a single, specialized, Class D IP address. This is an IP address in the range of 224.0.0.0 to 239.255.255.255. Multicast mode on the NXU-2B consists of a multicast UDP channel for VoIP and status bit traffic. No serial traffic is exchanged. It can be used whenever more than two units wish to hear each other's audio.

The NXU-2B communications mode can be set using the BCAST command or Communications Mode pulldown menu from the web page. BCAST 0 sets the unit to Normal mode, BCAST 1 sets the unit to Connectionless mode, and BCAST 2 sets the unit to Multicast mode. Once again, Connectionless mode is reserved for special applications and should not be used for day-to-day operation. Its use outside the advisement of JPS Interoperability Solutions is not supported.

To use a set of NXU-2Bs in Multicast mode, they must all be put into the same multicast group. To do this, first select a Class D IP address, port, and vocoder for use by the entire group.

Then configure each NXU-2B in the group so that:

- Its server IP address is the IP address of the multicast group.
- Both its server port and VoIP port are the ports selected for the multicast group.
- It's set to use the vocoder selected for the group.

Once these configuration steps are complete, packets sent by any unit in a multicast group will be received by all other units in that group.

NOTE: Please note that multicast operation is guaranteed to work only in LAN environments or private WANs where multicast-enabled routers are in use. Multicast mode will not work over the Internet because not all routers on the Internet are multicast-enabled.

3.5.1 Store Setup Changes with SAVE Command

After any configuration changes have been made, SAVE must be typed in order to store the new settings in memory. The NXU-2B will automatically restart after changes have been saved. If you do not make any changes and want to return the serial port to the data mode, type TRAN to place the serial port in transparent mode.

End of Section Three

4 Operation

4.1 General

This Section contains information and instructions required for proper operation of the NXU-2B. Refer to Figure 2-1 Front and Rear Views for locations of LEDs.

4.2 Front Panel Indicators

All front panel indicator LEDs are explained below, starting at the left side of the unit.

4.2.1 Power LED

This yellow LED is lit whenever DC power is applied to the unit.

4.2.2 Link Active LED

The green Link Active LED is illuminated whenever the NXU-2B has an IP connection open to another NXU-2B on the network. If this indicator is not lit, either the NXU-2B does not have an active VoIP connection or the connection has been lost.

4.2.3 Channel Active LED

This green LED is lit whenever COR is active. This also indicates that the NXU-2B is sending audio data across the IP link.

4.2.4 Audio Input LED

This yellow LED is provided as a visual aid in setting the proper input audio level for optimal operation. See the next page for instructions for setting the proper level.

4.3 Rear Panel Connectors

Section 2 contains full explanations and pinouts for all rear panel connectors. Figure 2-1 displays connector locations.

4.4 NXU-2B Operation

Basic operation and control of the NXU-2B is discussed in the following paragraphs. These instructions assume the NXU-2B has already been correctly configured per Section 3 Configuration.

4.4.1 Operation at Power-Up

When the units have been connected and configured and are attached to the network the client will automatically connect to the server when power is applied.

NOTE: If no default server has been specified for the client to contact (using the SRVRIP command; see Section 3.4.8, Client/Server Selection), the client unit will wait until a manual connection is requested, either via serial or telnet commands or via the web interface. If the client is able to connect to the server, the LINK ACTIVE indicator will light indicating the connection.

4.4.2 Input/Output Audio Level Adjustments

At this point, the audio input level to the NXU-2B may be set by adjusting the “RX input level” in the web browser Configuration page. With normal audio input applied at the Audio/Control connector, adjust the RX input level browser setting until the AUDIO INPUT indicator flashes on voice peaks. The “TX output level” browser control sets the audio output level from the NXU-2B and may be adjusted to the level suitable for the equipment connected to the unit. Don’t forget to save your changes when you are content with the audio levels.

Selecting a value for RX input level means that the NXU-2B expects that level as its nominal input. That is, if the NXU-2B RX Audio Input is set to 0, the unit expects, and operates best, with an input of 0dBm. Likewise, selecting a value for the TX output level means that the NXU-2B will produce that level as its nominal output level, assuming that the remote NXU-2B (or other linked RoIP device) has its audio input configured correctly.

4.4.3 COR Input Description

The COR input on Audio/Control controls the flow of data across the network. When COR is not active the units will send a keep-alive packet every 4 seconds just to keep the connection from timing out. If a unit has an active COR input, that unit’s audio input will be transferred across the network and will appear at the audio output on the Audio/Control connector at the other unit. While the COR input of an NXU-2B is active, the PTT output will remain active on another NXU-2B it’s connected to. The audio channels are independent, and full duplex operation is possible. If the radio or other audio equipment does not have a COR output, it’s possible to tie the NXU-2B COR input line to the active state so that data will be transmitted continuously. Alternatively, VOX or VMR mode may be selected.

4.4.4 RS-232 Serial Data

RS-232 data is sent across the network connection to the RS-232 connector on the unit at the other end of the link. Any data input to the RX DATA line on one end will appear at the TX DATA line on the other end. The serial port data may be sent even while audio is being transmitted as the two functions are independent. Audio and RS-232 data are multiplexed over the same IP connection.

NOTE: If data is to be transferred across the IP link, the NXU-2B serial port must not be in the Command Mode (see Section 3.4.1). Be sure to return the unit to the Transparent Mode (by issuing a TRAN command) if you have placed the unit in Command Mode.

4.4.5 Auxiliary I/O

The NXU-2B has two sets of independent inputs and outputs that may be used for control of the user’s equipment. AUX IN 0 and AUX IN 1 are active-low inputs which, when activated on one end, will cause AUX OUT 0 and AUX OUT 1 on the other end to become active. The AUX OUT lines are open drain devices, and each is capable of sinking 100 mA. *Note: These auxiliary I/O lines are designed for switching and control applications, and do not have quick enough response times to send or receive data.*

4.5 Controlling Connections

Normally the NXU-2B client automatically connects to the preprogrammed NXU-2B server when power is applied. The user may also manually control the connection state of the NXU-2B client. This can be done via the serial port (by entering command mode as described in Section 3.4.1) or via the network using Telnet or a Web Browser.

4.5.1 Web Browser Control

The NXU-2B client connection may be managed by browsing to the NXU-2B client IP address and selecting the Connection Management menu option. The user may then issue connect or disconnect commands via the web browser.

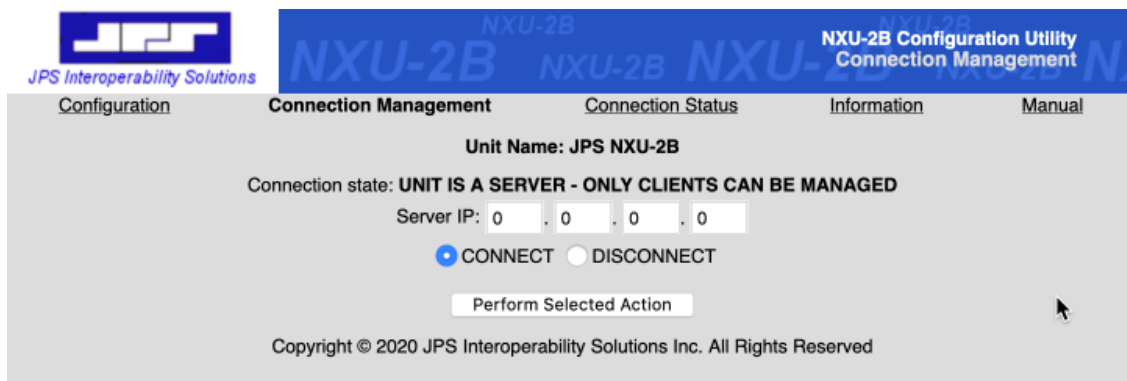


Figure 4-1 NXU-2B Connection Management Screen

4.5.2 Serial or Telnet Connection Control

When using the serial port (in command mode) or Telnet, the user may disconnect a client from a server by typing:

DISC

A connection may be made to a server by typing:

CONN <IP address>

The status of these commands may be viewed by typing:

STAT

STAT returns the following responses:

CON <IP address> The unit is connected to an NXU-2B at address <IP address>

DIS The unit is not connected

ATT <IP address> The unit is attempting a connection to <IP address>

Depending upon the characteristics of the network, the CONN and DISC commands may not take effect immediately. In order to determine when a CONN or DISC command has completed, issue the STAT command repeatedly to poll the status of the connection.

4.5.3 Realtime Status Monitoring

The Realtime Status page allows monitoring the status of the various inputs and outputs in real time without requiring the user to refresh the page. This is useful for remote status monitoring when the NXU-2B is located remotely and only network access is available.

In addition to showing the status of the front panel indicators (Link Active, Channel Active, and Audio Input Level) the Realtime Status page also shows the status of PTT and the Auxiliary Inputs and Outputs.

On this page the user can also adjust the audio input and output levels with the level up/down buttons and then click Save to store the new audio levels after the desired levels have been achieved. The Save button is only enabled if the audio levels have been changed.

NOTE: *Only one user may access the Realtime Status page at a time. If the browser is left open on the Realtime Status page another user will be prevented from accessing the page until the browser window is closed.*

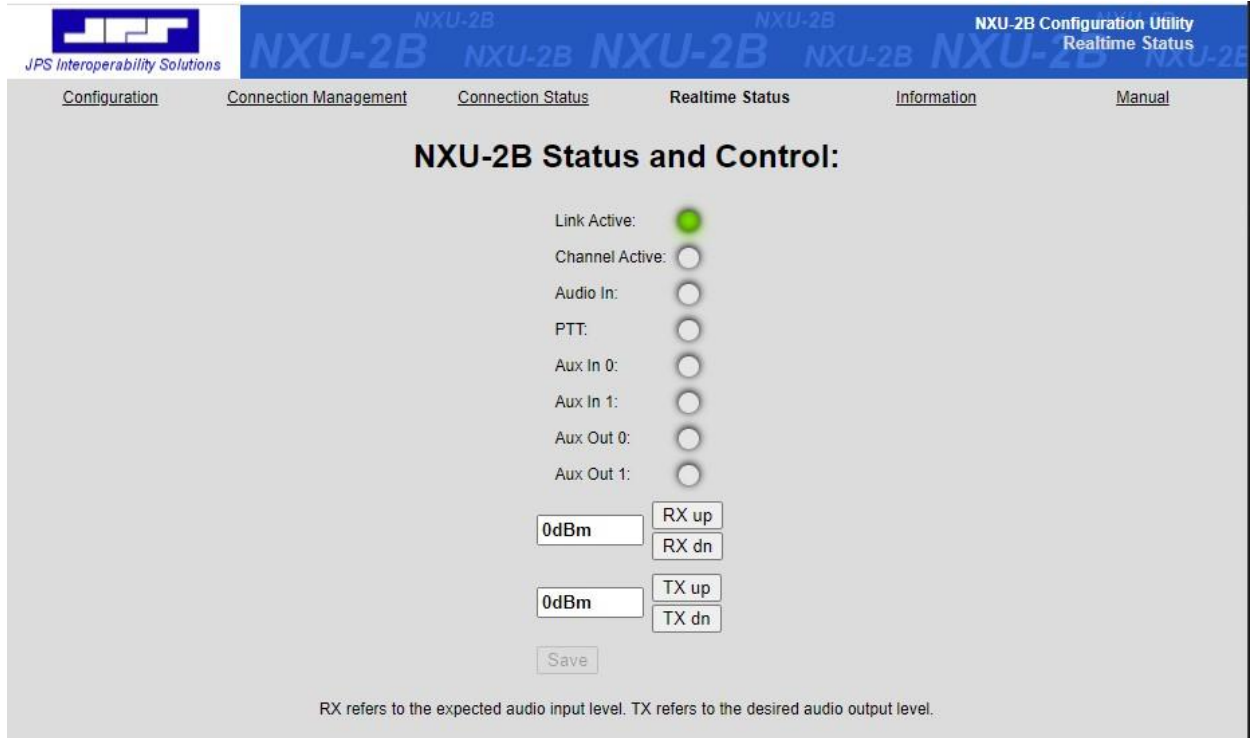


Figure 4-2 NXU-2B Realtime Status Page

End of Section Four

5 Security

In some applications, it may be desirable to restrict network access to the configuration or connection management features of the NXU-2B. The NXU-2B can be programmed to one of several different levels of security via the serial port by using the SECURITY command in the Command Mode. Possible settings are listed below:

| | |
|---------------------|---|
| SECURITY 0 | Full configuration allowed, default value |
| SECURITY 8 | Telnet access disabled |
| SECURITY 32 | Connection management via HTTP disabled |
| SECURITY 64 | Configuration via HTTP disabled |
| SECURITY 128 | All HTTP (web) access disabled |

The above numbers may be added together to select various security options. For example, setting the security level to 136 (128+8) disables both telnet and HTTP access. Setting security to 96 (64+32) allows the connection status to be monitored by HTTP, but no configuration or connection changes may be made via HTTP. Setting security to 24 (8+16) disables telnet access and requires the user to enter a password for HTTP access.

NOTE: The default security setting from the factory is SECURITY 0, which places no restrictions on network access to the NXU-2B.

5.1.1 Password Setting

The NXU-2B may be set to require a username and password for HTTP (web) access and for firmware updating. The default setting requires no username or password. To program a username and password, browse to the NXU-2B IP address and select the Security link. There you may enter an Administrator username and password. Click Save Changes to save the new username and password. At this point the username and password will be required for any NXU-2B web access as well as for any firmware updates.

The screenshot shows a web interface titled "Security Credentials". It contains two input fields: "Administrator Name:" and "Administrator Password:". Below the input fields are four buttons: "Save Changes", "Clear Changes", "Software Update", and "Reboot NXU-2B". At the bottom of the interface, there is a copyright notice: "Copyright © 2021 JPS Interoperability Solutions Inc. All Rights Reserved".

Figure 5-1 Web Access with Password Protection

When the NXU-2B is programmed to require a username and password, any attempt to access the unit via HTTP will result in the web browser displaying the following dialog:

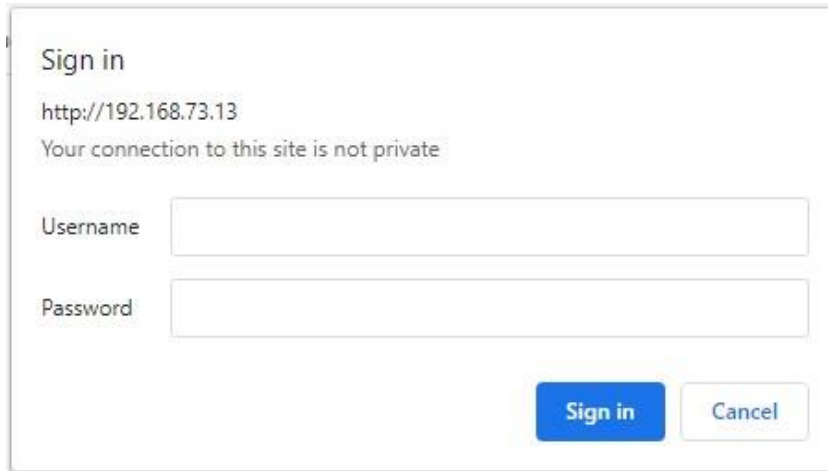


Figure 5-2 Network Password Dialog

In order to access the NXU-2B you must enter the Administrator username and password that was previously programmed using a web browser. Once you have entered the username and password you will not need to enter it again unless you exit your web browser.

NOTE 1: To provide an extra layer of security, the security level must be programmed via the serial port. The Administrator username and password are programmed via the web browser interface.

NOTE 2: if you forget the username and password you may reset the NXU-2B to factory defaults (where there is no username or password) by following the instructions in Section 3.4.25 Restoring Factory Defaults.

5.1.2 Remote Reboot

The NXU-2B may be rebooted by clicking the “Reboot NXU-2B” button on the Security page. Allow 10 seconds for the unit to reboot and become operational again.

End of Section Five

6 NXU-2B Field Optimization Guide

This Section assumes that the NXU-2B Manual has already been configured per the previous instructions in this manual. The purpose of this Field Optimization Guide is to assist with various adjustments and “tweaks” for best performance with the varying radio and communications systems encountered in the field.

There are several paths to optimization, most important is:

- Are you using a JPS Custom Radio Interface Cable (strongly recommended)?
- Are you creating your own interface cable?

The *JPS Custom Radio Interface Cables* were designed by JPS Systems Engineers who investigated the radio’s analog interfaces, then designed an appropriate interface between the radio and the JPS equipment, including verification in the lab. Some interfaces are simple, others not so. Some require DC blocking capacitors or unusual level-setting networks. The JPS cables include a small circuit board that contains every type of matching/interface network required for the interfaces to hundreds of different radio makes & models.

Along with each JPS radio interface cable is an Applications Note specific to the type or types of radios associated with that cable. The Application Note lists the basic settings to optimize the interface within the JPS equipment in tandem with the cable. Just as importantly, it lists any radio programming, or switch/level/jumper plug settings required at the radio for proper operation. JPS cables are always the best option for interfacing a radio to the NXU-2B or other JPS equipment.

6.1 Radio Interface Using JPS Custom Radio Cables

This section will assume that a JPS radio interface cable is used. See the next section if not.

The cable should easily connect to the radio; many are built by splicing a cable manufactured for the specific radio to the appropriate signal lines on the JPS cable.

Follow the instructions of the Application Notes that came with the cable. If the notes are missing, request a new set from JPS Customer Service at support@jpsinterop.com or (919) 790-1011.

Included in the Application Notes are:

- Configuration settings for the rear analog interface, optimized for the JPS Cable when used with the associated radio or other communications device. Note that Applications Notes were created for use with a variety of JPS gateways; pay attention only to the configuration settings available on the NXU-2B Configuration Page.
- Changes that may be required or suggested for the radio itself; either in its configuration or programming.

Next step is to take care of optimization and/or settings that must be adjusted in the field. Most of the following are best accomplished using a test count from a “companion radio” that’s in communication with the donor radio cabled to the NXU-2B.

NOTE: If replacing an NXU-2A with a new NXU-2B, remove the audio crossover adapter at the rear panel AUDIO/CONTROL connector (assuming one is being used). This adapter is not needed when using a JPS Radio Interface Cable with an NXU-2B; the unit will not function properly with it.

6.1.1 RX Audio Input Level

Some minor adjustment may be required, mainly due to radio-to-radio variations. **A way to make sure the level is adjusted properly is to:**

- Use a companion radio to communicate with the donor radio, speaking into the microphone in a voice level consistent with standard usage. The Audio Input LED should flash with voice peaks. Adjust if it never or constantly flashes.
- Note: The RX (receive) input level values on the NXU-2B Configuration page indicate the actual level of audio being received. If the incoming level is -12 dBm, the Receive Input Level should be set to -12dB. This must be understood to know which way to change the audio level for proper operation. If the NXU-2B, when set to -12 dB, is not receiving enough audio, the value must be set to a lower number to correspond to the actual input level. The NXU-2B will then apply additional gain/reduced attenuation.

6.1.2 TX Audio Output Level

The TX (transmit) output level should be set to properly modulate the donor radio transmitter. Audio coming from the donor radio, when doing a normal voice volume radio count, should be heard in the companion radio at the same level as received conversations from other radios in the system (as heard in the companion radio).

Note: Doing the RX level adjustment before setting the TX audio level and verifying it will help prevent a mutually erroneous condition where a too-low RX audio input is compensated by a too-high TX audio input on a cross-connected channel. This condition is worsened whenever a third interface is introduced to the system – its incoming audio will be too low for one of the mutually-erroneous interfaces and too high for the other.

6.1.3 VOX/VMR Sensitivity

The VOX threshold may benefit from optimization (either more or less sensitive) due to system variations or user preferences. More sensitive means less audio level must be detected for the incoming audio to be declared valid. Less sensitive is of course the opposite. Increased sensitivity makes it more likely that falsing (declaring the input valid when it is not) will occur; decreased sensitivity increases the potential that valid speech may be missed. Changes may be desired due to level of static on the channel, quiet talkers, or desire to never miss any audio, even if some falsing occurs.

6.1.4 TX Audio Delay

If the donor radio is used with a trunked radio system, it may be necessary to adjust the TX (transmit) Audio Delay. If initial syllables are missing in the RX audio of the field radio (when

listening to transmissions from the NXU-2B/donor radio) increase the TX delay of NXU-2B analog interface connected to that donor radio.

Explanation: When a radio user initiates a transmit sequence for a trunked radio, that user depresses the PTT switch on the radio, which sends a signal to the system's trunking controller, asking to be assigned to a free (not currently busy) channel. The trunking controller sends a signal back to the user's radio that automatically sets the radio to a free channel, and signals this to the radio user by tone called a *channel acquisition tone* or simply a *go-ahead* tone. The trunked system radio user is trained to not begin talking until this tone is heard.

RX Audio Delay must be increased if initial syllables are clipped on incoming audio of a Radio Channel; see below. If you are using a cross-connected radio channel and additional increases in TX Audio Delay have no effect on missed first syllables in the field radio, then it may be necessary to increase the RX Audio Delay in that cross-connected Radio Channel. An uncommon but possible condition.

6.1.5 RX Audio Delay

Delay in the RX audio occurs by processing the COR detection immediately but holding the incoming audio in a buffer and spooling it out after the set delay time. This resolves the (uncommon) condition for a Radio Channel where the COR indication or detection occurs late and initial incoming syllables are therefore clipped.

The NXU-2B is designed to prevent this as well as practical, through proper design of the various COR Detection algorithms and by including a minimum RX Audio Delay for VOX & VMR modes, but additional delay can be added if needed.

6.2 Radio Interface Using Customer-Designed Radio Cables

For customers who plan to create their own radio interface cables, JPS strongly recommends using the Unterminated Radio Cable, JPS P/N 5961-291115. This shielded cable includes the D15 end of the cable that plugs directly into the NXU-2B rear analog port, along with the small PCB found in other JPS cables – this circuitry has a variety of variable attenuating, terminating and DC-blocking components; essentially everything that JPS Systems Engineers have deemed necessary to interface any of the several hundred types of radios they have created custom cables for. This seven-pin cable is unterminated on the radio side, allowing radio specific portion of the Application Notes for this cable, like all other JPS Custom Radio Cables Application Notes, contains information to help in the cable design and, in particular, explains how to determine which of the various configuration options is best (e.g. how to decide how to choose between the COR options of VOX, VMR, or Hardware COR).

NOTE: Older versions of the Unterminated Radio Cable Application Notes relate to its use with the ACU-1000 or ACU-T gateways. All relevant information applies also to the NXU-2B.

6.3 Radio Interface Troubleshooting Tips

6.3.1 Symptom: User in Field Complains of Missed First Syllables

Cause: Donor radio is trunked, need to compensate for Channel Acquisition Delay

Cause: Slow-to-key transmitter on donor radio

Cause: Secure donor radio, need to compensate for encryption or scrambling delay

Solution: Increase TX DELAY

6.3.2 Symptom: User in Field Complains of Missed Syllables Mid-Conversation

Cause: Dropout from Radio Channel using VOX or VMR COR Detection Type

Solution: Increase VOX/VMR HANGTIME

Alternative Solution: Decrease VOX/VMR SENSITIVITY (make it more sensitive)

Alternative Solution: Verify that RX audio level is sufficiently high – a talker at normal level should cause flashing of the Audio Input LED with voice peaks.

6.3.3 Symptom: User in Field Complains of Dropped Audio

This refers to dropped audio that is not necessarily always either initial or mid-conversation.

Cause: Radio Channel not always activating VOX or VMR COR Detection Type when it should

Solution: Decrease VOX/VMR SENSITIVITY (make it more sensitive)

Alternative Solution: Verify that RX audio level is sufficiently high – a talker at normal level should cause flashing of the Audio Input LED with voice peaks.

6.3.4 Symptom: Continuous Ping-Pong between Cross Connected Radios

Cause: ‘Ping-Pong’ is caused by the tendency of some radios to temporarily unscquelch at the end of a transmit sequence. This momentary Active COR condition in a donor radio will cause a momentary transmit sequence in any devices that are cross-connected to that donor radio. If one of the cross-connected devices is another donor radio with the same ‘momentary unscquelch at the end of a transmit sequence’, then the Radio 1 momentary unscquelch will key Radio 2, whose resulting momentary unscquelch keys Radio 1 in a continuing sequence.

Solution: Use the COR INHIBIT (after PTT) TIME function to make the receiving NXU-2B ignore an incoming Active COR signal for a short time after the channel ends a PTT session. Watch the Channel Active LED on the NXU-2B panel and increase the COR Inhibit time until the Channel Active LED no longer flashes at the cessation of PTT.

Alternative Solution: Change COR SENSE to VMR

6.3.5 Symptom: False Keying of Donor Radio by Radio Channel

Cause: Extraneous RFI emissions present at frequency/level that keys a donor radio

Solution: Eliminate RFI emission source

Alternative Solution: Transit power of other, nearby donor radios may be excessive, so if possible. reduce to just enough to link to repeater

Alternative Solution: Modify antenna placement

Alternative Solution: Change COR SENSE to VMR

6.3.6 Symptom: Radio Channel Experiencing Continuous Active COR State

Cause: Donor radio is introducing continuous noise

Cause: Donor radio is non-FM type, without the quieting characteristic of a frequency modulated signal. These are most likely Amplitude Modulated radios, such as commonly used by aircraft, or HF/single side band radios. They typically lack a Hardware COR output and high noise level causes VOX to false on the noise.

Solution: Change COR SENSE to VMR

6.3.7 Symptom: Audio Sounds Too Weak

Cause: Received audio level from donor radio (or other device type) is too low

Solution: Lower RX INPUT LEVEL until NXU-2B Audio Input LED flashes with voice peaks

Cause: Transmit audio level delivered to donor radio is too low (verify/rectify cause above first!)

Solution: Increase TX OUTPUT LEVEL until donor radio is properly modulated.

6.3.8 Symptom: Audio Sounds Too Loud or Distorted

Cause: Receive audio level from donor radio (or other device) is too high

Solution: Increase RX INPUT LEVEL until NXU-2B Audio Input LED flashes with voice peaks

Cause: Transmit audio level delivered to donor radio too high (verify/rectify cause above first!)

Solution: Lower TX OUTPUT LEVEL until donor radio is properly modulated.

6.4 Troubleshooting Table

The following table may be used to help troubleshoot problems you may encounter during installation or operation of the NXU-2B.

| <i>Table 6-1 Troubleshooting Tips</i> | |
|---|---|
| Symptom: | Possible Causes: |
| Main Power LED is not illuminated | Check that AC adapter is operational and firmly plugged in. |
| Cannot place the unit into Command Mode as outlined in Section 3.3 | <p>Check RS-232 connections Verify terminal settings: 9600 baud, 8 data bits, 1 stop bit, no parity</p> <p>(Note: if you have previously used Command Mode to set the serial port baud rate to a value different than 9600 then you must use the new baud rate to enter Command Mode.)</p> <p>Verify that no flow control, either hardware or software, is being used in your terminal program. Make sure you wait at least 5 seconds, and then type +++ (three plus signs) within 1 second.</p> |
| Settings made in Command Mode do not appear to take effect. | You must issue a SAVE command after making changes in order to save the new settings and restart the NXU-2B. |
| Client and Server units are properly configured and online but LINK ACTIVE is not on. | <p>Verify that both the Client and Server NXU-2B units are “visible” on the network by “pinging” their IP addresses from a network-connected computer.</p> <p>Verify that the Server’s IP address has been programmed into the Client using SRVRIP command. The port used by the NXU-2B for receiving audio from the network has a default value of 1221. Under normal circumstances, there is no reason to change. If necessary, it can be changed using the PORT command. Type PORT<port number> and press ENTER. The port number must be different from the command port and range between 1 and 65535.</p> <p>- OR -</p> <p>If there is not a default server programmed into the client, verify that a manual connection has been entered per Section 4.5 Controlling Connections. Verify that the PORT has not been changed from the default value of 1221, or if it has, make sure the PORT value is the same on both Client and Server. Verify that any network firewalls in place allow traffic on UDP and TCP port 1221. Verify that another NXU-2B client is not already connected to the server.</p> |
| LINK ACTIVE is on, but no audio is transmitted. | Verify that the COR line is active. Audio is only transmitted when COR is active. |

| <i>Table 6-1 Troubleshooting Tips</i> | |
|---|---|
| CHANNEL ACTIVE indicator is on continuously. | Verify that the COR polarity is programmed properly. See section 3.3.8. If NXU-2B is attached to a radio COR line, make sure the radio squelch is set properly. |
| Audio has pauses and/or gaps in it. | Check for low bandwidth or excessive latency on the network by running a trace route from a network-connected PC to the NXU-2B at the other end of the link. |
| Cannot browse to the NXU-2B's IP address | Check that your computer's IP address and subnet mask are compatible with that of the NXU-2B. Verify that you can "ping" the NXU-2B at its IP address. |
| RS-232 data is not being transmitted across the IP link | Verify LINK ACTIVE indicator is on. Verify that neither NXU-2B is in Command Mode; issue a TRAN command to place the RS-232 port in transparent mode if necessary. |

End of Section Six

7 NXU-2B Firmware Update

7.1 NXU-2B Firmware Update Procedure

From time to time JPS Interoperability Solutions may make firmware updates available for the NXU-2B. These updates may fix software defects or add new features. Any software updates will be available via the JPS web page at www.jpsinterop.com

To update the NXU-2B firmware you will need to access the NXU-2B via a web browser. Browse to the IP address of the NXU-2B and select the Information link. From the Information page select the Security link. The security link is only available from the Information page. On the Security page you can set the administrative username and password, and you can also update the NXU-2B software by clicking the “Software Update” button. You will see the following page:




JPS Interoperability Solutions
JPS Firmware Upload
Configuration for Ethernet0 At "192.168.1.200"

To update firmware click Choose File and browse to new firmware (.bin) file. Then click Send File to update firmware.

Firmware file: No file selected.

Figure 7-1 Firmware Upload

Click on “Browse” and browse to the location on your computer where you saved the firmware image. The firmware file will have the form of “NXU2B_xxx.bin” where xxx will reflect the version number. Select this file and click “Open” in your browser. Make sure this is the file you want to load, and then click “Send File” in the NXU-2B firmware upload page. The browser will display “Program success!” and the NXU-2B will reboot. After the reboot the unit will be running the updated firmware. Browse to the NXU-2B IP address and verify that the firmware version reported is the same as the firmware you uploaded.

NOTE 1: The NXU-2B and computer should be connected to a reliable power source throughout the firmware update procedure. If the power is interrupted during the firmware update process the unit might be rendered non-functional.

NOTE 2: The NXU-2B firmware update is performed using port 20034 on the device. If attempting to update an NXU-2B not on the same local network as your PC, be sure to forward TCP traffic on port 20034 through the routed network to the IP address of your NXU-2B.

End of Section Seven

8 NXU-2B FAQ (Frequently Asked Questions)

8.1 General

This section provides answers to some frequently asked questions about the installation and operation of the NXU-2B.

How much network bandwidth does the NXU-2B consume?

The NXU-2B bandwidth usage varies depending on the application. When COR is inactive and no audio is being transmitted across the link, the bandwidth usage is essentially zero, since a small “keep-alive” packet is only sent every 4 seconds. When COR is activated and the default voice compression method is used, audio will be sent across the link at approximately 15Kbps. If a full-duplex connection is active (COR is active on each end) then the total bandwidth usage for audio will be approximately 30Kbps. Selecting a different voice compression method will increase the bandwidth accordingly. Voice compression method 2 will require approximately 18Kbps (half-duplex), method 3 will require 27Kbps, method 4 will require 36Kbps, and method 5 will require approximately 70Kbps. If RS-232 data is being sent simultaneously then the bandwidth will be increased by the RS-232 data rate, plus the TCP overhead.

My application does not provide a COR line. What should I do?

COR is usually obtained from a radio and indicates that a signal is being received. If you do not have a COR line, or a line that performs this function, then you can either tie the NXU-2B COR line to its active state or you can use VOX mode. VOX mode is preferred since enabling COR permanently will cause data to flow continuously across the link, even if no audio is present.

I have a 1000 Mbps (Gigabit) Ethernet. Can I connect the port on the NXU-2B to my network?

Most 1000Mbps equipment (switches, routers) will work with either 10Mbps or 100Mbps connection, so it should work without any problems. Check with your network administrator if you're unsure about your network equipment capabilities.

Where can I find a description of the VoIP protocol used by the NXU-2B?

The NXU-2B protocol is proprietary and not available to end-users without a license. Contact JPS for further information.

My system uses pilot tones and/or tone keying. Does the NXU-2B support this?

Yes. Pilot tones and keying tones are not normally needed on the NXU-2B (due to its support for hardware COR and PTT lines) but are supported and will work with the proper vocoder selection. Tones are not supported when using the 13 Kbps vocoder (VOCODER 1). You must use one of the higher bit-rate vocoders to use any type of tone signaling.

After losing power on one end of an NXU-2B link, it takes a while for the units to re-establish communications. Why is this?

The NXU-2B will wait up to 20 seconds before determining that the link has been disconnected. After that, it will attempt to close the IP connection, which may take several seconds. Then it has to open a new connection. This process may take 30 to 45 seconds, depending on your network.

What is the difference between a static IP address and a dynamic IP address?

On an IP network such as the Internet, the IP address is like a phone number. It is a unique number that identifies the network device, and it allows connections to be made between network devices. There are two kinds of IP addresses, those that are permanently assigned and those that are assigned temporarily. Permanently assigned IP addresses are called static IP addresses, while temporary IP addresses are called dynamic IP addresses. Static and dynamic IP addresses work the same way, but a dynamic IP address is like having a telephone number that nobody else knows; it effectively limits you to making outgoing calls only.

Why do we need static and dynamic IP addresses? Why not just assign addresses permanently like phone numbers?

One problem with IP addresses is there are not enough to go around. There are "only" about 4 billion IPv4 addresses available. On the surface that would appear to be enough, but some companies use a lot of them, the military uses a lot of them, and all the millions and millions of people using the Internet use a lot of them. To ease this problem, many Internet providers only assign an IP address to a computer when someone actually dials in to connect to the Internet. When they disconnect, the IP address goes back into the pool of addresses so someone else can use it. This makes sense in cases where computers might sit for a long time without needing to access the Internet, as there is no point in tying up an IP address when it's not being used. There are plans for an upgraded IP addressing system (IPv6) that will fix the problem of too few IP addresses, but for now it is a limitation we must live with.

What kind of IP address does the NXU-2B need?

NXU-2Bs are configured to be either a client (the one that establishes the connection) or a server (the one that accepts the connection.) The client can have either a static or a dynamic IP address, but the server **MUST** have a static IP address. However, it is best if both units have static IP addresses.

Who assigns IP addresses?

For Internet access, your Internet Service Provider (ISP) will assign IP addresses to you. If you are on a private network, (like a WAN or LAN) then your network administrator will assign IP addresses. You should never program an IP address into an NXU-2B without checking with the ISP or network administrator first.

What happens if two NXU-2Bs have the same IP address (or an NXU-2B has the same address as some other device)?

Bad things will happen. Well, not bad things, but obviously it will not work properly. Both units will respond at the same time, causing network errors. The extreme case would be if an NXU-2B is programmed to have the same IP address as an existing computer on the same network. This would likely render that computer unusable for network functions and could cause other users to have problems as well. The bottom line is that two devices on the same network cannot share the same IP address.

What is a firewall?

A firewall is a device that prevents people outside of a network from accessing computers of devices inside the network. It's a security device. A company firewall prevents incoming network connections, so no one outside the company can access the company's computers via the Internet.

How does a firewall affect the NXU-2B?

A firewall may prevent a connection between two NXU-2Bs if one is behind the firewall and the other is not. This may occur if the client unit is outside the firewall as the firewall is intended to prevent connections initiated from outside the firewall.

Should I use a firewall with the NXU-2B?

Strictly speaking from the standpoint of the NXU-2B, there is no reason to use a firewall with the NXU-2B. The NXU-2B is a stand-alone network device which poses minimal security risks. However, if the network the NXU-2B is on is shared with computers, servers, or other network devices, then a firewall may be advisable. Talk to your network administrator about such situations.

What do I do if my network has a firewall?

If you know (or suspect) the network you are on has a firewall, go ahead and try to connect the two units. The firewall may already be properly configured. If it is not, then the following things should be considered.

If a server unit is behind a firewall, then the server unit's VoIP port needs to be opened on the firewall for both TCP and UDP. This is called "opening a hole in the firewall" and should only be done by (or with the cooperation of) the network administrator. This will allow TCP and UDP packets through the firewall so they can be received by the server unit. There is no security risk in doing this since the NXU-2B cannot be made to access files or forward information to or from other systems.

If a client unit is behind a firewall, then nothing needs to be configured on the firewall. Most firewalls will allow traffic back through them that is related to a connection that was initiated by a computer on its network.

What is NAT?

NAT (Network Address Translation) is a scheme by which many network devices can share one IP address. The NAT router translates packets passed through it between the single public IP address it holds and the private IP addresses used by devices on its network. This means that no computers behind the NAT router are directly accessible from outside the network since none of them have public (or routable) IP addresses.

How does NAT affect the NXU-2B?

Using NAT does not directly affect the operation of the NXU-2B. Special considerations should be made only in the event that multiple server units will be located behind a NAT router. In that case, each unit will need to be assigned a different VoIP port and the NAT router configured to allow both TCP and UDP traffic for the VoIP ports of all the units behind it. Client units are not affected by NAT and no special considerations need be made.

Should I use NAT with the NXU-2B?

The only time it is advisable to use NAT with the NXU-2B is when you wish to have multiple units on a network but have only one public IP address. An example of this would be a bank of NXU-2Bs sharing a broadband type connection such as DSL or cable modem where only one IP address is allocated by your ISP.

After installing a pair of NXU-2B's, the LINK ACTIVE light comes on, stays on for about 20 seconds, and then goes out. This cycle repeats endlessly. What's going on?

The most likely cause is a firewall, which is preventing UDP traffic on port 1221. See the question above about firewall configuration.

I want to connect my NXU-2B serial port to the ACU-1000 serial port, but the cable you supplied doesn't work. What kind of cable do I need?

The RS-232 serial cable supplied with the NXU-2B is a straight-through cable used to connect the NXU-2B to a PC serial port. In order to connect the NXU-2B port to an ACU-1000 you need a DB-9 male-male null modem cable, also called a crossover cable.

Why do I need a null modem cable to connect the NXU-2B to the ACU-1000? I don't need one when I connect my PC.

RS-232 serial devices are divided into two types. Devices that provide control information are called DTE (Data Terminal Equipment) devices. Devices that accept control information are called DCE (Data Communication Equipment) devices. In the "old days" the DTE devices were terminals and computers, while the DCE devices were modems. The RS-232 standard specified that DTE devices would connect to DCE devices using a straight-through cable. If you wanted to connect two like devices (DTE to DTE or DCE to DCE) then you needed a null modem (crossover) cable. The PC is a DTE device, and the NXU-2B and ACU-1000 are DCE devices. That is why you need a crossover cable for connecting an ACU-1000 to an NXU-2B.

Can I change the vocoder on the NXU-2B?

Yes. This is the voice compression method used to convert the audio signal into a digital format. There are times when the user may want or need higher voice quality or transparency to certain kinds of signaling tones. The VOCODER (Voice Compression) command allows the selection of different vocoders, albeit at the expense of network bandwidth.

Can I pass modem tones over the voice port of the NXU-2B?

Some types of modem tones (such as FSK) will work if you select one of the higher bit rate vocoders, such as VOCODER 4 or VOCODER 5. Complex modem waveforms (such as 56K modem data) will not pass no matter what vocoder is selected. Pilot tone, keying tones, and other similar signaling tones will work properly with the 24, 32, and 64 Kbps vocoders.

In general data should be sent via the RS-232 port.

I've connected my radio to the NXU-2B, I have the levels turned all the way up, and can still barely hear the audio. What's wrong?

The NXU-2B uses balanced audio on the input. If, instead of connecting to both balanced input lines, you connect your audio to one audio input and ground, you'll get the effect described above. There is enough leakage in the transformer to get some audio through, but it won't work properly. The solution is to ground one side of the NXU-2B balanced input.

I've connected my radio to the NXU-2B, and it works, but the audio sounds very "tinny" and doesn't have much bass.

Make sure you haven't used the discriminator output, which is sometimes available on FM receivers and transceivers. Discriminator audio is pre-emphasized, and there is no de-emphasis circuitry in the NXU-2B. You'll need to use your regular audio output instead.

I've connected the NXU-2B to my computer serial port as described in Section 0 of the NXU-2B manual, but I can't put the NXU-2B into Command Mode as described in 3.4.1. What do I do now?

First, you need to make sure that you have the flow control set to 'None' in the serial port configuration menu of your terminal program. Second, you must follow the instructions in Section 3.4.1 exactly. Wait 10 seconds and then type three plus signs +++ and nothing else. If you type more than three plus signs the procedure won't work. Wait a few seconds and try again. In addition, the three plus signs must be typed within a one second period in order to be recognized.

I've configured my terminal program and followed the procedure exactly, and I still can't get the 'OK' prompt telling me that the NXU-2B is in Command Mode. Now what?

If the NXU-2B has been configured previously and the baud rate was changed to something other than the factory default of 9600 then you'll need to set your terminal program to use the new baud rate in order to enter the Command Mode.



End of Section Eight

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