
BRIC-Link III
Product Manual

COMDEX

BRIC-LINK III MANUAL

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ABOUT COMREX

Comrex has been building reliable, high-quality broadcast equipment since 1961. Our products are used daily in every part of the world by networks, stations and program producers.

Every product we manufacture has been carefully designed to function flawlessly, under the harshest conditions, over many years of use. Each unit we ship has been individually and thoroughly tested.

Comrex stands behind its products. We promise that if you call us for technical assistance, you will talk directly with someone who knows about the equipment and will do everything possible to help you.

You can contact Comrex by phone at 978-784-1776. Our toll-free number in North America is 1-800-237-1776. Product information along with engineering notes and user reports are available on our website www.comrex.com. Our email address is info@comrex.com.

WARRANTY AND DISCLAIMER

All equipment manufactured by Comrex Corporation is warranted by Comrex against defects in material and workmanship for one year from the date of original purchase, as verified by the return of the Warranty Registration Card. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you obtain return authorization from Comrex and return the product, shipping prepaid, to Comrex Corporation, 19 Pine Road, Devens, MA 01434 USA. For return authorization, contact Comrex at 978-784-1776 or fax 978-784-1717.

This Warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification performed by anyone other than Comrex Corporation.

With the exception of the warranties set forth above, Comrex Corporation makes no other warranties, expressed or implied or statutory, including but not limited to warranties of merchantability and fitness for a particular purpose, which are hereby expressly disclaimed. In no event shall Comrex Corporation have any liability for indirect, consequential or punitive damages resulting from the use of this product.

I. INTRODUCTION

The Comrex BRIC-Link III is a low-cost, high-performance solution for audio-to-IP conversion. Leveraging many of the core technical aspects of Comrex's successful remote broadcast ACCESS product line, the BRIC-Link III provides for an elegant way of moving Linear or compressed audio with very low delay. BRIC-Link III may be used over a range of IP links, is very simple to use, and doesn't require the expense of more full-featured codecs. While it carries an entry-level cost, BRIC-Link III maintains superb audio specifications and hardware reliability, making the system suitable for STLs and other mission-critical functions.

BRIC-Link III is contained in a small desktop package. Two BRIC-Link IIIs may be installed to occupy 1U of rack space.

APPLICATIONS

The BRIC-Link III is uniquely suited to point-to-point "nailed up" high-quality audio links over a variety of data networks, like ISM band IP radios, T1s, satellite channels, WANs, and LANs. The robustness of the BRIC Normal technology (Broadcast Reliable Internet Codec) used in the box allows the system to perform well on the public Internet as well (using AAC or Opus compression modes).

AUDIO CODING

For users concerned about delay and coding artifacts, the BRIC-Link III offers a robust stereo or mono Linear mode that does not compress audio. In addition, unique to real-time audio codecs, BRIC-Link III offers FLAC lossless compression, reducing network throughput by 30-40% with absolutely transparent coding and no tandem coding concerns. For situations where further reduced bandwidth is desired, BRIC-Link III offers AAC/HE-AAC modes as standard, allowing superb audio quality at dramatically reduced data rates. For compatibility with mobile phone and web applications, BRIC-Link III also implements Opus audio compression, along with VoIP standard G.722.

TRANSMISSION MODES AND DELAY

The BRIC-Link III is a true codec, offering a full-duplex stereo encoder and decoder in each unit. When two-way transmission is not required, the reverse channel may be disabled. The BRIC Normal technology incorporated includes a jitter buffer manager that automatically balances delay and stability, dynamically increasing and decreasing delay based on network performance. For networks where QoS is known, these parameters may be set to maintain a consistent level of jitter buffer.

End-to-end coding delay in Linear modes is less than 25 ms. Delays when using FLAC and Opus modes are less than 30 ms. AAC modes incorporate around 100 ms total end-to-end delay while HE-AAC modes deliver around 220 ms.

In addition to coding delay, network propagation and jitter buffers will add delay to any IP link and are network dependent.

SWITCHBOARD SERVER

Switchboard is an optional feature available to BRIC-Link III that allows the codec to “sync” with Comrex’s cloud-based traversal server. **Switchboard** facilitates connections between codecs without any knowledge of IP addresses on either end of a link. Switchboard traversal server allows for monitoring presence and status information for all Comrex codecs in a user’s fleet, and assists with connections through routers and firewalls that might be difficult otherwise. Note: BRIC-Link III requires the purchase of a Switchboard Traversal Server License for use with Switchboard.

CROSSLOCK

BRIC-Link III comes with a reliability feature called CrossLock VPN. Comrex codecs running firmware version 4.0 or higher are compatible with CrossLock. This is a transport layer that adds the following features:

- Error Correction (ARQ and FEC);
- Dual Network support (Bonding and Redundancy modes, or optional Network Fallback);
- Enhanced statistics and diagnostics.

Use of **CrossLock** is optional, and requires a Comrex codec running firmware version 4.0 or higher on each end of the link. **CrossLock** connections can be made via the Comrex **Switchboard** function (as mentioned above) or manually. For manual connections, **CrossLock** requires extra settings to assure connections are only made within your known group of codecs. Firmware version 4.3 and higher also supports **CrossLock** when using very data-intensive algorithms like Linear PCM and FLAC.

Users running firmware 4.3 or higher are also able to utilize **HotSwap**, which is a feature of **CrossLock** that allows users to designate one network in a **CrossLock** connection as *primary* and the other network as *secondary* in order to maintain connections in the event of a primary network failure. Once configured, **HotSwap** will automatically move active connections onto the *secondary* network whenever a *primary* network failure is detected, and then move the connection back once the *primary* network is active again.

FRONT PANEL INTERFACE

BRIC-Link III offers four front panel buttons and indicators which can be assigned various functions. These easy-access functions include:

- 1 **Auto-Connect** - Quickly initialize an audio connection with a pre-defined remote entry without utilizing the Web User Interface or contact closure connector.
- 2 **Contact Closure** - Easily send contact closure signals to a far-end connected codec.

II. BRIC-LINK III DIAGRAMS AND INSTALLATION

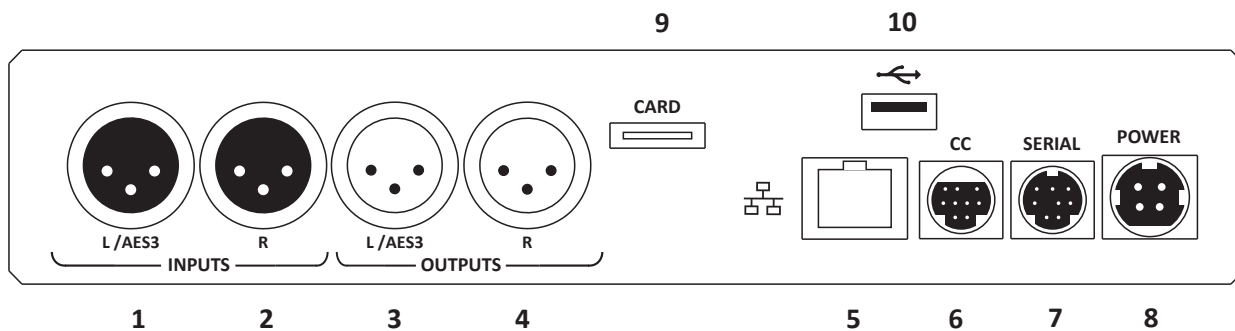


FIGURE 1 REAR PANEL DIAGRAM AND DESCRIPTIONS

- 1 **Left Audio/AES3 Input** - Accepts professional level, balanced analog audio, or if configured, AES3 stereo digital audio for input.
- 2 **Right Audio Input** - Accepts professional level, balanced analog audio.
- 3 **Left Audio/AES3 Output** - Delivers professional level, balanced analog audio, or if configured, AES3 stereo digital audio for output.
- 4 **Right Audio Output** - Delivers professional level, balanced analog audio.
- 5 **Ethernet 1000baseT** - Connection for network connections.
- 6 **Contact Closures** - Provides for 4 contact closure triggers, and 4 open-drain style contact closure outputs.
- 7 **RS-232** - Provides serial data I/O across the IP link. Data rate is configurable.
- 8 **Power** - 4-pin connector for attachment of Comrex approved DC power adapter. Requires 15 VDC @ 1 A.
- 9 **Card Slot** - For future use.
- 10 **USB** - Used to attach a USB-to-Ethernet adapter, for using dual networks via *CrossLock*. Can also attach a *Comrex Connect Modem* for limited 4G cellular connectivity via *HotSwap*.

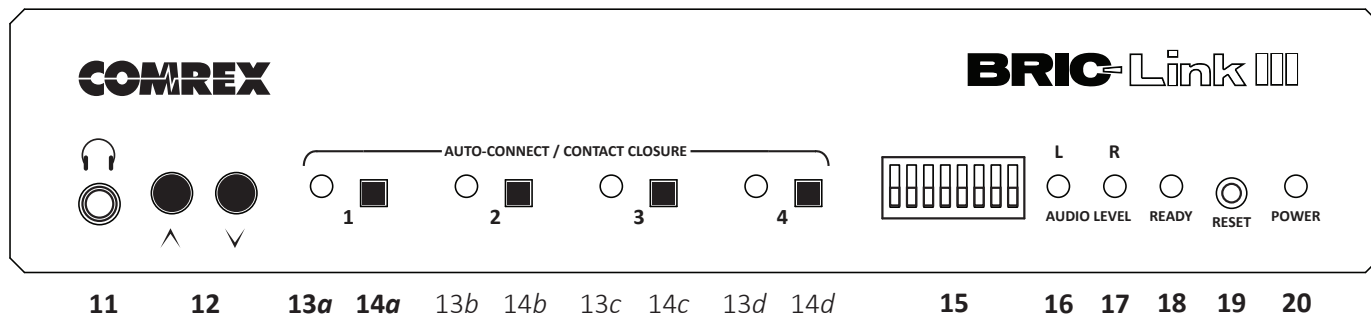


FIGURE 2 FRONT PANEL DIAGRAM AND DESCRIPTIONS

- 11 **Headphone Jack** - 3.5 mm TRS output to monitor input audio or decoded audio (selectable via dip switch).
- 12 **Headphone Level Control** - Allows adjustment (Up/Down) of headphone output. Pressing both Up and Down together will immediately reset volume to minimum (no output).
- 13 **Auto-Connect/Contact Closure Indicators** - Show auto-connected call status, or various states of incoming/outgoing contact closures.
- 14 **Auto-Connect/Contact Closure Buttons** - May be configured to quickly establish connection to pre-defined remote entries, or assigned to trigger “sent” contact closure signals to far-end connected codec.
- 15 **DIP Switches** - 8 individual DIP switches allow selection of certain operational parameters (see **DIP Switch Settings** on **page 17**).
- 16 **Left/Mono I/O Level Indicator** - Tri-color LED shows left channel input or output level.
- 17 **Right I/O Level Indicator** - Tri-color LED shows right channel input or output level.
- 18 **Ready/Status LED** - Bi-color LED shows Ethernet carrier loss (Red) or valid connection state (Green).
- 19 **Reset Button** - Issues a hardware reset to the system when pressed momentarily.
- 20 **Power Indicator** - Red LED illuminates when DC power input is present.

MONO VS. STEREO

Because BRIC-Link III can encode and/or decode in stereo and mono modes, it's important to understand how the audio inputs and outputs are handled in each mode. While in stereo mode, left and right inputs and outputs correspond to left channel and right channel audio, respectively. In mono mode, the audio is handled differently:

Mono Inputs

In mono encode modes, BRIC-Link III uses the left channel of the stereo input for delivery to the mono encoder.

Mono Outputs

In mono decoder modes, mono audio is delivered to both left and right output connectors.

PINOUTS - BALANCED AUDIO

Stereo professional level connections are available on the rear panel via XLR connectors for left and right input and output. These connectors are wired as follows:

- 1 Ground
- 2 Balanced Audio +
- 3 Balanced Audio -

These connectors have a fixed level where a full scale signal represents +20 dBu (22 Vpp).

PINOUTS - AES3

When configured via the DIP switches, the left input and output become AES3 digital ports. The jack connectors are wired as follows:

- 1 Ground
- 2 AES3 +
- 3 AES3 -

To use AES3, the front panel DIP switches must be set appropriately. AES3 input connections can be at 32, 44.1 or 48 kHz. On the BRIC-Link III, the output audio sample rate automatically locks to the input sampling rate. If analog input is used, (or AES3 input configured and unconnected), AES3 output is always 48 kHz.

PINOUTS - SERIAL PORT

The **Serial Port** is pinned to match serial connections on older Macintosh computers, so commercially available adapter cables should have the proper pinning.

Pin #	Function	Direction
1		
2		
3	TX Data	From BRIC-Link III
4	Ground	
5	RX Data	To BRIC-Link III
6		
7		
8	Ground	

PINOUTS - CONTACT CLOSURES

Contact closures are available via the 9-pin mini-DIN connector on the rear panel of the BRIC-Link III. Inputs are triggered by shorting the respective input to Pin 9. Outputs consist of an open collector circuit which, when inactive, will offer a high-impedance path to Pin 9 and, when active, will offer a low impedance path to Pin 9. These outputs are capable of sinking up to 200 mA at a voltage up to 12 V.

Pin 1	Output #1
Pin 2	Output #2
Pin 3	Output #3
Pin 4	Output #4
Pin 5	Input #1
Pin 6	Input #2
Pin 7	Input #3
Pin 8	Input #4
Pin 9	Ground

DIP SWITCH SETTINGS

BRIC-Link III has a set of eight DIP switches used for audio and indicator configuration.

DIP Switch #	Function	Default (Down)
1	Analog/AES3 Input Select	Analog
2	Analog/AES3 Output Select	Analog
3	For Future Use	
4	Level LEDs TX/RX Select	TX
5	Headphone out select TX/ RX	RX
6	Future Use	
7-8	Factory Reset	

RESET TO FACTORY DEFAULT USING DIP SWITCHES

To factory reset your device using DIP switches, follow these steps:

- 1 Put DIP switches 7 & 8 up.
- 2 Wait for Auto-Connect/Contact Closure indicator #1 to flash.
- 3 Press and release each of the four Auto-Connect/Contact Closure buttons once from left to right in sequence.
- 4 Put DIP switches 7 & 8 down.
- 5 BRIC-Link III will reboot itself with factory default settings applied.

III. QUICK START - MAKING CONNECTIONS WITH BRIC-LINK III

This section skips over many of the details concerning the configuration of remote connections with BRIC-Link III, and focuses instead on the minimum information needed to establish a connection. BRIC-Link III connections with and without the use of the Switchboard server will be covered.

FINDING BRIC-LINK III'S IP ADDRESS

Initial IP configuration is handled using the **Comrex Device Manager** software. This program can be downloaded from the BRIC-Link III support page of the Comrex website. As shown in **Figure 3**, running the Device Manager and clicking the **Scan for Devices** button will produce a list of all Comrex IP codecs found on the LAN. Refer to **page 21** for more information about Device Manager.

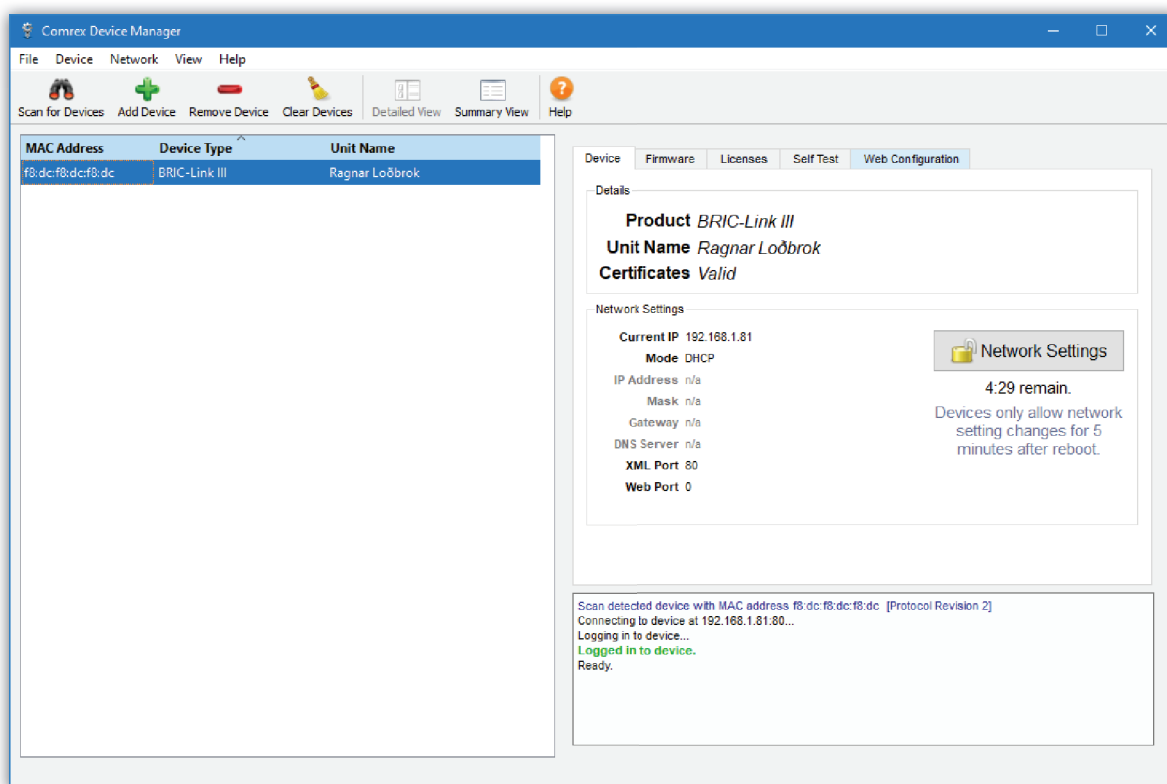
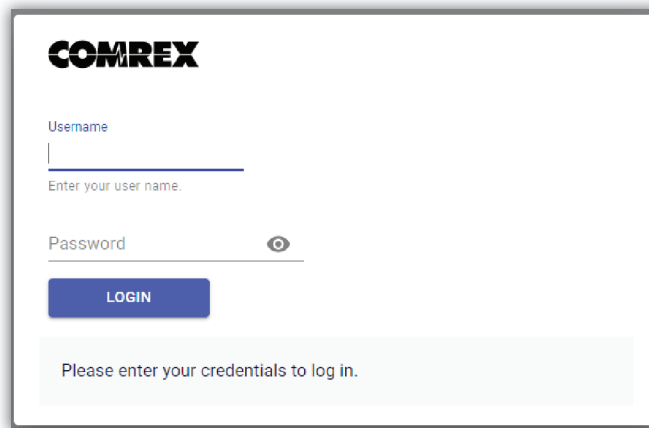


FIGURE 3 SCANNING FOR DEVICES

LOGGING IN

After determining the IP Address of BRIC-Link III, open any computer's web browser on the same network as BRIC-Link III. Type the IP address in the browser URL to navigate to BRIC-Link III's *Web User Interface* "Login" page, as seen in **Figure 4**. Log in to BRIC-Link III with any username and the default password "comrex". **Note that it is highly recommended to change to a new password for security purposes. Refer to page 37 for more details.**



COMREX

Username

 Enter your user name.

Password 

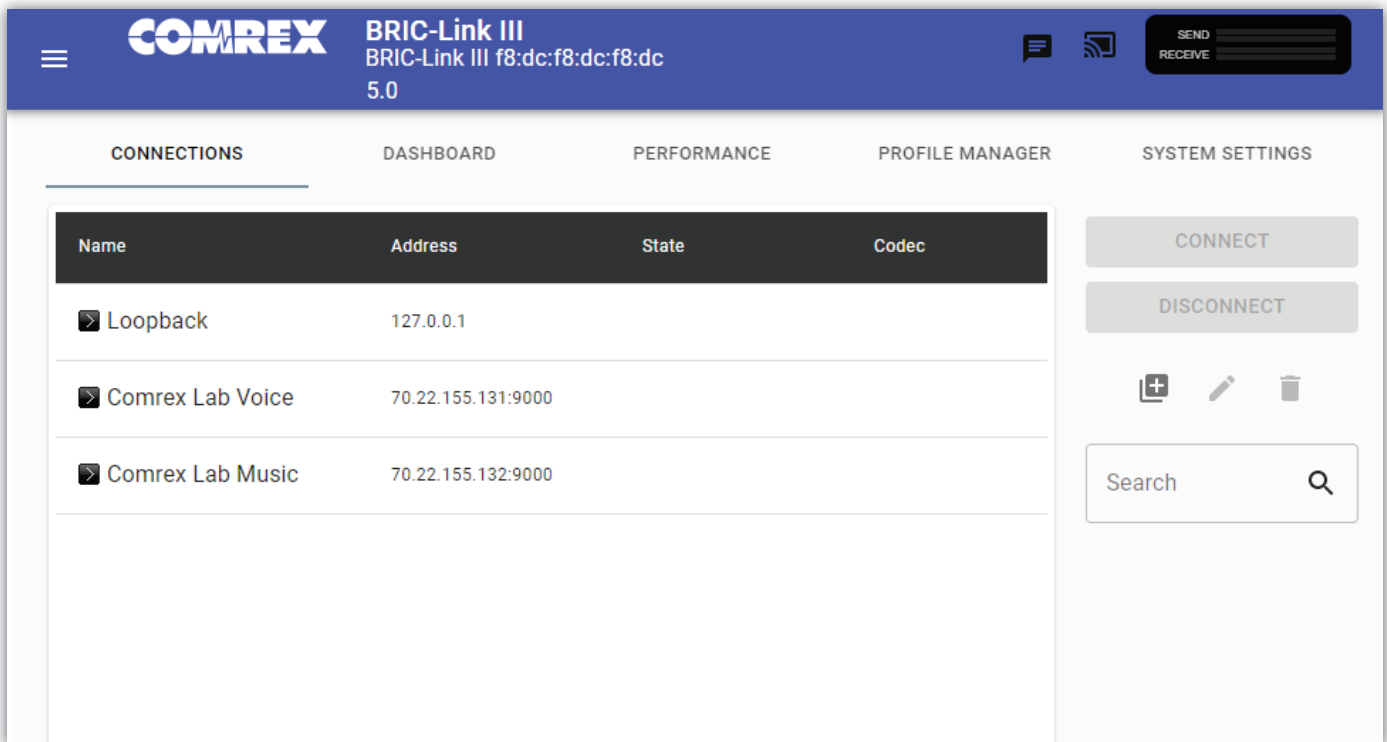
LOGIN

Please enter your credentials to log in.

FIGURE 4 WEB INTERFACE LOGIN

MAKING CONNECTIONS

On the Web Interface, select the **Connections Tab**. As seen in **Figure 5**, this tab will populate with a list of available remote codecs to call. “Loopback” will connect BRIC-Link III to itself for diagnostic purposes. The next two default Connections will be “Comrex Lab Voice” and “Comrex Lab Music”, which are available for public test connections for *Mono* and *Stereo* audio respectively. Add a new Connection by clicking the **Add new remote** button () and entering the IP address of the unit you wish to connect to. You can choose a default audio profile, or one you have created. Refer to **page 33** for information about creating profiles.



COMREX BRIC-Link III
 BRIC-Link III f8:dc:f8:dc:f8:dc
 5.0

SEND
RECEIVE

CONNECTIONS DASHBOARD PERFORMANCE PROFILE MANAGER SYSTEM SETTINGS

Name	Address	State	Codec
☒ Loopback	127.0.0.1		
☒ Comrex Lab Voice	70.22.155.131:9000		
☒ Comrex Lab Music	70.22.155.132:9000		

CONNECT
DISCONNECT

Search 

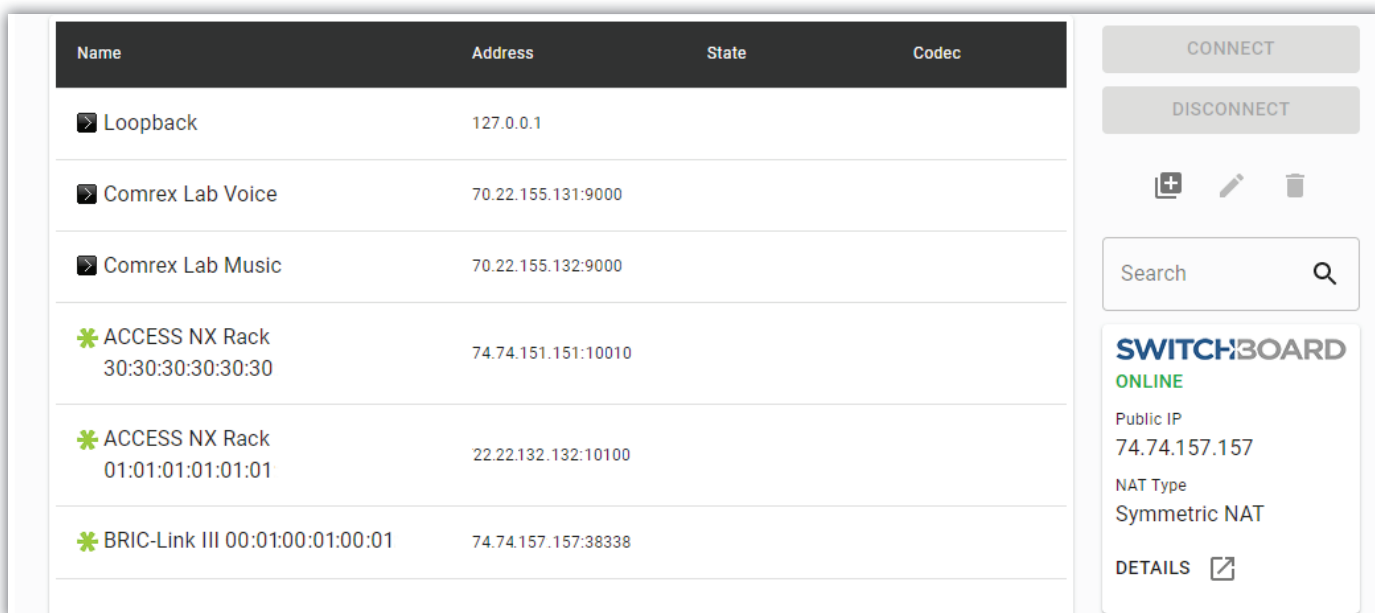
FIGURE 5 CONNECTIONS TAB

Find the new remote you added in the **Connections Tab** and click the “Connect” button to initiate a connection. You can then click the “Disconnect” button when you are ready to end the connection.

MAKING SWITCHBOARD CONNECTIONS

If you are using Switchboard to connect, be sure that you have purchased a **Switchboard Traversal Server License**, and added your BRIC-Link III to a Switchboard account using its unique **Switchboard ID** (MAC address). Refer to **page 59** for more information about setting up a Switchboard Account.

On the Web Interface, select the **Connections Tab**. As seen in **Figure 6**, this tab will populate with a list of available remote codecs to call. When the BRIC-Link III is “synced” with Switchboard, connections to other codecs in a user’s Switchboard account are simple. Go to the listings on the bottom that appear with a “Gear” icon on the left side. Any units with a Green Gear icon are available for Switchboard connections. Highlight the one you want to connect to and select the “Connect” button on the right side of the screen to initiate a connection.



The screenshot displays the Switchboard Connections web interface. It features a table with columns for Name, Address, State, and Codec. The table lists several connections, including Loopback, Comrex Lab Voice, Comrex Lab Music, and three entries for ACCESS NX Rack and BRIC-Link III. The BRIC-Link III entry is highlighted with a green gear icon. To the right of the table is a sidebar with a CONNECT button, a DISCONNECT button, a search bar, and a section for SWITCHBOARD status (ONLINE) and public IP (74.74.157.157). A DETAILS link with an external link icon is also present.

Name	Address	State	Codec
Loopback	127.0.0.1		
Comrex Lab Voice	70.22.155.131:9000		
Comrex Lab Music	70.22.155.132:9000		
* ACCESS NX Rack 30:30:30:30:30:30	74.74.151.151:10010		
* ACCESS NX Rack 01:01:01:01:01:01	22.22.132.132:10100		
* BRIC-Link III 00:01:00:01:00:01	74.74.157.157:38338		

CONNECT
DISCONNECT
+ ✎ 🗑️
Search 🔍
SWITCHBOARD
ONLINE
Public IP
74.74.157.157
NAT Type
Symmetric NAT
DETAILS 🔗

FIGURE 6 SWITCHBOARD CONNECTIONS ICONS

RECEIVING INCOMING CONNECTIONS

By default, BRIC-Link III is set to automatically answer incoming connections, whether or not Switchboard is used to make them. Incoming connections will appear at the top of the connections list while they are active. They can be disconnected locally by highlighting them and clicking “Disconnect”.

IV. USING THE DEVICE MANAGER PROGRAM

Initial configuration of BRIC-Link III is performed using Comrex **Device Manager**, a Windows- and MAC OS-executable program that can be downloaded from the Comrex website. **Device Manager** is also used for applying **Firmware updates** and installing licenses, such as a **Switchboard Traversal Server License**.

Please note: In order to configure a BRIC-Link III unit for the first time (without knowing the unit's IP address), **Device Manager** must be run on a computer located on the same network (e.g. physical LAN connection) as the unit itself. If this is not possible, an Ethernet crossover connection between the BRIC-Link III and a computer should be used for configuration.

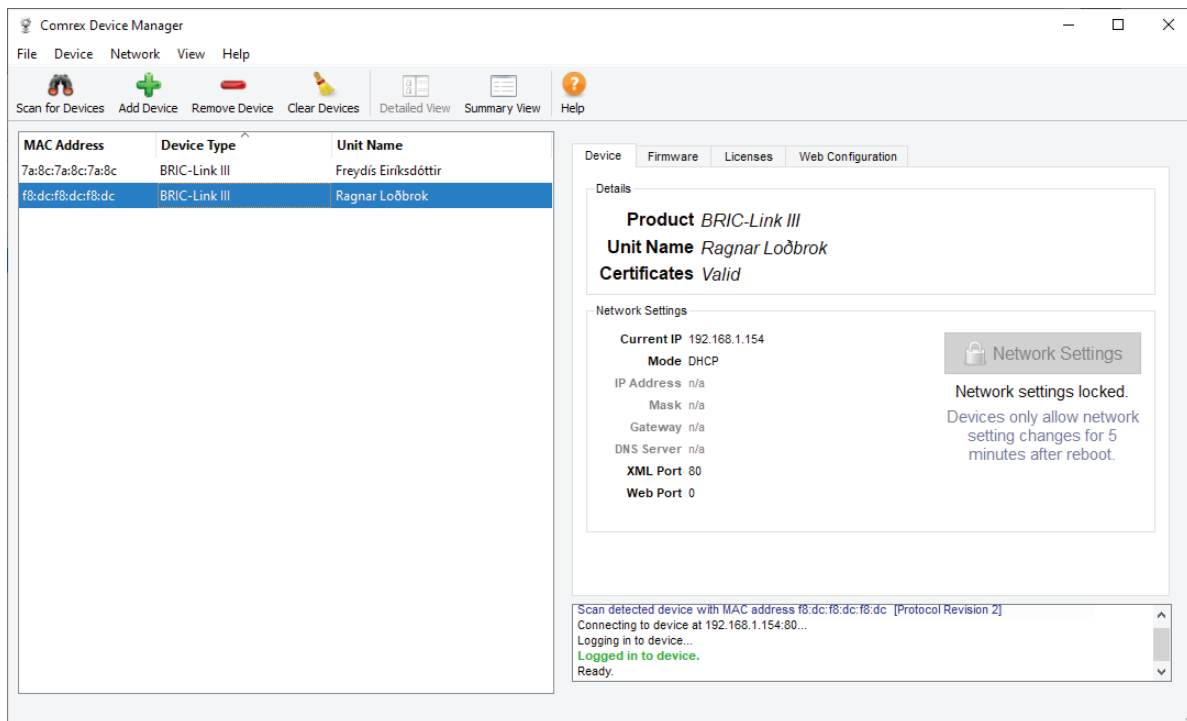


FIGURE 7 DEVICE MANAGER

As shown in **Figure 7**, running the **Device Manager** and clicking the “**Scan for Devices**” button will produce a list of all Comrex devices found on the LAN. If the default password has changed, **Device Manager** will prompt for the password to BRIC-Link III after the scan.

Figure 7 shows the four tabs that appear on the right-hand pane after **Device Manager** has logged in. The fourth tab is labelled **Web Configuration**. This will open a simplified setup interface for BRIC-Link III called **Toolbox**. The **Toolbox** interface allows for configuration of several options including the Ethernet port. Log in to **Toolbox** with any username, using the correct password (default = **comrex**).

Once logged into **Toolbox**, choose the **Network/Admin/CrossLock** option and then choose **Set up Ethernet**. Choose the Ethernet port that appears in the list, which will look like **Figure 8**.

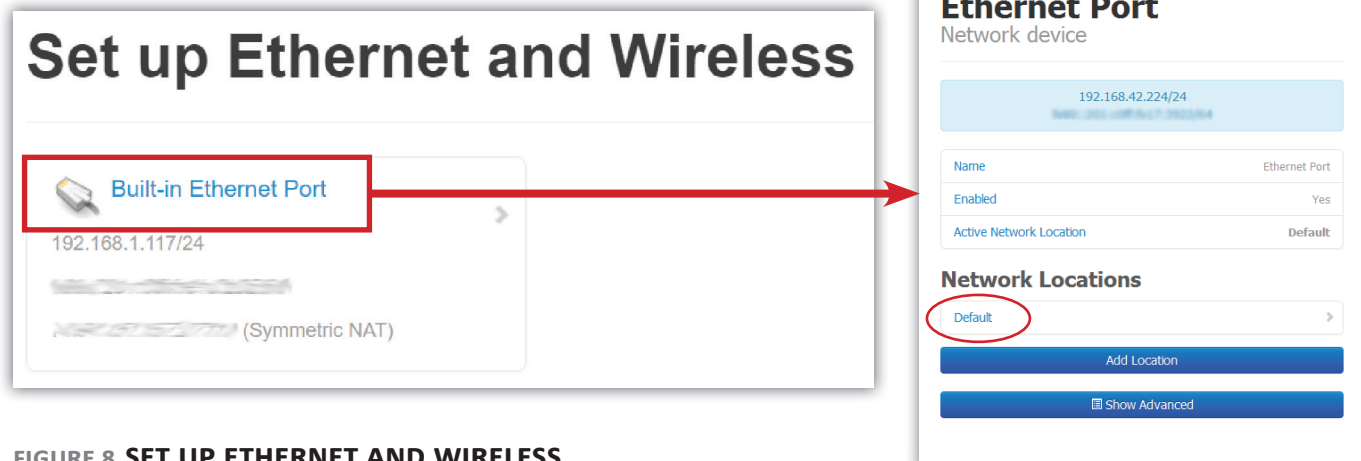


FIGURE 8 SET UP ETHERNET AND WIRELESS

Generally, it is recommended to configure the Ethernet port of BRIC-Link III for a static IP. This will facilitate access to the **Web-based Interface** with a browser and allow for easier configuration of routers or firewalls (if necessary). If the BRIC-Link III is to be installed on a managed LAN, Comrex recommends consulting with the IT services provider about obtaining a static IP address.

As mentioned in the previous section, BRIC-Link III is configured for **DHCP** by default. This means that it tries to extract an unused IP address from the network router upon booting. To change the Ethernet IP addressing to **static**, select the “**default**” location at the bottom of the list (as shown in **Figure 8**) and change the “**IP Type**” to **static**. The system will prompt a list of static settings as shown in **Figure 9**.

As can be seen in **Figure 9**, the *static IP address, the Netmask, the Gateway Address*, and at least one *DNS Server Address* must be configured in the proper fields to set a static IP address. Once that information has been input, click the “**back**” button and select **Apply Changes** to have BRIC-Link III accept and activate the new Ethernet settings. Note that if the IP settings of the Ethernet port have been changed, the connection to the **Toolbox** interface will no longer work. Click the “**Scan for Devices**” button on **Device Manager** to re-sync with the new IP address.

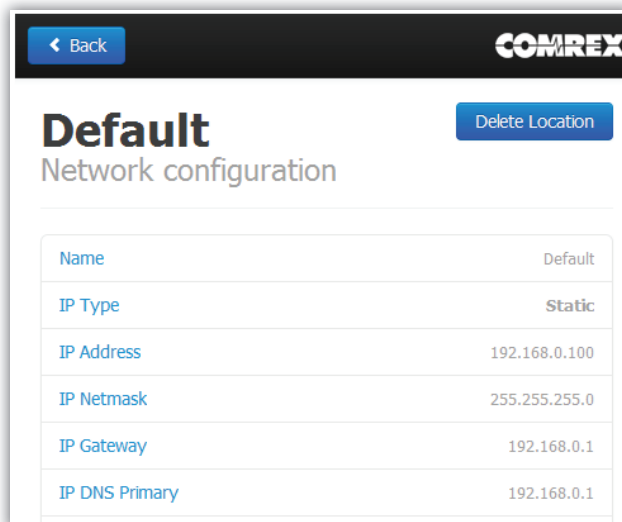


FIGURE 9 NETWORK CONFIGURATION

UPDATING FIRMWARE USING DEVICE MANAGER

While Device Manager is open and synced to a codec, it's a good time to check to see if an update is available for the product.

To do this, select the “Firmware” tab, shown in **Figure 10** below.

The unit's current firmware and the most recently released version of firmware for the unit are listed at the top of the tab (**1** in **Figure 10**). If the device isn't running the latest version of firmware, click the “Get Latest Version” button (**2** in **Figure 10**) and download it. (If the unit's Firmware is current, the button will be grayed out.) Next, select “Update Device” (**3** in **Figure 10**), choose the .upd file you just downloaded and click OK, and Device Manager will then update BRIC-Link III's firmware.

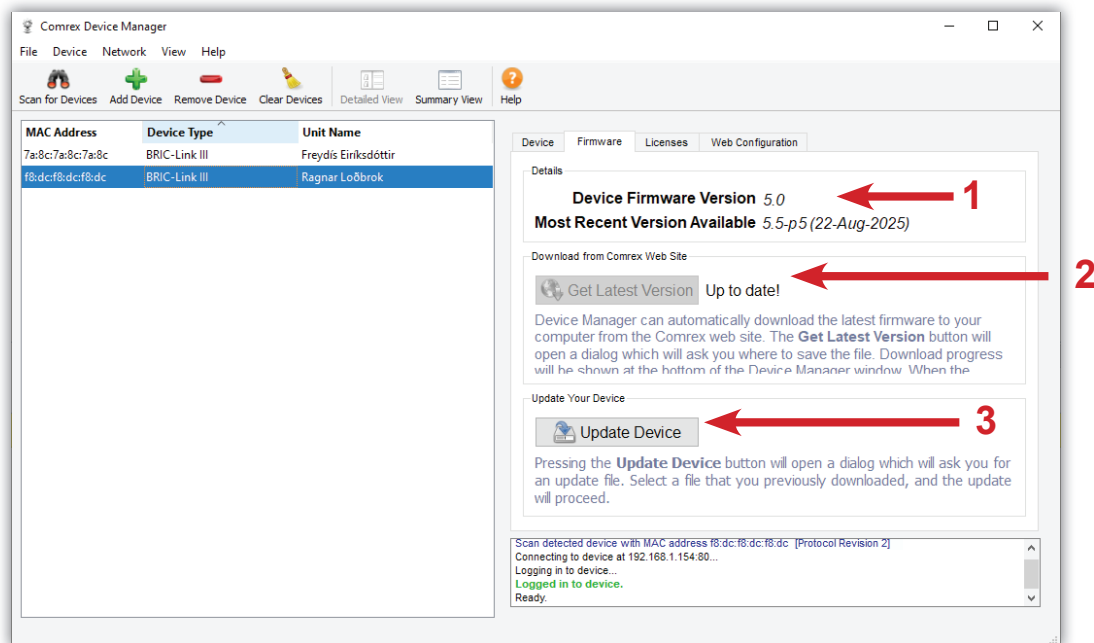


FIGURE 10 FIRMWARE TAB

NETWORK RECOVERY MODE

Since the Ethernet settings are made with a web connection, keying in incorrect static IP information can result in losing access to the **Network Manager** interface entirely. If this happens, it is possible to be “locked out” of the unit (i.e., unable to log in). **Device Manager** has a network recovery tool to help with this: **Network Recovery Mode**.

For security reasons, **Network Recovery Mode** is only available during the first five minutes after a BRIC-Link III unit has (re)booted. Once those five minutes have elapsed, the unit will need to be rebooted in order to perform network recovery.

Figure 11 shows **Network Recovery Mode**. The “Scan for Devices” button has shown the presence of a BRIC-Link III on the network. On the “Device” tab on the right pane, the “Network Settings” button is activated and a countdown timer is started. Selecting this will allow changing of the primary Ethernet settings in the same way as Toolbox.

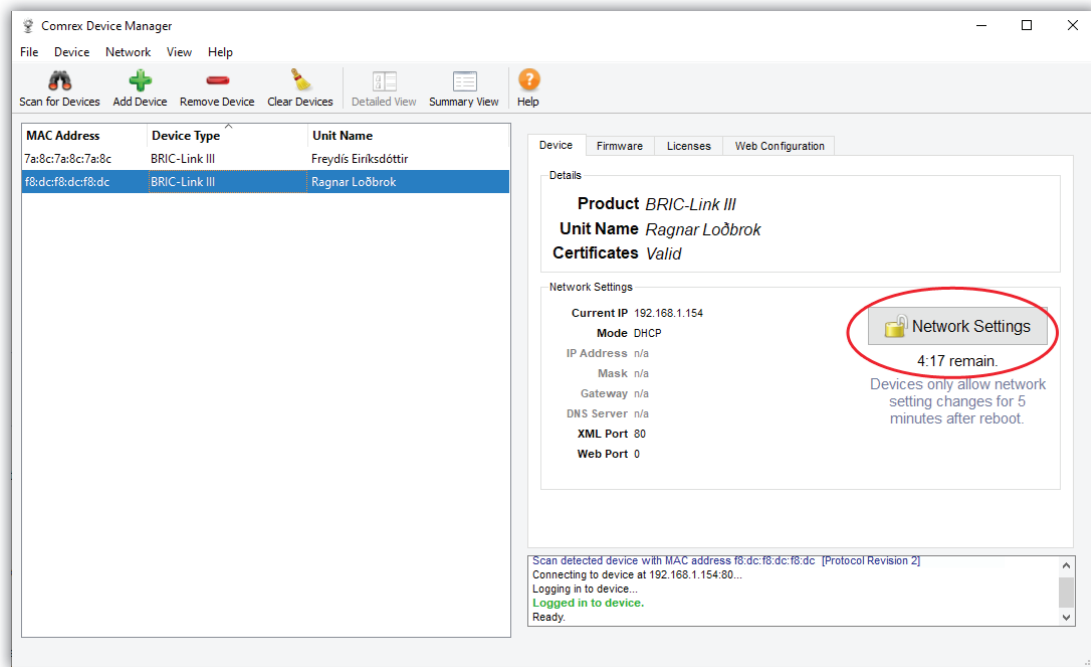


FIGURE 11 NETWORK RECOVERY MODE

Once the IP address is setup via the **Device Manager**, the rest of the setup and operation of the BRIC-Link III is done via the **Web User Interface**. This process is addressed in the following section.

V. CONFIGURING BRIC-LINK III

LOGIN

After using **Device Manager** to find or set BRIC-Link III's IP address, begin configuration by opening a web browser and entering that IP address into the URL field. Upon connection to BRIC-Link III, a login screen will appear (**Figure 12**). Enter any username and the correct password (default = **comrex**). This will access the “web GUI”, or **Graphical User Interface** display (**Figure 13**). Note: It is highly recommended to change from the default password to something more secure. See [page 37](#) for details on changing the Remote Control Password.

FIGURE 12 WEB INTERFACE LOGIN

INTERFACE PAGE SECTIONS

There are three main parts to the user interface screen (**Figure 13**):

- **Main Information Banner (1)**: This blue banner shows the *Product Type*, *Unit Name* and *Current Firmware* on the left side. The *Meters* on the right side display audio levels for active connections to the BRIC-Link III. The far-left side contains a “Hamburger” button (☰) which provides quick access to certain settings. This banner and the “Configuration Tabs” below will remain on screen as you navigate the interface.
- **Configuration Tabs (2)**: These tabs control which function of the interface you want to use, and consist of *Connections*, *Dashboard*, *Performance*, *Profile Manager*, and *System Settings*. They are described in detail in this section. Selecting one of these tabs determines what is displayed below in the “Content Panel”.
- **Content Panel (3)**: The primary focus of the BRIC-Link III user interface. The working contents of the currently chosen tab will appear here, underneath the tabs. This is where you will control connections, modify settings, monitor performance, etc.

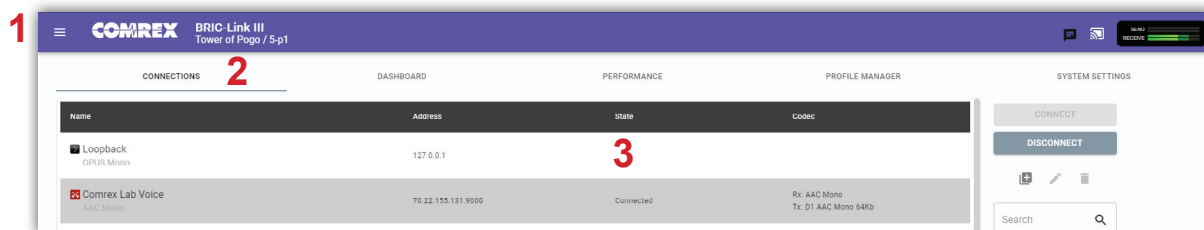


FIGURE 13 WEB USER INTERFACE

CONNECTIONS TAB

The **Connections** Tab is the first window in the user interface. This allows for monitoring device connectivity and controlling connections. This tab displays the *names* and *IP addresses* of all saved remotes, or “peers”. As seen in **Figure 14**, active connections will also display *status* information and the *encoding algorithms* being used by each end of the connection. This information is only available during an active connection.



FIGURE 14 CONNECTIONS TAB

If there are no other connections active, a connection can be initiated by selecting a remote from the list and clicking “Connect” on the right side of the screen. To end an active connection, select the active remote and click “Disconnect”.

By default, three factory remotes appear on the list. These remotes are used for troubleshooting connectivity:

1. **Loopback:** Allows for testing of localhost. BRIC-Link III will make an active connection to itself (input audio will be encoded then decoded and output from the same unit). This verifies proper functionality of the BRIC-Link III, as well as the chosen audio profiles and input/output wiring.
2. **Comrex Lab Voice:** This provides a talk feed (mono input) from the Comrex headquarters in Massachusetts, USA for testing remote connections.
3. **Comrex Lab Music:** This provides a music feed (stereo input) from the Comrex headquarters in Massachusetts, USA for testing remote connections.

CREATING NEW REMOTES

To add a new remote unit to the list, click the **Add a new remote connection** icon (⊕) on the right side of the screen. A dialogue box will appear and require the *IP address* of the remote unit to be input (as seen in **Figure 15**). Users may assign a **Remote Name** and either choose an audio **Profile** or proceed with the “Default Profile”, which is automatically selected. To get started, BRIC-Link III includes *factory profiles* to choose from. Custom profiles are possible and are covered in a later section (see **page 33**).

A stored remote can be edited using the **Pencil icon** (✎). In the event that a stored remote is no longer desired, it can be deleted using the **Trash icon** (🗑).

Note: When adding a remote, the default network port will be **UDP 9000**. If the “receiving” unit is set for a non-standard network port, it must be entered in the “calling” unit’s **Remote** entry, after the IP address (e.g. 192.168.7.23:9004).

Edit New Remote Settings

Remote NameNew Peer

IP Address or Phone Number

Use CrosslockYes

Switchboard ID

Connection Password

Profile(Default Profile)

Backup Remote

Fall ForwardNo

IP address or phone number (POTS) for direct connection to a remote, without the use of CrossLock.

Current Default

input text for setting above

APPLY CHANGES

CANCEL CHANGES

SET TO DEFAULT

FIGURE 15 ADD NEW REMOTE CONNECTION

DASHBOARD TAB

The Dashboard Tab is designed to be open during active connections. As seen in **Figure 16**, it provides a quick view of some vital parameters.

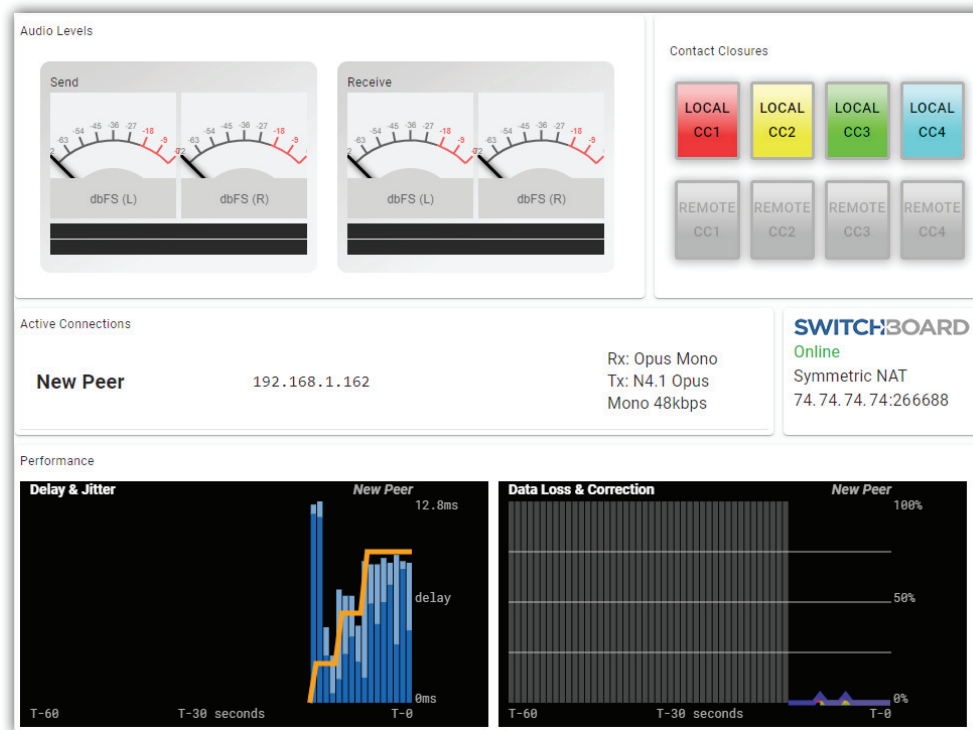


FIGURE 16 DASHBOARD TAB

1. The audio level meters give a quick indication of send and receive levels.
2. The Contact Closure section gives a visual indication of the state of each input (local) and output closure (remote). The input closure boxes also function as buttons to trigger closures locally.
3. The Active Connections section gives an indication of any currently active connections. If more than one connection is active, they will display in a list here.
4. Switchboard status, Public IP, and router information are displayed in the status box.
5. A quick view of the codec's receive stats are presented in the lower section. This is similar to the statistics presented under the "Performance Tab" described in the next section.

PERFORMANCE TAB

The Performance Tab includes information on data transmission and reception rates from BRIC-Link III to active remote connections. This allows for real-time monitoring of network quality during connections. Several headers are listed on this page and will drop down more information when clicked.

ACTIVE CONNECTION

Clicking the header “Active Connection” will show a basic chart of real-time codec receive performance. The first table, as shown in **Figure 17**, will give numeric statistics for the current active connection. If several connections are active (such as with “Multistreaming”) each will appear in a separate row.

Active Connection									
Remote Unit	Duration	RX Rate	RX Overhead	RX Delay	TX Rate	TX Overhead	TX Delay	Frame Loss	Remote Loss
BRIC-Link III 00:00:00:00:00:00	00:07:43	48.3kbps	15.9kbps (24%)	25ms	48.3kbps	15.9kbps (24%)	31ms	0%	0%

FIGURE 17 CONNECTION STATISTICS

Figure 18 displays a real-time graph which shows only statistics for the incoming data of the local codec. If a connection uses the optional CrossLock reliability layer, additional information will be shown under the “CrossLock” header.



FIGURE 18 JITTER/PACKET ERROR GRAPH

The left graph represents the work of the **Jitter Buffer Manager**. The area of most interest is the light blue area as shown in **Figure 18**, which illustrates a spread of jitter values (referenced to the current play out pointer) over the last second. If this area covers a large span, the relative jitter is high. If the light blue section of the graph is small or invisible over a time period, less jitter is present. Based on the historical value of this jitter figure, the buffer manager will expand or contract the receive buffer (lengthening or shortening overall delay). The time interval over which this measurement is assessed is called the “jitter window” and is adjustable in the “Advanced Profile” editor. The work of the Jitter Buffer Manager is shown by the yellow line, which is the target buffer delay that the system is trying to achieve, based on measurements calculated over the jitter window.

The graph on the right side shows a real-time and historical representation of frame loss. If the decoder does not receive packets in time, the chart will show a red bar indicating the percentage of lost packets over a one-second interval.

CODEC CHANNEL FIELD

Clicking on the “Codec Channel” header delivers information on the BRIC-Link III’s total receive rate and transmit rate (**Figure 19**), including information for multiple connections when applicable. When multiple transmit connections are active, this will show an aggregate rate of all outgoing connections.

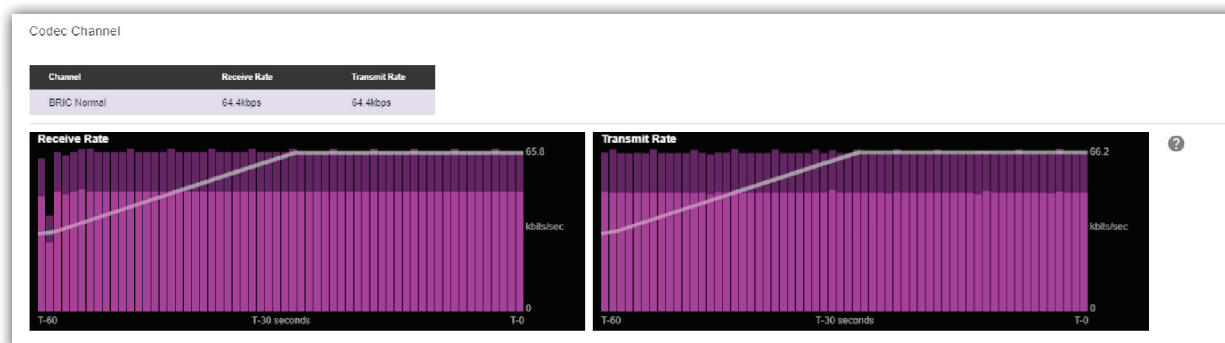


FIGURE 19 CODEC CHANNEL

CROSSLCK FIELD

Clicking on the “CrossLock” header opens a set of real-time graphs which monitor the status of the optional CrossLock reliability layer. These fields will not appear when non-CrossLock connections are active. These stats are a powerful tool for monitoring and diagnosing the quality of connections, as well as for managing the delay settings during the connection.

The CrossLock Stats are similar to the information available on the Active Connections graph; however, the CrossLock Stats show finer details about network performance in both directions. CrossLock stats are shown for both the data being transmitted from the local codec and the data being received by the local codec. All relevant stats are available for both directions.

PACKET LOSS GRAPH

The Packet Loss Graph (as seen in **Figure 20**) indicates, in percentage terms, what’s gone wrong on the network during each one-second window. Three different color-coded entries appear here: 1. **Packet Loss (dark red)** - The system has detected a packet has been completely dropped by the network and was never received by the decoder. 2. **Packet Late (bright red)** - The system received the packet, but it was too late for decoding and play out. 3. **Packet Recovered (green)** - The packet was either lost or late, but was recovered by either the Forward Error Correction (FEC) or the Automatic Repeat Query (ARQ) error correction built into CrossLock.

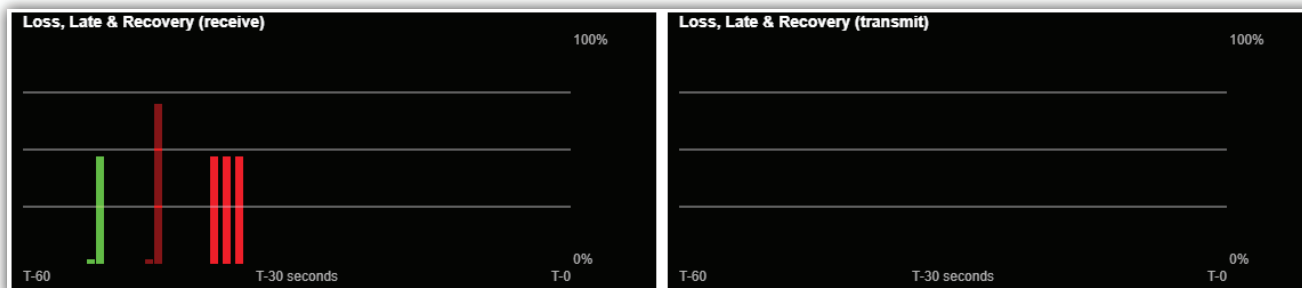


FIGURE 20 PACKET LOSS GRAPH

UTILIZATION GRAPH

The Utilization Graph (seen in **Figure 21**) indicates the incoming and outgoing utilization of the network. The bars indicate the average data rate used by the system during each one-second window. It is possible that the size of these bars will vary because CrossLock (in some modes) has control over data rate through a technique called “throttling”. Based on network feedback statistics, CrossLock will reduce or increase the utilization dynamically. If more than one network device is in use, the utilization graph will be color-coded, indicating the relative utilization of each network device. A color-code key for network devices appears below the graph. Overlaid on the network utilization graph is a gray line. This is the encoder target rate, which reflects the bitrate chosen in the profile used in the connection. This is treated as a maximum value, so utilization should mostly remain below this line.

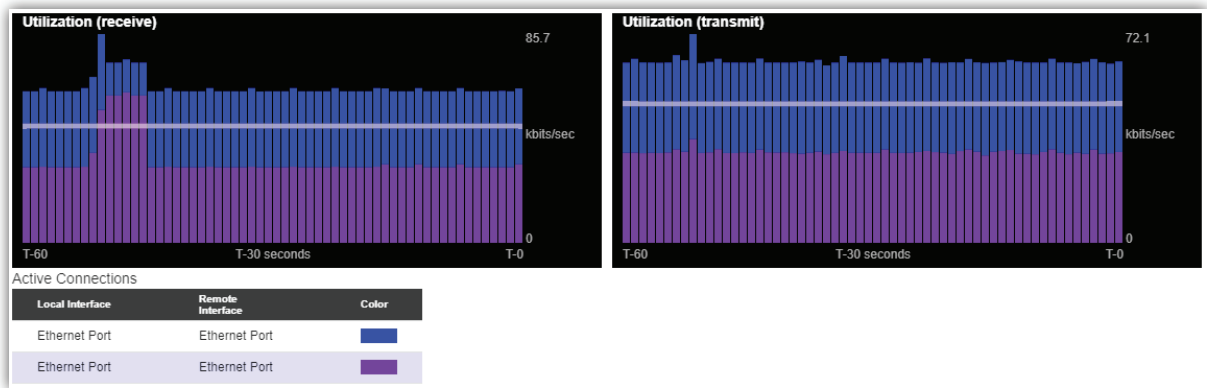


FIGURE 21 UTILIZATION GRAPH

CROSSLOCK SETTINGS

Clicking the “CrossLock Settings” header during an active connection will display the CrossLock **delay sliders**. There are independent sliders available for transmit and receive operation, as shown in **Figure 22**.

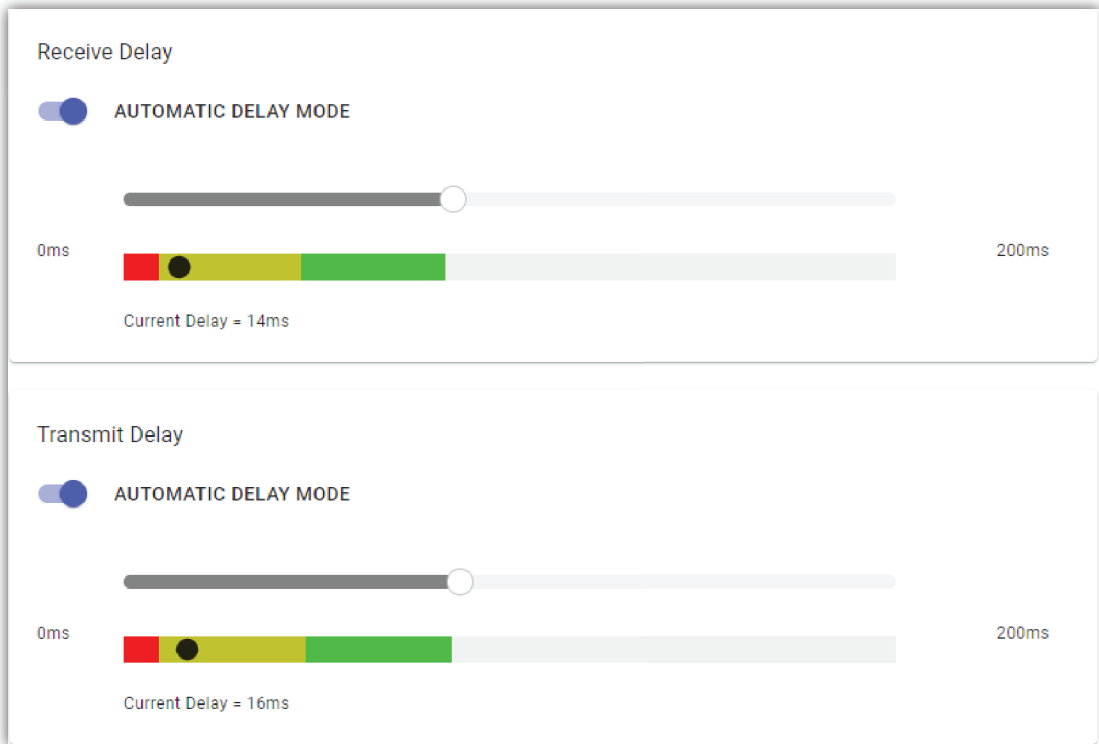


FIGURE 22 DELAY SLIDER BARS - AUTOMATIC DELAY MODE

For most CrossLock connections, the sliders should be left at their default Automatic Delay Mode settings. However, during connections on unusual networks, these sliders are available to quickly adjust the current delay settings. The most powerful way to stabilize any streaming connection is to have the decoder add a delay buffer to the connection. This compensates for changes in the rate packets are received (known as jitter). CrossLock uses a combination of decode delay buffering and error correction to keep connections stable.

At the start of a CrossLock connection, the sliders are in “Automatic Delay” mode and the information on the sliders is purely for informational purposes. Clicking off the “Automatic Delay” option sets the system to “Manual Delay” mode and allows the slider to be moved with a mouse (see **Figure 23**). The entire slider is scalable, and the range of it from left to right will vary from one hundred milliseconds to several seconds depending on the range of delays currently being addressed. The sliders will reset when a CrossLock connection ends.

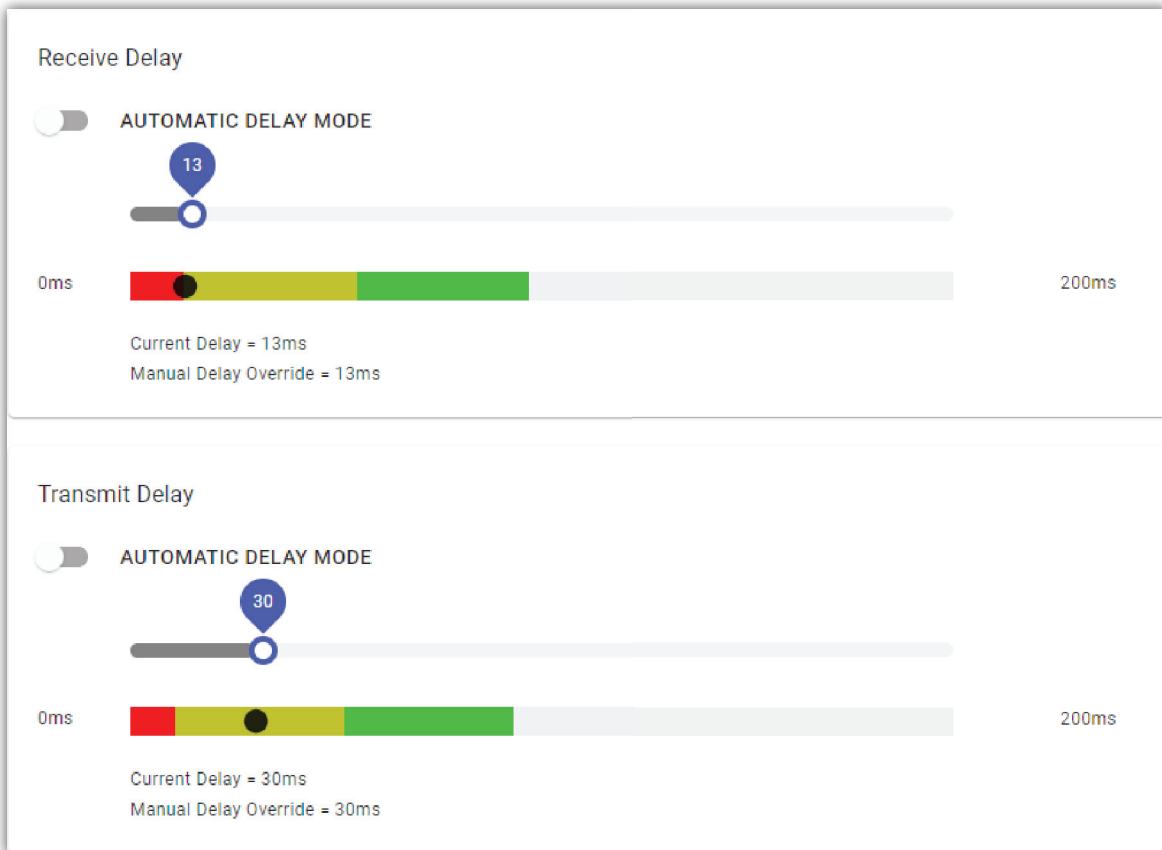


FIGURE 23 DELAY SLIDER BARS - MANUAL DELAY MODE

In either Auto or Manual mode, a series of color bars are overlayed on the slider, to signify delay “zones” of safety. As shown in **Figure 23**, furthest left is the red zone, which indicates a buffer level that is too low for stable transmission. The yellow zone indicates a delay buffer that may have stability issues, and the green zone indicates a buffer level that should provide more stability. These “zones” scale, increase and decrease in size based on the history of jitter experienced by CrossLock on the network. In “Automatic Delay” mode, the dark dot signifies the **Current Delay**, which is the best compromise value calculated by the system to balance stability and delay. Upon switching to “Manual Delay” mode, the **Current Delay** dot will move to follow where the **Target Delay** indicator is dragged.

Please note: These sliders are intended for quick changes during an active connection. Any settings made in Manual Mode will be erased after the current CrossLock session is terminated. In order to make delay buffer changes permanent, use the settings in the “Profile Manager” Tab as outlined in the next section.

PROFILE MANAGER TAB

The **Profile Manager Tab** provides a powerful set of controls for BRIC-Link III which determine the network and audio settings to be used for outgoing remote connections (**Figure 24**). Rather than adjusting system-wide settings prior to each connection, **Profiles** allow for a variety of specific encoding/decoding and delay settings which can be selected for use on any remote peer connection initiated from the local BRIC-Link III.

It is often unnecessary to create any new profiles since BRIC-Link III ships with a set of factory default profiles that cover most users. These factory profiles are locked for editing to avoid losing access to their basic functionality, but the **Profile Manager** tab allows for creating custom profiles when necessary. Please remember, though, that these profile settings only apply to connections initiated from the local BRIC-Link III. Incoming connections from another unit are defined by that unit’s profile settings.

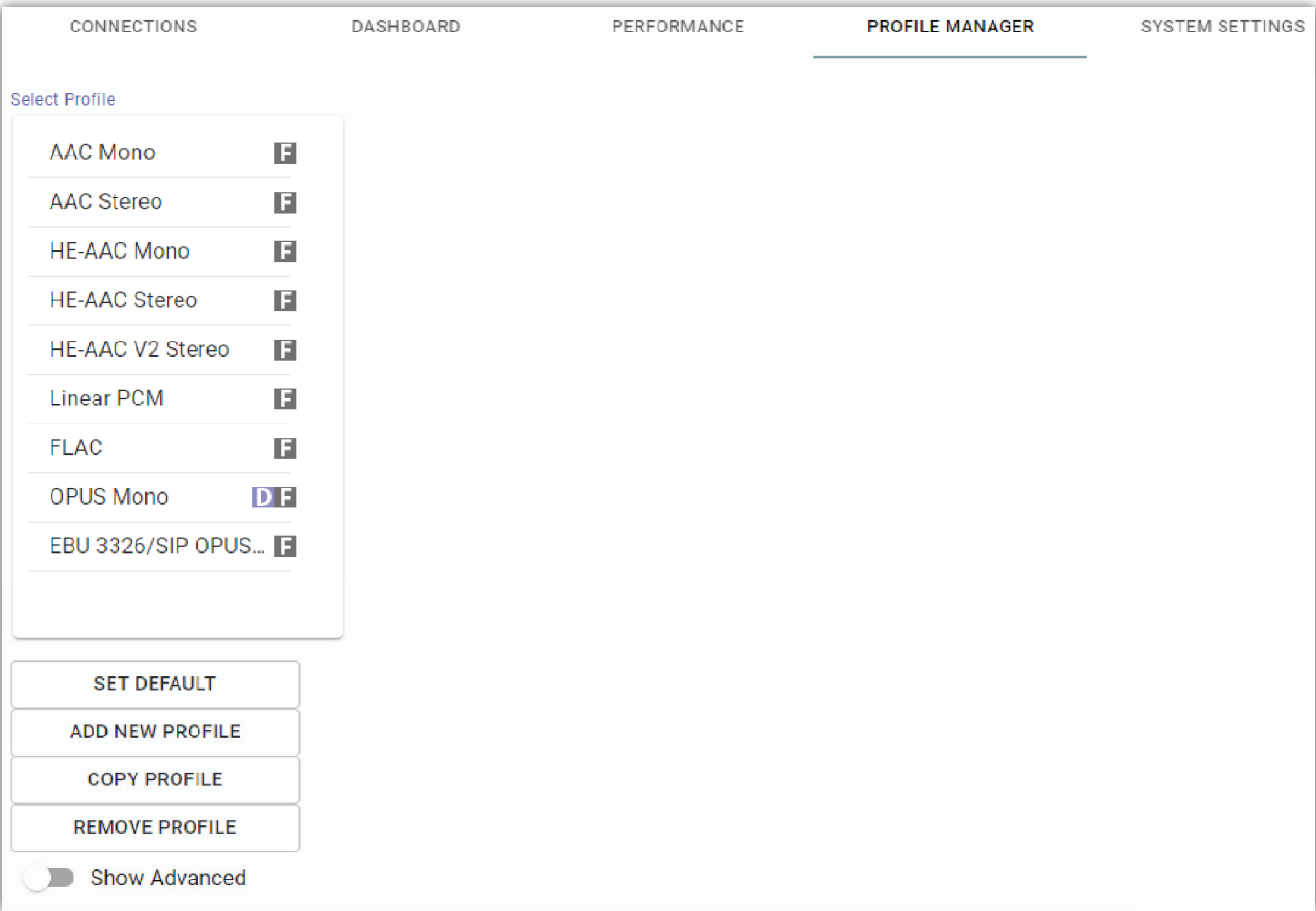


FIGURE 24 PROFILE MANAGER TAB

Profile creation is segmented into commonly used and advanced options. In order to simplify the interface, **Advanced Options** are normally hidden from the user. Please note: Building a profile doesn’t change how any remotes are connected until that profile is assigned to a remote on the **Connections Tab**. Once a profile is defined, it will be available on the **Connections Tab** to be assigned to any defined connection.

BUILDING A PROFILE

To build a new profile, select “**Add New Profile**” (1 in Figure 25), and a new profile will appear on the list named “**New Profile**”. Select it to display a list of Profile Settings, which appears to the right of the profiles list (2 in Figure 25). Selecting a setting here will display the “Adjust Profile Setting” panel to the right of the settings list (3 in Figure 25). After choosing options or inputting data in this panel, the “Apply Changes” button must be clicked in order to save any changes.

It may be useful to create new profiles based on a **copy** of one of the already existing factory profiles, which can be done by selecting a profile from the list and clicking “Copy Profile”. Although this section discusses building new profiles from scratch, a similar process can also be used to modify a newly copied profile.

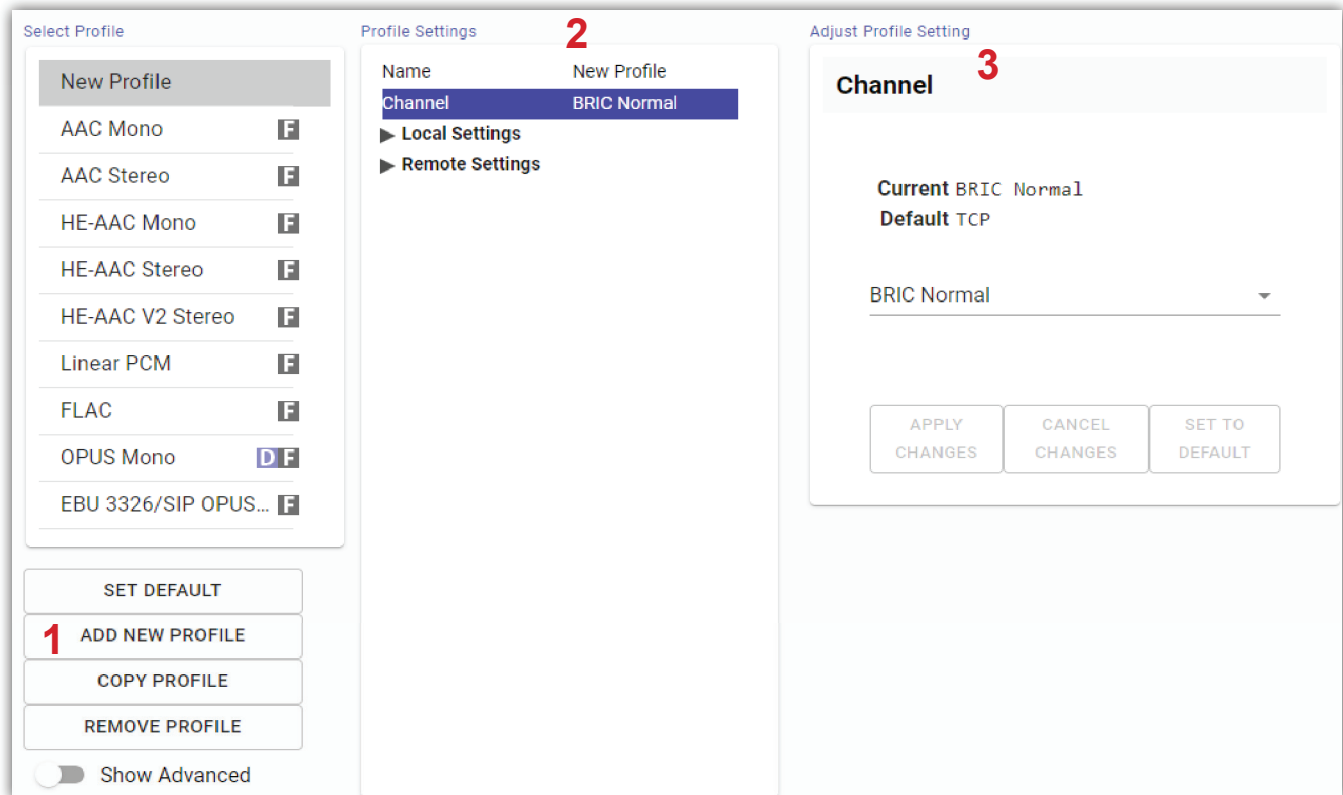


FIGURE 25 CREATING NEW PROFILES

The first **Profile Setting** that can be changed is the profile’s **Name**. This name is used to identify the profile when selecting from the list in the **Connections Tab**, and should be unique to avoid confusion.

Next is the **Channel** option, which allows for selecting between a standard Comrex IP connection (**BRIC Normal**) or one of the other connection modes offered by BRIC-Link III. Note that when using the CrossLock reliability layer, BRIC Normal mode is chosen here, as this is the protocol that runs with the CrossLock VPN.

Other Channel options include a modem-based connection, IP Multicast (a method to deliver audio to multiple locations), EBU3326/SIP for compatibility, and less often used protocols like standard RTP, TCP, and HTTP. Different aspects of these channel types are described in later sections. The following section will mostly refer to options available under the **BRIC Normal** channel. Note: It is important to define the channel of a profile before moving on to other options, since the choices in the subsequent sections will vary based on this choice. Make sure to press “Apply Changes” in order to confirm each change made.

LOCAL & REMOTE SETTINGS

When choosing an IP-based channel (i.e., BRIC Normal), users will be presented with two categories of options: Local and Remote. The **Local Settings** are used to determine how the local BRIC-Link III behaves (the one that “makes the call”), and the **Remote Settings** will determine how the remote Comrex codec behaves (the one that “receives the call”). Each category lists the following options:

Connection Timeout - Under normal circumstances, a connection will be terminated on one end, and the other end will drop the connection in turn. However, if a network failure occurs or a connection is ended abruptly (e.g. because the power to one unit was unexpectedly killed), the system will drop the connection after a predetermined time. The default is 60 seconds, but this can be shortened or lengthened as desired. If an indefinite connection is necessary, refer to **Operating BRIC-Link III in a 24/7 Environment** on **page 70** for additional information.

Encoder - Using this menu, users can select the encoder (or “algorithm”) used to send audio from this BRIC-Link III (under **Local Settings**) as well as the encoder used to send audio to this BRIC-Link III (under **Remote Settings**). The default value of the remote encoder is to follow the local encoder (i.e., it will send audio using exactly the same encoder mode it receives). This is defined as “Follow Mode” in the remote encoder selection table. See the **About the Algorithms** section on **page 83** for more information on selecting encoders. It is unnecessary to define any **decoder** types when using Comrex codecs because they automatically adapt to the incoming stream.

Transmit On/Off - This option determines whether the selected encoder (local or remote) is actually sending any data. By default, Transmission on all encoders is turned on, but there may be circumstances where one-way operation is desired (e.g. **Multistreaming**, as described on **page 86**). Turning off the local encoder transmission disables **outgoing** audio and disabling the remote encoder transmission disables **incoming** audio.

ADVANCED LOCAL & REMOTE OPTIONS

The following advanced options apply to both the local and remote entries and largely deal with the performance of **Jitter Buffer Manager**. This is actually a very complex decision-making process involving many variables, and most of the time the default parameters should work well. These advanced options are a means of overriding these defaults, and Comrex recommends that users take care when changing them. Note that when it comes to settings that effect the jitter buffer manager, local settings affect the decoder on the local side, and remote settings affect the decoder on the remote end.

Frames per Packet - This function allows the encoder to wait for variable “X” number of frames to exist before sending a packet. This option differs from **FEC** (Forward Error Correction) because each frame is only sent once. Setting this value to a number higher than one can reduce network usage, at the expense of delay. This is because packet overhead bits like IP and UDP headers are sent less often.

Decoder Downmix - This option controls the method by which decoded stereo audio will be down-mixed to mono. Mono output can be created using only audio from the Left or Right stereo channel, or by combining both channels.

Loss Cushion - Packets may arrive at the decoder displaying a range of statistical properties. They may arrive in reasonably good timing and in order, or half may arrive quickly with the other half delayed significantly. In some

cases, most of the packets arrive in a timely manner, but a small percentage of them may be extremely late. It is usually preferable to allow these late packets to be left out of the stream entirely and keep the delay lower. The decoder error concealment hides these packet losses. The **Loss Cushion** parameter instructs the buffer manager to ignore a certain percentage of late packets in its calculation. The default value is 5%. Applications that are not delay-sensitive may wish to reduce this value to zero, while extremely delay-sensitive applications may prefer to have this closer to 25%.

Retransmit Squelch Trigger - Retransmit Squelch options are used to determine how the buffer manager reacts to typical data dropouts like those seen on wireless networks. The Trigger option determines the amount of time the decoder must experience 100% packet loss before the Retransmit Squelch function is triggered. Default is one second.

Retransmit Squelch Max - The longest period of data loss during which the squelch function is active. Default is two seconds. During the squelch period, the buffer manager ignores the relative jitter experienced and does not adjust buffer size to compensate.

Fixed Delay - This option simply sets the **Delay Cushion** and **Delay Limit** at a similar value, so that the delay buffer is defined to the chosen value and will not increase or decrease significantly.

Delay Cushion - The jitter buffer manager works to keep absolute delay to a minimum. Some applications are not delay sensitive and rely less on the jitter buffer manager. The **Delay Cushion** setting is a way to instruct the manager not to attempt to drive the delay below a certain value. For example, if the delay cushion is set to 500 ms, this amount of fixed delay will be added to the buffer. If the jitter manager needs to increase the buffer it will do so, but will not go below the 0.5 second level.

Delay Limit - The inverse of the **Delay Cushion**, this parameter instructs the manager not to wind the buffer out beyond a certain delay value, regardless of how many packets are lost. This is useful in applications where staying below a certain delay figure is essential, but use of the delay limit can result in very poor performance if the network jitter dramatically exceeds the limit.

Jitter Window - This parameter defines the amount of time (in minutes) that historical network performance is analyzed in order to make the rest of the calculations. As an example, if the **Jitter Window** is set to the default of five minutes, and if a dramatic network event happens and the buffer manager reacts (perhaps by increasing the buffer), the event will be included in the manager's calculations for the next five minutes. If the network experiences improved performance over this period, the manager may choose to wind the buffer back down after the five minutes has passed.

Buffer Management On/Off - This is a diagnostic setting used to troubleshoot buffer manager performance by the factory. For usage, it should always remain "on".

CrossLock Managed Delay - There are two ways BRIC-Link III can calculate its target delay, and therefore, how much decoder buffer to add. The first is the BRIC-Normal way, and is the default for **non-CrossLock** connections. Buffer size is set based on a histogram of past jitter performance. This will incur the shortest delay possible. For

CrossLock connections, the buffer is increased to allow the use of error correction, so the buffer is thus based on a combination of the jitter histogram, and the round-trip-delay as calculated by the system. This will generally result in bigger decode buffers (and higher delays). Because it is lower, the default setting is to use the jitter histogram for all connections. This setting allows the profile user to instead use the **CrossLock** “error correction friendly” setting, for connections where delay is less important.

The following three settings are available to users in BRIC Normal mode. They are legacy settings for use in non-CrossLock connections. Most users should leave these settings as-is, as they can interfere with CrossLock connections. CrossLock settings now incorporate these functions.

Congestion Avoidance - Enabling this option allows the encoder to dynamically change the number of frames per packet sent, thereby reducing total data requirements. In addition, in most encode modes, enabling congestion avoidance provides the system a license to step down to a lower encode data rate if desired. This will happen automatically and with no audio interruption. Step down congestion avoidance is not enabled in the Linear PCM mode.

UDP Reliability - UDP, the Internet protocol used by BRIC Normal connections, does not have any inherent error correction capability. UDP Reliability adds an intelligent algorithm that requests packet resends when appropriate above the base UDP level. This UDP Reliability is useful on some wireless connections that have unsatisfactory performance due to packet loss.

Max Retransmission Rate - This parameter places an upper limit on how much additional bandwidth is utilized by the BRUTE UDP reliability layer. The default setting is 100, which allows the error correction layer to use the same amount of bandwidth as the audio stream. For example, if an audio stream is consuming 80 kb/s of network bandwidth, and UDP Max Retransmissions is set at 50%, up to 40 kb/s additional network bandwidth may be used for error correction.

SYSTEM SETTINGS TAB

The **System Settings** tab shown in **Figure 26** defines system-wide parameters that are not specific to a particular remote connection, such as *codec name*, *contact closures* and *how to handle incoming connections*. As with the **Profiles Tab**, basic options are shown by default and less frequently used settings are hidden until the **Show Advanced** option is selected.

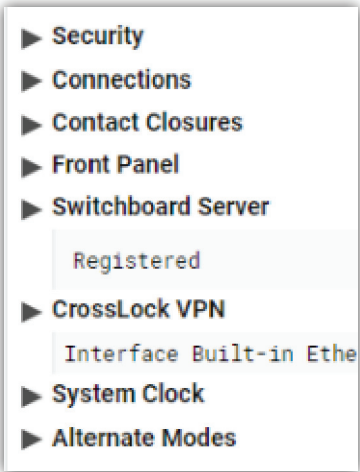


FIGURE 26 SYSTEM SETTINGS TAB

SECURITY SETTINGS

Remote Control Password - This allows for setting a user-defined password for the **web GUI** and **Device Manager** to control or configure BRIC-Link III. The default password is **comrex** (lowercase). It is highly recommended to change from the default password to something more secure. A new password can be entered here and must be set by clicking “Apply Changes”.

Note: Users should take note of any updated password, as a forgotten password may require a “factory reset” for users to regain access to BRIC-Link III (see [page 17](#) for details on how to reset BRIC-Link III to factory default, or contact *Comrex Tech Support* for assistance.)

CONNECTIONS

Unit Name - Users are encouraged to name their codecs here. The default name of a codec is the unique Switchboard ID (MAC address) of the unit. By changing this to something familiar and unique (e.g., “Roving reporter”, “Weather guy;”, etc.), you will see this name reflected in several places:

1. In the **Web User Interface**;
2. In Comrex-provided utility software such as **Codec Commander** and **Device Manager**;
3. In Switchboard Traversal Server peer lists.

Incoming Connection Password - This allows users to define a password that must be attached to all incoming connections before they are accepted. Remote units placing connections into this BRIC-Link III must know this password and apply it to the outgoing stream. Leaving the field blank will disable this function. Note: Connections made with Switchboard do not use this function.

Always Connect to Remote - This field is available to designate a remote for “always on” operation. This is useful in “nailed up” environments, where a signal is required across the link 24 hours a day. To assign an *always on* remote, simply pull down the menu and select which remote to designate as **Always On**. A connection will be made and sustained to the chosen remote. Remote connections must be created in the **Connections Tab** before they can be assigned to this function. Note: This functionality is not supported in Switchboard Connections.

Show Offline Switchboard Units - If enabled, shows offline Switchboard remotes in the remote list.

CONTACT CLOSURES

CC Connect Status - Allows for the activation of contact closure #4 out when connected. If this is selected, the signal follows the BRIC-Link III front panel “Ready” light, and CC4 will be **closed** when a valid connection is present and **open** when no connection is present.

Connect on CC1 (, CC2, CC3 and CC4) - Allows for assigning a particular remote that will be connected when its corresponding contact closure is engaged. To assign a remote connection to a contact closure, simply pull down the menu box under the desired closure and select the proper remote. A connection attempt will be made whenever the contact is triggered, and will disconnect whenever the contact is released.

FRONT PANEL

Button 1 Behavior (, Buttons 2, 3 and 4)- This option assigns a function to each of the four **Auto-Connect/Contact Closure** buttons on the front panel of BRIC-Link III. See **Configuring and Using the Front Panel Interface** on page 79 for more information on the use of the front panel interface.

- “No Action” is the default behavior, which disables the front panel button.
- “Momentary Contact Closure” sends the corresponding contact closure signal to the far-end connected codec as long as the button is depressed.
- “Latching Contact Closure” functions the same, except that the signal will remain active until the corresponding button is pressed again, or the remote connection is ended.
- “Quick Connect” enables the selection of a Remote entry to be activated when the corresponding button is pressed. When enabled, an existing Remote entry must be chosen from the **Button # Quick Connect** option below. A connection to the chosen remote is made instantly upon momentary press of the corresponding button. To disconnect, press and hold the button for 3 seconds until indicator light turns red.

Button 1 Quick Connect (, Buttons 2, 3 and 4)- This option assigns an existing Remote entry to each of the four front panel buttons. The **Button # Behavior** option above must be set to “Quick Connect” or this setting will be ignored. The drop down menu is populated with the list of Remote entries available on the **Connections Tab**. The default selection is “(None)”, which disables the Auto-Connect function.

SWITCHBOARD SERVER

Enable - This option enables the use of Switchboard to connect to remote units. (See **Making Switchboard Connections on BRIC-Link III** on page 54 for more information on using the Switchboard Traversal Server.) **Note:** BRIC-Link III requires the purchase of a Switchboard Traversal Server License for use with Switchboard.

Server Address - Domain address of the Switchboard server.

Secure - Enables secure connections to Switchboard Server. This is enabled by default.

Static CrossLock Peers - When using CrossLock without Switchboard, remote peers can be managed in this list.

CROSSLOCK VPN

Enable - This option enables the CrossLock VPN added reliability layer to connect to remote units. (See **Making CrossLock Connections on BRIC-Link III** on page 48 for more information on using the CrossLock VPN.)

Retransmit Delay - This section allows the selection of additional delay for the retransmission of lost packets when calculating auto-delay targets. The 2xRTT setting is selected by default.

Redundant Transmission - Enable to transmit data on all interfaces simultaneously to increase reliability at the cost of available bandwidth. The default setting is Off.

Encoder Throttle - This option will allow the system to reduce the bitrate of encoded media when network conditions deteriorate. Disabling this option will prevent the system from lowering the quality of the encoded media, but will also significantly reduce the ability of the system to handle networks with variable performance. This setting is set to Yes by default.

HotSwap CC Indicator - When enabled, this setting will activate a selected contact closure when a CrossLock backup interface is configured and has become activated due to failure of the primary interface(s). This is set to Disabled by default.

HotSwap CC Unit - This setting allows users to select which unit to indicate HotSwap failover on. This is set to Remote by default and additionally includes a Local and Both selection.

SYSTEM CLOCK

NTP Enabled - Enables the use of NTP network time synchronization. This setting is set to Yes by default.

NTP Server - This allows users to set the address of the NTP server. This is set for 0.comrex.pool.ntp.org by default.

Timezone - Users can set their Timezone in this setting. This allows for inputting a User's Timezone by Region, Country, and Timezone.

ALTERNATE MODES

BRIC Normal Settings

- **Accept Incoming Connections** - This determines if this BRIC-Link III is used for incoming normal IP connections. If this function is not enabled, BRIC-Link III will only support **outgoing** calls using BRIC Normal Mode.

EBU3266/SIP Settings

- **Accept Incoming Connections** - This determines whether incoming calls are accepted in EBU3266/SIP format (used for compatibility with other manufacturers who follow this protocol).
- **Incoming Connection Profile** - This allows users to select whether SIP calls will take place using a specific encoding algorithm. Note: If this option is chosen, only calls using the selected algorithm are allowed. Default is "None".
- **Use SIP Proxy** - This option determines whether the SIP function is "registered" to a SIP cloud server. If this setting is enabled, then the address, user name, and password for the proxy must be added in the relevant fields.
- **SIP Proxy Address** - IP address or URL of the SIP proxy used.
- **SIP Username** - Username for logging into registered SIP server; provided by the SIP service provider.
- **SIP Password** - Password for logging into registered SIP server; provided by the SIP service provider.

ADVANCED SYSTEM SETTINGS

When the **Show Advanced Settings** option is enabled, additional options and categories are displayed.

SECURITY

Remote Control - This enables remote control and firmware update functionality. This option may be changed in the System console only and is View Only in the Web Interface.

Remote Diagnostics - When activated, this option allows for remote diagnostics capability. The default setting is Off.

Web Server Port - This controls the port that the UI web server uses when remote control is enabled. The default setting is TCP 80.

AUXILIARY SERIAL

Baud Rate - Allows for controlling the Baud Rate of the serial port. Default is set to 9600.

Data Bits - Allows for the configuration of number of data bits. Default is set to 8.

Stop Bits - Configures the number of stop bits. Default is set to 1.

Flow Control - Allows for selection of the flow control method. Default is set to None with options for HW (RTS/CTS) and SW (XON/XOFF). This has no functional effect on BRIC-Link III.

Parity - Users can select parity protection with this setting. Default is set to None with the additional options for Odd or Even.

CROSSLOCK VPN

UDP Port - Sets the UDP port used for CrossLock VPN Connections. Default is set to UDP 9001.

Permissive - Allows users to accept CrossLock connections from any unit. This is set to No by default.

Authentication - Enables the authentication of connections. Default setting is No.

Protection - Enables AES encryption and payload integrity protection to prevent tampering with or interception of the transmitted content. This option has a SIGNIFICANT system overhead. Default setting is No.

Maximum Delay - Maximum allowed target delay, in milliseconds. Set to 5000 ms by default.

FEC - Enables data loss protection. This option controls protection on data transmitted to the remote end. Disabled by default.

FEC Delay - Amount of delay to allow for FEC. Lower packet rates will require higher delay to remain effective.

Retransmit - Enables retransmission of lost data. This option controls protection on data transmitted to the remote end.

Header Compression - Enables the compression of headers to reduce overhead, especially at lower bitrates. Default is set to Yes.

Base FEC - Applies a constant base amount of FEC sufficient to recover the specified rate of packet loss. Default is set to 0%.

STUN Server - Displays IP address of the STUN Server. Default is stun.comrex.com.

Always Connect - Allows users to attempt to maintain a VPN connection to a selected peer whenever possible. Default is set to None.

BRIC NORMAL SETTINGS

IP Port - This option defines the incoming UDP port—the number to be used for incoming IP connections. The default is **UDP 9000**. CrossLock connection is defaulted to **UDP 9001**. Note that since most BRIC-Link III codecs

attempt a connection on this port number, changing it can mean the remote units in the field must dial specifically to the new port number in order to connect to the BRIC-Link III. An outgoing call must be made to a specific port number in the form of **IP-ADDRESS:PORT#**. For example, dialing port **UDP 9004** on the Comrex test line is formatted **70.22.155.131:9004**.

HTTP SETTINGS

Accept Incoming Connections - Users can set BRIC-Link III to listen for and automatically answer any HTTP incoming calls. This option is set to No by default.

IP Port - This option defines the incoming UDP port—the number to be used for incoming HTTP connections. The default is TCP 8000.

Encoder - This defines the encoder used for HTTP streaming. Default is HE-AAC V2 Stereo 48 kB.

User Agent Blacklist - List of SIP user agents that are not allowed to communicate.

Genre - Users can define the Genre for HTTP streaming. Default value is set to Live.

Info URL - Informational URL associated with the stream. This setting is left blank by default.

Public - Allows users to define the HTTP stream as a Public Stream. Default setting is No.

STANDARD RTP SETTINGS

These settings offer several modes that allow compatibility with specific IP coding devices. For complete details, please review the **IP Compatibility** appendix on **page 105**.

Accept Incoming Connections - Listen for and automatically answer incoming calls.

Incoming Connection Profile - Use this profile for incoming connections.

IP Port - Allows users to designate an incoming network port.

RTP Compatibility Mode - Enables compatibility with select RTP audio streaming devices.

Return Channel Enable - Enables a return channel sent back to the transmitter for incoming calls.

Return Channel Encoder - For incoming calls, this specifies the codec to be used for the return channel.

Return Channel Frames per Packet - Determines how many audio frames are included in each packet. Values over 1 will reduce network bandwidth but will increase delay. This is set to 1 by default.

Incoming Timeout - For incoming calls, this specifies time connection timeout. Set to 60 seconds by default.

EBU3266/SIP SETTINGS

IP Port - The port used by the SIP negotiation channel when using EBU326/SIP Mode. If this port is changed, it's likely to break compatibility with other manufacturer's codecs.

User Agent Whitelist - List of SIP user agents that are allowed to communicate. **Only** SIP agents on this list can communicate with the BRIC-Link III. Note: This setting is not enabled when using a registered SIP proxy.

User Agent Blacklist - List of SIP user agents that are not allowed to communicate.

VIP QC Password - For legacy purposes with the **VIP QC** app, which has been deprecated.

RTP IP Port - The port used for audio transfer during EBU3326/SIP mode. Since this port info is transferred during the negotiation process, it can be changed without breaking compatibility. Note: RTSP data is **always** sent and received on the port **one number higher than this**.

Public IP Override - Enable this in an environment where ports have been forwarded through a router to the BRIC-Link III. SIP protocol assumes no ports are forwarded and may have trouble connecting if this function is not enabled.

Use STUN Server - Determines whether or not to use the STUN derived address in the outgoing fields. BRIC-Link III has alternate NAT Traversal ability so this is off by default.

SIP Proxy Keepalive - Defines how often the SIP proxy handshake happens when no call is present.

SIP Domain - When registering with some SIP services, a separate domain entry is required. If this is not populated, the domain of the SIP proxy entry is used.

SIP Auth Username - When registering for some SIP services, a separate **Auth Username** is required. Do not populate unless a specific entry is required by the provider.

Send RTP To Source Port - A NAT Traversal function used with smartphone apps. Enabled by default.

SIP Routing - Specifically required by some SIP servers (e.g. **OpenSIPS**). Modifies the behavior of the route header.

TCP SETTINGS

BRIC-Link III performs best when using UDP for connections, but there are some rare circumstances when the system may need to be switched over to TCP operation. This advanced option defines how *incoming* TCP calls are handled. *Outgoing calls* are defined as TCP when their profile is configured. BRIC-Link III normally listens for incoming calls on both TCP and UDP ports, and chooses the first to arrive. If a TCP call is detected, BRIC-Link III will attempt to use the same TCP link to transmit in the reverse direction.

Accept Incoming Connections - This allows turning TCP Auto Answer on and off. Disabling this function means only outgoing TCP calls can be established.

IP Port - Users have the option of setting the incoming TCP port number, which can be different than the UDP port number.

*Note: Warnings given above about changing port numbers also apply here—connections with mismatched port numbers **will** fail.*

VI. NETWORK MANAGER

Located in the three-line “Hamburger Menu” (☰) in the upper left hand side of the Web User Interface, the **Network Manager** allows configuration of the network settings for BRIC-Link III. Selecting Network Manager will bring up the screen shown in **Figure 27**. The available networking connections from BRIC-Link III are presented on the left hand side of the screen in the “Select Network Device” section. This area will populate with the available Ethernet ports or 4G modem adapters used to make a network connection. Here, the IP and DNS settings for these network connections can be configured. Because there may be bandwidth, firewall, and/or security concerns involved when installing BRIC-Link III on a managed LAN, Comrex **strongly** recommends that users consult their IT manager in environments where these concerns are present. **Appendix C** on **page 108** offers a quick reference of ports/services used by BRIC-Link III.

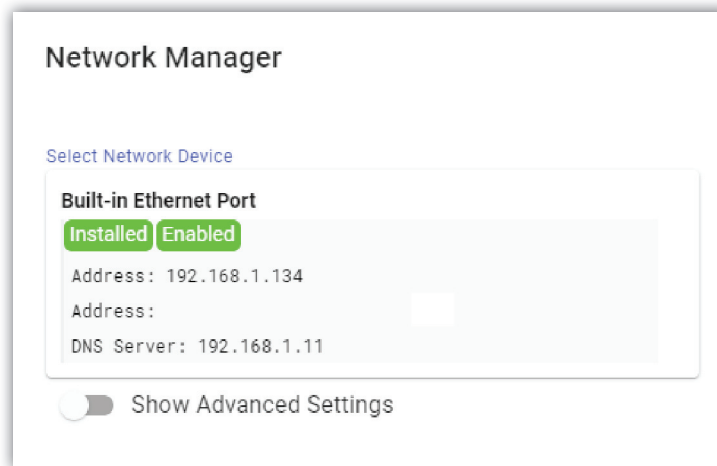


FIGURE 27 NETWORK MANAGER

The primary Ethernet port for BRIC-Link III is configured for **DHCP** by default. In this configuration, BRIC-Link III will be assigned an IP address from a pool of available IP addresses from the network router upon booting. If BRIC-Link III is connected to the Internet, it should display connection information for the Ethernet Port, including IP and DNS server addresses. (If it doesn't display this information, confirm that the unit is connected to the Internet and that the Ethernet Port is enabled.)

ETHERNET PORT SETTINGS

Select the **Built-in Ethernet Port** to display the **Device Settings** panel as seen in **Figure 28**. This port can be renamed, as well as enabled and disabled in this panel. The **Active Network Location** section will note which “Location” the unit is currently using for the Ethernet Port. A “Location” is a selectable set of network configurations (described in more detail on **page 45**). By default, the **Active Network Location** section will be populated with the “Default” Location. This “Default” Location is configured for DHCP and is initially enabled on all new units.

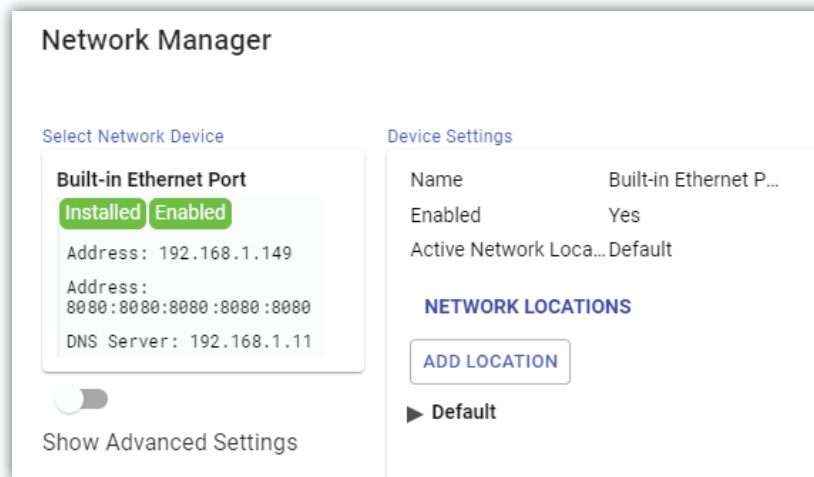


FIGURE 28 ETHERNET PORT DEVICE SETTINGS

USING A STATIC IP ADDRESS

DHCP operation works well for individual connections, but may lack the consistency required for more prolonged use in a given location. Setting a **Static IP Address** will allow BRIC-Link III to keep the same IP configuration every time it makes or receives a connection. This is especially helpful for managing *port forwarding* rules, or for issuing a direct *Public IP address*. For users who wish to have a consistent Static IP address for their BRIC-Link III, this can be configured by editing the settings for the **Default** Network Location.

First, click to expand the **Default** settings under “Network Locations” (1 in Figure 29). Next, select **IP Type** (2 in Figure 29) to open the “Adjust Device Settings” panel on the right side of the screen. Then, select the drop down list to change from *DHCP* to *Static* (3 in Figure 29). Note: The “Gateway” IP type is not applicable for most usage of BRIC-Link III and should not be selected here.

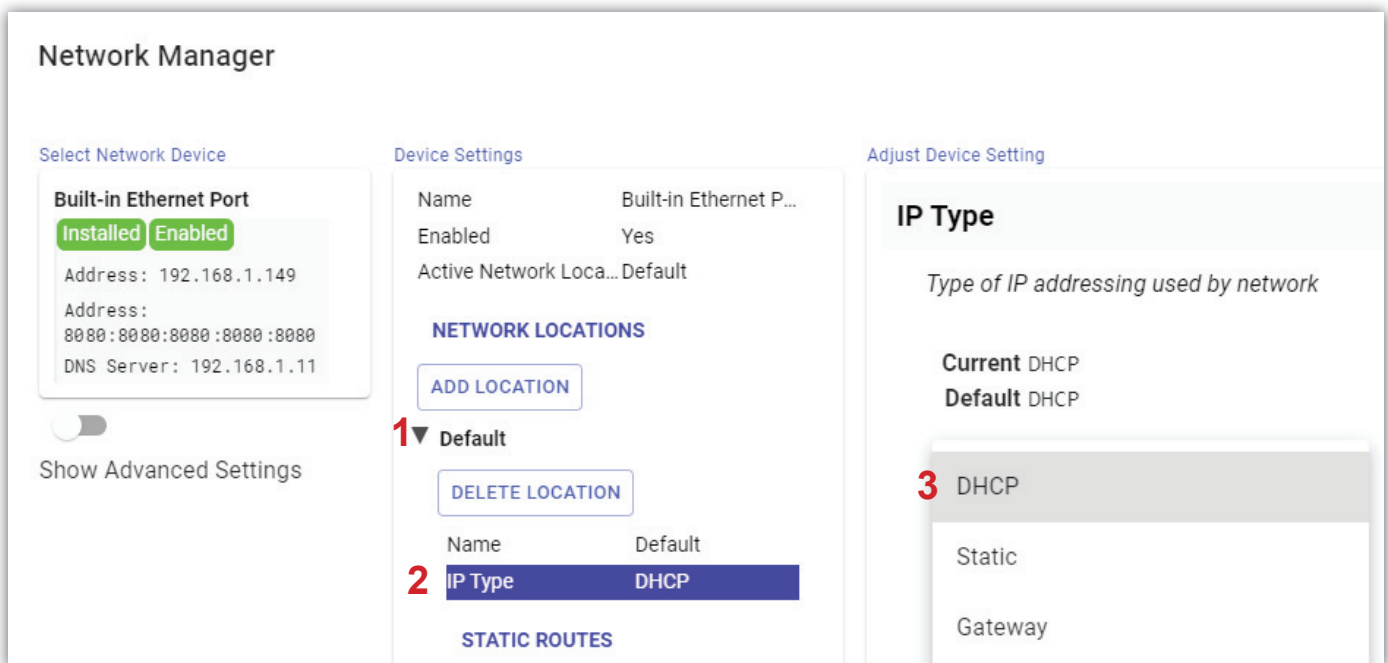


FIGURE 29 ETHERNET PORT LOCATION SETTINGS

After selecting *Static* from the drop down list, click the “Apply Changes” button. This will save the new IP type and allow new options in the “Device Settings” section (1 in Figure 30). **Static mode** requires network-specific values to be entered in each of these new fields. Enter BRIC-Link III’s new **IP address**, its **Netmask** and its **Gateway Address**, as well as at least one **DNS Server Address**. Be sure to click “Apply Changes” after each value is entered.

Note: Once the IP address, Netmask, Gateway and DNS have been entered, a new “Apply Changes” button appears in the center “Device Settings” panel (2 in Figure 30). Clicking this will finalize the new IP settings for BRIC-Link III.

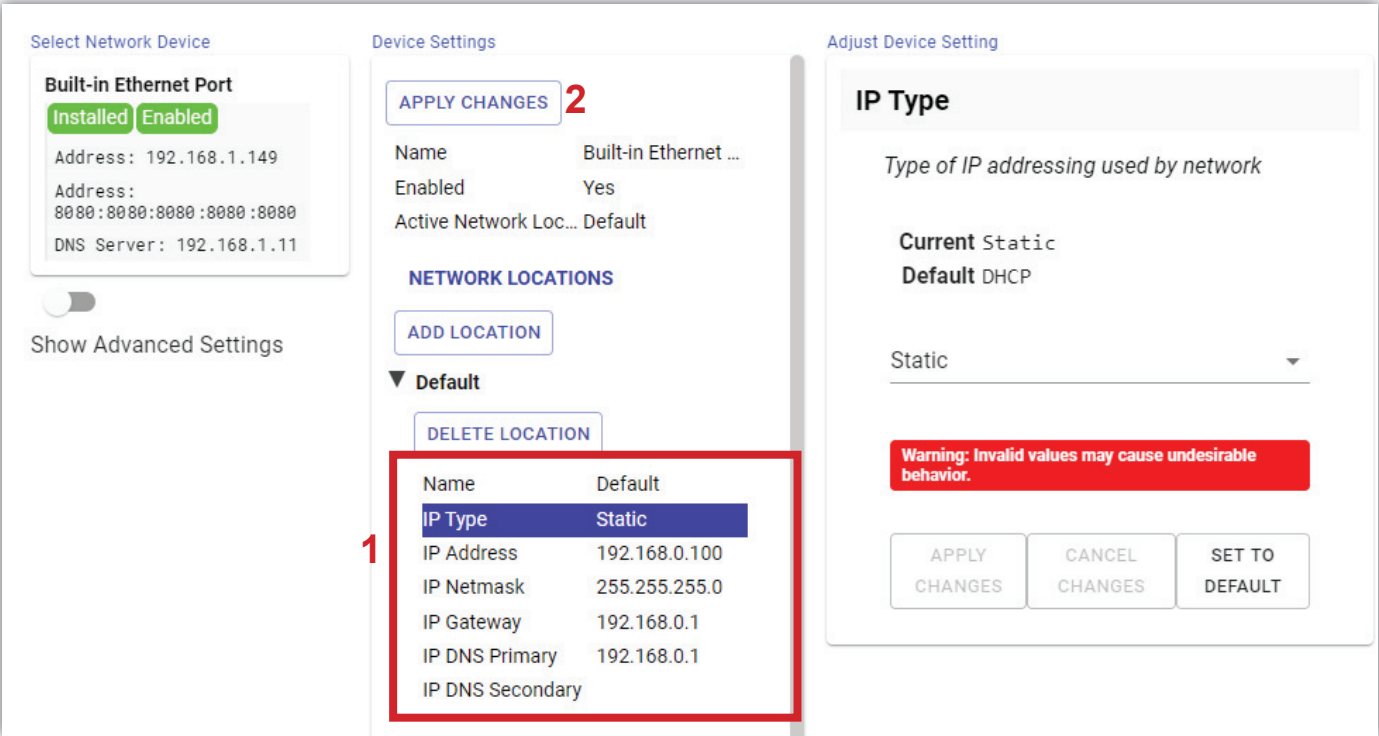


FIGURE 30 REQUIRED STATIC IP VALUES

NETWORK LOCATIONS

While using or modifying the “Default” **Network Location** may work for many users in a stationary environment, BRIC-Link III also allows new “Locations” to be added for increased versatility. A “Location” is a selectable set of network configurations that offers on-the-fly connection to different Networks. Storing settings in this way allows for operation in multiple physical locations (i.e., different studios, etc.) without overwriting the network configurations set for previous places. For example, when operating in a new studio in New York City, a user can create a **Location** called “New York” and apply the necessary IP settings for just that studio; then BRIC-Link III can be brought back to its own studio in Paris and simply change the **Active Network Location** back to one called “Paris”. In general, the most often-used IP settings should be applied to the “Default” Network Location, and less frequently-used settings should be applied to new Locations as needed.

To create a new Network Location, click the **Add Location** button under the “Network Locations” header. Then click to expand the **New Location** settings that appear below, and proceed with configuration as described in the previous section. The process from here is the same as editing the “Default” location, except that users can change the name of the “New Location” to something more memorable for a particular usage. Once a Network Location has been added, it can be implemented through the **Active Network Location** option in the “Device Settings” panel. As always, be sure to click “Apply Changes” after selecting any new options.

Static Route Settings (located below the “Network Locations” list) present advanced network configuration for users with complex and multilayered networks. As this is an uncommon need for most users, Comrex recommends users interested in learning more refer to the Static Routing Technical Note at www.comrex.com.

3G/4G CONNECTIONS

BRIC-Link III allows the limited use of 4G Mobile data connections by utilizing the **HotSwap** feature with a **Comrex Connect Modem**. 3G connection is also possible on certain carriers. The use of 4G modems as a primary network is not supported on BRIC-Link III. See **page 75** for more details on using **HotSwap**.

When a **Comrex Connect Modem** (with an activated SIM card) is plugged into BRIC-Link III, a new entry will appear in the “Select Network Device” panel of the **Network Manager** (see **Figure 31**). 4G connections generally populate “Device Settings” automatically as Cellular connections are SIM specific.

It is possible to modify the APN setting if the default is not correct by selecting the SIM option under “Carrier Networks” and selecting **APN**. New values can be input into the field manually (after selecting “Show Advanced Settings”). Additionally, some pre-programmed APNs may be selected based on the list of carriers programmed into BRIC-Link III. By setting the *Region*, *Country*, and *Provider* option, the list will suggest the proper APN by carrier.

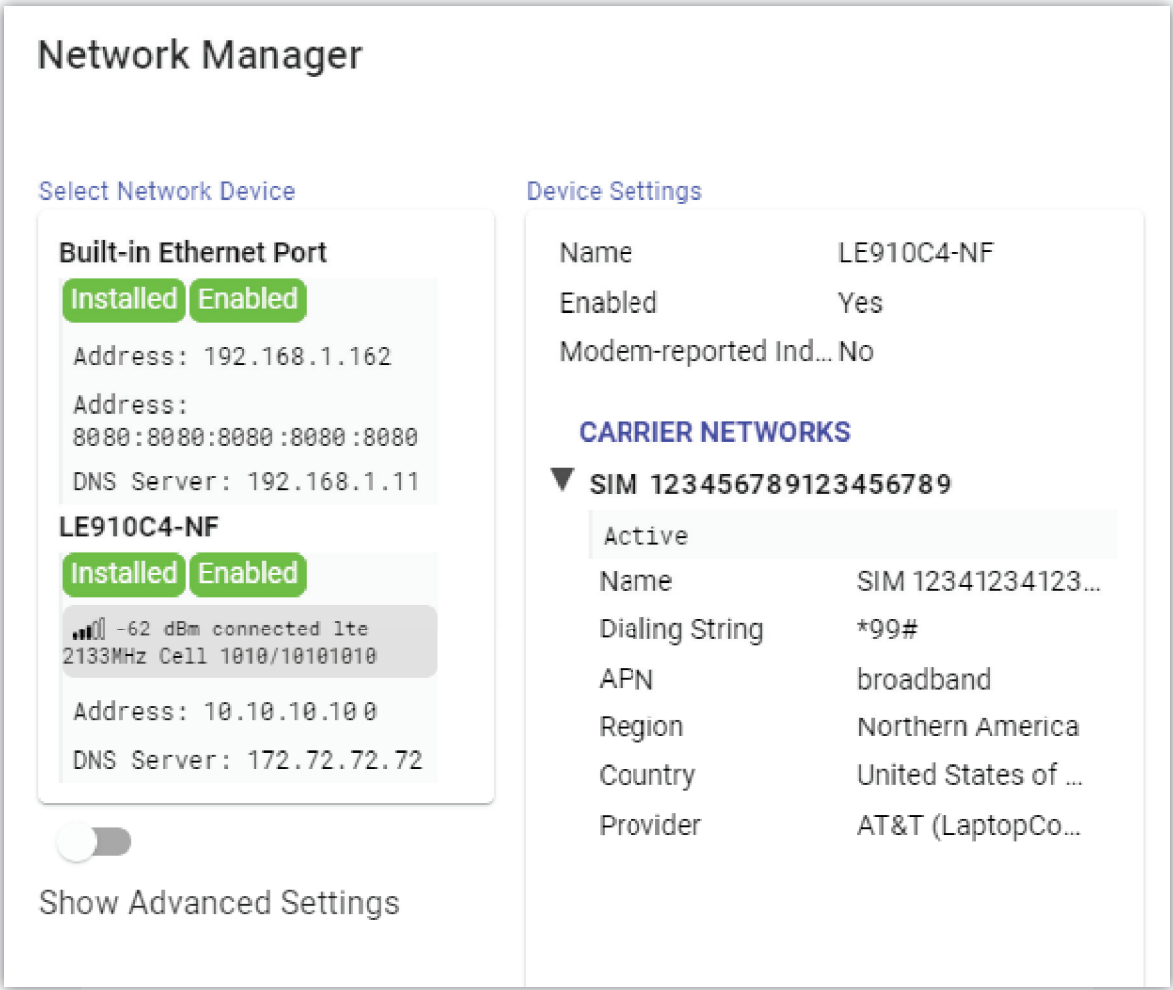


FIGURE 31 4G MODEM SETTINGS

Modem-Reported Indicator - Allows users to use the modem-reported value for the number of bars of signal strength indicated, which is generally more accurate. Modem must be re-attached after changing this option. This option only appears for **Comrex Connect Modem** network entries.

ADVANCED NETWORK DEVICE SETTINGS

When **Show Advanced Settings** (in the lower left corner) is selected, the following options also appear:

Preserve After Reset - This option ensures that changes to the unit's network configuration will be preserved even if the device is reset to factory defaults. This setting is disabled by default, and Comrex advises users to be cautious when enabling it. If the Ethernet parameters are set incorrectly, it is possible to be locked out of the BRIC-Link III, and you will then have to use the **Device Manager** program's "Network Recovery Mode" (discussed on **page 23**) in order to log into it.

Use With CrossLock - This option allows for specifying whether this Ethernet port will be used for **CrossLock** connections, and is enabled by default. It may be valuable to disable this setting in select circumstances, such as when using the main Ethernet for control purposes only or as a secondary port (added via USB-Ethernet converter) for **CrossLock** media. The "Backup" option allows this network to be used only as the secondary network when utilizing **HotSwap** (see **page 75**). **Comrex Connect Modems** used in BRIC-Link III will always be set to "Backup".

Broadcast Config - This option allows the unit to be identified and configured via broadcast communication on the web-based interface and **Device Manager**. It is enabled by default.

VII. MAKING CROSSLOCK CONNECTIONS ON BRIC-LINK III

Comrex first introduced **CrossLock**—its technology that creates an additional reliability layer to ensure quality broadcast connections—with version 4.0 firmware in 2016. As an increasing majority of users updated their units to CrossLock-capable firmware, connections made using CrossLock became the norm for Comrex codecs and are considered standard in BRIC-Link III and ACCESS Codec connections. (For details on making basic connections without CrossLock, see the **Quickstart** section on **page 19**.)

HOW CROSSLOCK WORKS: A BRIEF OVERVIEW

CrossLock is available on BRIC-Link III and other Comrex audio codecs running firmware version 4.0 or higher. To understand how CrossLock works, it's helpful to first focus on non-CrossLock connections (as shown in **Figure 32**). Without CrossLock active, a codec will make **BRIC Normal** connections to BRIC-Link III on port 9000. Audio and connection data are then sent over this single network port across the public internet, to be decoded on the far end.



FIGURE 32 NON-CROSSLOCK CONNECTION

Alternatively, when CrossLock is used, it establishes a Virtual Private Network (VPN) between the hardware on both the transmitting and receiving end before a connection is established. Using this VPN, codecs can transfer much more information than is possible on Non-CrossLock legacy connections. This information includes network status, packet loss statistics, error correction parameters, media statistic information to set encoder throttle rates, and information required to establish links over multiple networks. As shown in **Figure 33**, BRIC Normal connections happen within the **CrossLock VPN** Layer. The CrossLock connection between the Comrex hardware happens over a single port (9001) but the BRIC Normal connections take place virtually on their usual legacy ports inside that VPN.

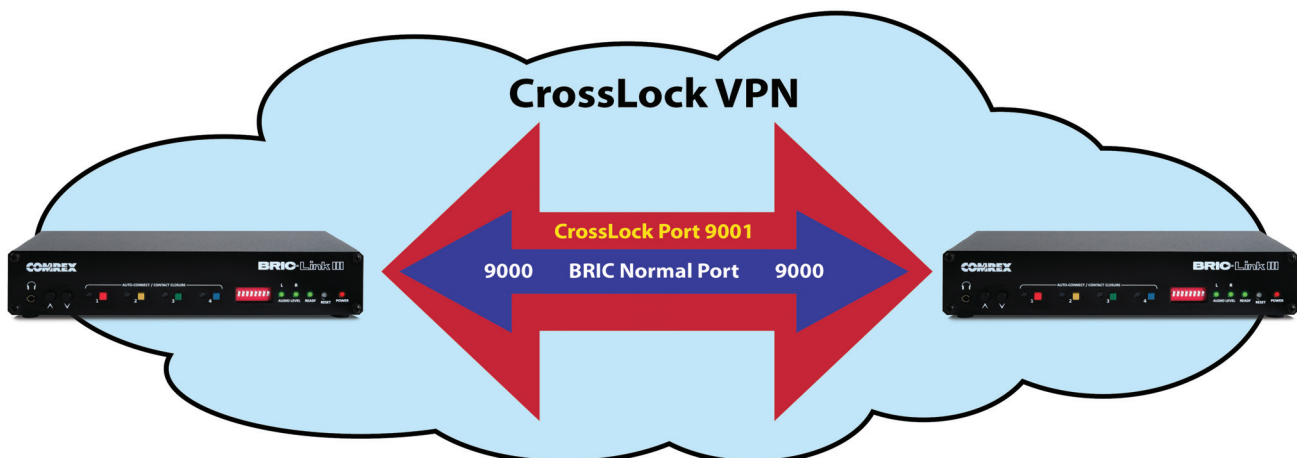


FIGURE 33 CROSSLOCK VPN

When enabled, the **CrossLock VPN** is created immediately when the first new connection is initiated, and remains for a short time after the last connection ends. The VPN provides a safe “tunnel” through the public internet, keeping units on both ends constantly aware of any necessary details to ensure the best connection possible.

One limitation of CrossLock is that each codec that joins the **CrossLock VPN** must be familiar with the others. This process takes place automatically when **Switchboard** is used (see **page 54** for details on making CrossLock connections with Switchboard). The following section describes the special configuration required for initiating CrossLock connections that don’t use Switchboard.

MAKING MANUAL CROSSLOCK CONNECTIONS

Manual CrossLock connections require special configuration on both sides of the link. This primarily involves programming the **Switchboard ID** (or primary Ethernet MAC address) for each unit into Remote entry on the codec on opposite side of the link. In other words, each codec must have a **Remote** entry containing the Switchboard ID of the other unit in order to create a successful **CrossLock VPN**.

Note: A typical connection involves a “calling” unit and a “receiving” unit, and the **remote** entry is usually only needed on the “calling” unit because it initiates the connection. Manual CrossLock connections differ in that the “receiving” unit should also have a **remote** entry that is unused but still required for VPN purposes. In the case of this “dummy” entry, it’s not actually important for the *IP address* field of the **remote** entry to be correct while receiving an incoming connection. The entry on a “receiving” unit must simply be enabled for CrossLock operation and it must have the correct *Switchboard ID/MAC address* of the “calling” unit.

When BRIC-Link III connects to an **ACCESS MultiRack**, instances #2-5 have special Switchboard IDs consisting of the primary Ethernet MAC followed by a “-x” suffix (e.g., 00:01:A2:3B:4C:55-4 for instance #4).

CREATING NEW CROSSLOCK REMOTES

Login to BRIC-Link III’s **Web User Interface** and open the **Connections Tab** (this page loads first by default, as seen in **Figure 34**).



FIGURE 34 WEB USER INTERFACE CONNECTIONS TAB

To add a new remote unit to the list, click the **Add a new remote connection** icon (⊕) on the right side of the screen. A dialogue box will appear and require the *IP address* of the remote unit to be input (as seen in **Figure 35**). The “Use CrossLock” field should be set to “Yes”, and the **Switchboard ID/MAC address** of the unit on the far end should be entered in the next field. Users may assign a **Remote Name** and either choose an audio **Profile** or proceed with the “Default Profile”, which is automatically selected.

Figure 35 shows the 'Edit New Remote Settings' dialog box. The fields and their values are as follows:

Field	Value
Remote Name	
New Peer	
IP Address or Phone Number	
Use Crosslock	Yes
Switchboard ID	
Connection Password	
Profile	(Default Profile)
Backup Remote	
Fall Forward	No

FIGURE 35 REMOTE SETTINGS

Note: When adding a remote, the default network port will be **UDP 9000**. If the “receiving” unit is set for a non-standard network port, it must be entered in the “calling” unit’s **remote connection** entry, after the IP address (e.g. 192.168.7.23:9004).

Connection Password - This function can be enabled on any Comrex codec to filter incoming connections. When enabled, attempted incoming connections will be rejected without the proper case-sensitive password. See **page 37** for details on setting an *Incoming Connection Password* in the **System Settings** tab. For outgoing connections, the password is entered in the “Connection Password” field of the **Remote Settings** page and must match the password set on the receiving end.

Profile - Remote entries require selection of an audio **Profile** to determine which encoding algorithms to use, but will use the system’s “Default Profile” if nothing else is chosen. BRIC-Link III includes several factory profiles to choose from, each of which enables a full-duplex link. Factory-provided profiles offer commonly used encoders and settings, but are locked for editing to avoid losing access to their basic functionality. Depending on use and environment, custom profiles can be made in the **Profile Manager** tab (see **page 32** for more on audio profiles).
Note: While CrossLock generally supports the encoding algorithms that operate on any 4.x-level firmware, the more data-intensive algorithms (e.g. Linear PCM and FLAC) are only supported on units running firmware version 4.3-p4 or higher.

Backup Remote - BRIC-Link III features an ability to have an automatic backup to a designated remote connection. A specific backup connection (for when the primary fails) is designated when a new remote is created. As shown in **Figure 36**, selecting the backup option opens a menu allowing selection of other outgoing remotes that have been created. The **Backup Remote** feature works in conjunction with a remote entry’s *Local Timeout* parameters, which are defined by the chosen audio **Profile**. BRIC-Link III can sense an IP Connection failure, and will wait for a time designated by the *Local Timeout* parameter. If the connection is restored during this time, no backup will occur. If the timeout lapses without re-connection to the primary remote, BRIC-Link III will automatically connect to the

designated **Backup Remote**. This connection will be retained until the connection is either manually terminated or the **Fall Forward** function reestablishes connection to the Primary Remote.

Edit Remote Settings

Remote Name	New Peer
IP Address or Phone Number	192.168.1.149
Use Crosslock	Yes
Switchboard ID	00:01:00:01:00:01
Connection Password	
Profile	(Default Profile)
Backup Remote	(None)
Fall Forward	No

Optionally select a backup remote to connect to if the connection to this remote is lost.

Current (None)

Default

(None)

(Keep retrying this remote)

Loopback

Comrex Lab Voice

Comrex Lab Music

FIGURE 36 CHOOSING A BACKUP REMOTE

Fall Forward - If the primary remote is restored while a backup remote connection is active, BRIC-Link III will detect a valid signal indicating that the primary remote is once again available. When **Fall Forward** is enabled, it will automatically disconnect the backup and revert back to the primary remote. To enable this feature, click the **Fall Forward** option in the “Edit Remote Settings” panel and select “Yes”.

CREATING A “RECEIVING” REMOTE ENTRY

Once the remote connection entry is saved on the “calling” unit, a similar entry must be added to the **Connections Tab** of the other unit in the link. Login to the **Web User Interface** of the “receiving” unit, and follow the same process as described above to add a new remote using the *Switchboard ID/MAC address* of the “calling” unit. An *IP address* is not required for this. For applications where connections will always be initialized from one end, this new remote entry will remain in the connections list, seemingly unused. The entry is, however, used in the background every time the connection is established, helping to create the necessary VPN for **CrossLock** to function.

Once a connection is established from the other end, the “receiving” unit’s **Connections Tab** will show the incoming connection on the top of the remote list. An example shown in **Figure 37** illustrates how the “receiving” remote entry will appear unused even during an active connection from that remote. This differs from how the connection will appear on the “calling” unit, as described in the following section.

Name	Address	State	Codec
BRIC-Link III 01:01:01:01:01:01	(CrossLock)	Connected	Rx: Opus Mono Tx: N4.1 Opus Mono 48kbps
Loopback	127.0.0.1		
Comrex Lab Voice	70.22.155.131:9000		
Comrex Lab Music	70.22.155.132:9000		
New Peer	192.168.1.149		

CONNECT
DISCONNECT
+ ✎ 🗑
Search 🔍

These are the same Remote

FIGURE 37 INCOMING MANUAL CROSSLICK CONNECTION

CONNECTING AND DISCONNECTING

Once the remote connection entries are saved on both units in the link, the connection can be established using the **Web User Interface** on either end. Locate the desired remote entry in the **Connections Tab**, highlight the remote and click the “Connect” button on the right side of the screen. When a connection is attempted, the “State” column in the connection table will change to reflect the progress of the connection (as shown in **Figure 38**). If the connection fails, the reason for the connection failure will be shown in this column. When the remote connection succeeds, the encoder and decoder mode will be reflected in the “Codec” column (shown as “Tx:” and “Rx:”, respectively). To end a connection, highlight the remote and select Disconnect.

CONNECTIONS				DASHBOARD	PERFORMANCE	PROFILE MANAGER	SYSTEM SETTINGS
Name	Address	State	Codec				
Loopback	127.0.0.1						
Comrex Lab Voice	70.22.155.131:9000						
Comrex Lab Music	70.22.155.132:9000						
New Peer	192.168.1.149	Connected	Rx: Opus Mono Tx: N4.1 Opus Mono 48kbps				

FIGURE 38 REMOTE CONNECTION STATUS

SPECIAL NOTES FOR CROSSLINK CONNECTIONS

MULTIPLE NETWORK SETUP

For added reliability, multiple networks may be attached to BRIC-Link III and used together during a CrossLink connection. A second Ethernet cable can be added using a USB-to-Ethernet adapter. When two Ethernet cables are detected, both networks will be added to the CrossLink VPN and used for media transfer (unless specifically disabled for CrossLink use). During an active CrossLink connection, the **Performance Tab** on the Web User Interface will show the ratio of data being applied to networks on both the send and receive direction.

Default Network-Bonding - By default, data is apportioned between the networks in a “Bonding” mode. This means the entire data channel is broken into pieces and apportioned among the networks. This mode is best for networks of unknown quality. If one network becomes constrained, data will be allotted dynamically among the others. Bonding mode is very effective even when one network drops entirely, often providing glitch-free audio as data is switched over.

Redundant Transmission - Alternatively, CrossLink can be configured for “Redundant” mode. This is best for networks of known good quality. In Redundant mode, all data is reproduced over every available network, and only the first packet to arrive at the decoder is used. This mode can be enabled in the **System Settings Tab**, by selecting “Redundant Transmission” under the “CrossLink VPN” header. This is a system-wide setting.

HotSwap - CrossLock can also be configured to use one network only when the primary network fails. This is called “HotSwap” mode and is described in detail on **page 75**. HotSwap is not a system-wide setting, and must be enabled on a particular network by opening the **Network Manager** and clicking “Show Advanced Settings”. To enable HotSwap, select the network that will be used as a backup, and open the “Use with CrossLock” option. Then change the value from “Yes” to “Backup”, and click “Apply Changes”. This network will then only send active connections when the primary network has failed. Note: a small amount of data is still active on this network at any given time during successful connections on the primary network. This ensures a quick activation of the backup network upon primary network failure.

CROSSLOCK CONNECTIONS TO ACCESS MULTIRACK

Without CrossLock active, a codec will make BRIC Normal connections to MultiRack instance #1 on port 9000. Instance #2 will connect on 9002 and instance #3 will connect on 9003. These are the default BRIC Normal ports used on the MultiRack side, but any codec attempting to connect to these instances must account for these ports as if they were non-standard.

The CrossLock connection between the Comrex hardware happens over a single port (9001) but the BRIC Normal connections take place virtually on their usual legacy ports within that VPN. The system will show these virtual connections happening on ports 9000, 9002 and 9003 (these are the BRIC Normal ports), but the only actual connection between hardware is happening on 9001. For this reason, if you only intend to make CrossLock connections to MultiRack, only UDP port 9001 needs to be open or forwarded.

USING NON-STANDARD PORTS FOR CROSSLOCK

In the special circumstance where the default CrossLock port of UDP 9001 can not be used (e.g. several BRIC-Link III codecs sharing a single IP address), then the process for making manual CrossLock connections becomes more complex. For more information on these settings, refer to the Technote “Using Multiple Comrex Codecs Behind A Single IP Address” on www.comrex.com.

VIII. MAKING SWITCHBOARD CONNECTIONS ON BRIC-LINK III

WHAT IS SWITCHBOARD?

Switchboard is a feature that allows a Comrex codec to “sync” with a cloud-based server maintained by Comrex. This allows for easy connections to be made between codecs without any knowledge of IP addresses on either end of the link. It also provides presence and status information about all the Comrex codecs in your fleet, and can help make some connections through routers and firewalls that might be difficult otherwise.

Switchboard is enabled by default on all **ACCESS** audio codecs, which often travel and connect in various locations. BRIC-Link III, on the other hand, is particularly suited for point-to-point “nailed up” audio links. As such, Switchboard’s versatility and ease of use in connections to unknown networks is not necessarily a core-function of this codec that is famous for its “set it and forget it” usability. Although it is not enabled by default, BRIC-Link III can be activated for use on Switchboard through the purchase of a **Switchboard Traversal Server License**. Contact an authorized Comrex dealer for more information.

This section of the manual describes the procedure for making and receiving connections on BRIC-Link III via the Comrex Switchboard server. This is the easiest, but not the only way to make BRIC-Link III connections. As described in the previous section, manual connections can be made but require additional configuration for each remote that is not necessary when using Switchboard. Once BRIC-Link III is added to a **Switchboard Account**, connections can be made with as little as one step.

For details on setting up a **Switchboard Account**, see the next section on **page 59**. For many users, someone in their organization will have already done this, and those users can proceed with the instructions below.

MAKING SWITCHBOARD CONNECTIONS

Once BRIC-Link III is added to a **Switchboard Account**, connections to any other codec in that account can be made by logging into the **Web User Interface** of the unit. The **Connections Tab** will appear different for units that use Switchboard (as shown in **Figure 39**).

Name	Address	State	Codec
Loopback	127.0.0.1		
Comrex Lab Voice	70.22.155.131:9000		
Comrex Lab Music	70.22.155.132:9000		
ACCESS NX Rack 30:30:30:30:30:30	74.74.151.151:10010		
ACCESS NX Rack 01:01:01:01:01:01	22.22.132.132:10100		
BRIC-Link III 00:01:00:01:00:01	74.74.157.157:38338		

CONNECT

DISCONNECT

+ ✎ 🗑

Search 🔍

SWITCHBOARD
ONLINE

Public IP
74.74.157.157

NAT Type
Symmetric NAT

DETAILS 🔗

FIGURE 39 SWITCHBOARD PEERS

PEERS

The *Remotes* list will show special entries for any units (or “**peers**”) that can be connected to via Switchboard. The “*gear*” icon (⚙️) next to each Switchboard peer indicates the availability of connection to that unit. BRIC-Link III can connect to any **peer** with a *green gear* next to its name. A *yellow gear* signifies that the peer is currently busy with another connection, whereas a *red gear* signifies that it is inaccessible (usually due to network incompatibility). Any Switchboard peer that is currently offline or has lost communication with the TS server will be hidden from this list by default; however, BRIC-Link III can be configured to “Show Offline Switchboard Units” via the *Connections* section of the **System Settings Tab** (see **page 37**). Offline peers are displayed with a *gray gear* icon when shown.

By selecting a Switchboard peer and clicking the edit “*pencil*” icon (✎) on the right side, you can change several important aspects of the Switchboard connection:

- Use CrossLock** - Determine whether the connection will be made over the CrossLock Layer and port arrangement, or over the legacy BRIC Normal protocol and port arrangement. Note: this choice affects which IP ports are used for connections, so there are implications concerning firewalls and routers (refer to **Appendix C** on **page 108**).
- Connection Password** - This adds an extra layer of security to the connection. This is a password that has been programmed into the receiving codec, and will be required on the outbound side for proper connection. Since Switchboard provides its own connection filtering, passwords are not normally used in this mode.
- Profile** - Choose one of the factory supplied or custom built profiles for this connection. This defines encoders used in both directions, along with a long list of other parameters. See the Profile section in the setup section for more details. If none is specified, the profile designated as default will be used.
- Backup/Fall Forward settings** - Allows a backup peer to be chosen, as described in detail on **page 50**.

CONNECTIONS

Once your Switchboard peers are configured, connecting to one is simple. (You can also easily connect to any existing peer using the default configuration.)

1. Select the desired Switchboard peer.
2. Make sure the “gear” icon is green.
3. Click the “Connect” button on the right side of the screen.

Switchboard connections can be ended from either end of the link, by choosing the active connection in the list and clicking “Disconnect”. Active connections will display additional information such as the *connection state* and the *encode/decode algorithms* (as seen in **Figure 40**).

Comrex Lab Music	70.22.155.132:9000		
⚙️ ACCESS NX Rack 30:30:30:30:30:30	74.74.151.151:10010		
⚙️ ACCESS NX Rack 01:01:01:01:01:01	22.22.132.132:10100	Connected	Rx: Opus Mono Tx: N4.1 Opus Mono 48kbps
⚙️ BRIC-Link III 00:01:00:01:00:01	74.74.157.157:38338		

FIGURE 40 CONNECTED SWITCHBOARD PEER

Incoming connections will appear as new entries in the Switchboard peer list while they are active. They can be disconnected the same way.

SWITCHBOARD STATUS

When Switchboard is enabled on BRIC-Link III, additional status information appears on the right side of the **Connections Tab**, including “Public IP” and “NAT Type” (as shown in **Figure 41**). The IP ports currently used by the unit can also be shown by clicking the “Details” button. This information is often useful for IT managers to open or forward network ports. Note: BRIC-Link III’s unique **Switchboard ID/MAC address** can be found here in the “Details” pop-up window. This ID is required to add units to a Switchboard account, as described in the next section of this manual.



FIGURE 41 SWITCHBOARD STATUS

FOLLOWING MULTIPLE CONTACT LISTS

Part of setting up a **Switchboard Account** involves managing a feature called “Contact Lists” (see **page 61**). Adding units to a Contact List allows codec users to find and connect to any unit on that list, as long as that codec is set to **follow** that Contact List. When a codec is set to follow more than one Contact List, the codec user will be able to find and connect to units on all the followed Contact Lists. However, this changes the way codec users will interact with Switchboard. To understand the difference, first see the BRIC-Link III’s **Web User Interface** as it appears when only one Contact List is followed (**Figure 42**).

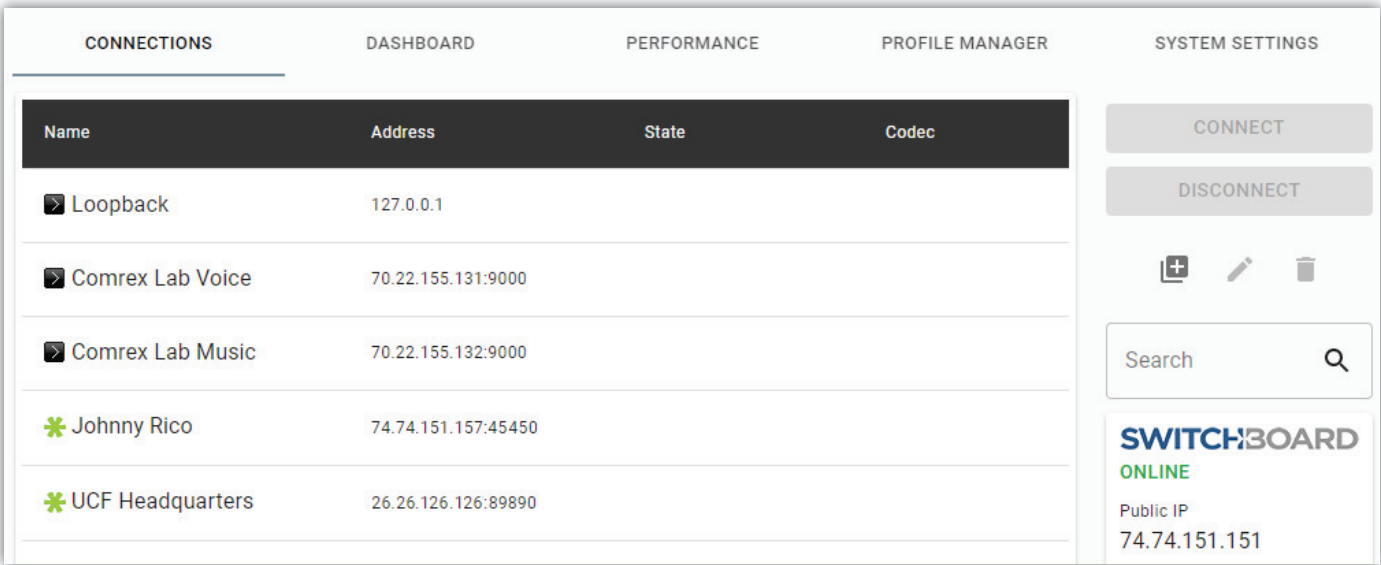


FIGURE 42 FOLLOWING ONE CONTACT LIST

The **Connections Tab** will usually show any units that are on a followed Contact List, with a color-coded “gear” icon indicating the unit’s connectivity status. When multiple Contact Lists are followed, the **Connections Tab** will instead show each Contact List, with a “Folder” icon (as seen in **Figure 43**).

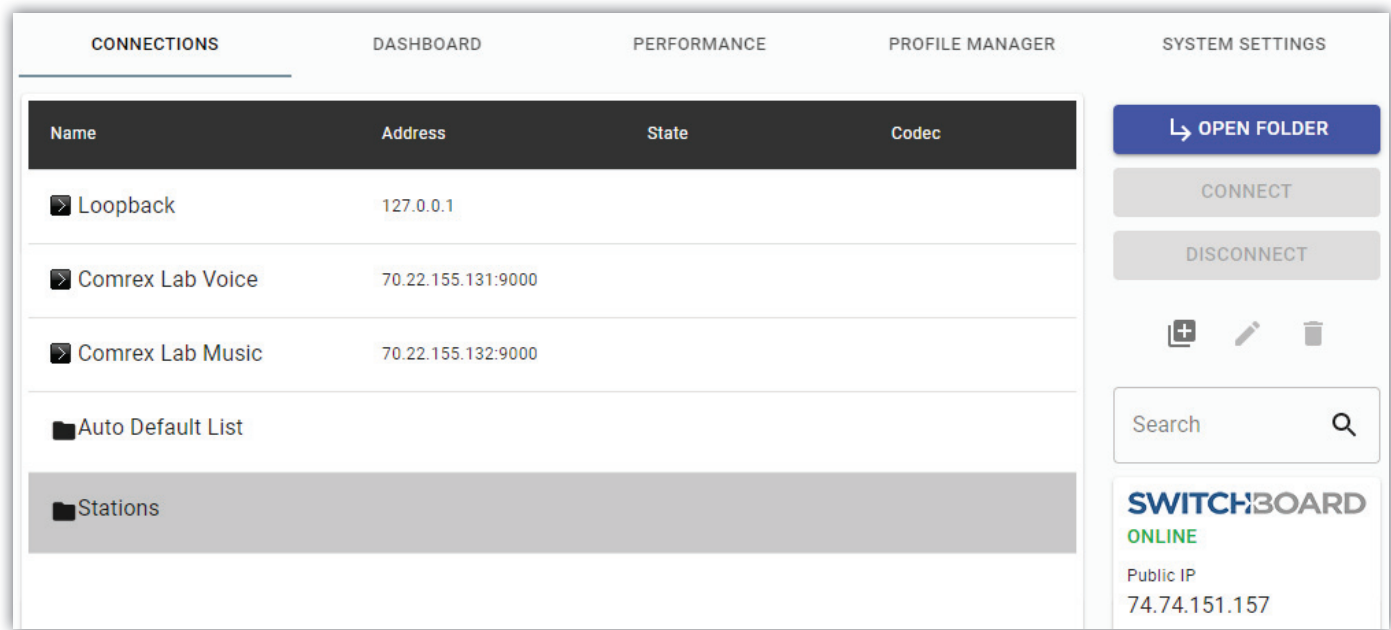


FIGURE 43 FOLLOWING MULTIPLE CONTACT LISTS

Select any Contact List and click the “Open Folder” button on the right side of the screen (or double-click the Contact List) to open that List. Units on that List will now be displayed with their familiar “gear” icon (**Figure 44**).

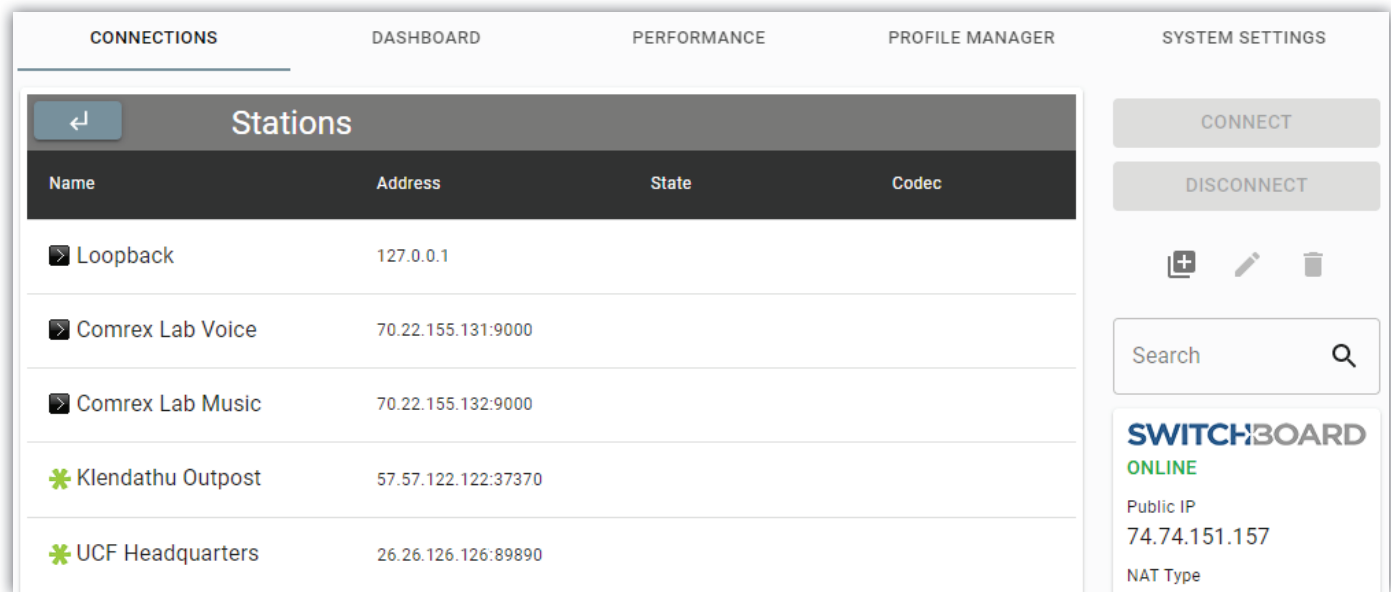


FIGURE 44 OPENED CONTACT LIST

A new header also appears above the Connections list, displaying the name of the opened Contact List, and a “Back” button (⬅️), used to close the current Contact List and display all available Lists again. Connections to units on the opened Contact List can be made as usual, and active connections will remain connected even if the Contact List folder is closed on this screen (i.e., an active connection may be **hidden from view** when this happens).

Note: While units can follow multiple Contact Lists that contain the same peer, a peer will only appear in one Contact List, to prevent “duplicate entries”. If the “Auto Default List” is used as *Master List* containing all units on an account, that List will now only show peers not already available in another Contact List. If the same peer is in several followed Contact Lists, it will typically only show up in the alphabetically-first List.

Following multiple Contact Lists is especially useful when receiving **Shared** Lists from other accounts, as described in the next section.

IX. SETTING UP A SWITCHBOARD ACCOUNT

The **Switchboard Traversal Server** is a service built and maintained by Comrex on the public Internet that facilitates connections between audio codecs by allowing them to share network and status information across a fleet of other codecs. Devices added to a **Switchboard Account** can share connectivity parameters with any other units on that account, and the Switchboard server will keep these units up to date on how best to connect across various network types. **Note:** BRIC-Link III requires the purchase of a Switchboard Traversal Server License for use with Switchboard.

A **Switchboard Account** offers several ways to control a fleet of codecs. This section of the manual offers a brief overview of how to set up and configure a basic **Switchboard Account** online. For more detailed information and advanced setup instructions, see the **Switchboard Setup for Audio Codecs** guide available on Comrex's website (www.comrex.com).

LOGGING IN TO SWITCHBOARD

In order to use Switchboard, users must first have an account with the server. This account can be obtained by contacting Comrex at 978-784-1776 / 800-237-1776, or by emailing techies@comrex.com / info@comrex.com. Only one account is required for each group of codecs. Once a user name and password are provided, navigate to **Switchboard.comrex.com** in a web browser and log in to access the account page (as shown in **Figure 45**).

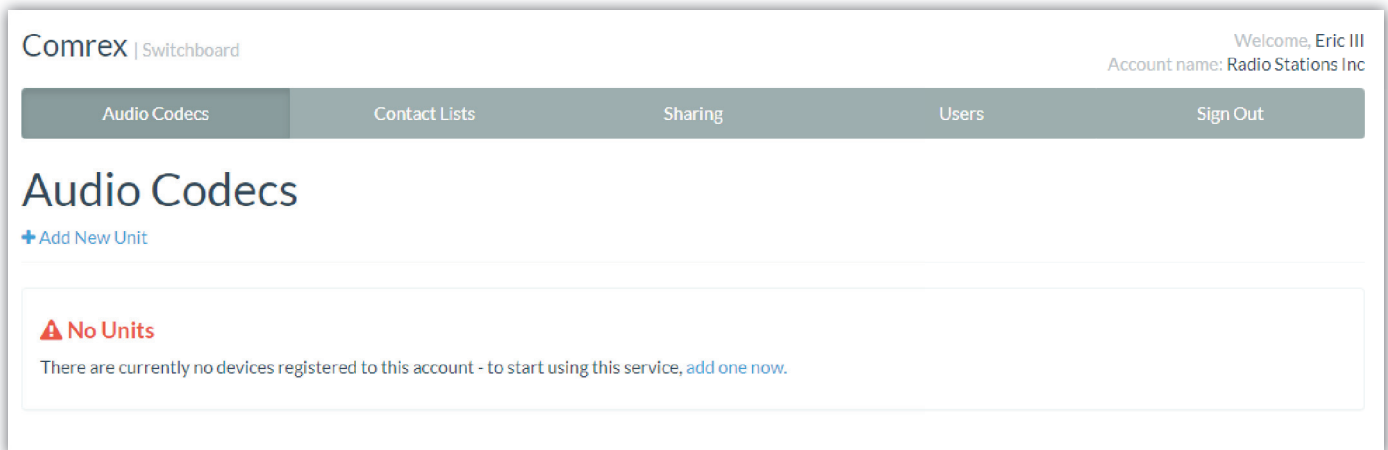


FIGURE 45 SWITCHBOARD ACCOUNT PAGE

ACCOUNT PAGE LAYOUT

The Switchboard Account interface is organized by the **Tabs** shown across the top of the screen. The functions of each Tab will be explained in the next few sections. To log out of the account interface, use the **Sign Out Tab**.

AUDIO CODECS TAB

The **Audio Codecs Tab** is the first page loaded when logging in to a Switchboard account. This Tab displays a list of all codecs on the account, and allows new codecs to be added (for new accounts, there will be a notice stating that no units have been added to the account). Units added to an account are listed on this page with helpful information such as *connection status* and *IP address*.

ADDING UNITS

Click “Add New Unit” to open a dialogue box that will ask for the Switchboard ID (Ethernet MAC address) of the Comrex codec you wish to add (shown in **Figure 46**). BRIC-Link III’s Switchboard ID can be obtained from the **Web User Interface** (see **page 56**) or by utilizing Comrex’s **Device Manager** program (see **page 21**).

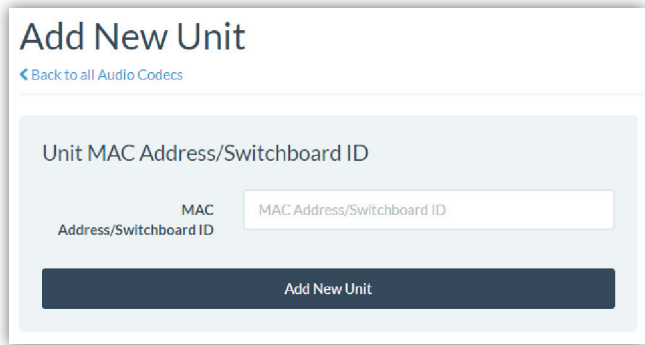


FIGURE 46 ADD NEW UNIT

After entering the Switchboard ID and clicking “Add New Unit”, the next dialogue box will ask which **Contact List** the unit should use—and which **Contact List** it should be added to (**Figure 47**). Contact Lists are a method for Switchboard to determine which units can “see” which other units within an account. For a basic setup these options can be left at their default values (use the “Auto Default List”).

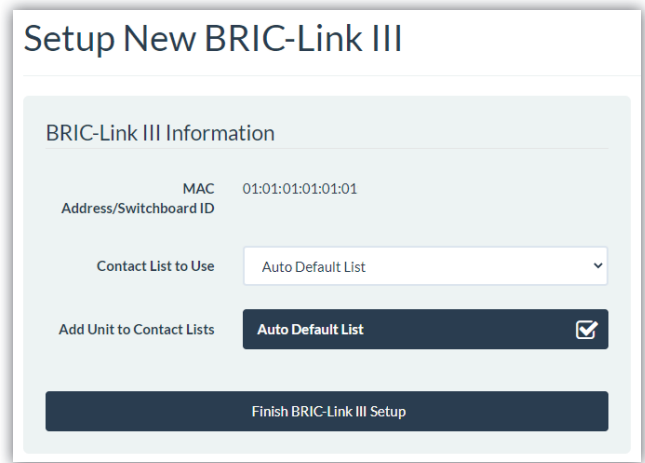


FIGURE 47 DEFAULT CONTACT LIST

After choosing Contact Lists, click “Finish BRIC-Link III Setup”, and the unit will be added to the list on the **Audio Codecs Tab**, among other units on the account, if any (as shown in **Figure 48**). More detailed information for each unit can be viewed by clicking the “Details” button on the right side of the screen.

Audio Codecs

[+ Add New Unit](#)

	Product Name ▾	Unit Name MAC/Switchboard ID ▾	Connection Status ▾	IP Address ▾	Firmware ▾	
	BRIC-Link III Audio Codec	Carl Jenkins 00:00:00:00:00:00	Idle	74.74.151.151	5.0	Details
	BRIC-Link III Audio Codec	Johnny Rico 01:01:01:01:01:01	Idle	74.74.151.157	5.0	Details
	ACCESS NX Rack Audio Codec	UCF Headquarters 30:30:30:30:30:30	Idle	74.77.171.177	4.5-p6	Details

FIGURE 48 AUDIO CODECS ADDED

CONTACT LISTS TAB

The **Contact Lists Tab** displays the “Contact Lists” available on the account (as shown in **Figure 49**), and allows new Contact Lists to be added. Contact Lists are like phonebooks; each codec can be added to a List (or several Lists), and each codec can choose which List (or Lists) to use when “calling” other units. Users can manage which units appear on each Contact List using this Tab.

Comrex | Switchboard

Welcome, Eric III
Account name: Radio Stations Inc

[Audio Codecs](#)[Contact Lists](#)[Sharing](#)[Users](#)[Sign Out](#)

Contact Lists

[+ Add New Contact List](#)

Contact List	Contact List Members	
Auto Default List Audio Codec Default	BRIC-Link III Carl Jenkins ACCESS NX Rack UCF Headquarters	BRIC-Link III Johnny Rico Details Edit
Stations Audio Codec	ACCESS NX Rack UCF Headquarters	Details Edit
Troopers Audio Codec	BRIC-Link III Carl Jenkins	BRIC-Link III Johnny Rico Details Edit

[Bulk Actions](#)

FIGURE 49 CONTACT LISTS TAB

AUTO DEFAULT LIST

New Switchboard accounts will have one built-in Contact List, called “Auto Default List”. For a basic setup, this list works well as a “Master List”, and should include all units on an account. In some situations, it might not be desirable for every codec to be able to see and connect to every other codec in a fleet. To help filter what’s displayed on a codec’s interface, new Contact Lists can be created by clicking “Add New Contact List” on this page.

ADDING CONTACT LISTS

Clicking “Add New Contact List” brings up a dialogue box that will ask for a *List Name* and a selection of codecs to be included in the List (as seen in **Figure 50**).

Audio Codec Contact List Information

Contact List Name

Troopers

Units in Contact List

Carl Jenkins

BRIC-Link III | 00:00:00:00:00:00

Johnny Rico

BRIC-Link III | 01:01:01:01:01:01

UCF Headquarters

ACCESS NX Rack | 30:30:30:30:30:30

☐

Make this the default Contact List?

Create New Contact List

FIGURE 50 CREATING CONTACT LISTS

All of the available codecs on an account are listed to choose from. Clicking any of the codecs adds a “check” mark and includes that codec in the new List. Click a “checked” unit to remove the check mark and that unit will no longer be included in the new List. Once the desired units are selected, and a *List Name* is entered, click the “Create new Contact List” button to save the new List. This Contact List will now appear on the **Contact Lists Tab** and units on the account will now be able to **Follow** this List from their *Unit Information Page* on the **Audio Codecs Tab**.

SHARING TAB

The **Sharing Tab** displays a list of “Shares” that have been set up for the account (as seen in **Figure 51**), and allows new Shares to be created (a new account will have no Shares listed yet). Shares are very similar to Contact Lists; however, Shares allow units on a different Switchboard account to see and connect to certain units in this fleet. On this Tab, users can view and edit Shares created on this account, as well as Shares sent from other accounts.

Shares owned by this Account

Share	Units in Share	Shared With Accounts	
Heroes Enabled	Carl Jenkins BRIC-Link III Johnny Rico BRIC-Link III	Communications, Ltd. Remotely Enabled	Edit Accounts

Shares from other Accounts

Share Name	Units Being Shared With Your Account	
6th Division Communications, Ltd. Fully Enabled & Active	Klendathu Outpost ACCESS NX Rack	Disable Delete

FIGURE 51 SHARING TAB

Shares created locally are shown in the “Shares owned by this Account” section, and display a list of *Units in the Share* along with the name of *the account that is being given access to these units*. Users can modify the Share using the buttons on the right side of the screen.

Shares created by other accounts are shown in the “Shares from other Accounts” section and display the *Name of the Share*, the *Account* they are from, as well as a list of *Units being shared to this account*. Local users cannot modify incoming Shares, but the buttons on the right side of the screen allow for *Disabling* or *Deleting* the Share.

CREATING SHARES

Click “Add New Share” to open a dialogue box as shown in **Figure 52**.

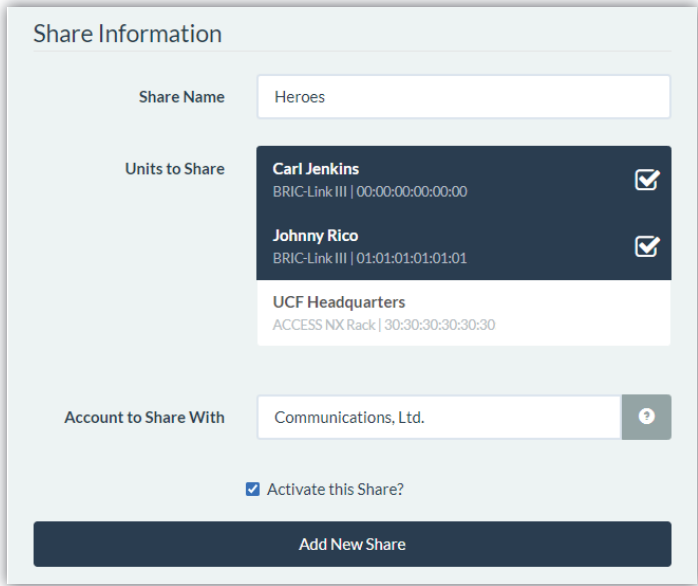
A screenshot of a 'Share Information' dialog box. It has a title bar 'Share Information'. Below it, there are three main sections. The first section is 'Share Name' with a text input field containing 'Heroes'. The second section is 'Units to Share' with a list of three items: 'Carl Jenkins' (BRIC-Link III | 00:00:00:00:00:00) with a checked checkbox, 'Johnny Rico' (BRIC-Link III | 01:01:01:01:01:01) with a checked checkbox, and 'UCF Headquarters' (ACCESS NX Rack | 30:30:30:30:30:30) with an unchecked checkbox. The third section is 'Account to Share With' with a dropdown menu showing 'Communications, Ltd.' and a help icon. At the bottom, there is a checkbox labeled 'Activate this Share?' which is checked. A large dark blue button labeled 'Add New Share' is at the very bottom.

FIGURE 52 ADD NEW SHARE

Any units on the account can be selected by clicking the *Unit Name* in the list to add a “check” mark. The name of the account that will receive this Share must be spelled exactly as it appears in that account’s Switchboard page. After naming the Share, selecting units to share, and designating a “destination account” to Share to, click the “Add New Share” button to save this Share locally. The option to “Activate this Share?” is selected by default, and enables the new Share to show up on the **Sharing Tab** of the destination account. This option can be “unchecked” and activated later if a Share is being created ahead of time, and units are not yet ready to be shared.

RECEIVING SHARES

On the **Sharing Tab**, Shares that have been granted from a different Switchboard account will be listed in the “Shares from other Accounts” section. These Shares must be added to a Contact List before codecs on this account can see the units that have been shared.

For a basic setup, Shares can be added to the “Auto Default List” so that they show up with the full list of units on the account. From the **Contact Lists Tab**, click the “Edit” button for the “Auto Default List” to open the dialogue box shown in **Figure 53**. Any Shares that have been granted to this account will be shown underneath the list of *Units*.

Contact List Information

Contact List Name: Auto Default List

Contact List Units:

- Carl Jenkins
BRIC-Link III | 00:00:00:00:00:00 ☒
- Johnny Rico
BRIC-Link III | 01:01:01:01:01:01 ☒
- UCF Headquarters
ACCESS NX Rack | 30:30:30:30:30:30 ☒

Shares in Contact List: 6th Division
Communications, Ltd.

Update Contact List

FIGURE 53 **ADDING SHARES TO A CONTACT LIST**

Click the name of the Share on the list to add a “check” mark, similar to selecting units. Once the Share is “checked” all units within that Share will be visible to any codecs that are following the “Auto Default List”. They can now be connected as if they were on the same account.

USERS TAB

The **Users Tab** displays a list of users who can log in and manage the account (as shown in **Figure 54**), and allows more users to be added (a new account will show only the current user). Switchboard allows multiple users to be added by entering a unique *username*, a secure *password*, and a valid *email address*. User entries added here can also be removed from the account anytime if they are no longer needed.

Audio Codecs Contact Lists Sharing **Users** Sign Out

Users in account Radio Stations, Inc.

[+ Add New User](#)

Name	Username	Email	Phone	
Eric III	eric3	eric@radiostationsinc.com		Edit

FIGURE 54 **USERS TAB**

ADDING NEW USERS

To add a User, click “Add New User”, and a dialogue box will appear (as shown in **Figure 55**).

The form is titled "User Information" and contains several input fields. It has a light blue header and footer. The fields are: Username (a single line), Password and Confirm Password (two side-by-side lines), Full Name (a single line), Email Address (a single line), and Phone Number (a single line). At the bottom is a dark blue button labeled "Add New User".

User Information	
Username	
Username	
Password	Confirm Password
Password	Confirm Password
Full Name	
Full Name	
Email Address	
Email Address	
Phone Number	
Phone Number	
Add New User	

FIGURE 55 ADD NEW USER

Enter a unique *Username* and a secure *Password* for the new User (this will be the user’s login credentials). Then enter the User’s *Full Name* and a contact *Email address*. A *Phone number* is optional, but can assist in communication among Switchboard users. Click “Add New User” when finished and the User will be displayed on the **Users Tab**. Any User given login credentials can access the Switchboard account and perform any the actions described previously.

SWITCHBOARD THEORY AND CONCEPTS

This section contains more detailed technical and conceptual information about how Switchboard works, rather than how it is used. This can be helpful to understand what goes on behind the scenes each time a codec connects via Switchboard.

Switchboard offers a distinct advantage facilitating connections because it’s not always simple to connect two devices, which are essentially “peers”, over the Internet. There are two major reasons for this. First, initiating communication to a device over the Internet requires knowing its IP address. This is the number that gets applied to the destination field of an IP packet, so internet routers can determine how best to send it along its way. Second, traffic can often be blocked or lost along the way even if the IP address is known.

Every device that connects directly to the public Internet must have an IP address. However, when web browsing or sending email, this information is usually hidden from the user. In the traditional client/server scenario, such as web browsing, a Uniform Resource Locator (URL) is used to represent the IP address of the web page, which is decoded by a Domain Name System (DNS) server. Once a computer requests a web page by URL from a web server, the web server can automatically derive the reply address from the request and respond to it. So the traditional four segment decimal address (e.g., 70.22.155.130) is completely obscured to the user.

Even if you know your IP address, it’s quite possible that address will change over time. This is because the vast majority of internet users establish their addresses via the Dynamic Host Configuration Protocol (DHCP), whereby a server maintained by the Internet Service Provider (ISP) will deliver one of their available addresses to the client

on initial connection. That address is “leased” from the server for a particular time period, and after the “lease” expires, the server is free to change it.

The commonly used Network Address Translation (NAT) router adds to the confusion, making codecs even harder to find. Most Local Area Network (LAN)-based Internet connections (as opposed to computers connected directly to ISPs) actually negotiate with a local router containing its own DHCP server. This router assigns the LAN computer or device a “private” IP address for identification within the local network.

The challenges of connecting codecs behind NAT routers will be addressed in more detail shortly. For now, remember that one of the problems NAT servers add is that private IP addresses delivered to codecs (and the only addresses of which the codecs are aware) have no bearing on the public addresses seen from the Internet. In extreme scenarios, several layers of address locality can be stacked, assuring that the IP address assigned to a device is several degrees removed from the public IP address used for connections (as illustrated in **Figure 56**). Additionally, each address in the stack is often temporary and able to change at any time.

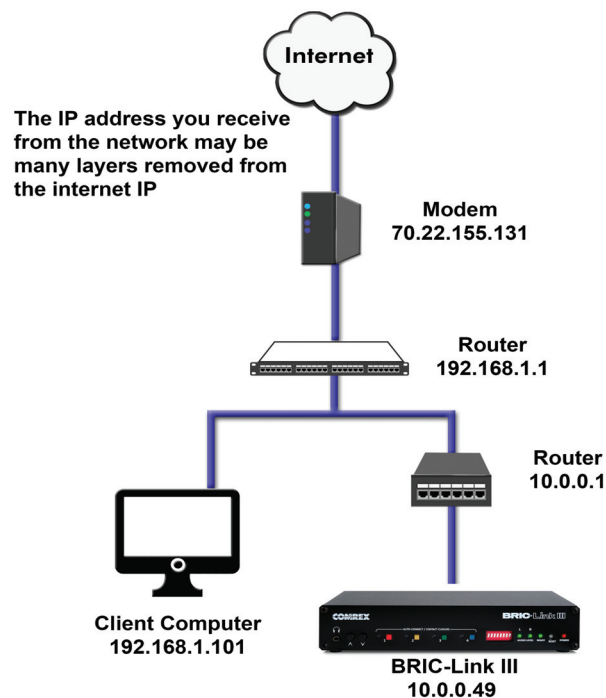


FIGURE 56 LOCAL AREA NETWORK

Before deployment of Switchboard, the answer to this dilemma was to assure that the codec located in the studio had a fixed, public IP address. This meant that the address was allocated exclusively by the ISP, and that address was entered manually into the configuration of the codec and not subject to change. This scenario worked because IP “calls” are usually initiated from the field. As long as the field unit can find the fixed address of the studio unit and send a stream to it, a reverse channel can be created easily and automatically by the studio unit, using the source information contained in the incoming packets. In this scenario, the studio IP address must be memorized or input into each codec individually.

The first function Switchboard works around is the dynamic IP address problem by acting as a Directory Server. Similar to a DNS, this Directory Server function stores real IP addresses and translates them into user-friendly names, but on a much smaller scale that is only relevant to Comrex codecs. Codec users can name their codecs and use those names to establish connections, rather than using IP addresses. The codecs themselves need only know the public IP address of the Switchboard server, and that server provides them with the more elusive IP addresses

of other codecs in their group. Because Switchboard stays on a fixed IP address which is programmed into all Comrex codecs, this works naturally and easily.

Once enabled, a codec in a group that is physically connected to the Internet will sync with the server. The server recognizes the sync attempt by the unique Media Access Control (MAC) address of the device reaching out to it (which the server knows from an internal database). The current public IP address of the codec will be obtained by the server and a user directory will be updated with the new IP address. In addition, the availability status of the codec is also updated. The codec will then “ping” the server if anything changes (address, status, etc.). As we’ll see, this “ping” function will prove useful in other ways as well.

Once the codec has updated its status with the server, it instantly downloads the directory of IP addresses and statuses of other codecs within the group. This information forms a “Buddy List” of sorts that gets integrated into the codec’s connection address book. Codec users see the whole address book as it is updated in the background, and are given easy-to-understand icons depicting the presence and connection status of the remote units made available to them by Switchboard. The address book may still contain entries made manually by entering IP addresses into the codec, but those are signified by different icons in the user interface.

If IP addresses should change, the codec will re-sync with the server from the new address, and all will be updated automatically. Connections can be made by simply clicking on the correct name, without any updating on the part of the user.

The other roadblock to connecting devices over the internet, which stems from the use of NAT routers, is the inability to accept unsolicited incoming connections from the Internet. Generally, this function acts as a rudimentary firewall and is a net positive for security, but it does cause headaches for codec users. A router that receives a connection request doesn’t have a clue where to forward that stream unless it has specific instructions programmed into it (as illustrated in **Figure 57**). These instructions are known as “port forwarding”.

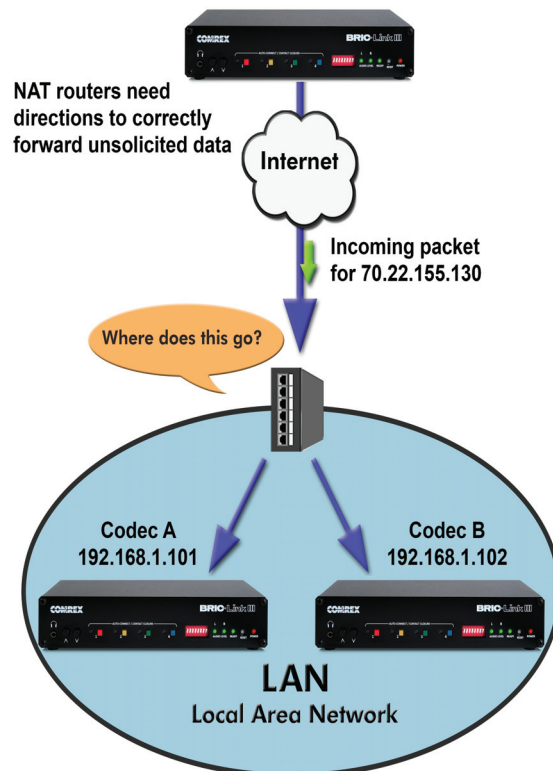


FIGURE 57 NAT TRAVERSAL

This can work well for fixed installations, but it's not always an easy task to obtain that kind of security access on corporate routers. Additionally, forwarding functions are implemented differently depending on the hardware. One can easily imagine the complications of obtaining or managing port forwarding on the LAN when arriving at a new remote venue. This would likely encounter a large amount of resistance or confusion on the part of local IT staff.

In describing NAT routing, it's important to understand the concept of ports. These are numbers, like the source and destination IP addresses, that are attached to each packet. They further qualify which application on a computer (or codec) is meant to send or receive a packet. In a typical codec application, Codec X will send a packet from Address A/Port B, to Address C/Port D on the Destination Codec Y. A codec that has multiple applications running (like streaming audio while simultaneously serving a configuration web page) would deliver these applications from, and to, different port numbers, but perhaps to the same IP address. Port numbers are also used by NAT routers in segmenting applications flowing through them, and they may change source port numbers at will.

The term “Network Address Translation” (**NAT**) refers to the ability of a router to translate requests from computers (or codecs) within its LAN into formats usable on the public internet. On its most basic level, this involves replacing the private “source” or return IP address in each packet with the true public IP and remembering where that packet was sent. This insures that any response can be forwarded back to the proper device.

A good way to think of this is that an outgoing packet “punches a hole” in the router, through which authorized reply packets may be returned to the codec for a limited time (as shown in **Figure 58**).

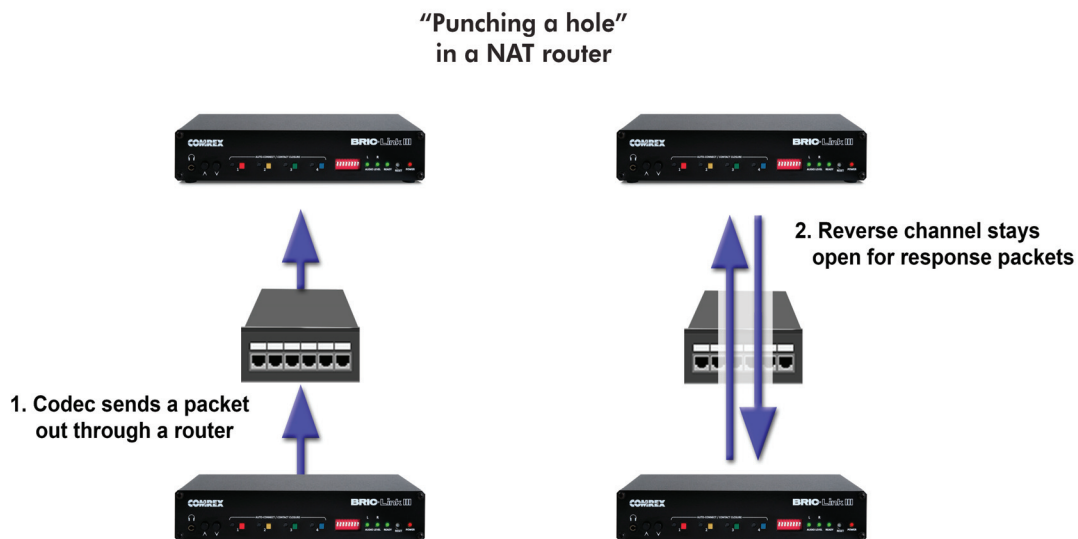


FIGURE 58 BIDIRECTIONAL COMMUNICATION

Switchboard aids in breaking through these different types of routers for incoming calls. Because it is in constant contact with all subscribed codecs, it can send and receive test patterns to determine whether one or more NAT routers exist on a link and what type they are. It can then choose a connection method to be used to circumvent any issues.

Depending on the what network restrictions it detects, Switchboard can:

- Instruct the calling codec to make a normal connection (no NAT detected).
- Use the hole punched by connection to the Directory Server for incoming connections from other codecs.
- —or instruct the called codec to make the connection in the reverse direction.

The second option, which utilizes the outgoing Directory Server “ping” described earlier, is very useful. The interval of this ping is adjustable, but defaults to about one minute, which is short enough to keep a hole punched through the majority of NAT routers.

These techniques are based loosely, with enhancements, on a generic internet protocol called STUN (Simple Traversal of UDP through NAT). The system works well in all environments except one: when both users are sitting behind a symmetric NAT. In this situation, calls will fail even with Switchboard. The only option in that environment is to resort to port forwarding on one side of the link.

Overall, Switchboard takes the complexity of interactions between public and private internet and translates the user experience into a simple point-and-click methodology, giving Comrex codec users more freedom with less effort.

X. OPERATING BRIC-LINK III IN A 24/7 ENVIRONMENT

A BRIC-Link III audio connection can be configured for “always on” operation. This allows for constant STL communication and operations requiring long-term connections. A backup connection can also be set for automatic “fallback” if the primary connection fails, ensuring transmissions stay active. This section will detail how to maintain a constant and persistent connection between codecs even during network disruptions.

HOW BRIC NORMAL CONNECTIONS WORK

In BRIC Normal mode (the default mode of operation), BRIC-Link III transfers all its audio data via the UDP 9000 protocol. This is in contrast to most web-based connections like browsing and email, which use the bidirectional TCP protocol. UDP, unlike TCP, is not “connection oriented” (i.e., no virtual connection actually exists in this protocol layer between the devices). In UDP, the transmitter simply launches packets into the network with the correct address, hoping the network will make its best effort to deliver the packets in a timely fashion. If a packet is delayed or lost, no error message is sent from the receiving unit and no packets are retransmitted. It is up to the receiver to cover up any lost data, if possible. This allows the Internet to deliver packets with the smallest amount of overhead and delay. As there is no coherent connection built between the codecs, there isn’t any connection to break in the event of network failure. The encoder simply propels packets into the network, regardless of whether they arrive. If the network fails and is later restored, the packets stream will be restored to the decoder.

For most broadcasting applications, it’s useful to simulate a connection-oriented stream, so BRIC-Link III uses a low-bandwidth sub channel to deliver information back to the encoder about overall connection status. It does this in its “application layer”, rather than the “transport layer” where UDP exists. By default, it monitors the health of a connection and if no data is detected as received by the decoder for 60 seconds (this is a user defined timeout), it “tears down” this connection and reverts to an idle state. This indicates to the user that the network has failed and the problem must be addressed.

One benefit of having the connection protocol in the application layer is that its use is optional, and it can be modified for particular applications. For 24/7 operation, there is no advantage to the connection ending if no data is received for the timeout interval. In fact, it is preferable to continue the UDP audio stream using the “Always Connect To” function.

ALWAYS CONNECT TO

“Always Connect To” is a system-wide setting for BRIC-Link III which locks the codec into a dedicated mode, removing certain user controls in favor of maintaining constant connection to a given remote. This is the primary method for establishing 24/7 operation.

When **Always Connect To** is enabled, BRIC-Link III will take the following actions:

- 1 A connection is immediately established between BRIC-Link III and the chosen remote codec.
- 2 The timeout value is ignored for the active connection; the audio data stream will never be torn down regardless of “application layer” data status. Note: The timeout value is still calculated for the purpose of the **Backup Remote** option, as described later in this section.

- 3 If BRIC-Link III is powered-down or loses network connectivity, it will re-establish the connection to the chosen remote as soon as it is powered-on and the network is available.
- 4 The local **Disconnect** control is disabled and the chosen remote can no longer be edited or deleted. Note: The **Disconnect** function on the receiving side is still enabled, but will result in an immediate re-connection by the initiating side.

The **Always Connect To** option can be found by selecting “Connections” in the **System Settings Tab** (as seen in Figure 59).

The screenshot shows the 'SYSTEM SETTINGS' tab with a sidebar on the left containing a tree view of settings categories: Security, Connections, Contact Closures, Front Panel, Switchboard Server, CrossLock VPN, System Clock, and Alternate Modes. The 'Connections' category is expanded, showing fields for Unit Name (Njáll Þorgeirsson), Incoming Connection Password, Show Offline Switchboard Units (No), and 'Always Connect To' (None). The main panel on the right is titled 'Always Connect To' and contains the instruction 'Keep connection to this remote established at all times'. It shows 'Current (None)' and 'Default (None)', followed by a dropdown menu currently set to '(None)'. At the bottom are three buttons: 'APPLY CHANGES', 'CANCEL CHANGES', and 'SET TO DEFAULT'.

FIGURE 59 ALWAYS CONNECT TO SETTING

Select the drop down menu, currently set to “(None)”, to display a list of available remotes. Selecting any existing remote will set BRIC-Link III to maintain constant connection to that remote whenever possible (Figure 60).

This close-up view of the 'Always Connect To' settings panel shows the dropdown menu expanded, displaying a list of available remotes with 'STL 1' selected. The 'APPLY CHANGES' button is highlighted in blue. The other buttons, 'CANCEL CHANGES' and 'SET TO DEFAULT', are in a lighter gray.

FIGURE 60 SELECTING A BACKUP REMOTE

After selecting a remote, click the “Apply Changes” button to save changes and initiate the “24/7” connection. As a system-wide setting, **Always Connect To** does not require additional configuration in the **Remote entry**; however, additional configuration of that remote is possible (e.g., establishing a **Backup Remote**, as described below).

Note: The following **Backup Remote** options can be used *with* or *without* the **Always Connect To** function. These options can assist in automatically reconnecting an interrupted connection—or diverting to a secondary remote if needed—but using the **Always Connect To** function is the only way to ensure that connections are established immediately upon power-up of the local BRIC-Link III.

BACKUP REMOTE

BRIC-Link III’s **remote entries** can be configured with additional options for constant connections. When creating or editing a remote entry from the **Connections Tab**, a field is available called **Backup Remote**, as shown in **Figure 61**.

Edit Remote Settings

Remote Name

STL 1

IP Address or Phone Number

92.92.192.192

Use Crosslock

Yes

Switchboard ID

01:01:01:01:01:01

Connection Password

Profile

(Default Profile)

Backup Remote

(None)

Fall Forward

Yes

Optionally select a backup remote to connect to if the connection to this remote is lost.

Current (None)

Default

(None)

APPLY CHANGES

CANCEL CHANGES

SET TO DEFAULT

FIGURE 61 **BACKUP REMOTE**

Select the drop down menu, currently set to “(None)”, to display a list of available options. These options will determine what BRIC-Link III does in the event of a connection timeout. Select a backup option from the list, and click “Apply Changes” (as shown in **Figure 62**).

Optionally select a backup remote to connect to if the connection to this remote is lost.

Current (None)

Default

STL Backup

APPLY CHANGES

CANCEL CHANGES

SET TO DEFAULT

FIGURE 62 **BACKUP OPTION**

One of these options is “(Keep retrying this remote)”. If a connection is lost for longer than the timeout value (default is 60 seconds), using this mode will allow the unit to ignore the timeout and keep a persistent connection attempt on the same remote entry. The difference between this and the **Always Connect To** function is that the **Disconnect** function will not be disabled and the connection will not be re-initiated on a power-up. This mode is meant for users who are making longer-term temporary connections, and do not want the system to time out and disconnect in the event of network failure.

72

FALLBACK AND FALL FORWARD

The other options in the drop down menu are a list of all the available remote entries that can be used as a backup for the already selected remote (the **Primary remote**). BRIC-Link III can establish a “Fallback” connection to the chosen **Backup remote** if an active connection to the **Primary remote** is lost for longer than the timeout value (default is 60 seconds). Once the connection has been established to the **Backup remote**, the Fallback connection will be maintained even if the **Primary remote** becomes available again.

Alternatively, there is an option in the **Edit Remote Settings** dialogue box (**Figure 61**) called “Fall Forward”, which is disabled by default. If this option is enabled, the system will constantly attempt to reconnect the **Primary remote** while connected to the **Backup remote**. If reconnection to the **Primary remote** is successful, the Fallback connection to the **Backup remote** will be terminated.

CONNECTION TIMEOUT AND BACKUPS

Many of the **Backup remote** functions rely on a connection timeout value, which is determined by the **Audio Profile** used for the remote entry. Although this timeout value is usually used for terminating connections when not operating in a 24/7 environment, the value is still calculated when making persistent connections and plays an important role in handling connection interruptions.

As an example, a BRIC-Link III can be set to **Always Connect To** a codec at a transmitter site, with a **Backup remote** set in case the primary remote loses power. If lightning strikes and the primary remote goes offline, BRIC-Link III will keep trying to connect to the primary remote for the default 60 seconds before moving the connection over to the backup remote. The timeout value in this case is a double-edged sword, as it tells the BRIC-Link III to fix the connection problem, but only after 60 seconds of “dead air”. Opting for a lower connection timeout (such as 10 seconds) can shorten the time it takes for the fallback connection to activate, and reduce downtime. However, if a timeout value is set too low (such as 1 second), it may tell BRIC-Link III to make an unnecessary switch to the backup remote whenever a minor network hiccup occurs.

To raise or lower the connection timeout value, open the chosen audio profile in the **Profile Manager Tab**. The timeout values are shown by selecting the drop down arrows for **Local Settings** and **Remote Settings** under the “Profile Settings” column (as shown in **Figure 63**).

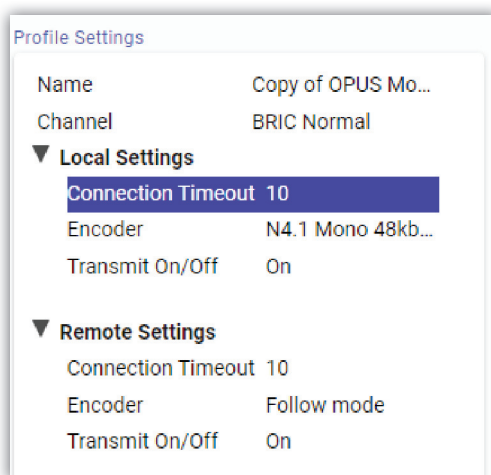


FIGURE 63 BACKUP OPTIONS

Note: Only a custom profile can be edited; factory profiles are locked to ensure basic functionality. For details on creating a custom profile, see [page 33](#).

Select the existing values for **Local Timeout** and **Remote Timeout** to input new values. Be sure to click “Apply Changes” after each value is input. **For most usage, the Local and Remote timeout values should be the same.** If incoming data and outgoing data are expected to differ, the values may be set accordingly (Local Timeout for outgoing data and Remote Timeout for incoming data).

After making changes to any profile, be sure the intended profile is actually being used by the Remote entry in the **Connections Tab**, and that any active connections using that profile are disconnected and reconnected to apply the new changes. See **page 49** for more details on managing Remote entries.

XI. HOTSWAP

BRIC-Link III connections are able to utilize a feature called **HotSwap**, which allows users running **CrossLock** in “Dual Network” mode to designate a primary and secondary network. This secondary network (e.g., wireless 4G) serves as a backup to the primary in case of network failure, but will remain dormant until such failure occurs. A typical usage scenario would be a codec that is active 24/7 providing an STL connection, using a metered backup network, as shown in **Figure 64**.

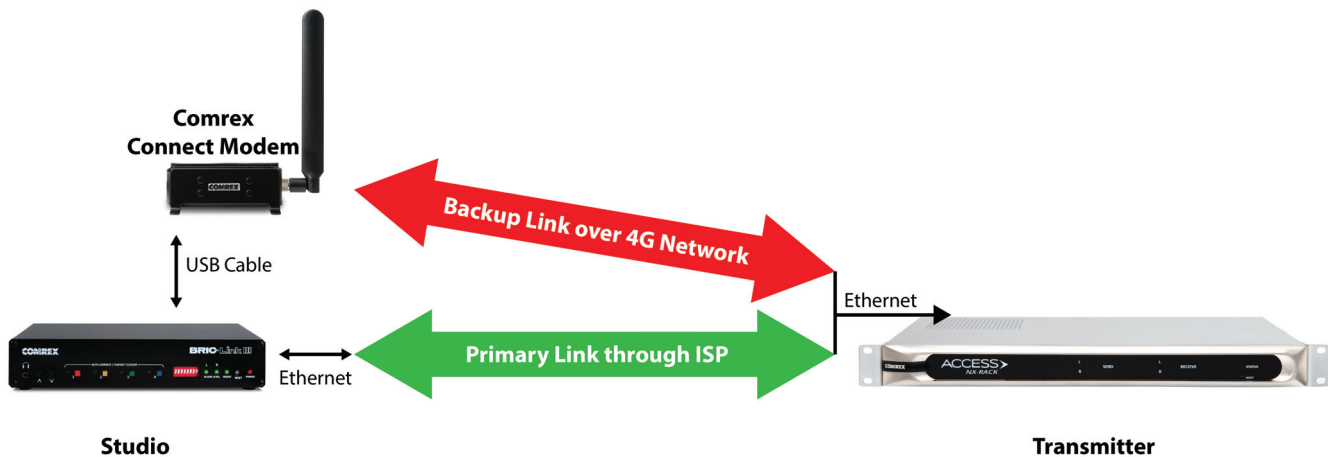


FIGURE 64 HOTSWAP

4G offers a unique advantage as a backup to hardwired connections, because the cause of any local network failure is highly unlikely to also affect wireless carrier towers. It is, however, impractical (and expensive) to run audio over a 4G mobile network 24/7. **HotSwap** ensures that the **CrossLock** connection prioritizes a different network (e.g., an Ethernet connection). In this example, if the primary hardwired network fails, **HotSwap** would divert the connection to the secondary 4G network as a backup. When the primary network is restored, **HotSwap** will switch back to it and return to holding the secondary network in a dormant state. Ethernet can be designated as either the primary or the backup network. 4G connection is supported on BRIC-Link III as the secondary, backup network only, and only when using a **Comrex Connect Modem**. BRIC-Link III does not support the use of other 4G or 3G modems.

Since **HotSwap** is an alternate mode of the **CrossLock** reliability layer, connections between codecs must be established via CrossLock in order to use it (refer to **page 49** for details on making CrossLock connections).

Note: Codecs on **both ends of the link** must be running firmware version 4.3 or higher in order to operate **HotSwap**.

DATA USAGE

It is imperative to note that even a backup network in a dormant state still utilizes a small amount of data. This is important when considering using 4G mobile networks. For 24/7 operation, this data will total less than 0.5 GB for a typical month of usage, assuming no **HotSwap** activity occurs. If the **HotSwap** function engages to a 4G network, much more data will be used while the primary network is down. Regardless of how **HotSwap** is used or set up, Comrex assumes no liability for data overage charges, even in the event of software bugs or any other failure of hardware or software. It is entirely the responsibility of the user to monitor any metered data usage.

SETUP

Setup for **HotSwap** is done entirely on the end of the link that has dual networks connected. On the BRIC-Link III, a second network can be added in one of two ways:

1. A second Ethernet connection, using a USB-to-Ethernet adapter,
2. A 4G **Comrex Connect Modem**, plugged into the USB port.

When a second network is installed, it will appear in the **Network Manager** page, underneath the Built-in Ethernet Port. Navigate to the **Network Manager** in the Web User Interface via the three-line “Hamburger” icon (☰) in the upper left-hand corner of the screen. A list of all networks attached to the codec and their statuses will populate under “Select Network Device”. Before proceeding, ensure that each network is *Installed* and *Enabled*, and configured with valid IP settings (see **page 43** for details on configuring networks).

Once a second network is installed and enabled, **HotSwap** is configured in two steps. First, the Secondary Network must be set to **Backup** mode, then the system-wide CrossLock settings must be taken out of normal Bonding mode.

CONFIGURING A BACKUP NETWORK

Select the intended Secondary Network, and open the **Use with CrossLock** option under “Device Settings”, as shown in **Figure 65** (“Show Advanced Settings” must be enabled). Change from the default “Yes” to “Backup”, and click “Apply Changes”. Note: If using a 4G Comrex Connect Modem, this option will already be set to “Backup”.

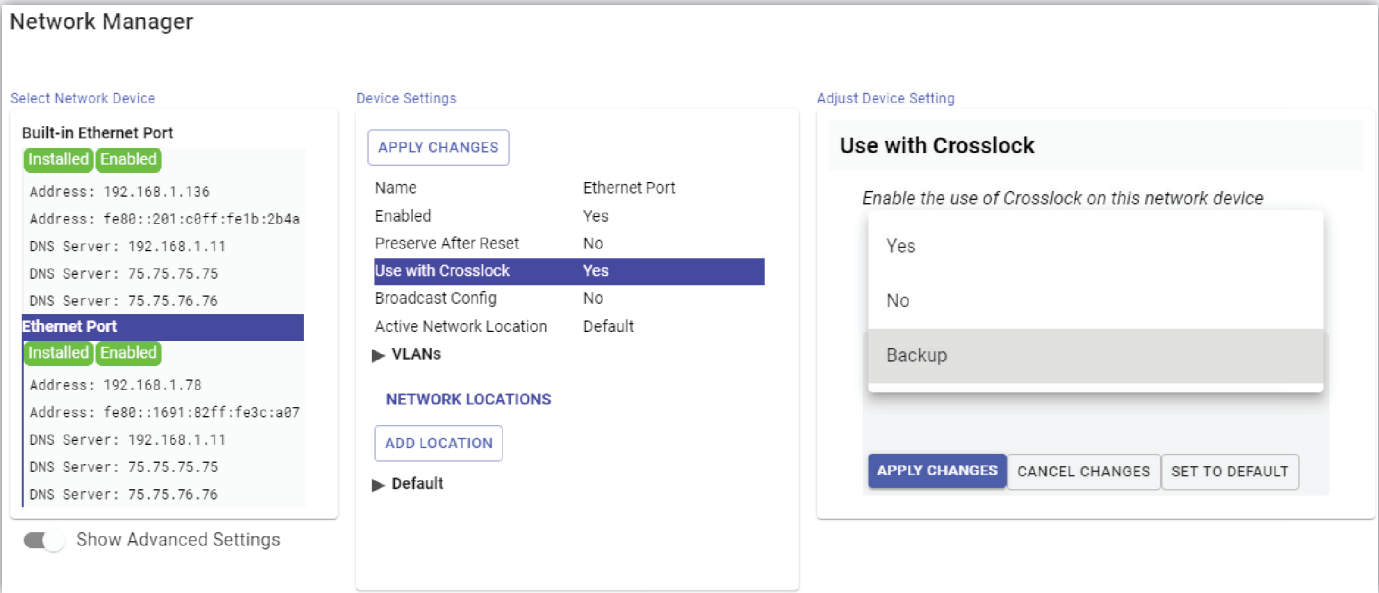


FIGURE 65 NETWORK SETUP

Audio and connection data will now only stream on the Secondary Network if the primary network fails. However, to allows faster reaction to network failures, the system-wide CrossLock settings still must be changed (as described below) to enable the entire audio stream to be redirected as one, rather than gradually as individual packets.

CONFIGURING CROSSLINK VPN SETTINGS FOR HOTSWAP

In the **System Settings Tab**, open the **CrossLink VPN** options and select “Redundant Transmission” (as shown in **Figure 66**). Change from the default “Off” to “On”, and click “Apply Changes”.

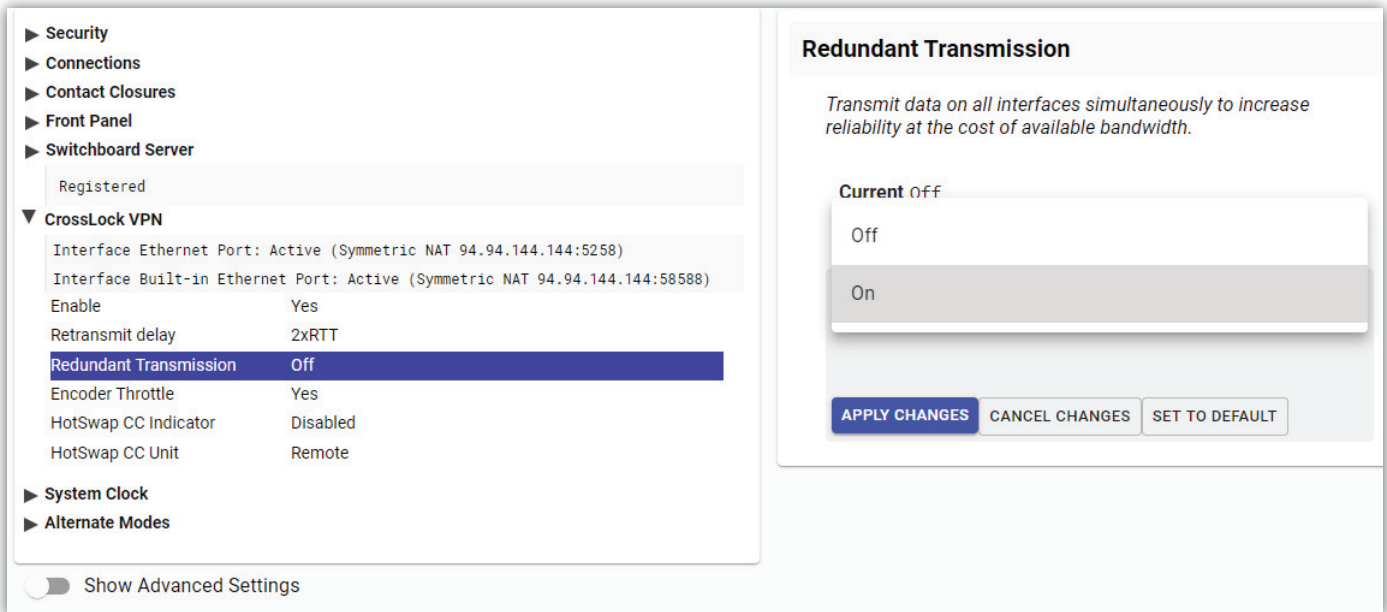


FIGURE 66 REDUNDANT TRANSMISSION

Note: Redundant Transmission is normally used to send the entire audio stream over all available networks simultaneously; however, when used with HotSwap, it simply allows the entire audio stream to be moved as one, but only when the primary network fails. Be sure to enable a Backup Network first to avoid unintended network usage.

CONFIGURING CONTACT CLOSURES FOR HOTSWAP

When **HotSwap** is enabled and the Primary Network fails, BRIC-Link III can send a contact closure signal to indicate the failed network state. The contact closure will activate when the Backup Network is in use, and can be configured to activate on either the Remote codec, the Local codec, or both.

Open the **CrossLink VPN** settings in the **System Settings Tab** and select “HotSwap CC Indicator” (as shown in **Figure 67**). Choose the intended contact closure port to activate during a network failure, and click “Apply Changes”.

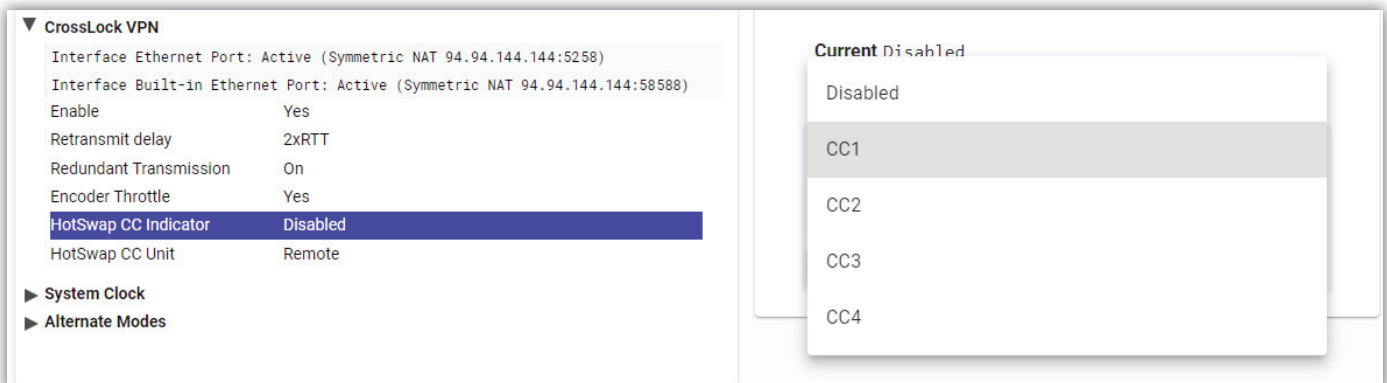


FIGURE 67 CONTACT CLOSURE INDICATOR

Note: HotSwap CC Indicator assignments will override any previous contact closure assignments made in the system settings.

Next, select the “HotSwap CC Unit” option, as shown in **Figure 68**. Choose which end (or ends) of the link should receive the contact closure signal when the Backup Network is in use, and click “Apply Changes”.

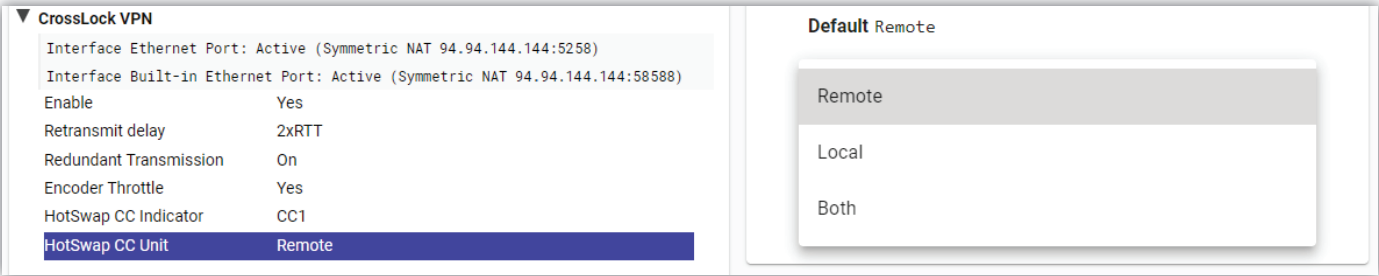


FIGURE 68 CONTACT CLOSURE UNIT

XII. CONFIGURING AND USING THE FRONT PANEL INTERFACE

The front panel of BRIC-Link III includes four software-programmable buttons with matching LED indicators for optional use. These **Auto-Connect/Contact Closure Buttons**, shown in **Figure 69**, can each be independently configured to send *momentary* or *latching* contact closure signals to a far-end connected codec (echoing the contact closure “send” terminals on the rear panel), or to immediately initiate an audio connection to a pre-defined Remote entry. An audio connection made using one of these buttons can be terminated by pressing and holding the same button for 3 seconds.

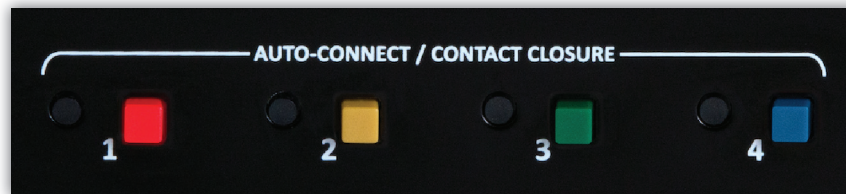


FIGURE 69 AUTO-CONNECT/CONTACT CLOSURE BUTTONS

CONFIGURING THE BUTTONS

The Auto-Connect/Contact Closure Buttons are configured using the Web User Interface under the **System Settings Tab**. As shown in **Figure 70**, selecting “Font Panel” reveals a set of options which control the function of each of the four buttons.

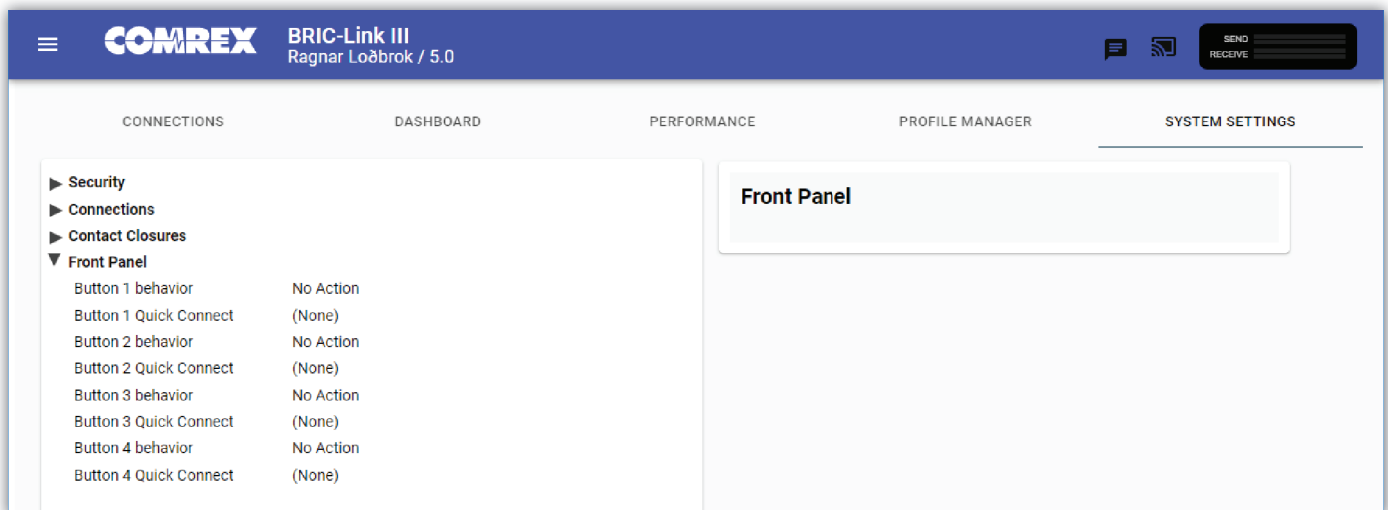


FIGURE 70 FRONT PANEL SETTINGS

Each button has a **Behavior** option, which defines the action taken when the corresponding button is pressed, and a **Quick Connect** option, which assigns an existing Remote entry to that button. The Quick Connect option can be configured at any time, but is only active when the Behavior option is set to “Quick Connect” mode.

BUTTON BEHAVIORS

Select any of the button *Behavior* options to assign a function to the corresponding Front Panel button. As shown in **Figure 71**, the behavior can be changed from the default setting (“No Action”) to one of three functions.

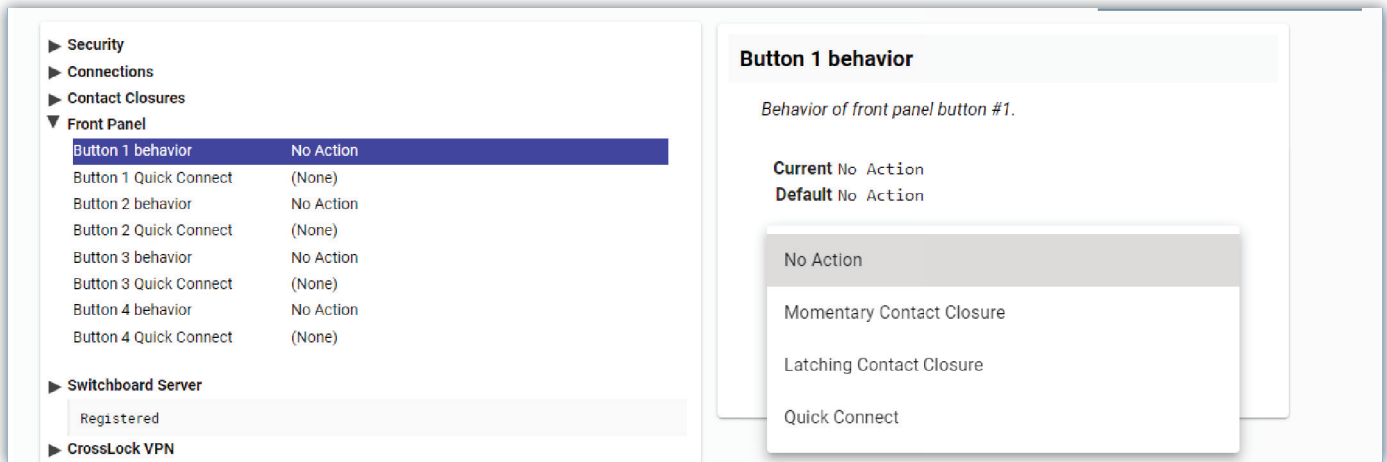


FIGURE 71 BUTTON BEHAVIORS

Momentary Contact Closure - While the corresponding Front Panel button is depressed, a matching contact closure signal is triggered. For example, *Button 1* will trigger *Contact Closure 1*, *Button 2* will trigger *Contact Closure 2*, and so on. During an active connection, a button press will perform the following actions:

- Trigger a hardware contact closure on the far-end connected codec.
- Show the “*Remote CC Active*” status on the **Dashboard Tab** of the far-end codec’s Web User Interface.
- Show the “*Local CC Active*” status on the **Dashboard Tab** of the local BRIC-Link III’s Web User Interface.
- Illuminate the corresponding LED indicator on the Front Panel of the local BRIC-Link III.
- If the far-end connected codec is a BRIC-Link III and its corresponding Front Panel button is configured for Contact Closure mode, that button’s LED indicator will also illuminate.

Latching Contact Closure - Functions the same as *Momentary Contact Closure* mode, except that the signal will remain active after a press of the button, lasting until the button is pressed again or the remote connection is ended.

Quick Connect - Enables the corresponding button to initiate an audio connection to an existing Remote entry. When the button is pressed momentarily, a connection sequence begins. BRIC-Link III will attempt to establish a connection to the chosen remote and the corresponding Front Panel LED will indicate the status of the connection (see **page 81** for status light information). To disconnect, press and hold the button for 3 seconds until indicator light turns red.

Note: When the “Quick Connect” behavior is chosen for any button, the corresponding “**Button # Quick Connect**” option below must also be configured in order to assign a Remote entry to that button.

QUICK CONNECT (REMOTE ASSIGNMENT)

This option assigns an existing Remote entry to any of the four *Auto-Connect* Buttons. The **Button # Behavior** option above must be set to “Quick Connect” or this setting will be ignored. The drop down menu is populated with the list of Remote entries available on the **Connections Tab** (For details on creating new Remote entries for this list, see **Creating New Remotes** on **page 26**). The default Quick Connect selection is “(None)”, as shown in **Figure 72**, which disables the Auto-Connect function. Select a Remote entry from the list and click “Apply Changes” to assign the corresponding button to that remote.

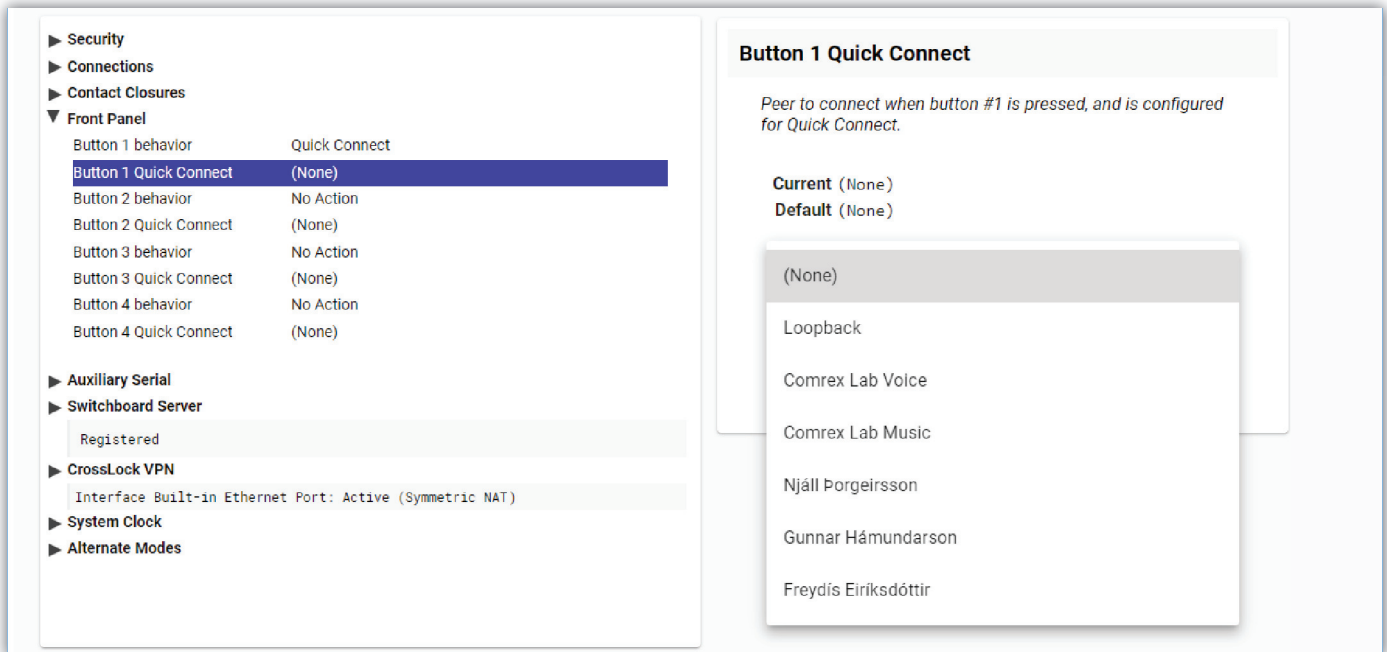


FIGURE 72 QUICK CONNECT REMOTES

AUTO-CONNECT/CONTACT CLOSURE LED INDICATORS

Each of the four *Auto-Connect/Contact Closure Buttons* on the front panel of BRIC-Link III has a corresponding LED indicator, which illuminates to show various statuses. These statuses depend on the *Button Behavior* settings that are applied to each button. With the *Behavior* set to “No Action”, the LED will remain unlit.

CONTACT CLOSURE MODE

When a Front Panel button is set to “Momentary Contact Closure” or “Latching Contact Closure” mode, the corresponding LED indicator will illuminate in the following ways:

- **Solid Blue** - Local Contact Closure signal is being sent to far-end. This status light shows the same whether the contact closure is triggered by a button, the Web User Interface or a physical contact closure connector.
- **Solid White** - A contact closure signal is being received from the far-end.
- **Red with White Flash** - Contact closure signal is being sent and received simultaneously.
- **Off** - No contact closure signals being sent or received.

QUICK CONNECT MODE

When a Front Panel button is set to “Quick Connect” mode, the corresponding LED indicator will illuminate in the following ways:

- **Solid Green** - Connected to the assigned remote. This status light shows the same whether the connection is initiated from the local end or the remote end.
- **Flashing Yellow (3 seconds)**- Local BRIC-Link III is busy. Connection cannot be established.
- **Alternating Yellow and Red (3 seconds)** - Remote unit is busy. Connection cannot be established.
- **Solid Red (3 seconds)** - Disconnecting. This status light shows the same whether the connection is terminated from the local end or the remote end.
- **Off** - The remote connection assigned to this button is inactive. (Other connections may be active.)

XIII. ABOUT THE ALGORITHMS

When building profiles for BRIC-Link III and remote devices, there are several different audio encoder options to use for each direction of the link. Different audio encoder options each have advantages and disadvantages depending on the situation. The following is a brief description of the available audio codec algorithms to assist in making the best choice.

AAC

This algorithm is a highly regarded standard for compressing audio to critical listening standards. It has been judged to produce “near transparent” audio at a coding rate of 128 kb/s stereo. The standard is a collaborative of several audio companies’ best efforts, and has become popular as the default audio codec of the **Apple™ iTunes™ program**. AAC should be considered the highest quality codec in BRIC-Link III. Enhancements like HE-AAC attempt to maintain a similar quality with reduced bandwidth and delay.

HE-AAC

This is a newer version of AAC designed for increased efficiency. The goal of this algorithm is to produce AAC-comparable quality at a lower bit rate. It does this by encoding lower frequencies to AAC, and higher frequencies using Spectral Band Replication (SBR). SBR is a technique that partially synthesizes these high frequencies. HE-AAC is trademarked by other companies as AACPlus™. HE-AAC (and close derivatives) is often used as the main audio codec for digital radio and satellite networks.

HE-AACV2

This algorithm further increases the efficiency of HE-AAC by adding intensity stereo coding. This results in a lower bit rate for stereo signals. Reduced rate HE-AAC mono is grouped into this category, although it does not contain v2 coding.

LINEAR PCM*

This encoder does not compress audio at all. It uses a 48 kHz sampling rate (using analog inputs or 48 kHz AES3) and applies small frames of linear audio to IP packets. This mode is only useful on high bandwidth LAN or managed WAN environments. Mono Mode requires a network capacity of 804 kb/s while Stereo (Dual Mono) Mode requires a network bandwidth over 1.56 Mb/s.

In Linear PCM, if the input AES3 sampling rate is 32 kHz or 44.1 kHz, the network stream will also run at this rate and the required bandwidth will be lower.

FLAC*

This encoder compresses audio data using a lossless algorithm. This means that the audio extracted from the decoder is identical to the audio input to the encoder, with no coding artifacts. FLAC typically removes 30-40% of the network data compared to Linear PCM, but the actual data rate is variable and is based on the complexity of the coded audio.

Using FLAC over Linear PCM typically results in a slightly higher (5 ms) overall delay.

G.722

This is a well known 7 kHz (medium fidelity) algorithm used in some VoIP telephones and codecs. It is provided for compatibility purposes, and is not considered a superior algorithm for audio codecs.

OPUS

A newer offering that combines low delay and low network utilization. Opus is included primarily for compatibility with softphone apps, and Internet connections using WebRTC (see Technotes about WebRTC on the Comrex website). Special CBR modes are offered for compatibility with Tieline products—avoid these in other applications. Due to its versatility in audio quality and low networking drain, Opus is the default profile for Comrex codecs.

**Linear PCM and FLAC are only supported for CrossLock connections on devices running firmware version 4.3-p4 or higher.*

Algorithm Comparison Chart for BRIC-Link III Codecs			
Required Bitrate	Coding Delay	Audio Bandwidth	
			AAC: Provides near transparent audio at relatively high data rates. Best used on non-constrained data networks - for situation where latency is not important.
64 kb/s	69 ms	20 kHz	D1 Mono
96 kb/s	69 ms	20 kHz	D2 Stereo
128 kb/s	69 ms	20 kHz	D3 Dual Mono allows independent programming to be sent on both L&R channels
128 kb/s	69 ms	20 kHz	D4 Stereo 128Kb
256 kb/s	69 ms	20 kHz	D5 Dual Mono 256Kb allows independent programming to be sent on both L&R channels
56 kb/s	69 ms	20 kHz	D6 Mono 56Kb
96 kb/s	69 ms	20 kHz	D7 Mono 96Kb
160 kb/s	69 ms	20 kHz	D8 Stereo 160Kb
			HE-AAC: Provides near transparent audio at low data rates - for situations where latency is not important.
48 kb/s	146 ms	20 kHz	E1 Mono
64 kb/s	146 ms	20 kHz	E2 Stereo
96 kb/s	146 ms	20 kHz	E3 Dual Mono allows independent programming to be sent on both L&R channels
			Linear PCM: Delivers transparent audio with no compression and very low delay - for use on high throughput networks.
768 kb/s	19 ms	20 kHz	F1 Mono
1536 kb/s	19 ms	20 kHz	F2 Dual Mono
512 kb/s	19 ms	15 kHz	F3 Mono
1024 kb/s	19 ms	15 kHz	F4 Dual Mono
			HE-AAC V2: Provides medium quality HE-AAC implementation using Spectral Band Replication.
18 kb/s	212 ms	12 kHz	G1 Mono 18Kb
24 kb/s	269 ms	12 kHz	G2 Stereo 24Kb adds Parametric Stereo to SBR for higher quality audio at low data rate
32 kb/s	184 ms	20 kHz	G4 Stereo 32Kb adds Parametric Stereo to SBR for higher quality audio at low data rate
48 kb/s	184 ms	20 kHz	G3 Stereo 48Kb adds Parametric Stereo to SBR for higher quality audio at low data rate
56 kb/s	184 ms	20 kHz	G5 Stereo 56Kb adds Parametric Stereo to SBR for higher quality audio at low data rate
			FLAC: Free Lossless Audio Compression provides transparent audio while conserving bandwidth. FLAC bitrate is variable and based on audio input.
~537 kb/s	26 ms	20 kHz	K1 Mono
~1075 kb/s	26 ms	20 kHz	K2 Dual Mono
~358 kb/s	26 ms	15 kHz	K3 Mono
~717 kb/s	26 ms	15 kHz	K4 Dual Mono
			Opus: A newer offering that combines low delay and low network utilization. Opus is included primarily for compatibility with softphone apps and Internet connections using WebRTC. (Special CBR modes are offered for compatibility with Tieline products - avoid these in other applications). 3.0-p9 firmware and higher (N4.1=Default Profile for 4.0 firmware)
48Kb/s	41 ms	20 kHz	N4.1 Mono 48kbps
56Kb/s	41 ms	20 kHz	N4.2 Mono 56kbps
64Kb/s	41 ms	20 kHz	N4.3 Mono 64kbps
64Kb/s	41 ms	20 kHz	N5.1 Stereo 64kbps
96Kb/s	41 ms	20 kHz	N5.2 Stereo 96kbps
128Kb/s	41 ms	20 kHz	N5.3 Stereo 128kbps
48Kb/s	41 ms	20 kHz	N6.1 CBR Mono 48kbps
64Kb/s	41 ms	20 kHz	N6.3 CBR Mono 64kbps
64Kb/s	41 ms	20 kHz	N7.1 CBR Stereo 64kbps
96Kb/s	41 ms	20 kHz	N7.2 CBR Stereo 96kbps
128Kb/s	41 ms	20 kHz	N7.3 CBR Stereo 128kbps
			VoIP: G.711 and G.722 coding algorithms for compatibility with SIP-style VoIP phones.
64 kb/s	35 ms	3 kHz	X1 G.711 a-law
64 kb/s	35 ms	3 kHz	X2 G.711 μ-law
64 kb/s	35 ms	7 kHz	X3 G.722

FIGURE 73 ALGORITHM PROFILES

XIV. MULTISTREAMING

BRIC-Link III supports the ability to run **one encoder** per connection, but this single encoder produces an audio stream that may be sent to up to three destinations simultaneously. This capability is referred to as a **Multistream**, as the encoder creates a separate but identical outgoing stream to each decoder. With this increased workload, a user's internet connection must be able to support these streams. For example, if an encoder runs at 35 kb/s network utilization, sending to two locations will require 70 kb/s upload speed from the network. Multistreaming should not be confused with IP Multicast, which is described in the next section.

Each BRIC-Link III can also only run **one decoder**, so it's important that in a **Multistream** environment, a maximum of one stream is sent in the reverse direction. This means that users interested in hearing a Multistream must turn off their encoders. The diagram in **Figure 74** shows a BRIC-Link III **Multistream** arrangement. Codec A is the Multistreamer, with Codecs B, C and D listening to the same audio. Codec B is set to return an audio stream back to Codec A, but Codecs C and D are in receive-only mode.

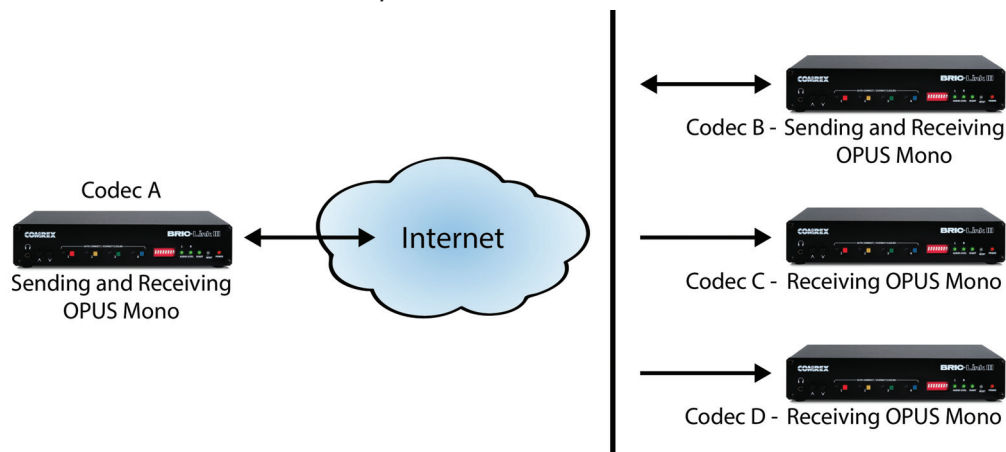


FIGURE 74 MULTISTREAMING ARRANGEMENT

In order to set up a Multistreaming scenario, a "Simplex" (i.e., one-way) Audio Profile must be created using the **Profile Manager Tab** (as shown in **Figure 75**). The **Transmit** option must be set to "Off" for either the **Local** or the **Remote** encoder, depending on the specific arrangement, as described below. The Simplex Profile must then be selected in the chosen Remote entry to activate receive-only mode.

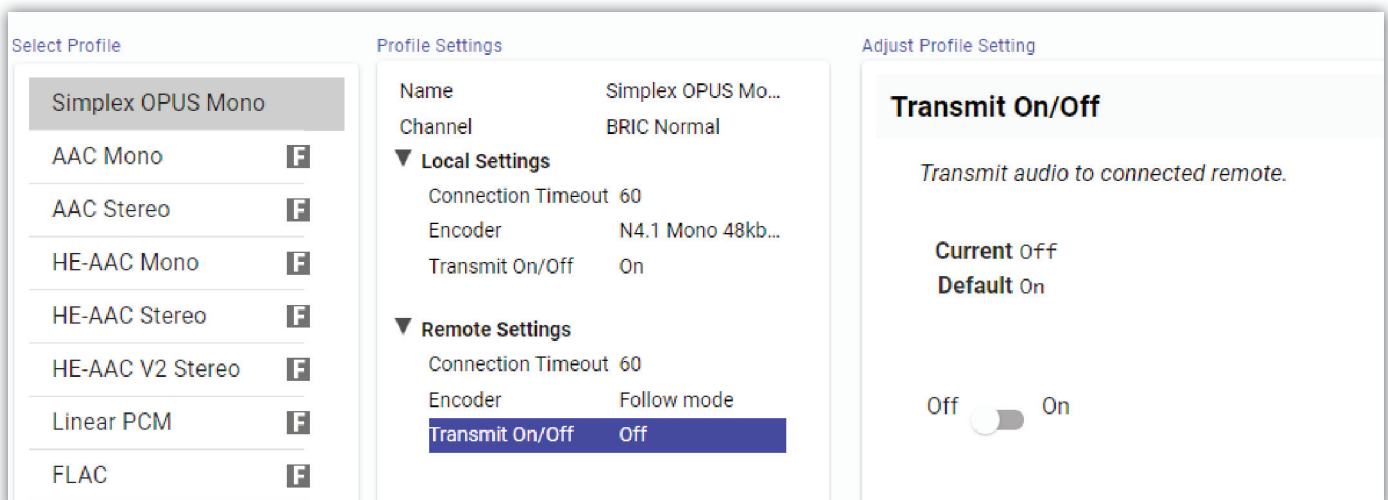


FIGURE 75 TRANSMIT ON/OFF

MULTISTREAMING ARRANGEMENTS

The following includes two examples of **Multistream** arrangements involving the BRIC-Link III. In the first environment, the BRIC-Link III that is serving the Multistream initiates calls; and in the second, the serving BRIC-Link III accepts all of the incoming connections. Refer to the diagram in **Figure 74** to better understand either scenario.

A MULTISTREAMING BRIC-LINK III INITIATES THE CALL

In the “Multistreamer as caller” model, two different profiles will be used on Codec A (the multistreamer). The first profile will be defined as a standard, Duplex BRIC-Link III connection. A factory profile can be used for this. The encoder to be used will be selected in the **Local Encoder** section (with Transmit “On”), and the stream desired in return will be defined in the **Remote Encoder** section (also with Transmit “On”).

The second profile must be built as a Simplex connection with the **Remote Transmitter** turned **Off**. The user of Codec A will define remote connections for Codecs B, C, and D. They will assign the Duplex profile to Codec B, and the Simplex profile to the others. They will then establish a connection with Codec B first, followed by C and D. As long as only one connection is requesting return audio, Codec A will not show the “Local Busy” message when adding the second and third connections.

A MULTISTREAMING BRIC-LINK III RECEIVES THE CALL

In the second model, where the serving BRIC-Link III accepts all incoming connections, all the profiles are built on the **Remote** BRIC-Link IIIs (Codecs B, C and D). Codec B will use a Duplex profile by defining the encoders in each direction, and assign it to Codec A (this can be a factory profile). Then Codecs C and D will each define a Simplex profile with their **Local Transmit** turned **Off**, and assign them to Codec A.

Codec B should connect first. When Codecs C and D connect, they will hear the same stream as Codec B, regardless of how their **Remote Encoders** are set in their profiles. As long as only one of the codecs is sending audio to Codec A, they will not receive the “Remote Busy” message when initiating the second and third connections.

Note: In either scenario, the first connection made between units in a **Multistream** will determine the encoders used for all other connections. Similarly, after the first full-duplex connection is made, all other attempts at full-duplex connections to either end will be rejected.

USING CROSSLICK WITH MULTISTREAM CONNECTIONS

CrossLock functionality brings increased connection stability in Multistreaming environments. To use CrossLock in a Multistream, create the Manual CrossLock Remote entries (refer to **page 49**) and simply apply the appropriate Simplex profiles to each Remote entry as described above.

If BRIC-Link III is using **Switchboard** (via the purchase of a Switchboard Traversal Server License), the Switchboard-generated Remote entries will use CrossLock by default, and these entries must simply be edited to use the appropriate Simplex profiles as described above.

xv. IP MULTICAST

IP Multicast is an efficient way of delivering BRIC-Link III digital audio streams to multiple locations within a compatible network. This method involves relying on the network to distribute the stream to the locations that require it, rather than creating an independent stream for each intended receiver.

Performing an IP Multicast requires the use of an **IP Multicast-capable network**. The commercial Internet, with few exceptions, is *not* capable of supporting IP Multicast. Some private LANs and WANs *are* IP Multicast capable.

IP Multicast does not support Duplex connections, and only supports a single-direction (i.e., Simplex) stream. An encoder can not receive input streams when multicasting. CrossLock is not supported and should be turned off for all IP Multicast connections.

The following section presupposes that IP Multicast users will be familiar with the basic concepts of setup and operation of the network, and will thus focus on how to configure BRIC-Link III for Multicast mode.

MULTICAST PROFILES

To configure BRIC-Link III for Multicast, a custom Audio Profile must be created in the **Profile Manager Tab** for either a Multicast Sender or a Multicast Receiver. As shown in **Figure 76**, when defining a new profile there is the option to choose a **Channel** for the audio stream. When the non-standard channel called “**Multicast**” is selected, the options available under “Profile Settings” will change. Multicast profiles have fewer options than other profile types, and some of the available options will have no effect (e.g. setting an encoder type on a Multicast receiver has no effect).

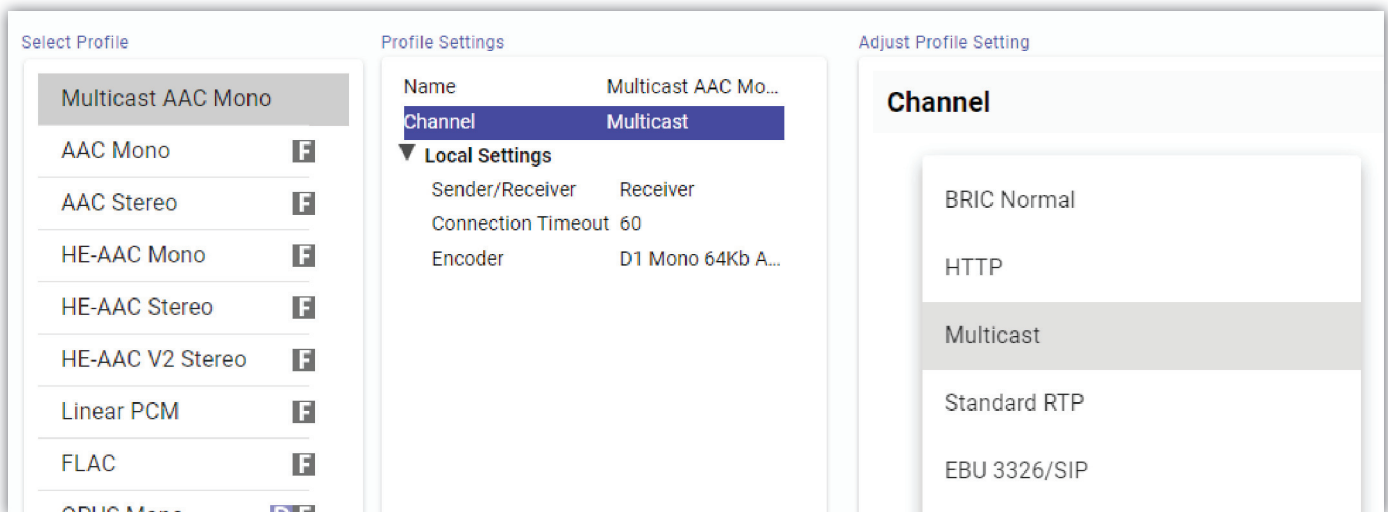


FIGURE 76 MULTICAST SETTINGS

The important settings for Multicast are:

- **Sender/Receiver** - Determines whether this particular BRIC-Link III is intending to generate and encode the IP Multicast stream (the Sender); or to retrieve and decode an existing stream (the Receiver).
- **Encoder Type** - Determines the algorithm format of the stream to be used by the encoder of the Multicast Sender—not relevant for Receivers.

In addition to the basic options for IP Multicast profiles, enabling the **Show Advanced** option will allow setting many of the same Advanced Options available for BRIC Normal (Unicast) profiles.

SETTING UP A MULTICAST REMOTE

Using this configuration, BRIC-Link III does not communicate directly with the other codecs in the link. All codecs involved in a **Multicast** must initiate independent connections to a designated network IP address. A Multicast Sender must initiate an outgoing stream, and a Multicast Receiver must initiate an incoming stream. These connections use Remote entries that are configured within a special IP address range known as a “Multicast Block”, typically **224.0.0.0** to **239.255.255.255**.

To establish a Multicast connection:

1. Define a Remote entry as having an IP address within the IP Multicast Block,
2. Select an IP Multicast profile (as either a “Sender” or “Receiver”),
3. Press **Connect**.

A codec connecting to a designated IP address as the **Sender** will encode audio and provide a single stream into the network. Codecs connecting to the designated IP address as the **Receiver** will pull the stream from the network and decode the audio as normal. The network provides the stream to any number of units that request it; meaning, additional codecs can connect as **Receivers** without any additional workload on the part of the **Sending** codec.

TIME-TO-LIVE

Time-to-Live (TTL) is a variable set by Multicast encoders to determine how long a packet is processed before it is dropped by the network. The default value of TTL in BRIC-Link III is 0, which limits its use to within a LAN environment. TTL may be manually changed on a **Multicast Sender** remote by configuring the IP address followed by a “/”, followed by the TTL value. An example remote Multicast encoder could be set for the address 224.0.2.4/255, which would signify an address with the Multicast Block with a TTL of 255 (which is the max value available).

CHANGING PORT NUMBERS FOR MULTICAST

The default port of UDP 9000 may also be changed on Multicast remote entries. The port number is assigned in the standard socket format, directly after the IP address, preceded by “:”, followed by the TTL. As an example, the IP address of a Multicast Sender on port 443 with a TTL of 100 would read: **224.0.2.4:443/100**.

XVI. STREAMING SERVER FUNCTION

BRIC-Link III has the ability to act as a streaming server, delivering AAC and HE-AAC to compatible PC-based media players. Currently tested media players include **WinAmp**, **VLC** and **Windows Media Player version 12 or higher**.

As a streaming server, BRIC-Link III takes a passive role, allowing media players to “pull” the audio stream spontaneously. By default, streaming server functionality is turned off. To enable it, go to the **System Settings Tab** of the **Web User Interface** and turn on “Show Advanced Settings”. As shown in **Figure 77**, select the **HTTP** drop down under **Alternate Modes**. The first option, “Accept Incoming Connections” should be changed to “Yes”.

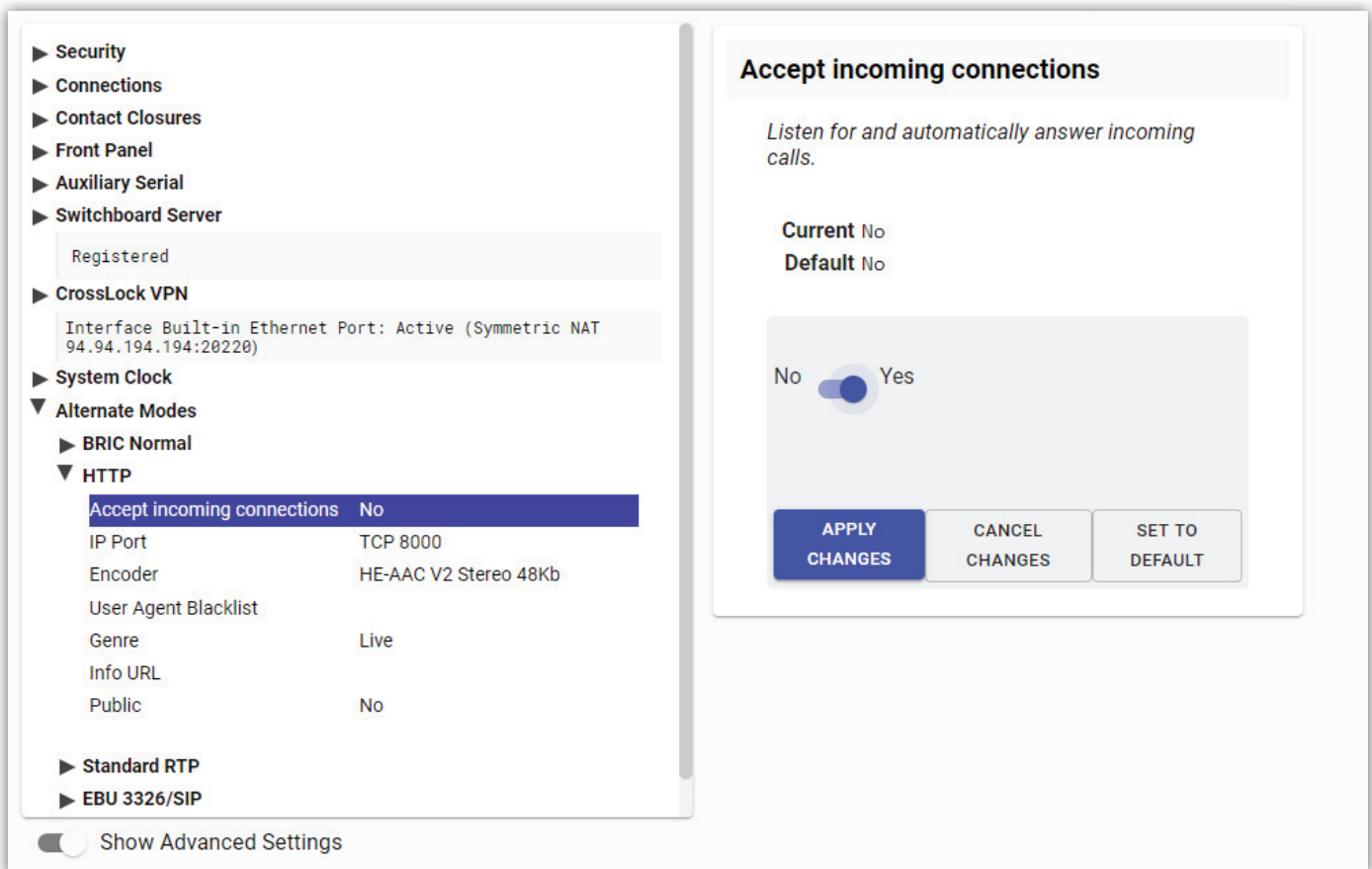


FIGURE 77 ACCEPT INCOMING HTTP CONNECTIONS

The default port for serving streams is TCP 8000. To create a custom port, change the HTTP setting labelled “IP Port”. Note that this port will need to be referenced in the URL provided to listeners.

Next, select an encoder for use by the streaming server. Only the encoder choices that are compatible with the media players listed will be shown in this menu. Choices span from a mono audio feed at 18 kb/s up to a stereo feed at 128 kb/s. Keep in mind, multiple streams will require this bandwidth along with around 25% overhead for each stream.

The **Genre**, **Info URL** and **Public** options may be set for anything, or left alone. These options, if applied, will be embedded into the stream.

DECODING A STREAM

To pull audio from a streaming BRIC-Link III, open one of the supported media players and select the option to open a URL-based stream.

In **Winamp** and **VLC**, input the IP address of the BRIC-Link III in the format of the following example:

http://192.168.0.75:8000

(using the actual IP address, and the actual port if not changed from default **8000**)

In **Windows Media Player**, input the IP address like this:

http://192.168.1.75:8000/stream.asx

(using the actual IP address and port number, of course)

SIMULTANEOUSLY CONNECTING BRIC-LINK IIIS AND STREAMING

BRIC-Link III can stream while connected to another Comrex codec in BRIC Normal mode, as shown in **Figure 78**. If the BRIC connection is using an AAC algorithm supported by media players, when an HTTP stream is requested it will be delivered using the same encoder as the BRIC connection, regardless of the HTTP settings. If the BRIC-Link III encoder is Linear or FLAC, the stream request will be rejected.

CONNECTIONS				DASHBOARD	PERFORMANCE	PROFILE MANAGER	SYSTEM SETTINGS
Name	Address	State	Codec	CONNECT DISCONNECT    Search 			
 VLC/3.0.11 LibVLC/3.0.11	75.68.1.75:62283		Tx: D1 AAC Mono 64Kb				
 Loopback	127.0.0.1						
 Comrex Lab Voice	70.22.155.131:9000						
 Comrex Lab Music	70.22.155.132:9000						
 BRIC-Link III 01:01:01:01:01:01 AAC Mono	92.192.2.197	Connected	Rx: AAC Mono Tx: D1 AAC Mono 64Kb				

FIGURE 78 SIMULTANEOUS CONNECTIONS

XVII. MAKING EBU3326/SIP COMPATIBLE CONNECTIONS

Comrex codecs utilize a set of protocols that allow easy IP connections to other Comrex codecs (as many other brands do for their own hardware). In general, when establishing connections between Comrex hardware, it's best to use these proprietary modes to take the most advantage of the features of the product.

However, many users have concerns about getting “locked in” to a certain codec brand. Because of this, an international committee called N/ACIP was formed by the European Broadcast Union to hammer out a common protocol to interconnect codec brands. This committee resulted in the establishment of **EBU3326**, a technical document describing how best to achieve this goal.

ABOUT EBU3326

EBU3326 by and large establishes a set of features each codec should support, and then leaves most of the heavy lifting to other, previously established standards like SIP (IETF RFC 3261). Topics not covered (yet) by EBU3326 include things like carrying ancillary data, contact closures from end-to-end, codec remote control, monitoring, and complex NAT traversal—which at this point are still left to the individual manufacturer's discretion. If these topics are important to a user's application, it's best to stick to a single codec vendor and their proprietary protocols.

The Tech 3326 document defines several mandatory encoding algorithms, and the transport layer that could be used on them for compatibility. But the most complex part of the standard was the decision on how to arrange Session Initialization, which is the handshake that takes place at the start of an IP codec call. The most commonly used protocol is called **SIP**, which is used extensively by VoIP phones and therefore was a logical choice. SIP carries the advantage of making BRIC-Link III compatible with a range of other non-broadcast products, like VoIP hardware, software, and even mobile phone apps.

EBU3326 IN BRIC-LINK III

BRIC-Link III does not fully comply with EBU3326, as it does not feature the mandatory MPEG Layer II codec. Aside from this, BRIC-Link III has been tested to be compatible with several other manufacturer's devices using encoders supported by both products. When using **EBU3326/SIP Compatible** mode (selectable in the user interface), ancillary data, contact closures, Switchboard TS, Multistreaming and Multicasting are not supported. Outgoing call profiles built with the EBU3326/SIP channel may lack some advanced options, and can not be set for different encoders in each direction (i.e., EBU3326/SIP calls are always symmetrical).

EBU3326/SIP MODES

A function of placing a SIP-style call is the ability to register with a SIP server. This is a server that exists somewhere on the network, usually maintained by a service provider. Several free servers exist that can offer registration, such as **Onsip.com**.

The BRIC-Link III allows EBU3326/SIP calls to be placed or received with or without registration on a SIP server. If registration is not enabled, connections are made directly to the compatible device by dialing its IP address, just like in **BRIC Normal** mode. Connections with registration enabled are first made between the local codec and the SIP server, and are then routed to the compatible device once the server responds.

UNREGISTERED MODE

Placing a call in **Unregistered EBU3326/SIP** mode is simple: just build a custom Audio Profile in the **Profile Manager Tab**, but instead of choosing **BRIC Normal** as the Channel, choose **EBU3326/SIP**. This will make sure the call is initiated on the proper ports and with the proper signalling. The majority of system settings relating to EBU3326/SIP relate to **Registered** mode.

REGISTERED MODE

Registering with a SIP server in **EBU3326/SIP** mode can have some advantages. When using a SIP server:

- The server can be used to help make connections between codecs through routers.
- The remote codec can be dialed by its SIP URI instead of IP address.
- The SIP server can be used to find codecs on dynamic IP addresses.

SIP SERVERS

A SIP server exists in a domain. This domain is represented by a web-style URL like **sipphone.com** or **iptel.org**. A SIP server or proxy generally handles IP connections within its domain.

SIP URI

A URI is an address method used for establishing connections via a SIP server, similar to a URL for websites. The SIP server assigns a fixed alphanumeric name to each subscribed account. For example, an Iptel user may be assigned the user name comrex_user. URIs consist of a SIP user name, followed by a domain, delineated with the @ symbol, like an email address. Comrex's Iptel user URI would be comrex_user@iptel.org. Comrex devices do not use the designation "sip:" before a SIP address.

If a connection is made exclusively within a single domain, the domain name can be left off. As an example, to make a call to this codec from another Iptel registered codec, the dialing string can simply be comrex_user (with the domain being assumed).

REGISTERING WITH A SERVER

At a minimum, you will need the following information when registering BRIC-Link III with a SIP server:

- The Internet address of your SIP proxy/server (e.g. **proxy01.sipphone.com**);
- The username on the SIP account (this is usually the dialing address);
- The password on the SIP account.

Figure 79 shows how this information can be applied: by enabling the **Use SIP Proxy** option under **EBU 3326/SIP** on the **Systems Settings Tab**. Add the necessary credentials listed above for the SIP domain login, and click "Apply Changes" to save each setting.

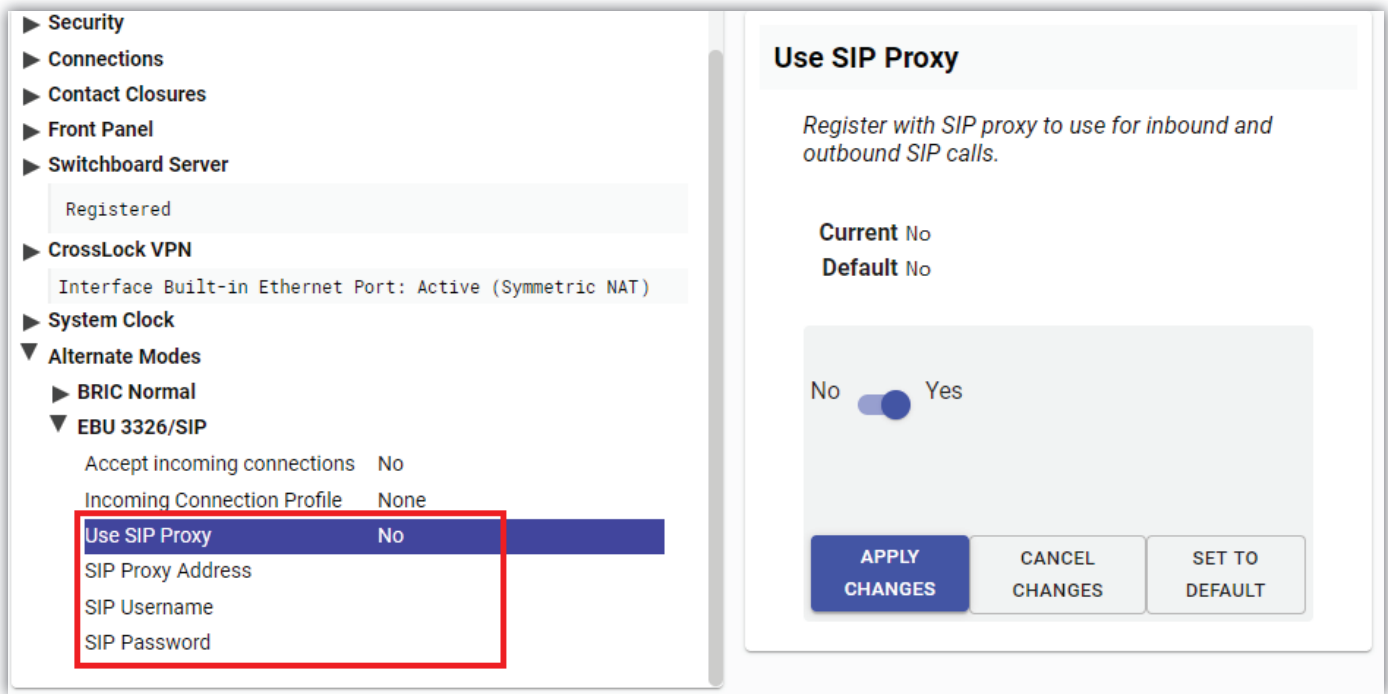


FIGURE 79 EBU3326/SIP SETTINGS

Once this information is correctly entered, a new field appears in the “Registration Status” box located on the **Connections Tab** (Figure 80).

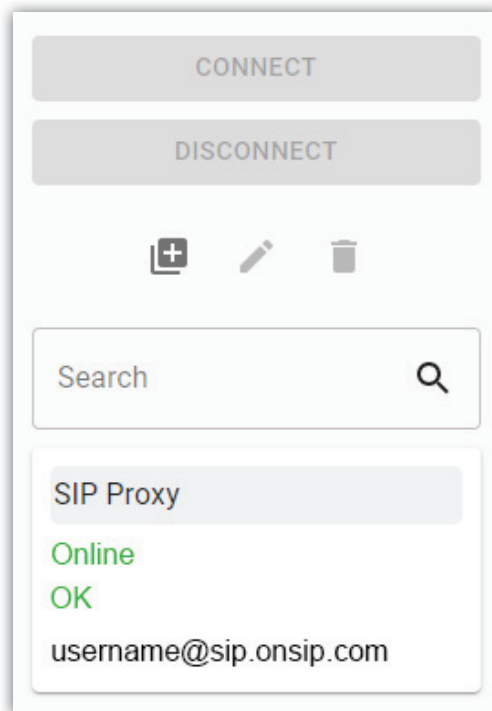


FIGURE 80 SIP STATUS

The status will reflect the progress of the registration process. When complete, this will display **Online**. If the box does not display **Online** after a short time, it means that registration likely failed. It’s best to go back and carefully check the registration info. It might also be useful to ensure the registration information is valid by configuring a VoIP phone or softphone with it and attempting registration.

SIP registration can be very simple with some servers, and others can require more advanced settings, which are described in the **Advanced Topics** section below.

MAKING REGISTERED SIP CALLS

When registered, calls made using an EBU3326/SIP profile behave differently than normal. The address field, regardless of whether it is a SIP URI or an IP address, is forwarded to the server. No connection attempt is made until the server responds.

If the server accepts the address, the call will be attempted. If not, an error message will appear in the status line. Some examples of reasons for call rejection by a server are:

- The server does not support direct connection to IP addresses (if the address is in this format).
- The server does not recognize the address.
- The server does not forward calls beyond its own domain.
- The server does not support the chosen codec.
- The called device does not support the chosen codec.
- The address is a POTS telephone number, and POTS interworking is not supported.
- The address is a POTS telephone number, and no credit is available (most services charge for this).

ADVANCED EBU3326/SIP TOPICS

The basic entries provided will allow support for the vast majority of EBU3326/SIP based applications. There are inevitably situations where the defaults won't work, however. Comrex has provided some advanced options that can help. These options are located in the **Systems Settings** and can be made visible by enabling **Advanced Options**:

- **IP Port** - Universally, SIP connections are supposed to use UDP port **5060** to negotiate calls between devices (and between servers and devices). Note that this is only the negotiation channel—actual audio data is passed on the RTP ports. Changing this port number will change which incoming ports are used to initiate connections and to which ports connection requests are sent. The change must be made on both devices, and this change will essentially make your codec incompatible with industry-standard VoIP devices.
- **RTP Port** - This is one of two port numbers used for audio data transfer (the port number directly above this is used as well). Because this port number is negotiated at the beginning of a call (over the IP port), this port may be changed without breaking compatibility. Note that many SIP standard devices use port **5004** for this function. Due to the negotiation, it is not important that these numbers match on each end. Changing this port to **5004** can actually have an adverse effect, as **5004** is the default port for other services on Comrex codecs.
- **Public IP Override** - See the **SIP Troubleshooting** for more information on this option.
- **Use STUN Server** - See **SIP Troubleshooting** for more information on this option.
- **SIP Proxy Keepalive** - Only applies to **Registered** mode. This variable determines how often the codec “phones home” if registered with a SIP server. It's important that the codec periodically “ping” the server, so the server can find the codec for incoming calls. It can be adjusted primarily to compensate for firewall routers that have shorter or longer binding timings, i.e., the router may have a tendency to “forget” that the codec is ready to accept incoming calls and block them.

- **SIP Domain:** This only applies to **Registered** mode. It's the name of the network controlled by the SIP server. This parameter must be passed by the codec to the server. Under most circumstances, this is the same as the server/proxy address, and if this field is not populated, that is the default. If, for some reason, the domain is different than the server/proxy address, then this field is used.

SIP TROUBLESHOOTING

In a nutshell, SIP establishes a communication channel from the calling device to the called device (or server) on port 5060. All handshaking takes place over this channel, and a separate pair of channels is opened between the devices: one to handle the audio; and the other to handle call control. The original communication channel is terminated once the handshaking is complete. Note that firewalls must have all three ports open for calls to be established correctly.

The primary area where SIP complicates matters is how an audio channel is established once the handshake channel is defined. In the common-sense world, the call would be initiated to the destination IP address, then the called codec would extract the source IP address from the incoming data and return a channel to that address. This is the default method Comrex devices use to create and maintain a connection.

But SIP includes a separate "forward address" or "return address" field, and requires that a codec negotiating a call send to that address only. This is important in the case of having an intermediate server, and works fine as long as each codec knows its public IP address.

OUTGOING CALL ISSUES

A unit making an outgoing call must populate the "return address" field. But any codec sitting behind a router has a private IP address, and does not know its public address. A codec will populate its private IP address (e.g. **192.168.x.x** style) into that "return address" field. The called codec will attempt to connect to that address and fail, as its private IP Address can't be reached from public Internet.

INCOMING CALL ISSUES

Incoming calls to codecs behind routers are complicated by the need to forward ports on the router to the codec. In the case of SIP, this must be three discrete ports (For Comrex codecs these are UDP 5060, 5014 and 5015)<6014 and 6015 with 3.0 firmware>. As the "forward address" is negotiated in SIP, the incoming unit is likely to populate the "forward address" field with its private address as well.

SOLUTIONS

Many times the "return address" field issue is fixed by the SIP server (in **Registered** mode) and no compensation measures are necessary. Often, the server insists on acting as a "proxy" and handles all the traffic itself. Outgoing and incoming streams are relayed directly by the server, solving any router issues.

In point-to-point connections this isn't possible, and some hacks are required to make this work. The first place to look is the router, as many modern routers are aware of this issue and may be configured to ease connectivity. If a router supports the **SIP Application Layer Gateway (ALG)**, enabling this option can fix the issue. The router will read the SIP handshake, find the outgoing address field, and replace it with the public IP. This is a valuable solution in environments where the router supports ALG. In environments where ALG is not available, **STUN** is a valuable alternative.

STUNNING SUCCESS

Another technique for working around the SIP-Router issue is by using a protocol called **STUN**. This can be enabled in Comrex codecs in the **Advanced EBU3326/SIP** options and allows for the codec to learn its public IP address. It does this by contacting a STUN server on the Internet (the default one is maintained by Comrex) and requesting its Public IP. If this option is enabled, the codec itself will handle the address switching.

Be aware of the “battling workarounds” issue, as ports are being translated by the router as well as IP addresses. If the ALG-enabled router receives an unexpected result in the SIP address field (as it might if using STUN), it may not translate ports as expected, and it’s likely that the call will fail. When in doubt, the best technique is to try a SIP call with STUN turned off, and if the return channel fails, try enabling STUN.

FIX OF LAST RESORT

Finally, there’s a brute-force option available on Comrex Codecs when STUN ports are blocked by a firewall, or are unusable for some reason. Under **Advanced System Settings**, a field is available called **Public IP Override**. Any address put into that field will be pasted into the address SIP field. A user can thus place their Public IP address (obtainable from many websites via a browser) in this location. Keep in mind, the Public IP Address is often subject to change over time, so it’s important to remember this change has been made on a codec.

XVIII. LICENSE & WARRANTY DISCLOSURES FOR BRIC-LINK III

LICENSES

MPEG-4 audio coding technology licensed by Fraunhofer IIS

<http://www.iis.fraunhofer.de/amm/>



BRIC-Link III uses proprietary and open-source software programs. Some of the open-source programs are licensed under the Gnu Public License (GPL). For more information on GPL see <http://www.gnu.org>.

As per the GPL, source code for this software is available on request from Comrex on CD-ROM or other electronic format. To obtain this software please contact our support department at +1 978 784 1776. We retain the right to charge a small handling fee for distribution of this software.

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Import code in keyimport.c is modified from PuTTY's import.c, licensed as follows:

PuTTY is copyright 1997-2003 Simon Tatham

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Libpcap

tcpdump

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All Equipment manufactured by Comrex Corporation is warranted by Comrex against defects in material and workmanship for one year from the date of original purchase, as verified by the return of the warranty registration card. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you obtain a return authorization from Comrex and return the product, shipping prepaid to Comrex Corporation, 19 Pine Rd, Devens MA 01434 USA. For return authorization, contact Comrex at 800-237-1776 or 978-784-1776 or email techies@comrex.com.

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XIX. SWITCHBOARD TRAVERSAL SERVER USE DISCLAIMER

TRAVERSAL SERVER DISCLAIMER

You have purchased a product from Comrex that uses the Switchboard TS (Traversal Server) to provide the ability to locate Comrex hardware via the Internet and to aid in the making of connections when certain types of NAT routers are involved in the link. Switchboard TS consists of two distinct elements: the firmware that functions within the codec hardware to enable use of the function; and a server deployed on the Internet which provides the services to the codec hardware. **Note:** BRIC-Link III requires the purchase of a Switchboard Traversal Server License for Switchboard compatibility.

The purchase you have made entitles you only to the firmware elements within your codec that utilize these functions. The functions of Switchboard TS, as implemented in your codec, are warranted to work as described (according to standard Comrex warranty terms found in your User Manual) when used with a properly functioning Traversal Server deployed on the Internet.

Comrex has deployed and provided you account details for a Switchboard TS account on our server, located at **<http://Switchboard.comrex.com>**.

Comrex provides this service, free of charge and at will. As such, Comrex offers no warranty as to availability of this server or of its function. Comrex reserves the right to discontinue availability of this service at any time. Comrex also reserves the right to remove any account from the server at **<http://Switchboard.comrex.com>** at any time for any reason. In no way shall Comrex be liable for this server's malfunction, lack of availability or any resultant loss therein.

The software that runs the Comrex Traversal Server on the Internet is available from Comrex in an executable format, free of charge, with basic instructions on how to set it up. The address of the server used for these functions is configurable in the codec firmware. If you wish to deploy your own Traversal Server, contact Comrex for details on obtaining this software.

Comrex is not liable for training or support in setting up a TS server, and the software is available without warranty or guarantee of suitability of any kind.

XX. CONFORMITY AND REGULATORY INFORMATION

SUPPLIERS' DECLARATION OF CONFORMITY

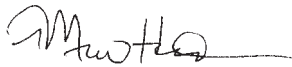
Place of Issue: Devens, Massachusetts

Date of Issue: **September 15, 2022**

Equipment: Comrex BRIC-Link III

Comrex Corporation, located at 19 Pine Road, Devens, MA in the United States of America hereby certifies that the Comrex BRIC-Link III complies with the Federal Communications Commission's ("FCC") Rules and Regulations.

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 the user will be required to correct the interference at his own expense.



Thomas O. Hartnett, Vice President, Comrex Corporation

EC DECLARATION OF CONFORMITY FOR R&TTE DIRECTIVE

We:

Manufacturer's Name: Comrex Corporation

Manufacturer's Address: 19 Pine Road
Devens, MA 01434

hereby declare on our sole responsibility that the product:

Comrex BRIC-Link III
Digital Audio Codec

to which this declaration relates is in compliance with the requirements of:

- FCC Part 15, Subpart B
- Innovation, Science, and Economic Development, Canada (ISED). Testing shall be performed in accordance with the requirements of ICES-003, Issue 7 (October 15, 2020), Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement
- EU Council Directive 2014/30/EU, the EMC Directive / UKCA EMC Regulations 2016
 - EN 55032:2015/A11: 2020, Electromagnetic compatibility of multimedia equipment – Emission requirements.
 - EN 55035:2017/A11: 2020, Electromagnetic Compatibility of Multimedia equipment – Immunity Requirements
 - EN 61000-3-2: 2014, Electromagnetic compatibility (EMC) – Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
 - EN 61000-3-3: 2013, Electromagnetic compatibility (EMC) – Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

Contact person: Thomas O. Hartnett, V.P., Engineering

Signed: 

Date: **15 September 2022**

U.S. AND CANADIAN REGULATORY INFORMATION FOR THE BRIC-LINK III

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA, as well as the applicable Industry Canada technical specifications.

If trouble is experienced with the Comrex BRIC-Link III, please contact Comrex Corporation at 978-784-1776 for repair or warranty information. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is solved.

No user serviceable parts are contained in this product. If damage or malfunction occurs, contact Comrex Corporation for instructions on its repair or return.

If you have specially wired alarm equipment connected to the telephone line, ensure the installation of the Comrex BRIC-Link III does not disable your alarm equipment. If you have questions about what will disable alarm equipment, consult your telephone company or a qualified installer.

APPENDIX A - IP COMPATIBILITY

BRIC-Link III is capable of encoding and decoding a choice of three different types of non-BRIC-Link III streams: **Standard RTP**, **Luci Live**, and **Zephyr Xstream**. The choice is exclusive—i.e., you must set BRIC-Link III specifically for the type of stream you wish to be compatible with and you will remain incompatible with the other two types unless you change it. This setting has no effect on normal BRIC-Link III functions, which continue to operate as before.

1. **Luci Live** - This PDA/PC-based software allows real-time streaming over IP links. As of version 1.2, **Luci Live** includes AAC and HE-AAC in addition to the default MP2 algorithm. BRIC-Link III can communicate with **Luci Live** only in Luci's AAC modes. Note: The free demo available from Luci does not incorporate the AAC functions; you must have a licensed and registered copy to use AAC.

To communicate with a **Luci Live** device:

- **Initial Setup** - This will define all Standard RTP connections to be Luci Compatible.
On BRIC-Link III's **System Settings Tab**, open the **Standard RTP Settings** option and choose **RTP Compatibility Mode**. On the pull-down box, choose **Luci Live**.
- **Incoming Connections** - **Luci Live** sends either an AAC or HE-AAC stream to the BRIC-Link III on UDP port 5004. These streams will be automatically decoded. By default, a return channel of AAC 56 kb/s mono is returned to the **Luci Live** product. The return channel may be altered to any Luci-compatible mode in the **Systems Setting** section.
- **Outgoing Connections** - Build a profile using the **Profile Manager Tab** on the BRIC-Link III and select a **Channel Mode** of **Standard RTP**. Then choose a Luci-compatible encoder for the outgoing call. The Luci software will control what type of stream, if any, is returned to the BRIC-Link III.

2. **Zephyr Xstream** - Xstream Firmware version 3.2.0 and higher support an "RTP Push" function that is compatible with BRIC-Link III in some modes. BRIC-Link III is not currently compatible with the Xstream's HTTP and SIP streaming functions.

There are several limitations imposed by the Xstream when using the RTP Push function:

- On the Xstream, only AAC and MP3 coding are available in this mode, and BRIC-Link III is only compatible with the AAC mode.
- The Xstream uses downsampling in modes below 96 kb/s, which is not supported by BRIC-Link III.
- In order for an Xstream to decode an BRIC-Link III stream, the default decoder setting must be changed from <Auto> to <AAC> in the codec menu of the Xstream.

To communicate with a **Zephyr Xstream**:

- **Initial Setup** - This will define all Standard RTP connections to be Xstream Compatible.
On BRIC-Link III's **System Settings Tab**, open the **Standard RTP Settings** option and choose **RTP Compatibility Mode**. On the pull-down box, select **Zephyr Xstream**.
- **Incoming Connections** - **Zephyr Xstream** sends an AAC stream to the BRIC-Link III on UDP port 9150. These streams will be automatically decoded. By default, a return channel of AAC 96kb/s mono is returned to the Xstream. The return channel may be altered to any Xstream-compatible mode in the **Systems Setting** section.

- **Outgoing Connections** - Build a profile using the **Profile Manager Tab** on the BRIC-Link III and select a **Channel Mode** of **Standard RTP**. Then choose an Xstream-compatible encoder for the outgoing call. The Xstream will control what type of stream, if any, is returned to the BRIC-Link III.

3. **Standard RTP** - This mode is set to receive a basic, unformatted AAC stream within a standard RTP/UDP structure. At present, this mode does not offer compatibility with other industry devices.

APPENDIX B - BRIC-LINK III ON UNIDIRECTIONAL NETWORKS

Under most circumstances, BRIC-Link III requires an IP path in both directions for successful connections, even when audio is being sent only one-way. For networks that provide data only in one direction, it is possible to use **Standard RTP** mode to establish and maintain these links. This section describes how to set that up.

The codec has several compatibility modes under the **Standard RTP** channel mode. The units default to a mode that is compatible with the **Luci Live** PC-based encoder. To use **Standard RTP** to make connections between Comrex codecs, this setting must be changed on both codecs in the link.

- On the BRIC-Link III, click the **System Settings Tab** and select “Show Advanced Options”.
- Find **Standard RTP Settings** and choose to edit the **RTP Compatibility Mode**.
- Change this setting to **Standard** and click “Apply Changes”.

STANDARD RTP SETTINGS

ENCODE SIDE SETTINGS ONLY

Connections of this type must be established from the encoding side of the link. A new profile must be built that uses the **Standard RTP** channel mode in the **Profile Manager Tab**. Choose an outgoing encoder along with any other special attributes in the Profile Settings. Name the profile something descriptive like “Simplex”. (See **page 33** for more details on creating a new profile.)

Next, create an outgoing Remote entry in the **Connections Tab**. Apply the new profile to that entry. Any connection made with that entry will connect in a unidirectional fashion.

DECODE SIDE SETTINGS ONLY

Enable “Show Advanced Settings” in the **System Settings Tab** for the receiving unit. Under the **Standard RTP Settings**, find the **Return Channel Enable** option. Disable the return channel and click “Apply Changes”. This will ensure that no channel will be established in the direction to the encoder.

FULL-TIME OR TRIGGERED CONNECTIONS

A Remote entry using a unidirectional profile can still utilize the tools required for automatic connection.

To set up a connection to be “always active” (i.e., reconnect in the case of power outage or network failure), choose that connection on the **System Settings Tab** as the **Always Connect To** location.

To trigger the connection when an external contact is closed, choose the connection under one of the **Contact Closure** settings on the **System Settings Tab**.

APPENDIX C - INFORMATION FOR IT MANAGERS

The purpose of this appendix is to describe all open ports required for services available on the Comrex BRIC-Link III.

The Comrex BRIC-Link III is a device designed to move real-time, wideband audio over IP networks. The main network interface is 1000BaseT-Ethernet. The device contains an optimized version of Linux kernel.

The IP parameters are set by a computer on the local LAN using a proprietary broadcast UDP protocol. To perform this function on the local computer, Comrex provides **Device Manager**, a Windows- or MAC-compatible application, available on our website at www.comrex.com. Once the BRIC-Link III is powered on, you have five minutes before this function is disabled.

IP parameters can also be changed online using the **Network Manager** in the Web GUI. Updates to the system are provided by a custom online updater utility. This update process is password protected and requires access to **TCP 80** and **TCP 8081**. In addition to the password protection, the update data itself must have a valid cryptographic signature from Comrex, or else it is rejected.

INCOMING SERVICES

Port	Service	Default
TCP 22	SSH*	Off (On for products shipped before 1 July 2017)
TCP 80-85	HTTP control	On
TCP 8081	Firmware upload	Open only during upgrade process
UDP 9000	BRIC Normal Media	On
UDP 9001	CrossLock Media	On
UDP 5060	SIP	Off
UDP 5004, 5005	Standard RTP	Off (On for products shipped before 1 July 2017)
UDP 6014, 6015	SIP RTP	Off
TCP 9000	BRIC Normal/TCP	Off
TCP 8000	HTTP Media	Off

*Only SSH clients with an authorized DSA key can access SSH services on the device. Other forms of authentication are disabled. This key is kept confidentially by Comrex for factory diagnostics only. SSH services may be disabled completely via the user interface.

OUTGOING SERVICES

Service	Destination
NTP	o.comrex.pool.ntp.org:123 (UDP)
Switchboard	switchboard.comrex.com:8090, switchboard.comrex.com:8081 (secondary) (TCP)
STUN	stun.comrex.com:3478 (UDP)
DNS Lookup	DNS Server:53 (TCP and UDP)

APPENDIX D - CONNECTIONS TO MULTIRACK

The purpose of this appendix is to describe how to reference the 5 individual codec instances when making connections to Comrex ACCESS MultiRack.

BRIC NORMAL CONNECTIONS

The Comrex ACCESS MultiRack allows users to make connections from up to 5 separate AES67 codec “instances”. This requires additional setup including the assignment of separate UDP ports for each MultiRack instance. UDP 9000 is the default port for BRIC Normal connections. Instance #1 on MultiRack will use the UDP 9000 port by default. Comrex generally recommends that End Users with MultiRack then use UDP 9002-9005 for instances #2-5 respectively (these are the system defaults for those instances), leaving UDP 9001 open for CrossLock.

When making Remote entries on BRIC-Link III to connect to a MultiRack, each instance must have its own separate entry. For BRIC Normal connections, this is done by entering the Public IP Address of the MultiRack followed by “:9000” for instance #1, and “:9002”, “:9003”, “:9004”, and “:9005” for instances #2-5 respectively. For example, Creating a BRIC Normal entry for instance #3 on a MultiRack would read: 99.98.197.196:9003.

MANUAL CROSSLICK CONNECTIONS

Manual CrossLock connections require special configuration options on both sides of the link. This primarily involves programming the Switchboard ID (or primary Ethernet MAC address) for each unit into a Remote entry on the codec on opposite side of the link. Each unit in the link must have a Remote entry containing the Switchboard ID (MAC address) of the other unit in order to form a CrossLock connection.

ACCESS MultiRack instances #2-5 have special Switchboard IDs consisting of the primary Ethernet MAC followed by a “-x” suffix (e.g., 00:01:A2:B3:C4:D5-4 for instance #4).

See **page 49** for more details on creating Manual CrossLock connections.

Note: Comrex Devices must be running at least Firmware version 4.5 to designate MAC Address suffixes when making Manual CrossLock Remote Entries.

MAKING CONNECTIONS WITH SWITCHBOARD

In order to use Switchboard, users must first have an account with the server, and codecs must be added to the account as peers (BRIC-Link III also requires the purchase of a Switchboard Traversal Server license). When adding an ACCESS MultiRack to your Switchboard Account, each instance must be added individually as a separate peer. The primary Ethernet MAC address is used here only for MultiRack instance #1’s Switchboard ID. Instances 2-5 use the same MAC address with a suffix (e.g. -2, -3, -4, and -5) added to designate that instance’s Switchboard ID.

As an example, if the primary Ethernet MAC address is 00:01:02:A3:B4:C5, that would be the Switchboard ID input for MultiRack instance #1. Instance #2 is added as 00:01:02:A3:B4:C5-2, instance #3 uses -3, etc.

See **page 59** for details on setting up a Switchboard Account.