Omnia® MPX Node

MPX Over IP at Extremely Low Data Rates

Installation & User's Guide

Version 1.3.35 May, 2020

2001-00522-000 OMNIA MPX NODE DECODER

2001-00529-000 OMNIA MPX NODE ENCODER

Omnia® Telos Alliance

TelosAlliance.com/Omnia

P/N: 1490-00211-002 --- OMNIA MPX NODE MANUAL

Creating the Most Exciting and Engaging Audio Experiences Imaginable

Congratulations on your new Telos Alliance product!

The gang here at Telos is committed to shaping the future of audio by delivering innovative, intuitive solutions that inspire our customers to create the most exciting and engaging audio experiences imaginable.

We're grateful that you have chosen audio tools from Telos® Systems, Omnia® Audio, Axia® Audio, Linear Acoustic®, 25-Seven Systems®, and Minnetonka Audio®. We're here to help you make your work truly shine. We hope that you enjoy your Telos Alliance product for many years to come and won't hesitate to let us know if we can help in any way.

Telos Alliance

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User Warnings and Cautions

The installation and service instructions in this manual are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified personnel.

This instrument has an autoranging line voltage input. Ensure the power voltage is within the specified range of 100-240VAC. The ~ symbol, if used, indicates an alternating current supply.

This symbol, wherever it appears, alerts you to the presence of uninsulated, dangerous voltage inside the enclosure – voltage which may be sufficient to constitute a risk of shock.

This symbol, wherever it appears, alerts you to important operating and maintenance instructions. Read the manual.

CAUTION: HAZARDOUS VOLTAGES

The instrument power supply may incorporate an internal fuse. Hazardous voltages may still be present on some of the primary parts even when the fuse has blown. If fuse replacement is required, replace fuse only with same type and value for continued protection against fire.

WARNING:

The product's power cord is the primary disconnect device. The socket outlet should be located near the device and easily accessible. The unit should not be located such that access to the power cord is impaired. If the unit is incorporated into an equipment rack, an easily accessible safety disconnect device should be included in the rack design.

To reduce the risk of electrical shock, do not expose this product to rain or moisture. This unit is for indoor use only.

This equipment requires the free flow of air for adequate cooling. Do not block the ventilation openings on the rear and sides of the unit. Failure to allow proper ventilation could damage the unit or create a fire hazard. Do not place the units on a carpet, bedding, or other materials that could interfere with any panel ventilation openings.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

USA CLASS A COMPUTING DEVICE INFORMATION TO USER

WARNING:

This equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used as directed by this manual, it may cause interference to radio communication. This equipment complies with the limits for a Class A computing device, as specified by FCC rules, part 15, subpart j, which are designed to provide reasonable protection against such interference when this type of equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference. If it does, the user will be required to eliminate the interference at the user's expense. Note: objectionable interference to TV or radio reception can occur if other devices are connected to this device without the use of shielded interconnect cables. FCC rules require the use of shielded cables.

CANADA WARNING:

"This digital apparatus does not exceed the Class A limits for radio noise emissions set out in the radio interference regulations of the Canadian department of communications."

"Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de Class A) prescrites dans le règlement sur le brouillage radioélectrique édicté par le ministère des communications du Canada."

CE CONFORMANCE INFORMATION:

This device complies with the requirements of the EEC council directives:

93/68/EEC (CE MARKING)

73/23/EEC (SAFETY – LOW VOLTAGE DIRECTIVE)

89/336/EEC (ELECTROMAGNETIC COMPATIBILITY)

Conformity is declared to those standards: EN50081-1, EN50082-1.

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Patent information can be found at TelosAlliance.com/legal

Updates

MPX Node features and operations are determined largely by software. Telos Alliance strives to provide the most stable and feature-rich software available. We encourage you to check for software updates from time to time by visiting our website or by contacting us directly.

Feedback

We welcome feedback on any aspect of our products or this manual. In the past, many good ideas from users have made their way into software revisions or new products. Please contact us with your comments or suggestions.

We support you…

By Phone/Fax

You may reach our Telos Support Team in emergencies by calling +1 216-622-0247. For billing questions or other non-emergency technical questions, call +1 216-241-7225 between 9:00 AM to 5:00 PM USA Eastern Time, Monday through Friday.

By Email

Non-emergency technical support is available at Support@TelosAlliance.com.

By Web

The Omnia Web site has a variety of information that may be useful for product selection and support. The URL is TelosAlliance.com/Omnia .

Service

You must contact Telos Alliance before returning any equipment for factory service. We will need your unit's serial number, located on the back of the unit. We will issue a return authorization number, which must be written on the exterior of your shipping container. Please do not include cables or accessories unless specifically requested by the Technical Support Engineer. Be sure to adequately insure your shipment for its replacement value. Packages without proper authorization may be refused. US customers, please contact Telos Alliance Technical Support at +1-216-622-0247. All other customers should contact local representative to make arrangements for service.

Warranty

For the latest Telos Alliance warranty, visit: telosalliance.com/warranty

Register your product

Register your product today to get the full benefits of our warranty, support, and product updates. telosalliance.com/product-registration/

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Web: telosalliance.com/support-request

1 Introduction

Overview

The Omnia MPX Node is a purpose-built broadcast codec for transporting FM composite (MPX) signals over IP networks. Like its namesake (the classic Axia xNode), Omnia MPX Node is a building block technology that helps stations leverage the growing power and capability of data networking. By transporting an FM composite signal rather than Left/Right audio, broadcasters can keep their on-air processing and RDS encoding at the studio, then deliver a transmission-ready, peak controlled FM multiplex signal directly to an FM transmitter without the need for transmitter-side peak limiting or stereo generation. Since MPX is transported over IP, signals are routable, and one-to-many distribution of "carbon copy" processing becomes possible. Each MPX Node can be set to either encode or decode, and a pair of units creates an end-to-end system. Omnia SST users can connect to the MPX Node, and stations with an Omnia 9 processor can purchase an Encoder license, such that MPX over IP signals can be sent directly via IP from the processor to a decoder.

About the µMPX Codec

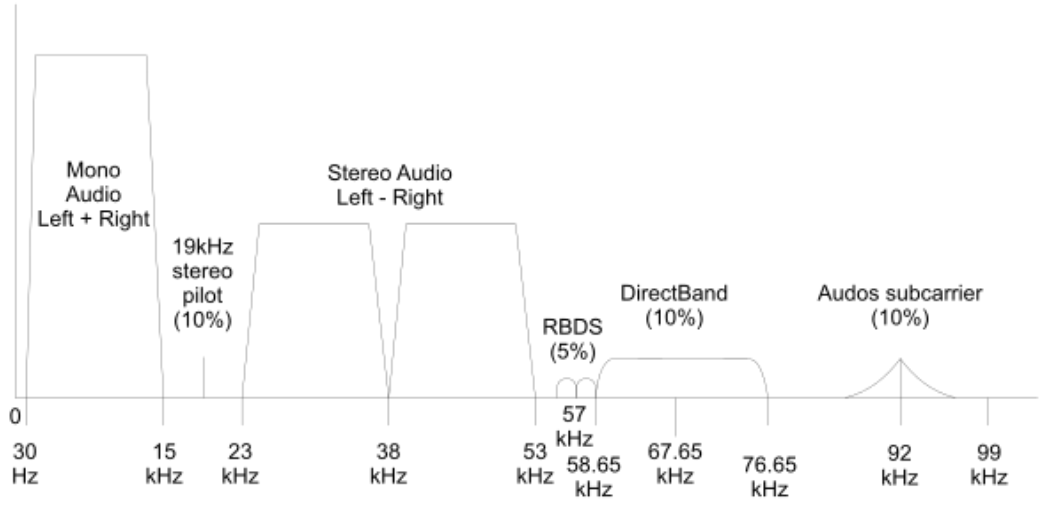
MPX Node utilizes µMPX ("micro" MPX), a specially designed audio codec purpose-built for FM radio that is able to transport high-quality Multiplexed FM signals over a relatively small 320kbps data pipe using UDP. While some companies have full-bandwidth "linear" MPX over IP offerings, distribution of such streams requires extremely high dedicated bandwidth, typically 2 megabits (Mb) or more. µMPX slashes the amount of bandwidth needed for distribution by nearly 84% to a remarkable 320kbps. By reducing data requirements, high-quality multiplexed audio can be economically routed from any audio processor, over IP, and directly into an exciter. Unlike codec offerings that are designed explicitly for stereo audio (MP3, AAC, etc), µMPX is purpose built for composite FM signals. µMPX uses a unique perceptual masking strategy, leveraging the native properties of FM multiplexed signals. For STL use, this approach provides a double benefit over stereo audio codecs because:

- Coding artifacts produced by stereo codecs require additional processing (post transport) to correct overshoots and other errors prior to stereo generation.
- Artifacts occurring in µMPX coding manifest as FM noise and go unnoticed.

With µMPX, lower bandwidth IP connections and narrow band STL channels can now be used to transport MPX signals. µMPX will create new audio distribution options and cut equipment needs and costs, as it leverages advances in the world's ever-growing IP infrastructure. Sound quality also benefits as this purpose-built codec makes its way into more places. As with all new groundbreaking technologies, potential applications for µMPX will only grow as creative radio engineers begin utilizing it. Watch for µMPX to make its way into an increasing number of Omnia products.

A Distinction from L/ R signals

An important concept for all readers to understand is that MPX Node transports modulated FM signals, not L/R audio. This modulated signal contains the components that make up an FM broadcast; L+R, 19kHz stereo pilot, L-R and RDS/RBDS at the first subcarrier. As an encoder, MPX Node converts composite analog FM to IP packets; as a decoder, it converts packets to analog composite FM. As such, the Encoder version needs to be fed by the output of an audio processor, while the decoder is intended to feed the analog composite input of an FM transmitter. In some ways, MPX Node may be thought of as a modem for FM signals. For reference, a diagram of FM signal is useful.



2 Quick Start Instructions

MPX Node is a computing appliance that interfaces to audio processing and FM transmission equipment. Installation and proper operation requires you to have some basic knowledge of computer networking, firewalls, port management, and other general computer skills, in addition to your radio broadcast knowledge.

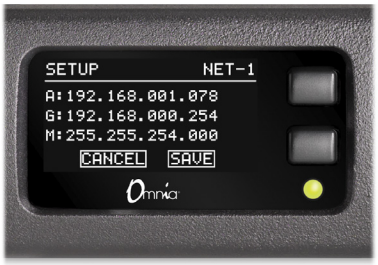
You are probably anxious to get your MPX Node(s) running. This section will help you get going.

MPX Nodes are controlled through an HTML5 web interface. In order to access this interface you need to log on to the unit by entering its IP address in a (modern) browser (our developers use Chrome for product testing). For convenience, both Encoder and Decoder nodes are set from the factory to obtain get IP addresses using DHCP.

Obtaining an IP address

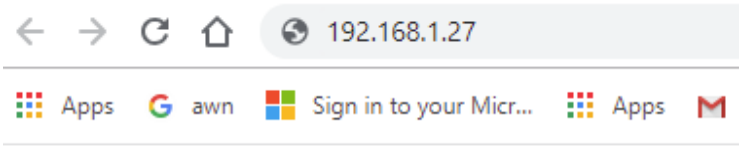
1. Plug your MPX Node into a network providing DHCP (either NET1 or NET2 ports can be used, but we recommend you use NET1 as your primary).
2. Power your unit up
3. Using the top control button on the front panel, scroll through the display pages to the Network port connected to your router. You should see an (up) indication, and a DHCP assigned IP address. In our example below, the network is plugged into NET1. (UP) indicates that your network is connected while (DN) indicates it is down.

4. If you don't have a DHCP server on your network, you can enter a static IP address from the front panel. Press and hold the bottom front panel button for 10 seconds until you see the Setup page.

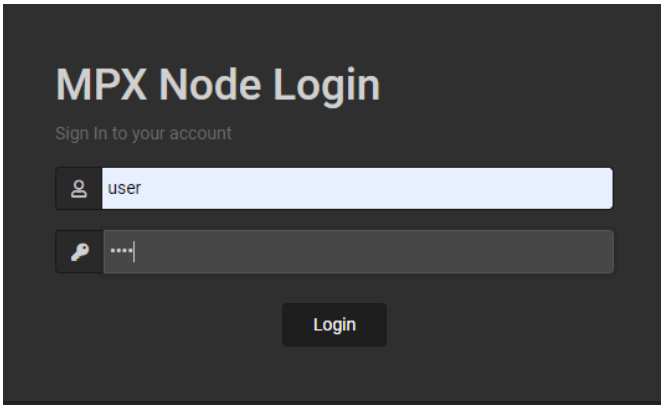


5. Use the upper front panel button to change values, and the lower button to advance to the next field. To save changes, advance to the SAVE field and press the upper button.
6. Once your MPX Node has a valid IP address, use a connected web browser to log in by entering it in the address bar:

Logging In

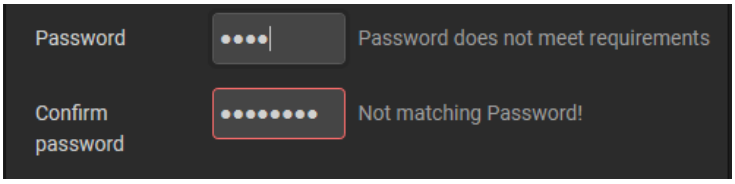


Once you enter the IP address of your unit in a connected browser, you will see the following login page:

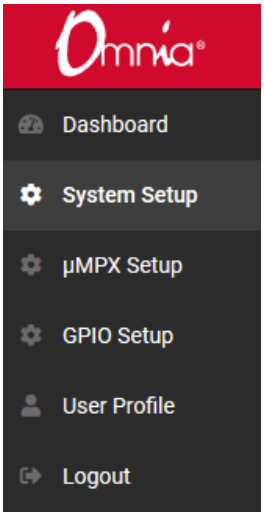


The factory default user name is user, the default password is also user.

- Once you enter this default, you will see the User Profile page. You must enter and save a new, unique password in order to access other control pages.
- For security, a password must meet the following requirements:
  - Length must be 8 characters or more
  - It must contain one or more uppercase letters
  - It must contain one or more lowercase letters
  - It must contain one or more numbers
  - It must contain one or more special characters, eg: ! @ # $ % ^ & * ? _ ~ £
- User and password names are case sensitive. Beware that some browsers and devices will attempt to capitalize the first letter in a field, possibly entering in a wrong character.
- The password entry dialog will indicate if your password meets requirements:



- Be sure to write your new user/password combination down. We suggest you text or email it to yourself.
- If you forget or misplace your user/password, you can reset it to the user / user default from the front panel. For more information check Password Reset in the User Profile section of this manual.



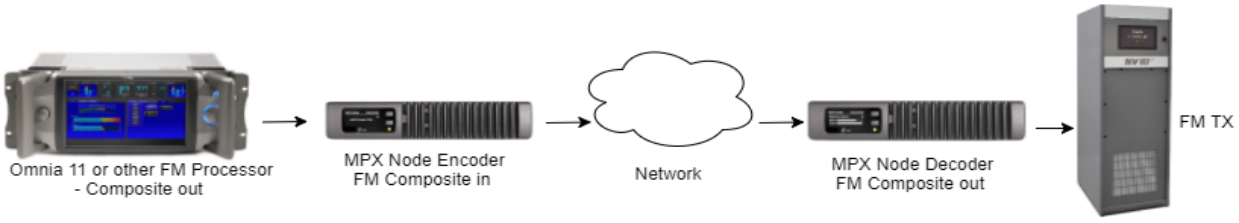
Once you log into your MPX Node, click through the selections on the upper left side of the user interface and have a look at the various setup pages of the unit. We're sure you'll find the displays and controls easy to understand and use.

3 Use Cases & Applications

These diagrams provide a quick snapshot of some of the ways MPX nodes can be used. This list is just a fraction of potential applications for this building-block technology. MPX Node can help simplify your transmitter rack, eliminating the need for further processing or stereo generation at the transmitter.

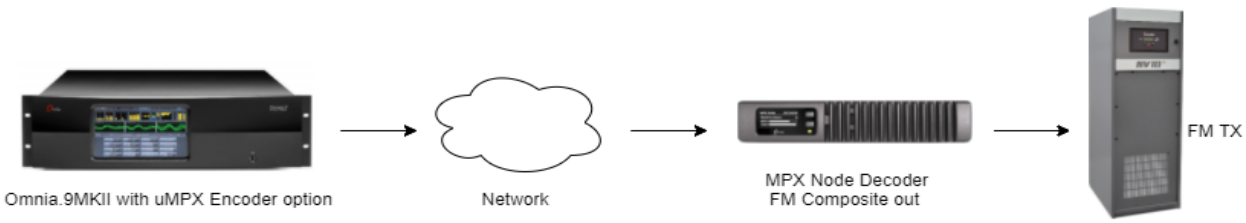
Simple STL: Use with Any FM Processor

MPX Node is processor agnostic. Composite output of ANY brand of FM processor feeds an MPX Node Encoder, while the Decoder feeds the transmitter .



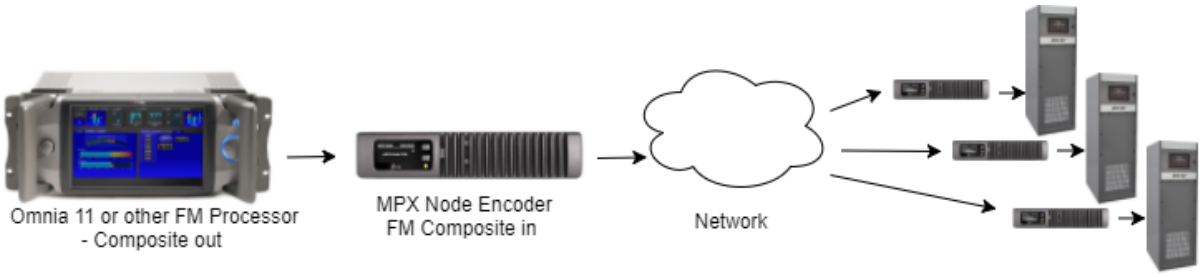
Omnia 9 as MPX Encoder

Now your processor IS the front end of your STL! With Encoding built right into the Omnia 9, a network connection, and a single or multiple decoder nodes, your setup just got less complicated, and your processor can now move back to the studio.



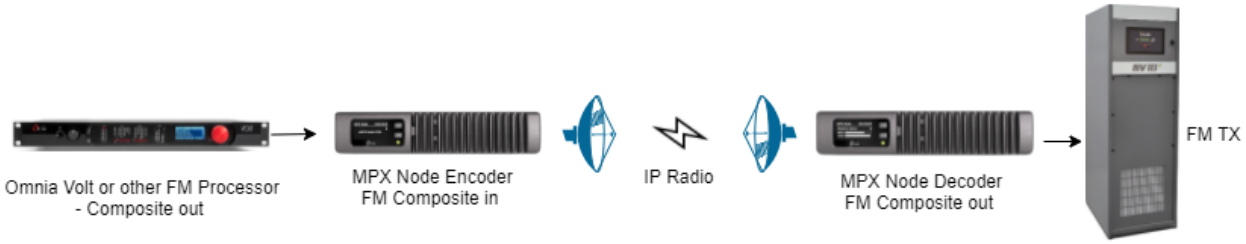
One Processor to Many Transmitters

This diagram gets at one of the primary benefits of MPX over IP: each decoder is a "carbon copy" of the main processor. Main sites, backups and repeaters all get the same signal. This leverages the value of your best processor, creates sonic uniformity at all TX sites, and means you don't have to tweak and adjust each transmission chain! Optional licensing for Multicast transmissions is available too.



Use with private networks, and IP radios

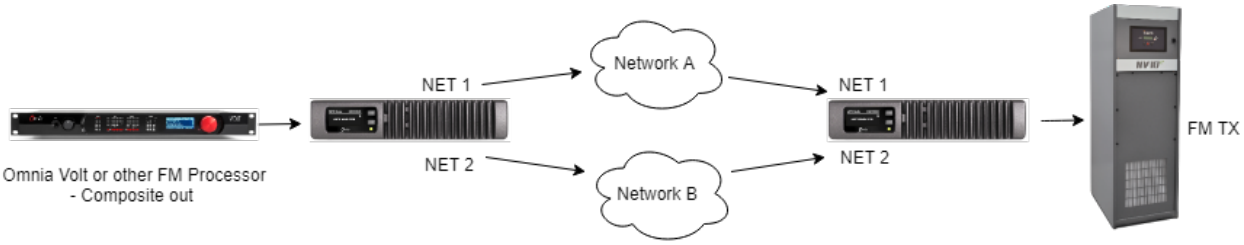
With µMPX, lower bandwidth IP connections and narrow band STL channels can now be used to transport MPX signals.



4 Redundant Paths and Backup Scenarios

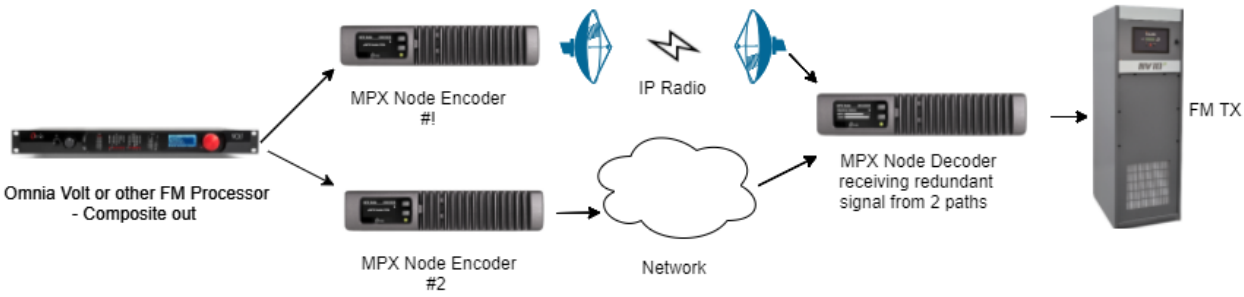
Single Encoder & Decoder, Dual Networks

In this illustration, NET1 and NET2 ports feed two entirely separate network paths. If packets are lost on one path, the Decoder grabs them from the other and seamlessly re-assembles the stream.



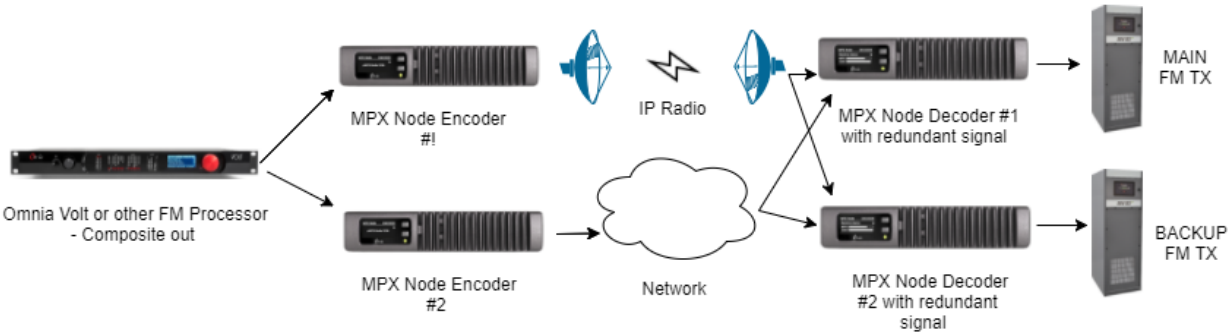
Dual Encoder, Single Decoder

In this illustration, a processor（or 2 processors located at different sites）feeds two Encoders. Both Encoders send the same signal over UDP to a single Decoder at the same IP and port address. If one of the links fails, the Decoder picks up the stream from the other Encoder after a brief failover period.（An external router may be required, depending on your link design）.

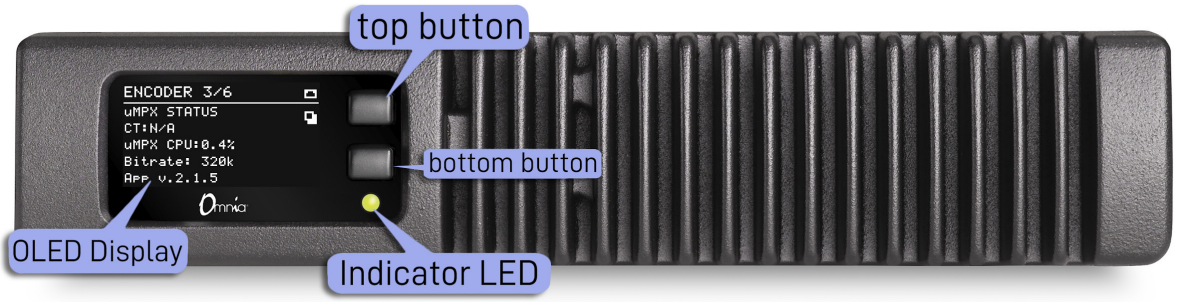


Dual Encoder, Dual Decoder

In this illustration, a second Decoder is added to the above so that both Main and Backup transmitters are both fed with signals served by separate network paths. (An external router may be required, depending on your link design).



5 The Front Panel



The MPX Node front panel consists of two buttons, an LED and a long-life OLED display, housed in a fanless, rugged cast aluminum body with integrated heat exchanger. The front panel provides fast access to system status information. Front panel data input is limited to IP address setup and password reset so you can get at the GUI , the real control point for all system operation.

Front Panel buttons

Use the top control button to scroll through the display pages. Page 4 (the NET1 page) may be edited, by pressing and holding the bottom button for 10 seconds until the IP address edit page appears. Once you are in this screen, the top button changes values while the bottom will advance you to the next field.

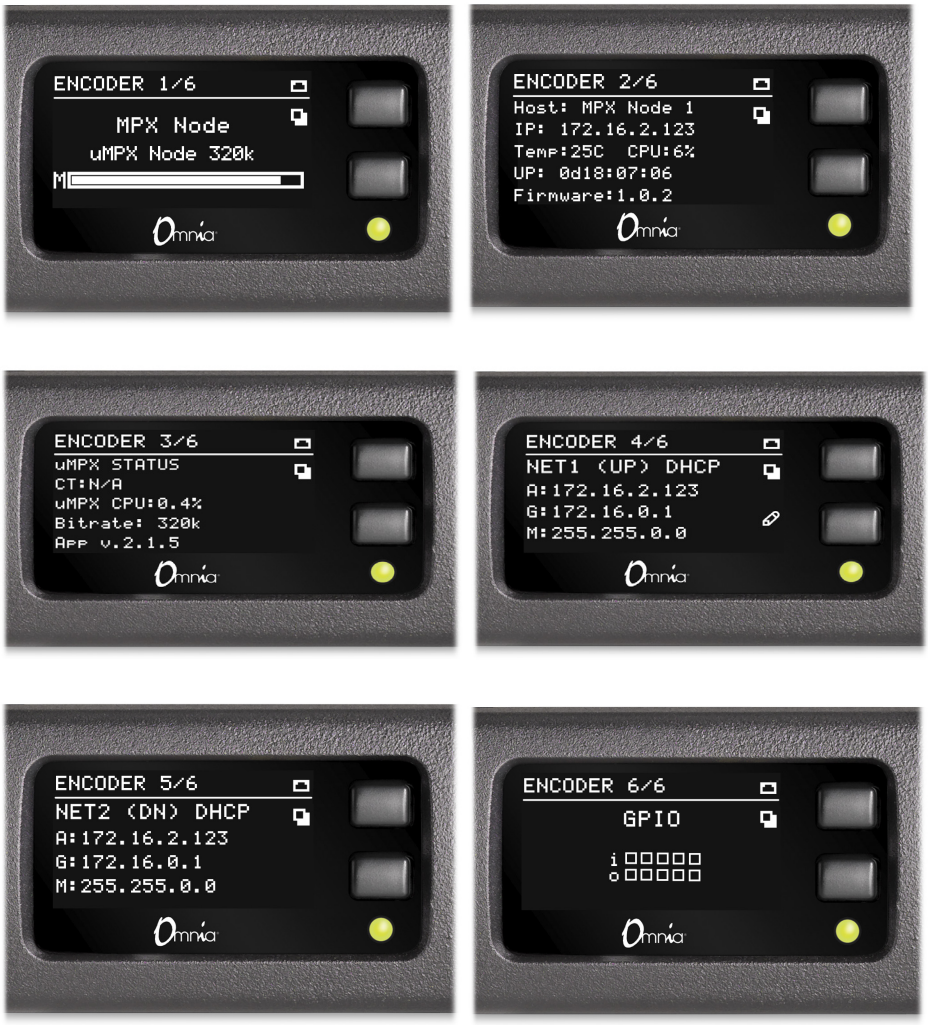
Front Panel indicator LED

The front panel indicator LED provides quick "at-a glance" status information about your MPX Node. Normally, this LED will be steady green, indicating your unit has properly started and is encoding or decoding normally. Red indicates the unit has not finished startup, is not connected to a network, or is not encoding or decoding.

	green	power present at startup, encoder on, sending stream	power present at startup, receiving stream
	flashing green	system actively booting	system actively booting
	solid red	Startup hardware check, encoding not enabled, no network connection	Startup hardware check, not receiving stream, no network connection

Be aware that if audio programming has stopped somewhere else in the airchain and only silence is being fed to the encoder, the LED will be lit green since the connection is still live, and a signal (encoded noise-floor audio) is being passed. The MPX level displays on the screen will indicate that the MPX level is very low.

OLED Display (Encoder)



OLED Display (Decoder)

Encoder and Decoder page descriptions

Pages for the Encoder and Decoder are very similar, with slight differences between certain displays.

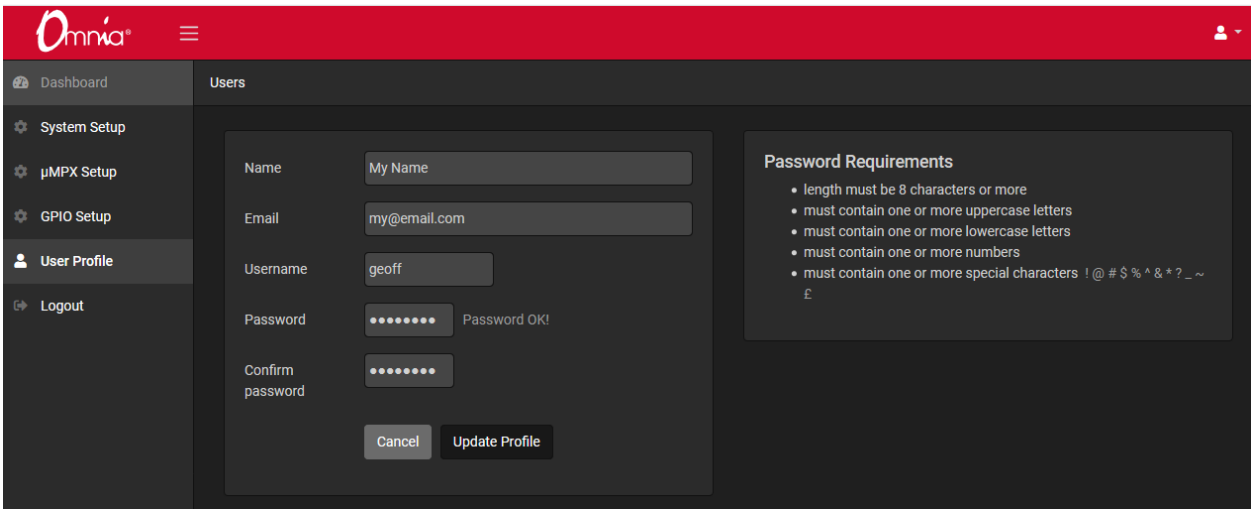
1. Page 1 (Encoder) displays the bitrate and codec mode in use, as well as MPX Level (M) with Clip indicator. Page 1 (Decoder) displays the codec in use, MPX Level (M) and data buffering (B).
2. Page 2 shows general status information including Host name, Temperature (Celsius), CPU utilization, Net status, Uptime, and Firmware version.
3. Page 3 displays µMPX codec, bitrate (Encoder) port status (Decoder).
4. Page 4 lists NET1 IP settings, where A is the unit IP Address, G is Gateway, and M is the subnet Mask.
5. Page 5 lists the NET2 IP settings, where A is the unit IP Address, G is Gateway, and M is the subnet Mask.
6. Page 6 displays the pins on your GPIO, where "i" = input and "o" = output. Pins 1-5 are counted left to right. This display is useful for performing GPIO wiring, validation and testing for connection to remote interfaces. As you assert pins, this display will show them go from inactive to active, similar to the GUI.

Pages 4 displays this "Pencil" icon, indicating you can edit the NET1 IP address settings from the front panel. For access, press and hold the bottom button for 10 seconds until the IP Setup screen appears.

Use the top button to change values, and the bottom button to advance to the next field. To save changes, advance to the SAVE field and press the top button.

6 User Profile

The User Profile page is where you manage password access to your MPX Node. Controls are the same for both Encoder and Decoder models. Only one user is supported per device, but you can have multiple sessions logged in under the same user.



User Information

Name

This text field should be the contact name for the primary user or organization. A name can be up to 64 characters.

Email

This field is the primary email address for the contact. At this writing, this information is used only as a record, and is written to the log file. Emails can be up to 254 characters

Username

This field must be supplied when you log into the unit. A user name can be from 1 to 64 characters.

Password

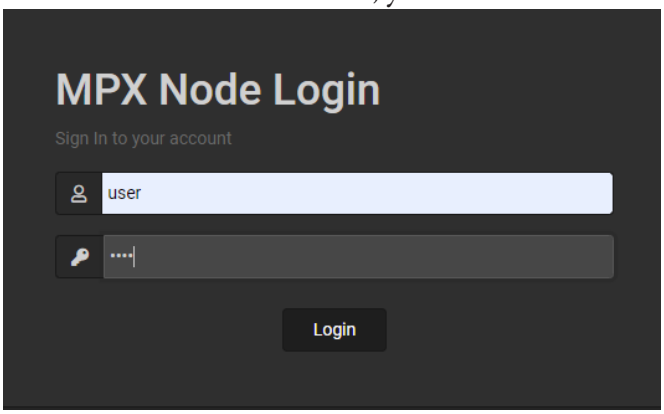
Passwords must be 8 characters long (up to 64). Requirements are below. As you fill out the Password field, check system will let you know if your password meets requirements. The Confirm Password field also indicates when your passwords don't match.

Update Profile

Press this button to update your Username / Password profile. Note that this will log you out of the system and you'll need to log back in with your new information.

Logging In for the first time

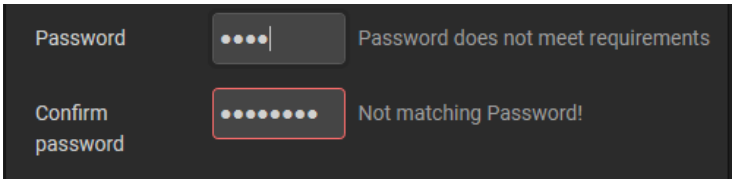
As covered in the Quick Start section of this manual, once you enter the IP address of your unit in a connected browser, you will see the following login page:



The factory default user name is **user,** the default password is also **user**.

- Once you enter this default, you will see the User Profile page. You must enter and save a new, unique password in order to access other control pages.
- For security, a password must meet the following requirements:
  - Length must be 8 characters or more
  - It must contain one or more uppercase letters
  - It must contain one or more lowercase letters
  - It must contain one or more numbers
  - It must contain one or more special characters, eg: ! @ # $ % ^ & * ? _ ~ £
- User and password names are case sensitive. Beware that some browsers and devices will attempt to capitalize the first letter in a field, possibly entering in a wrong character.

- The password entry dialog will indicate if your password meets requirements:



- Be sure to write your new user/password combination down. We suggest you text or email it to yourself.

Password & Config Reset

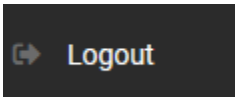
If you forget or misplace your user/password, you can reset it to the **user / user** default from the front panel. You can also reset configuration to the factory default.

- Go to the GPIO status page on the front panel

- Hold down the lower button for 10 seconds.
- Once the "Reset Functions" page is displayed, use the bottom button to select between Reset Password, Reset Config or Cancel.
- Use the top button to confirm the highlighted choice.

Logout

This control on the left side of the screen instantly logs you out the GUI. Additionally, the system will log you out after 30 minutes of inactivity.



7 Using the GUI

The MPX Node GUI is designed to be clear, logical and easy to use. It was built using web sockets and HTML 5, and should be controlled with a modern web browser. Legacy versions of Internet Explorer from your 14 year old Windows XP machine will not be up to the task, but your latest smartphone or iPad should work fine. For best results, a recent version of Chrome is recommended.

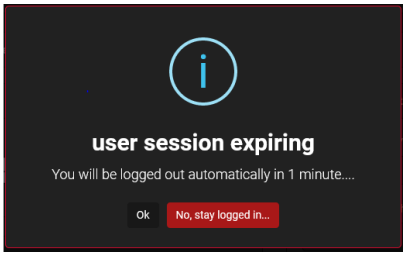
Screens automatically scale depending on the device you are using. If you see a field that looks truncated, try resizing the screen.

GUI Tips

There are a few conventions that we should mention as you get familiar with the GUI:

- If you are using a scroll bar to set a value, numbers will increase / decrease as you move the control right / left, but the value will not be set until you release your pointing device
- Instead of using a scroll bar to set a value, you can click on numeric fields and enter a precise value using a keyboard. A pop-up display will indicate you can type to enter a new value, press Enter to save, or click outside the field to cancel.
- Access to certain controls and menus may be dependent on the status of others. For example, the µMPX Encoder must be in the On position for you to have access to the bit rate selection drop-down menu.
- You may notice a short delay when you enable a control or switch before it becomes active. This is normal behavior
- Waveform and MPX level meters poll at a relatively slow rate of just a few times per second. Due to processing constraints, they can not offer the precision you would see from a dedicated modulation monitor. They are intended to supply basic indication of activity and relative levels without loading down critical audio functions.

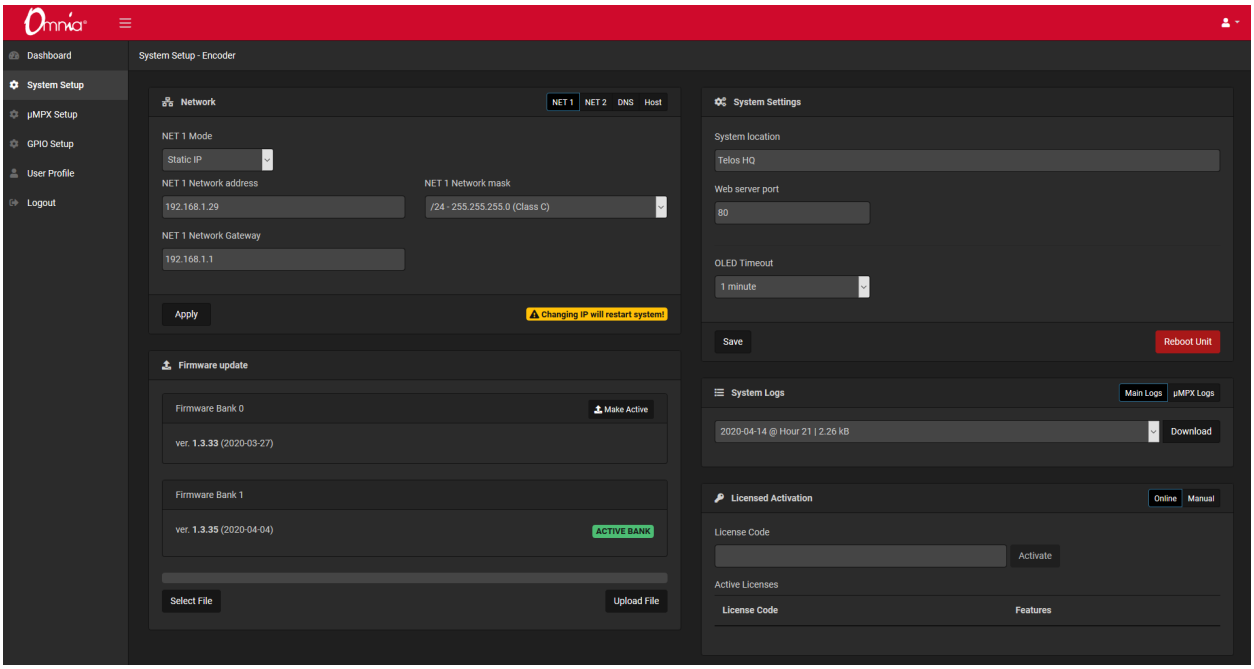
- If you are in one screen and leave it without saving changes, those changes will be lost. Likewise, if you are uploading new firmware, you must stay in the System Setup screen and allow the upload to finish, since switching screens will cancel the process.
- For security and to reduce the number of open sockets, the GUI will log out after 30 minutes of inactivity. An info screen will alert you so you can stay logged in if you are still active.



8 System Setup

The System Setup page is common to both the Encoder and Decoder versions of MPX Node, providing access to Network address settings, Host settings, firmware updates, License Activation for optional features and other administrative fields and controls. Use this page to enter a Hostname, set or change IP addresses for NET1 and NET2 ports, activate licensed options, set front panel OLED timeout, choose update files to upload, and set which of the two firmware banks is active.

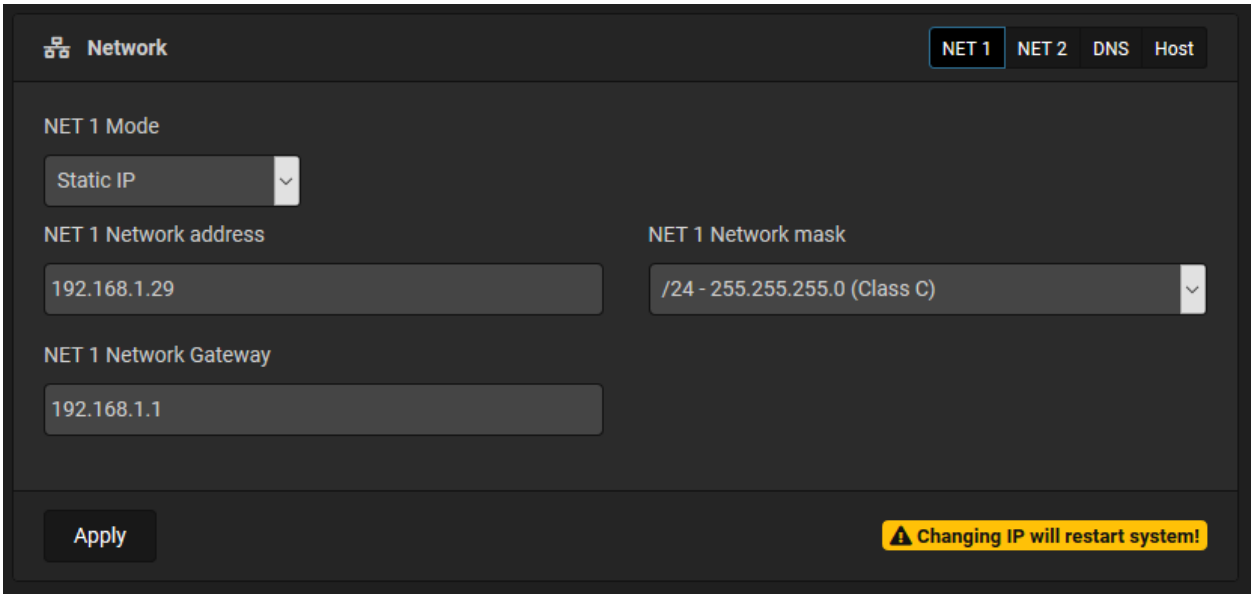
Note that when making lower level changes such as entering a new static IP address or updating firmware, the system will require a reboot for changes to be saved.



Network Setup

Network IP addresses and types are configured from the System Setup screen. Click on NET1 or NET2, depending on which network port you are configuring. MPX Node responds to pings across your network. You can use pings to determine if an address is valid and your network is working properly. You can enter values simply by clicking in the appropriate field and typing your selection. MPX Node will allow you to enter valid address combinations only. If you make a mistake, press ESC to revert to previous values.

For best results, keep NET1 and NET2 on separate subnets and gateways.



NET1 & NET2 Mode

Sets the port to use a Static IP address, or to be assigned an address by a DHCP server. Select NET1 or NET2 in the upper right corner of this section, then use the drop down menu to select between Static IP and DHCP. Units are shipped from the factory to use DHCP for ease of setup.

Network Address

Allows you to enter in a Static IP address when Static IP is selected. Most facilities will want to assign a static IP address to ensure predictable routing and addressing.

Network Mask

Allows you to enter a subnet address. In many cases this will be 255.255.255.0. A drop down menu allows you to select common mask address ranges. Separate subnets for NET1 and NET1 are recommended.

Network Gateway

Allows you to enter a gateway address connecting your unit to the Internet. If using both NET1 and NET2 for redundant or dual networks, be certain to provide different gateways.

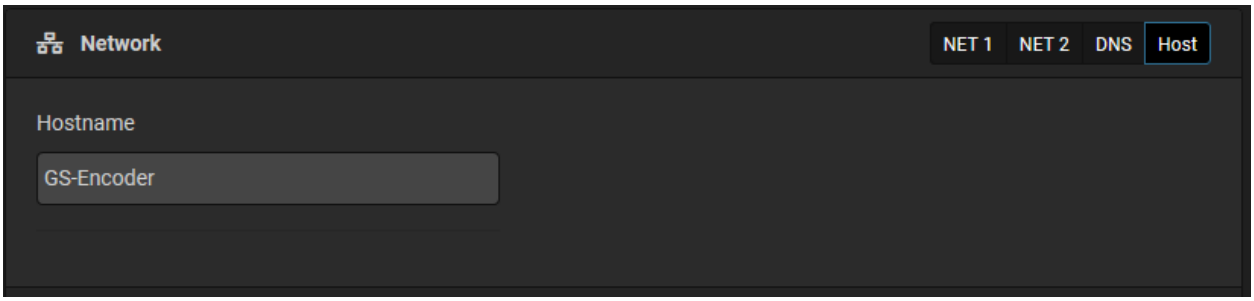
DNS Server

MPX Node DNS settings are defaulted to Google's 8.8.8.8 (primary) Domain Name Server, with 1.1.1.1 set as Secondary. These DNS values can be changed to another server address by clicking the DNS box, adjusting settings and pressing "Apply". DNS is used to set the unit's internal NTP clock. While MPX Node will function just fine without DNS, connection to an NTP server ensures that internal log files are properly time stamped.

If your firewall provides no route to the public Internet, using DHCP will allow the system to pick up advertised DNS servers.

Hostname

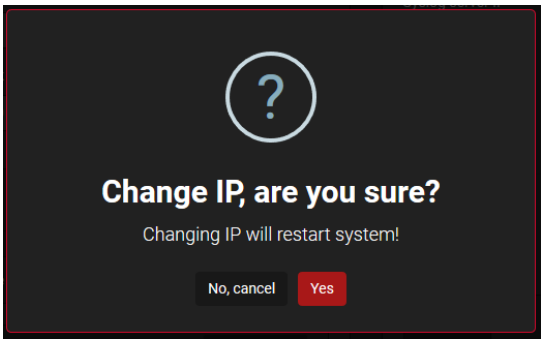
The Host tab allows you to set a hostname for your MPX Node. Use this field to enter a unique name for your Encoder or Decoder. "Host" is displayed on the front panel and GUI, and allows you to quickly identify the unit from other MPX Nodes. This is useful if you have several units on your network or in the same rack location. The Hostname is also displayed on the front panel as part of the screen saver.



Apply

Once you have changed IP settings（including DNS and Host settings）, press the Apply button.

A confirm dialog box will pop up, and you can cancel or select "yes" to proceed. A system restart is required to save changes to IP address settings. A restart takes less than a minute, and will break any current network connections, so make sure your unit is not on air before you proceed. If you cancel then leave the System Setup screen, any unsaved changes will revert to your last saved settings.



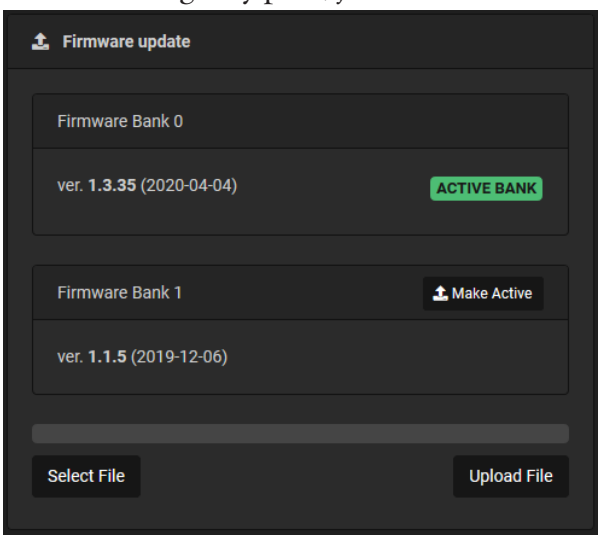
Updating Firmware

Like many Telos products, MPX Node features a dual bank firmware update system. This system is engineered so you can only upload new software releases into the non-active software bank, making uploading software and new version installation two different things. This system also allows you to revert to a previous version if desired. Note that in special cases, reverting to a lower version may be blocked to maintain version compatibility. To update:

1. Download an MPX Node software update (xxx.pkg) file to your computer
2. Click on the Select File button, and browse to the file location on your computer
3. Once you have selected the file (EG: from Windows Explorer), click on the Upload button.
4. A dialog box will appear, confirm the Upload button, a progress meter will indicate the status of the upload. You can safely upload firmware to the non-active bank without interrupting on-air operation.
5. When the upload is complete, select the Make Active button to switch firmware banks. You can change the active bank at any time, not just after an upload.
6. A confirmation screen will prompt you to proceed with a reboot. Note that activating new firmware requires restarting your unit. This will take about one minute, and will interrupt audio. Make sure your unit is not on-air when changing firmware or rebooting the MPX Node.

Note: if you switch screens during an upload, the process will be cancelled and you'll need to start over.

While updating over the network is more convenient than driving to the transmitter, there is always a risk of updating by remote since you aren't standing right in front of the unit. Experience teaches us to pick an appropriate time for remote updates, and be ready with a contingency plan, just in case!



System Settings

The System Settings section allows you to set various controls and time outs.

System Location

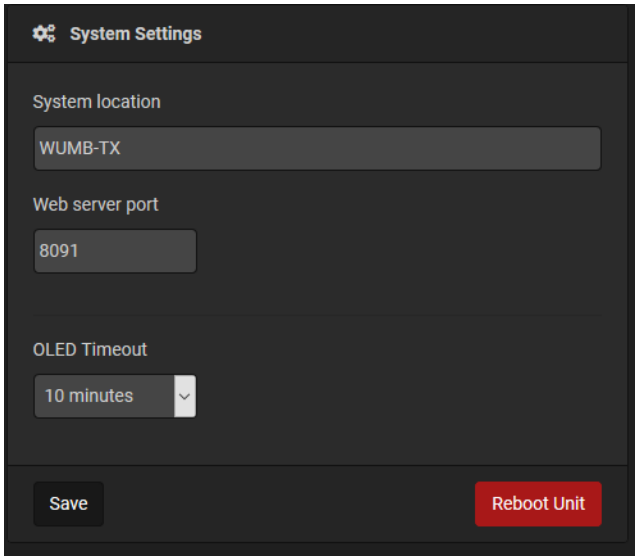
This text field allows you to describe where the unit is located in your physical plant. This information is used in system log files.

Web Server Port

This field allows you to enter a port address for the internal web server. While this is typically port 80, this field gives you the option of using a different port for web communication. (Note: If you do change the web server port make sure to use a different port number from the stream receive port number(s).

OLED Timeout

This drop-down control sets the timeout interval for the front panel OLED display's screen saver. Available choices are between 1 and 30 minutes. When the screen saver engages, "MPX Node" followed by the unit Hostname are painted randomly on screen, indicating the system is running, and helping prolong the lifespan of the OLED display. Pressing either front panel button will wake the display up.

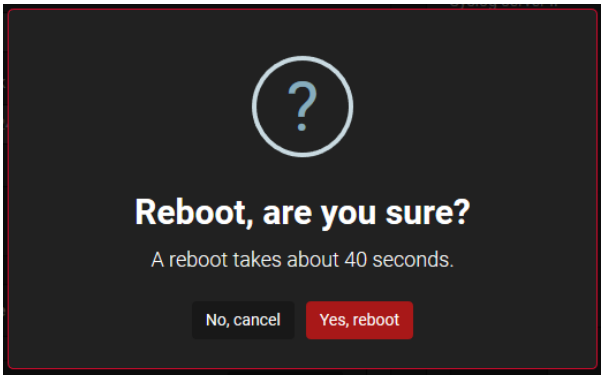


Save

After changing any of the System Settings in this section, use the Save button to confirm your changes. If you leave the System Setup page before pressing Save, changes will be discarded. A "General Settings updated" message will appear in the upper right corner of the display whenever you save changes.

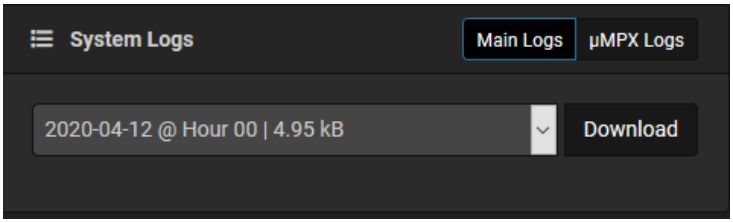
Reboot

The Reboot control restarts your MPX Node, without switching software banks. A confirmation screen (below) will ask you to confirm or cancel. Rebooting takes around 40 seconds, so make sure your unit is not on air when using it. If you have made changes to IP address settings and are rebooting the system from remote, be sure you have new addresses written down so you can still access the unit once rebooting is complete.



System Logs

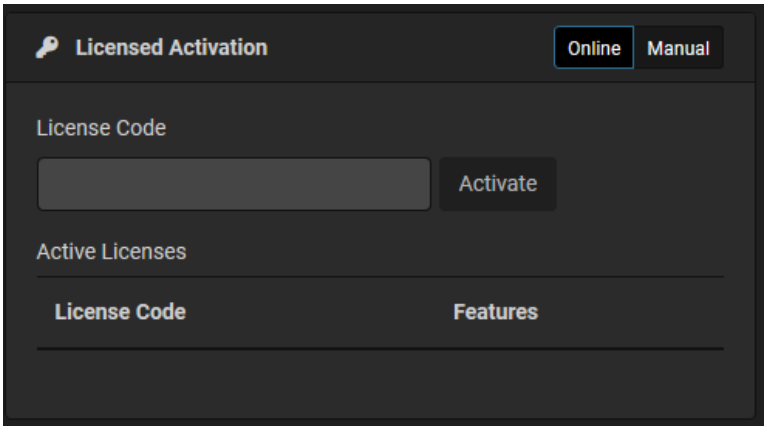
MPX Node's internal logging system continually writes log entries to the unit's storage drive on a rotating basis. Time-stamped logs are written for both the main system, and for the µMPX subsystem.



System logs make for pretty boring reading, but in certain cases, they can help our customer support and development staff diagnose problems and explain issues. In the event you need to call in with a support issue, you may be asked to download and email time/event specific log files to the Telos support desk.

License Activation

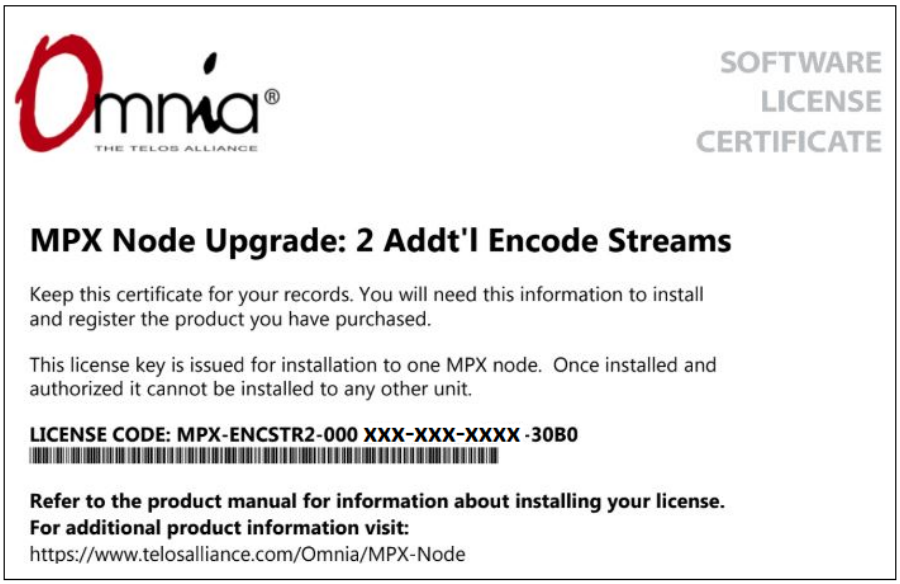
Extended features in the MPX Node are enabled via software licenses. These licenses can be purchased through your Omnia dealer, with license certificates delivered by email. The license activation interface allows you to enter a license code and choose a method of activation. It also displays active licenses in each unit.



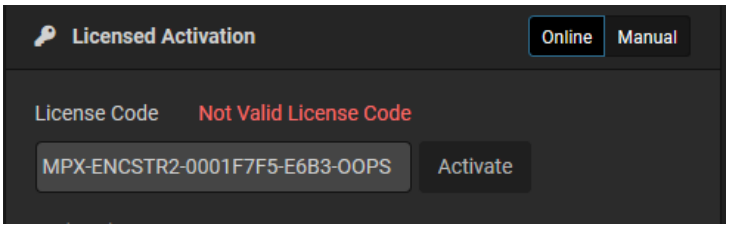
Available features include:

- Encoder MPX Node 2 Additional Encoder Streams（Encoder - Telos Part# 3002-00006-000）
- Encoder MPX Node 4 Additional Encoder Streams（Encoder -Telos Part# 3002-00007-000 ）
- Decoder MPX Node Multicast License（Decoder - Telos Part# 3002-00008-000）

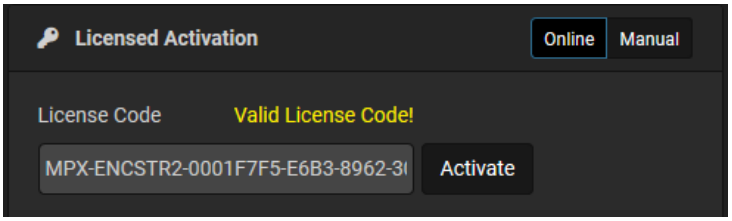
Licenses look like this:



To activate a license, open your .pdf certificate, then cut and paste the license code string into the License Code field. Before allowing you to activate, the system checks that the license has not previously been used and the syntax is correct. If you get a "Not Valid" warning, check your entry.

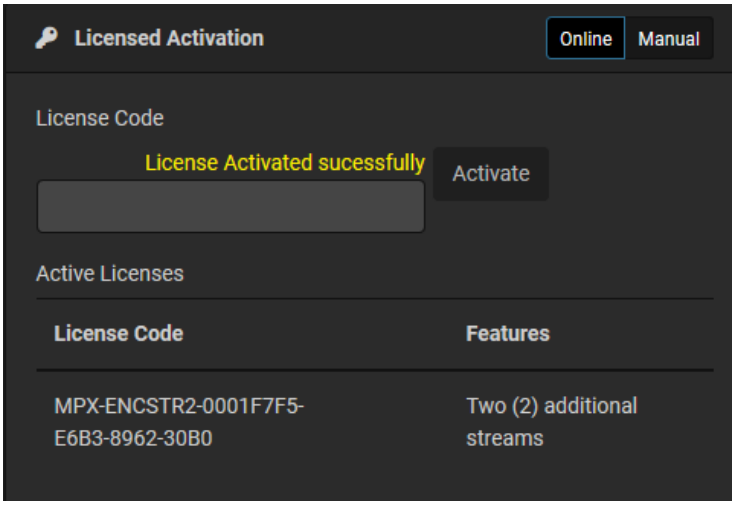


Once you have entered a valid code, the Activate button will light, and you can choose Online or Manual activation.



Online Activation

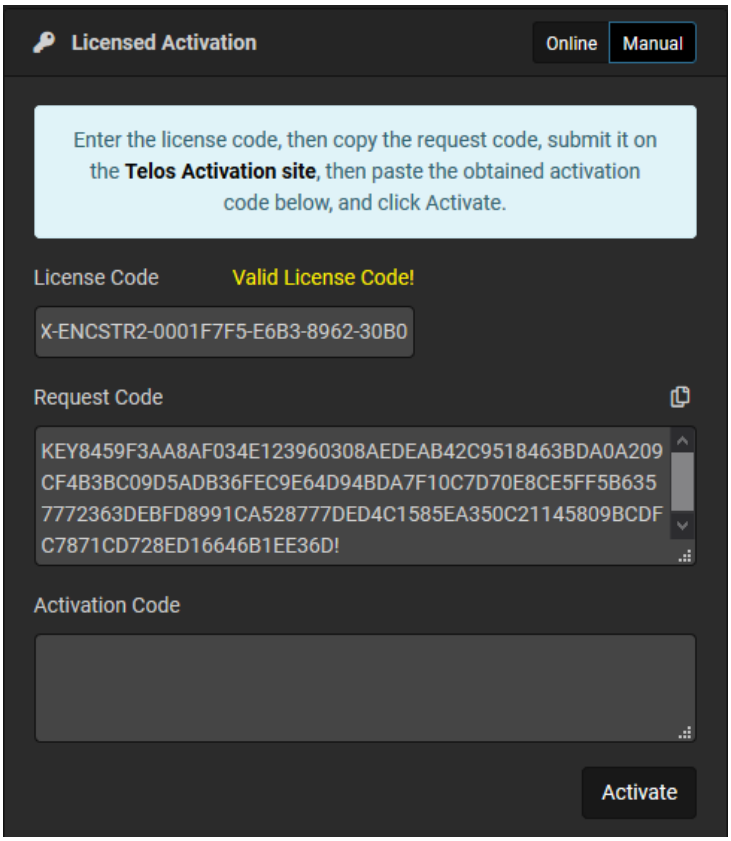
If your MPX Node is connected to the public Internet, Online activation is instantaneous. Once you press the Activate button, a "success" message will appear, and your license code number and feature description will be visible, as pictured below.



Manual Activation

If your MPX Node is not connected to the Internet, choose Manual activation and follow the on screen prompts:

- Enter the License Code
- Copy the request Code

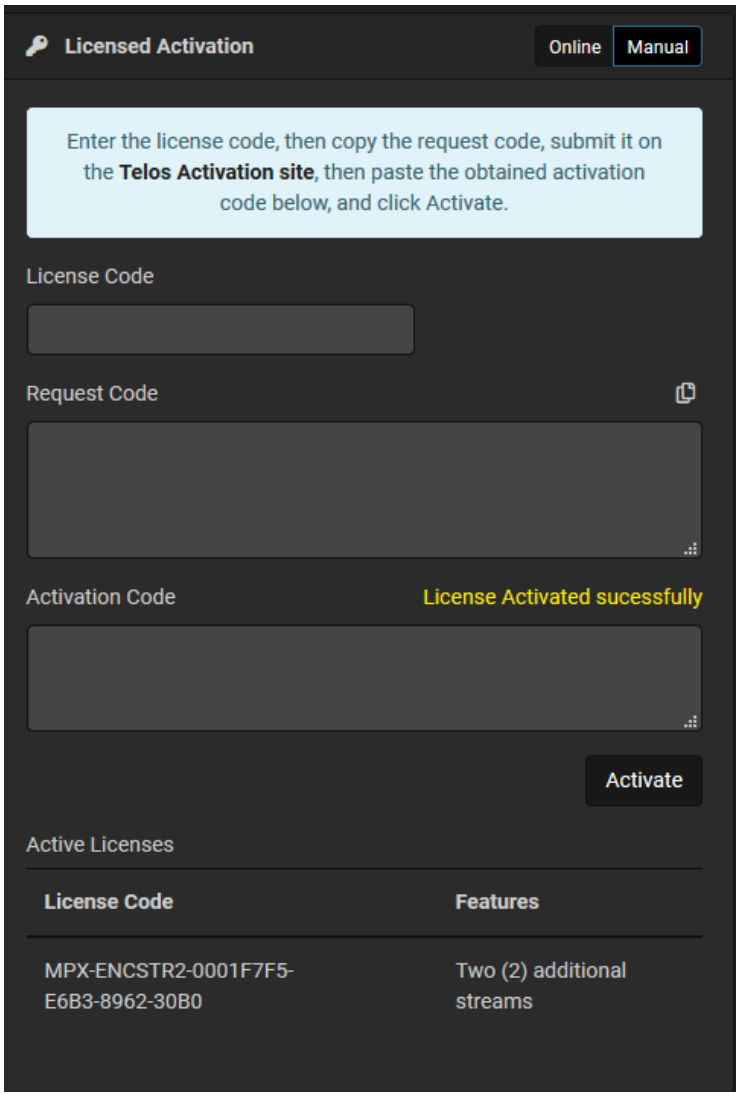


- Submit the request code on an Internet connected computer. The Telos Activation website can be found at https://secure.telos-systems.com/

- Paste the license request code in the window and press Submit

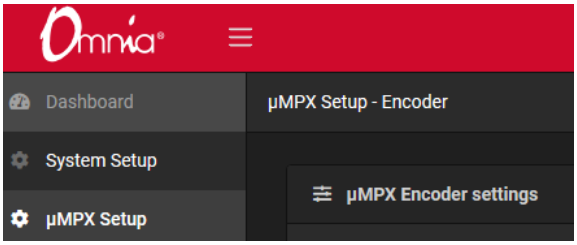
- Copy the Activation code from the Telos site, paste it in the MPX Node Activation Code field and press Activate.

- The screen will show “License Activated Successfully” and your license code number and feature description will be visible, as pictured below.



9 Encoder Setup

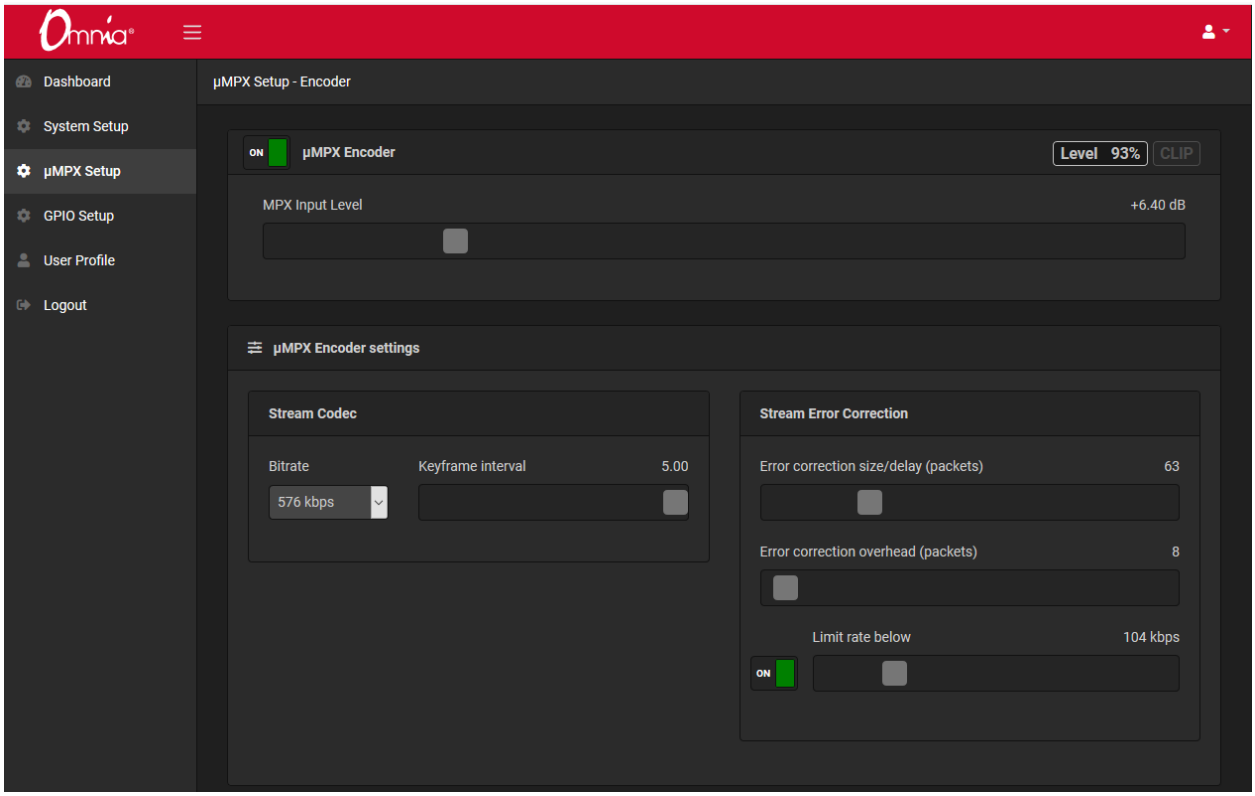
Verify that your unit is running as an Encoder by viewing the top line of the front panel display, or checking the upper left page title from the GUI. The word “ENCODER” will be prominent.



(If you are setting up a Decoder, proceed to the Decoder Setup section later in this manual)

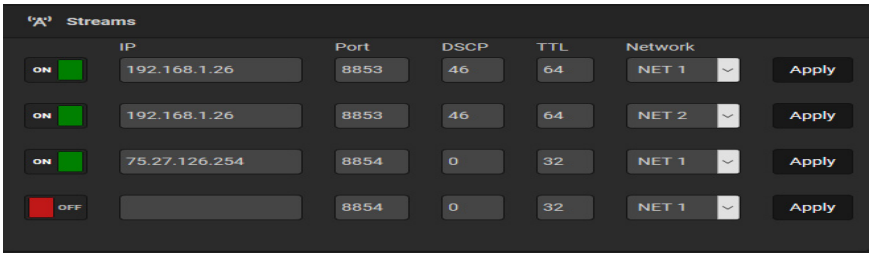
Internal switches are configured at the factory to set your MPX Node to Encoder or Decoder mode. Switch settings are detected on power up, and the Encoder or Decoder interface is displayed accordingly. In Encoder mode, the BNC connector on the rear panel acts as an FM composite Input. To encode a signal, feed it an analog composite signal just as you would feed an FM transmitter and verify you have incoming levels from the Dashboard menu page. MPX Node operates at standard levels: 3.5V peak-to-peak, low source impedance.

To configure Encoding, go to the µMPX Setup page:



MPX Node Encoders come standard with 2 output streams. Traffic can be sent via Uni-cast, or Multicast to destination decoders. There are multiple use cases for stream output, for example:

- Two MPX Decoders can be driven by a single Encoder, more if an extended Encoder license is installed.
- Two encoders（co located, or coming from different locations） can push streams to the same port on a single decoder to provide a failover source.
- Both network ports can push to a Decoder located at the same IP address and port number over two different networks. In this case, redundant packets are sent, and the Decoder can switch between two streams on a packet-by-packet basis, as shown here.

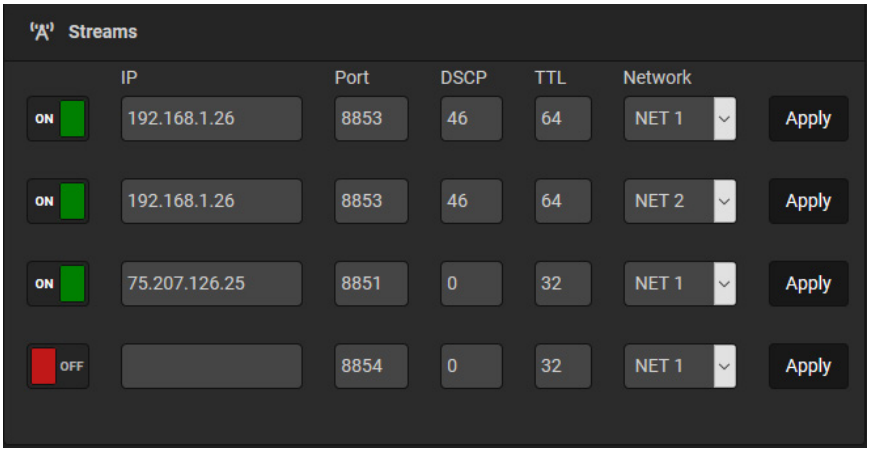


If you want to send more streams from your Encoder, you will need an extended license. Encoders can push up to 16 Unicast streams. Please note that the more Unicast streams you send, the more network uplink bandwidth is required, so be certain to factor in any bandwidth constraints

Licenses are sold in 2 and 4 stream versions. Please consult your dealer for purchase information.

- 2 additional output stream license（Encoder -Telos Part# 3002-00006-100
- 4 additional output stream license（Encoder -Telos Part# 3002-00007-100 ）

Upon license installation, more streams will appear on screen. The example below shows redundant streams being sent to a single decoder at one site, and the same signal sent to a 2nd decoder at another site.



Unicast Vs Multicast

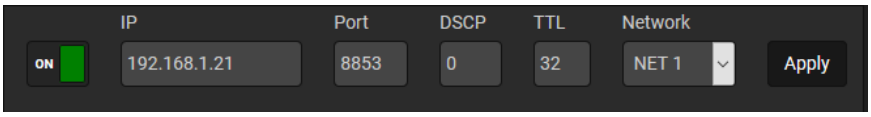
MPX Node Encoders can send either Unicast or Multicast streams. A Unicast stream is "point to point", sending IP packets to a single recipient on a network, including the public Internet. Each additional Unicast stream requires more bandwidth at the source.

A multicast stream is a one-to-many relationship. Packets are sent from the Encoder MPX Node to any Decoder MPX Node on the network that requests them. Multicast does require a private network, as multicast IP address ranges (224.0.0.0 – 239.255.255.255) can not be routed across the Internet. When using multicast, special consideration must be given to proper network configuration, especially QOS (quality of service) settings. These will vary depending on what other traffic is on the network.

Configuring Streams

The Output Streams section allows you to specify the IP address and port number of the Decoder you wish to send to. Note that If you edit settings, you must press Apply for changes to be recorded. Note that saving a stream will have immediate effect. Use caution when making changes to address fields so you don't break a connection to a decoder. µMPX uses UDP port 8854 by default.

While you can stream to multiple decoders, you can only do so using one common codec method and bitrate. Step by step instructions follow:



- Enter a valid IP address and port number belonging to a Decoder
- Select a network interface in the drop down menu. This selects whether the stream comes from the NET 1 or NET 2 physical port.
- Set Stream to "On" position.
- Press Apply button to save settings. Note that if you do not press Apply before leaving this page, settings will be lost.
- DSCP & TTL settings apply to Multicast networks
  - DSCP (Differentiated Services Code Point) sets the QOS (quality of service) packet priority for MPX Node data. 0 is the default. Having QOS properly set on your network is essential for avoiding dropouts and interruptions produced by other traffic.
  - TTL (Time To Live) is a mechanism that limits the lifespan of data in a network so that packets don't circulate indefinitely. The MPX Node default is 32.

µMPX (MicroMPX) Encoder Settings

Verify the µMPX Encoder is set to On in the field at the top of the screen. Unless Encoding is enabled, the MPX meters in Dashboard screen will be inactive, and the Level % indicator will appear frozen.

MPX Input Level

This gain control allows you to optimize the amount of level feeding the MPX Node's converters, and has a direct bearing on the loudness of your signal. To set it, supply a composite input with typical program material and attempt to adjust it so the level indicator gets as close to 100% as often as possible without the Clip indicator in the upper right corner going off. The value adjusted by the slider is not set until you release your mouse; once you release it, the gain number or value will update on screen.

Clip Indicator

The Clip indicator is calibrated to flash at 105%. While the Encoder has some internal input limiting, excessive clip light activity indicates a problem state, and you should reduce input levels. Generally, the clip indicator going off a few times a day will not be a problem. Note there is no adjustment on the Decoder side to undo clipping for signals that are coming in too hot, nor is there a clip indicator on the Decoder since the signal is already modulated. If the Clip indicator is going off constantly, reduce this level on the Encoder side.

Bitrate

The factory default (and lowest) µMPX bitrate is 320kpbs. Supported bitrates are 320, 384, 448, and 576 kbps. The choice of bitrate helps you manage the trade-off between bandwidth use and quality. Lower bit rates optimize bandwidth, while higher bit rates will increase sonic performance. All bitrates sound good, and most listeners will not perceive a difference. We recommend using the highest possible bitrate your connection supports. You can switch bitrates without audible artifacts.

Note that bitrates are averages over time, and there may be periods where certain audio very briefly demands higher actual data use than these published numbers. The codec will immediately attempt to reduce the size of the data that follows to compensate. Also, error correction settings will add some overhead to rate use depending on how they are set. If set to certain values, error correction can increase bandwidth requirements significantly. See below for more details on calculating error correction overhead.

Stream Error Correction

µMPX incorporates an advanced error correction scheme which can send error correction packets along with multiplexed audio. Utilizing error correction requires additional bandwidth. Settings in this section adjust how frequently these packets are sent, and how many are sent in each group. Delay Size and Overhead work in conjunction with each other, and there are combinations of values that should never be used（Overhead packets should never exceed Delay Size, for example, and the sum of both fields should never exceed 255）. A bandwidth limiter is also available to prevent error correction overhead from exceeding available bandwidth.

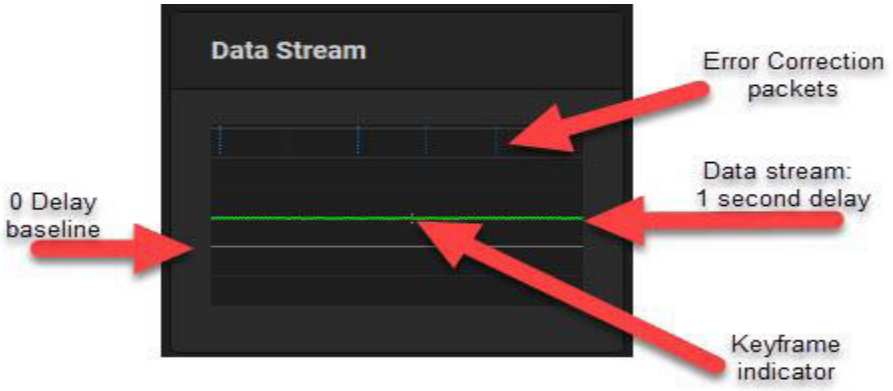
A formula for calculating how much total bandwidth will be consumed is:

（(Error correction overhead/Error correction size/delay）*bitrate）+bitrate=maximum bandwidth utilized.

So in practice, assuming you have a main bitrate of 320 kbps, with Size=64, Overhead=8, bandwidth would grow by about 12%: 320 + 320 * 8 / 64 = 360 kbps.

Error correction is disabled by default.

With a solid data connection, error correction may not be necessary. But if you start noticing drop outs, and see red vertical lines on the Decoder data display, you may need to enable some error correction at the Encoder, and increase delay at the Decoder in order to buffer more data at the receiver.



As you experiment with error correction settings in your Encoder, you can use the dashboard of your Decoder to observe cause and effect.

Things to note:

- The grey horizontal line represents a delay of 0.
- The green line is your incoming stream. Its horizontal position on this graph is driven by the amount of delay you have set in the Setup screen. This example shows a 1 second delay. As the delay is increased, this green line will rise. A smooth green line represents good, consistent quality.
- The short white lines that intersect the green stream line represent Keyframes. This example shows a Keyframe setting of 5 seconds
- Blue vertical lines represent error correction packets. The density of this display is controlled by the two Error Correction slider controls. The more error correction you apply, the more blue lines you will see. This example shows a 64 packet size, with 8 overhead packets, which is a good starting point setting if error correction is needed.
- Red vertical lines represent lost packets and errors. If you frequently see packet loss on the decoder side (see an example on page 48), try adjusting error correction settings, choose a lower Bitrate, increase your Decoder delay, or troubleshoot your network connection, external network QOS settings, external router, or other external components of your network. If you can not solve chronic drop out issues by taking these steps, consider running redundant streams over two networks, as discussed in chapter 10.

Keyframe interval

The µMPX server will periodically send "reset packets" to synchronize the system. Depending on the stability of the connection, it may be necessary to send these packets more frequently. On most connections, the default (and maximum) of 5 seconds is generally sufficient. Decrease this value to send reset packets more frequently, which results in the audio recovering faster after a drop. Keyframes have a slightly bigger size, which means that slightly less bits are available for MPX data.

Error Correction size/delay

Error correction size defines the span over how many packets recovery data will be sent. For example, a setting of 64 means that recovery packets will be sent at the end of the 64 packet block. The bigger this block is, the more latency you need at the decoder end to ensure that the first packets in the block can be recovered in time. µMPX sends about 94 packets per second. Assuming a block size of 94, you would need more than a second of delay / latency to allow for this much error correction.

A setting of 0 will disable sending of error correction packets. Smaller values will send packets more frequently and consume additional bandwidth.

Error Correction Overhead

This adjusts the number of error correction packets sent at each (size) interval, and works in conjunction with the Size value. As with the error correction span, a value of 0 will disable sending of error correction packets.

Because packet loss typically occurs in bursts, the Error Correction Overhead value is far more important for successfully recovering lost packets than Error Correction Size/Delay.

With the same Overhead setting, you can change the Size setting to trade-off between higher streaming bitrate overheads or higher decoder latencies. Using Size=64, Overhead=8 gives you the same amount of overhead as Size=32, Overhead=4, but will handle bursts of up to 8 dropped packets instead of 4. This comes at the cost of a higher required latency. Size=32, Overhead=8 gives you a similar recovery but the overhead is twice as big because the blocks are sent twice as often. Latency requirements are lower for a smaller block size.

Rate Limiter (On/Off)

Enables or disables rate limiting for the error correction packets. This setting can assist with bandwidth management when utilizing error correction. While it will not prevent you from exceeding available bandwidth, (µMPX has no way of knowing what your connection can provide) it will allow you to "fine tune" the amount of bandwidth used for error correction.

Turning the Rate Limiter off completely can actually cause dropouts if recovery packets are flooding the network, especially when Error Correction Overhead is set to a high value. The network may then decide to just throw away some of the packets. If you turn error correction rate/overhead on, it is recommended you leave this control enabled.

Limit Rate Below

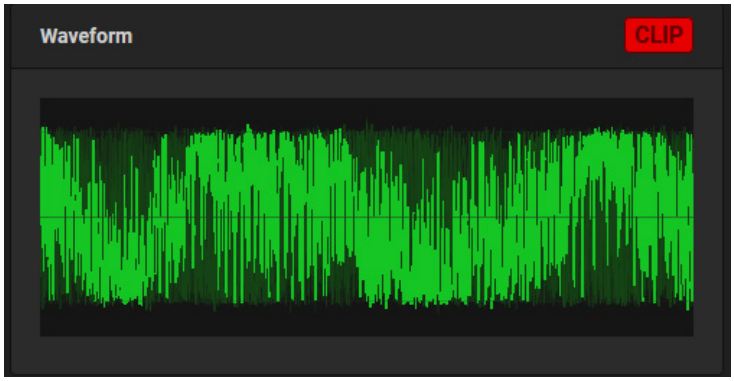
This control manages the bandwidth use (including error correction) limiting below the specified value. This value will change dynamically depending on the error correction span and overhead settings, so use this setting to predict approximately how much bandwidth your µMPX stream will ultimately consume when applying error correction.

Recovery packets are generated in burst after a block (Size) is finished. The rate limiter offers all the packets to the network in a controlled fashion, to avoid overloading it. If this value is set higher than what the network allows, the network can get overloaded and may then start to randomly drop packets. In extreme cases, the rate limiter throws away recovery packets to make sure that at least all the normal packets can get through. The network itself cannot distinguish between normal packets and error correction packets; in extreme cases it could throw away so many packets that it could actually cause dropouts.

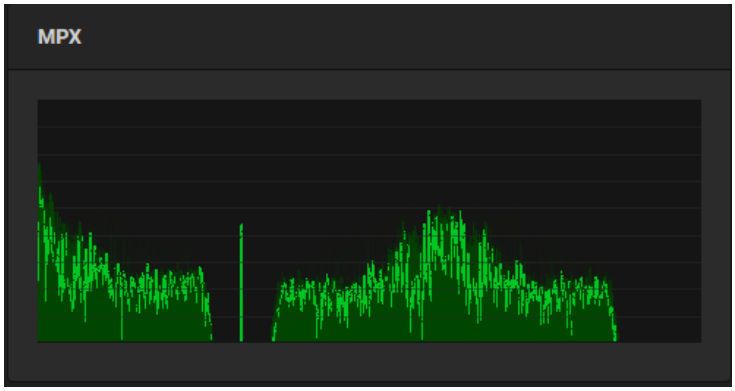
Encoder Dashboard

The Dashboard page provides a comprehensive information overview of Encoder system activity and status. If the Encoder is off, this display will appear to be frozen, and an "Encoder is off" message will appear:

To turn the Encoder on, go to the µMPX Setup page.



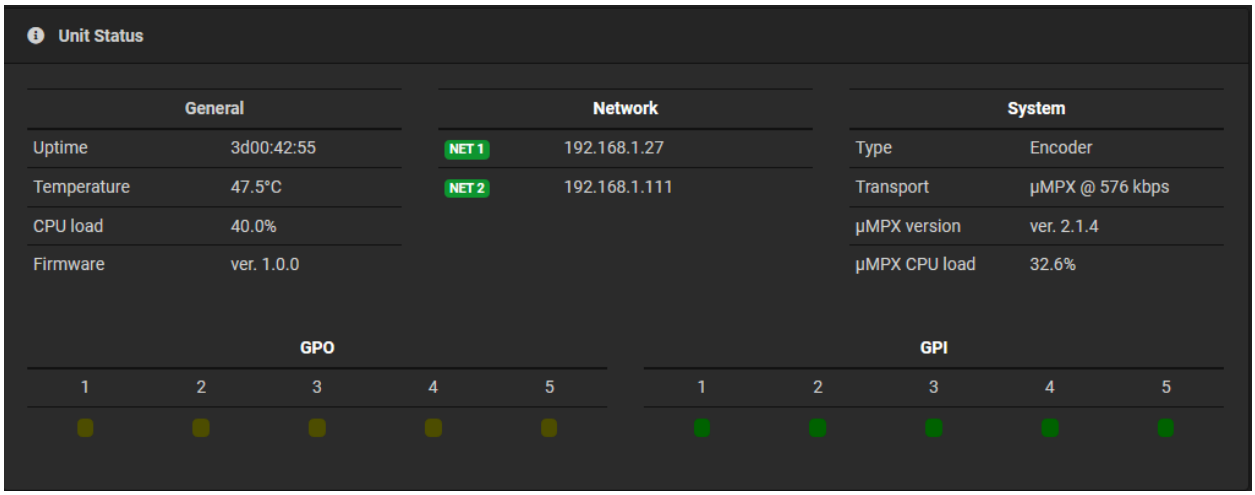
The Waveform display gives you a quick view of your audio levels, including a clip indicator that flashes when triggered by high levels. Input levels may be adjusted in the setup screen.



The MPX display provides a view of the FM signal, including L+R, 19kHz stereo pilot L-R, and RDS signals.

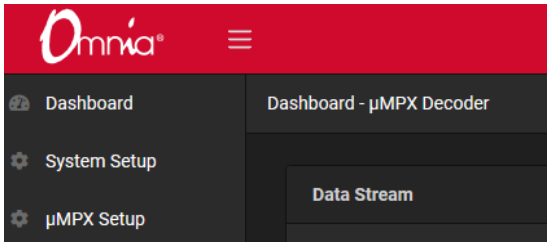
The Unit Status section of the Dashboard page provides general configuration, system and network information, and can be useful for checking the status of your unit for details like, uptime, CPU temperature and load and firmware versions.

GPI and GPO indicators show contact closure status, and can be useful for GPIO testing and configuration.



10 Decoder Setup

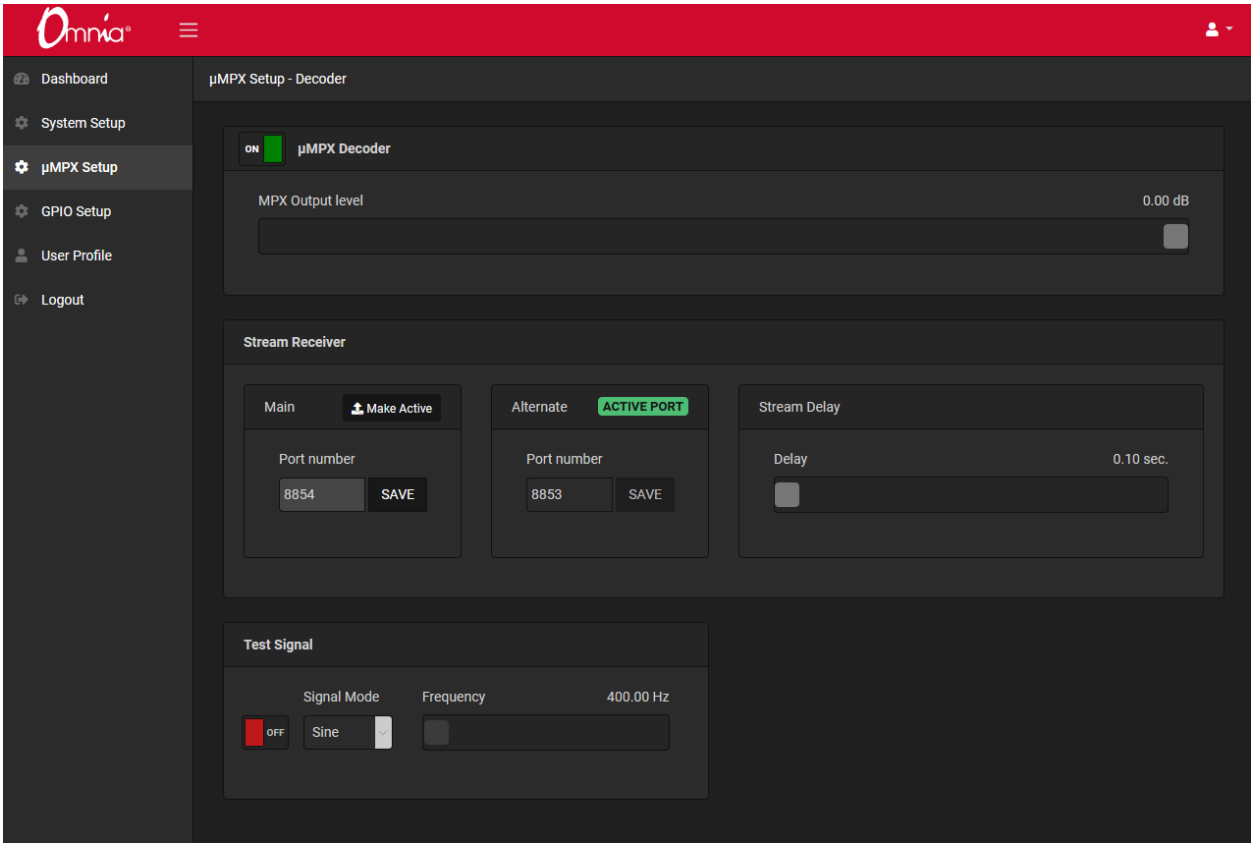
Verify your MPX Node is setup to run as a Decoder by checking the front panel display, or the Dashboard display in the GUI. The word “Decoder” will be prominent, as below.



µMPX (MicroMPX) Decoder Settings

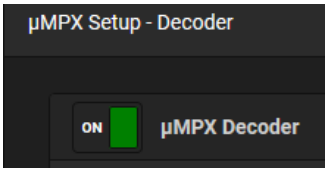
Internal switches are configured at the factory to set your MPX Node to encoder or decoder mode. Switch settings are detected on power up, and the encoder or decoder interface is displayed accordingly. In decoder mode, the BNC connector on the rear panel acts as an FM composite output. To decode a signal, feed it a µMPX stream over IP, then feed your FM transmitter with the analog composite signal on the BNC connector. MPX Node operates at standard levels: 3.5V peak-to-peak, low impedance.

The MPX Node decoder receives unicast traffic using UDP. An inbound µMPX signal must be pointed at the IP address assigned to the MPX Node. Port 8854 is the default port, which can be changed in the µMPX Setup screen. Inbound signals must be properly port-forwarded, and firewalls set accordingly so this traffic can reach the unit. Multiple streams can be pointed at a single decoder（including the same program on two streams for redundancy），and the port being listened to can be changed from the GUI or via GPI.



To configure decoding, go to the µMPX Setup page:

Verify the µMPX Decoder is set to On in the field at the top of the screen. Unless Decoding is enabled, the MPX meters at the bottom of this screen and in the Dashboard screen will be inactive.



The µMPX bitrate is set by the Encoder, and there are no controls or displays on the Decoder to register rates.

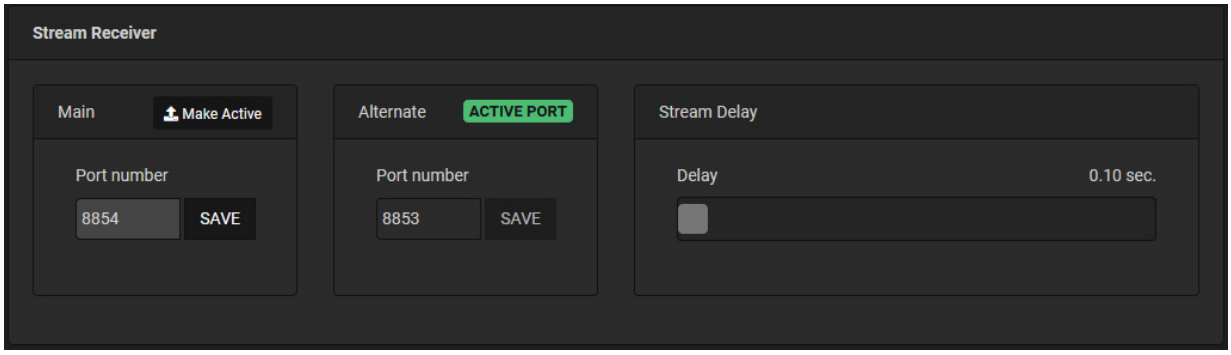
MPX Output Level

This slider should generally be set at 0.00dB (100.0%), the factory default value. If you wish to reduce the output level feeding your transmitter, click and drag the slider control to the left. Once you release the slider, your level values will be saved, and a green "updated" message will appear in the top right corner.

Note that levels must be optimized at the Encoder. While you can reduce the output level at the Decoder, if the signal you are receiving is clipped or distorted because encoding levels are too high, changing MPX Output level will not address the underlying problem with the source signal.

Stream Receiver

Your MPX Node has Main and Alternate port addresses for your inbound stream. The factory default is 8854. If you hover over the Default Port display, arrow buttons will appear, you can set a different value by indexing them up or down. Alternatively you can double click on the Port number field and directly enter a value. Once the Port number is set, click the save button. Note that your port address must match what is being sent by the encoder you are trying to receive from.



Port numbers can only be changed when a port is inactive, or the decoder is in the off position. Clicking on the "Make Active" button will switch ports, and a confirmation screen will display in the upper right corner.

Ports may be switched via GPI. Note that switching a port may take a second or two, depending on the time between keyframes, so don't expect switching to be immediate or completely seamless.

Network Redundancy and Stream Reception

Independent NET 1 and NET 2 ports, and automatic stream switching offer flexibility for those who wish to design fault tolerant MPX Node systems. Users with two different networks between their Encoders and Decoders enjoy special advantages. For example:

- A single encoder can push redundant traffic over two different networks by sending the same signal to a target Decoder port. If packets are dropped on one of the networks, MPX Node will seamlessly switch to alternate connection, and audio playback will be nearly seamless.
- Two encoders from different locations can be used to push streams to the same Decoder Port address, supporting a Main / backup scenario. Your decoder will bind to one incoming stream, and if it drops, it will transition to the other.
- A mix of these two approaches can offer even greater fault tolerance: two separate encoders, each pushing redundant streams to two separate ports over independent networks means you get the protection of stream switching, along with the redundancy of two separate sources.

If you want to send different programs to a single decoder, be sure to use separate ports so you can intentionally switch between them.

Multicast Stream Reception

With an optional Multicast stream receiver license (Telos Part# 3002-00008-100), MPX Node Decoders are able to receive streams over Multicast networks (refer to chapter 8 for instructions on license installation). For private networks attempting to send the same MPX signal to dozens or even hundreds of transmitters, Multicast may be the best choice.

Note that Multicast capability is restricted to the NET 1 ethernet port: Multicast traffic can not be received on Net 2. Remember that Multicast signals can not traverse the Internet, and require a private network.

Aside from the NET 1 restriction, redundant signal capabilities, described in the last paragraph are basically the same for both Unicast and Multicast.

Stream Delay

Decoded streams can be delayed from .10 seconds to 10 seconds in millisecond increments. You can use the slider to coarsely adjust the delay value, or simply click on the Delay (seconds) numeric field and type in a precise value. The Stream Delay can help you time align multiple decoders and can be useful for multiple frequency networks. Delays can not be set below the lowest value (one tenth of a second) due to buffering requirements.

The delay also works as a data buffer, and it may be necessary to increase it if you are running error correction. If you are getting dropouts on your decoder, try increasing the stream delay.

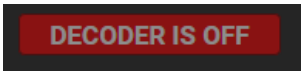
Test Signal

For setup and calibration purposes, a Test Signal generator is included. Enabling the Test Signal will interrupt program audio. You can generate sine waves from 1Hz to 80kHz. You can use the slider to coarsely adjust the Frequency value, or simply click on the Frequency numeric field and type in a precise frequency value. The Test Signal can be turned on and off via GPI.

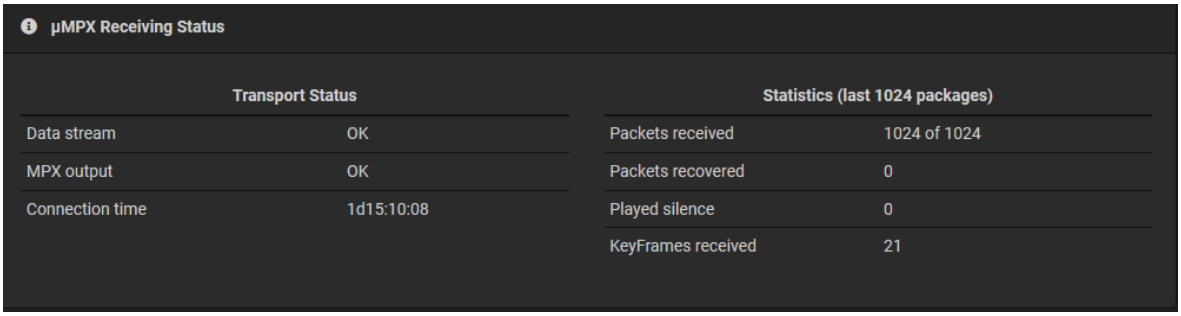
Decoder Dashboard

The Dashboard page provides a comprehensive overview of Decoder system activity and status. The Dashboard presents three sections: graphic displays, unit status, and µMPX receiver status.

The display section provides real-time indication of input stream performance. If the Decoder is off, this display will appear to be frozen, and a "Decoder is off" message will appear:



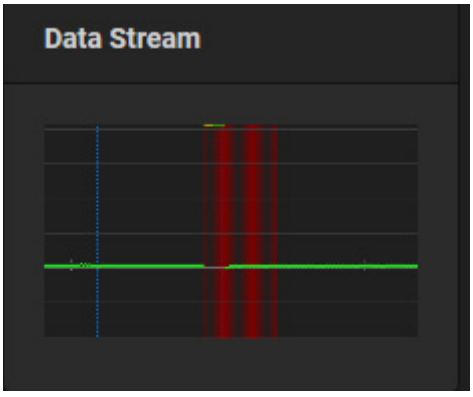
To turn the Decoder on, go to the µMPX Setup page.

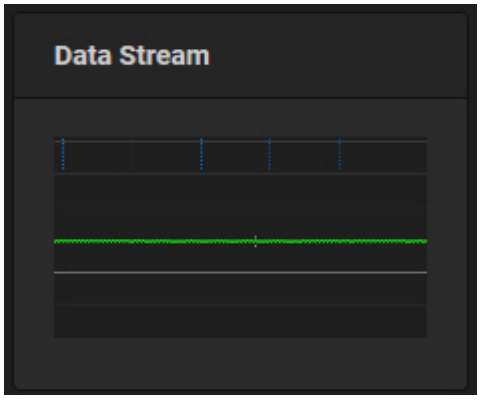


Dashboard Meter Section

Data Stream Display

This display provides a health indication of your incoming data stream.





As you observe effects in the Data Stream display of the Decoder dashboard, you will be able to influence this display through settings in your Encoder's Error Correction settings. Refer to the Stream Error Correction section of the Encoder section for more details.

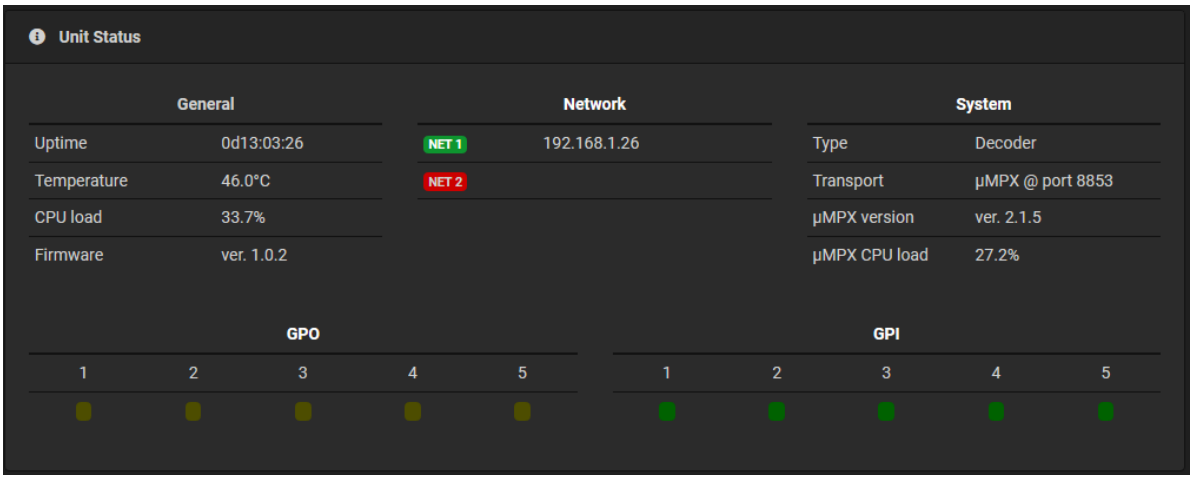
Things to note:

- The bolder horizontal grey line represents a 0 time delay
- The horizontal green line is your incoming stream. The right display above has 1 second of time delay set on the Decoder
- The short white lines that intersect the green stream represent the Keyframes
- Blue vertical lines represent error correction packets. The density of this display is controlled by the Error Correction slider controls. The more error correction you apply, the more blue lines you will see. If you are utilizing error correction on your Encoder, you will need to increase the delay on your Decoder to provide buffering.
- Red vertical lines represent lost packets and errors. The example above is showing serious, audible dropouts. If you frequently see packet loss on the decoder side, try adjusting error correction settings, choose a lower Bitrate, increase your Decoder delay, or troubleshoot your network connection, external network QOS settings, external router, or other external components of your network. If you can not solve chronic drop out issues by taking these steps, consider running redundant streams over two networks, as discussed in chapter 10.

Waveform and MPX displays

Waveform provides a quick visual display of your signal, and differences between silence, tone, and dense music will be obvious. The MPX display provides a view of the FM signal, including L+R, 19kHz stereo pilot L-R, and RDS signals. Be aware that these displays are captured before the Output Level slider control in the Decoder Setup page, and changing that control will affect your output to the transmitter, but not this graphic of the signal.

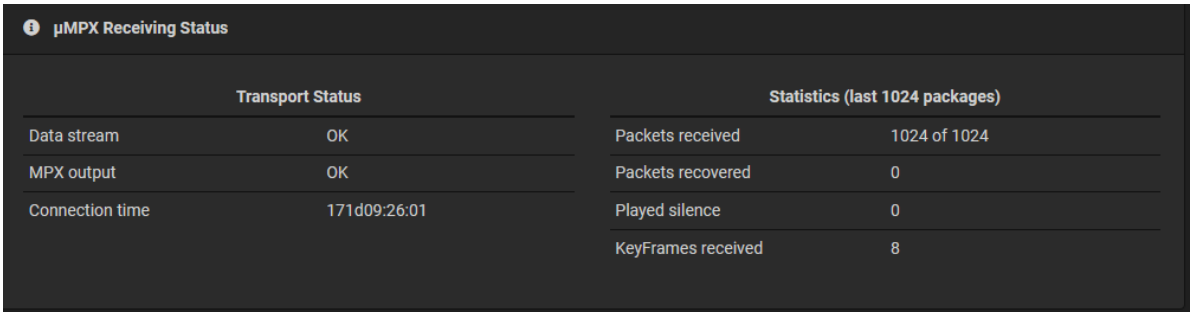
Dashboard: Unit Status



The Unit Status section of the Decoder Dashboard page provides general configuration, system and network information, and can be useful for checking the status of your unit for details like, uptime, CPU temperature and load and firmware versions.

GPI and GPO indicators show contact closure status, and can be useful for GPIO testing and configuration.

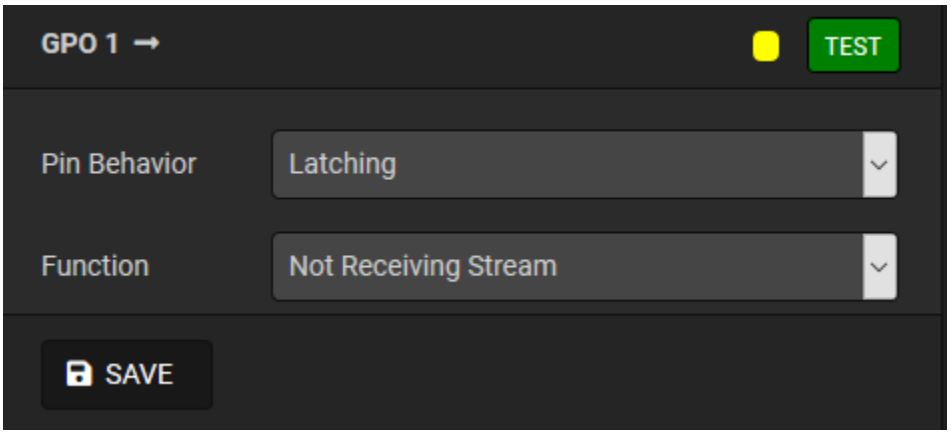
Dashboard: µMPX Receiving Status



The Receiving Status section provides indication of transport health and status, including a connection time read-out, and a short term statistics read-out for the last 1024 packets received or recovered.

11 GPIO

GPIO controls for both the Encoder and Decoder use the same conventions. Each GPI or GPO has its own control section comprised of 4 parts:



1. A drop-down menu for Pin Behavior selects between Latching and Pulse. For GPO's, pulse duration can be set to 250ms, 500ms, and 1 second, providing maximum flexibility in triggering other equipment.
2. A drop down menu for Function selects the available choices. Choices depend on whether you have selected Latching or Pulse behavior and whether your unit is an Encoder or Decoder. Some combinations are not permitted (for example, a latching pin type tied to a reboot function could result in a reboot loop; not exactly a "feature").
3. The Save button must be pressed once you have made a selection in the drop down menus. While there are individual Save buttons for each GPI or GPO section, any one of them will globally save the entire page. Note that if you move to a different screen before saving, settings will revert to previous values. When you press Save, you'll see a "GPIO settings updated" message in the upper right corner of the display.
4. A Test button and indicator lamp allows you to test your wiring, and verify that closures are firing. Test indicator lamps are also visible on the Dashboard screen(s). Note that the Test button is built to mimic the currently saved GPO or GPI pin behavior, for example, if you have selected a 1 Sec Pulse, the Test button will fire a pulse of this duration.

Encoder GPIO Functions

Encoder GPO Latch Functions	Encoder GPI Latch Functions
NET1 Status Up (high) Down (low)	µMPX Enccoder: Start (high) Stop (low)
NET2 Status Up (high) Down (low) Input audio Clipping	

Encoder GPO Pulse Functions	Encoder GPI Pulse Functions
Network1 up	Start µMPX Encoder
Network1 down	Stop µMPX Enccoder
Network2 up	Restart µMPX Encoder
Network2 down	Reboot MPX Node
Input audio Clipping	

Decoder GPIO Functions

Decoder GPO Latch Functions	Decoder GPI Latch Functions
Stream Received: Yes (high) No (low)	Active Stream Port: Main (high) Alternate (low)
Stream Playing: Yes (high) No (low)	µMPX Decoder: Start (high) Stop (low)
NET1 Status Up (high) Down (low)	Test Tone: Stop (High) Play (low)
NET2 Status Up (high) Down (low)	

Decoder GPO Pulse Functions	Decoder GPI Pulse Functions
Receiving Stream	Start µMPX Decoder
Not Receiving Stream	Stop µMPX Decoder
Playing Stream	Restart µMPX Decoder
Not Playing Stream	Main Port Active
Network1 up	Alternate Port Active
Network1 down	Play test tone
Network2 up	Stop test tone
Network2 down	Reboot MPX Node

Note that default Pulse pin polarity is wired low to high. For a pin diagram, refer to the Rear Panel chapter.

12 Rear Panel

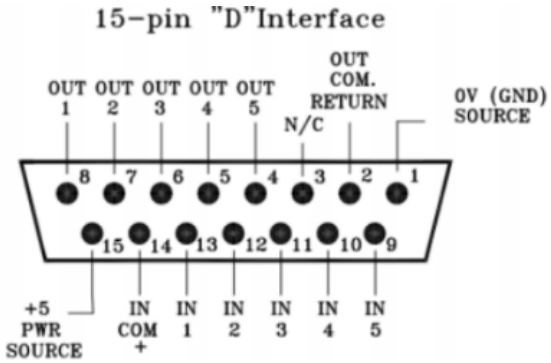
5 ports make up the MPX Node rear panel and are described here, going left to right.

Composite

This BNC connector provides FM composite Input or Output, depending on whether your MPX Node is configured as an Encoder or Decoder. MPX Node operates at standard levels: 3.5V peak-to-peak, low source impedance.

GPIO

This DB15 female connector provides 5 input and 5 output contact closures, which should be wired according to the diagram below. Closures are opto-isolated, and require a 5vdc power source. Functions of the pins are under software control, and may be assigned in the GUI GPIO section. While the DB15 connector is the same as that used in Axia xNodes, the pin layout is different for MPX Node.



There are two options for wiring up the GPIO connector.

1. Using the internal +5v and ground connections. Note that you will need to add jumpers between pins 1&2 and 14&15 on the GPIO connector
2. Using an external 5v power supply and its ground reference in place of the above jumpers. This option isolates the ground planes and 5v power rail from transients (such as EMP from a lightning hit).

The pins have internal pull-up resistors, so there is normally no need to select +5v for a high unless a change is needed to "High" from the default state.

NET1

The NET1 Ethernet port is intended as the primary MPX over IP connection, and should be used as the default connection for users only plugging a single network cable into the unit. NET1 and NET2 can be set to separate Subnets and Gateways, so independently buffered networking is possible. .

NET2

The NET2 Ethernet port is primarily intended as a control / admin port, but may be used to send / receive MPX over IP as well, with the exception that Decoders can not receive Multicast traffic on NET2. Integrated LED's indicate connection and network activity for both network ports.

12VDC Input

An external 12 volt power, 5 amp power brick with locking barrel connector（Telos Part# 1771-00112-100）is included. When inserting the male connector into the rear panel port, turn the locking ring counter-clockwise over the connector's threads to secure it in place.

Call-outs on the rear panel indicate where the MAC #1, #2 and Serial Number labels are placed. These numbers are generated during the manufacturing process, and identify the unique MAC addresses and unit serial numbers of each MPX Node. It should be noted that separate serial number series are assigned for Encoders vs Decoders at time of manufacturing, even though the base hardware is the same, and may be changed through an internal DIP-switch.

13 Internal Switch Settings

Two DIP-switch banks inside MPX Node allow you to configure the following:

1. You can change your Encoder into a Decoder or a Decoder into an Encoder. Encoder vs Decoder software initialization is driven by this switch setting.
2. You can select between 5 ohm (default) and 75 ohm impedance for the composite input connector
3. You can select between 4V (default) and 10V peak-to-peak output.

DIP-switch Access

In most cases, you will never have to open the unit, but in case you need to make adjustments to internal switches, work should be performed only by qualified technicians in a static controlled environment.

Notice:

Do not remove the circuit board from the chassis! Doing so will break the thermal seal on the processor possibly resulting in damage to the unit, and will void the warranty.

To gain switch access:

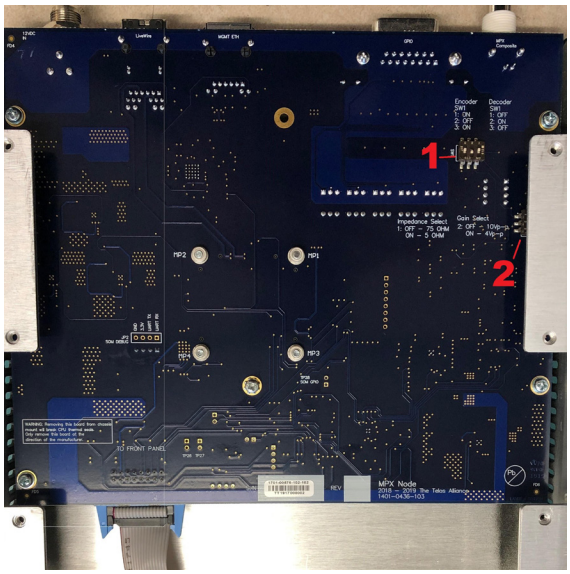
1. Disconnect power and other external cables
2. Remove the 16 screws on the top of the unit with a Phillips screwdriver.
3. Pull the lid up and away from the chassis.

Identifying Switches

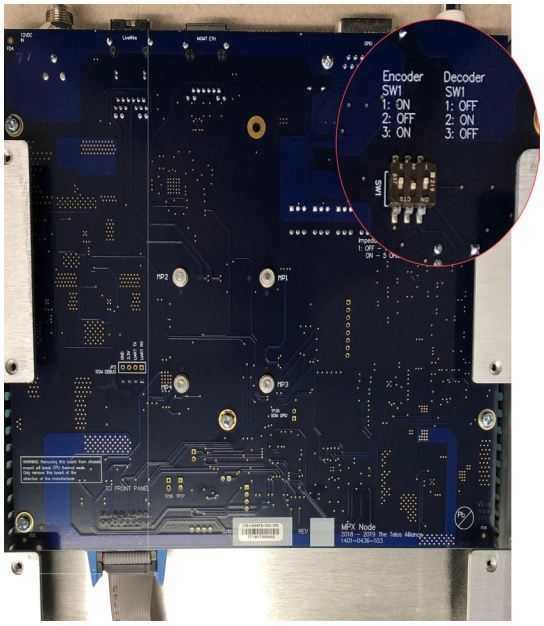
With the top cover removed, you can identify the 2 switch banks

Encode/Decode Mode Switch is closest to the composite connector.

The Impedance and Gain switch is under the chassis mount flange

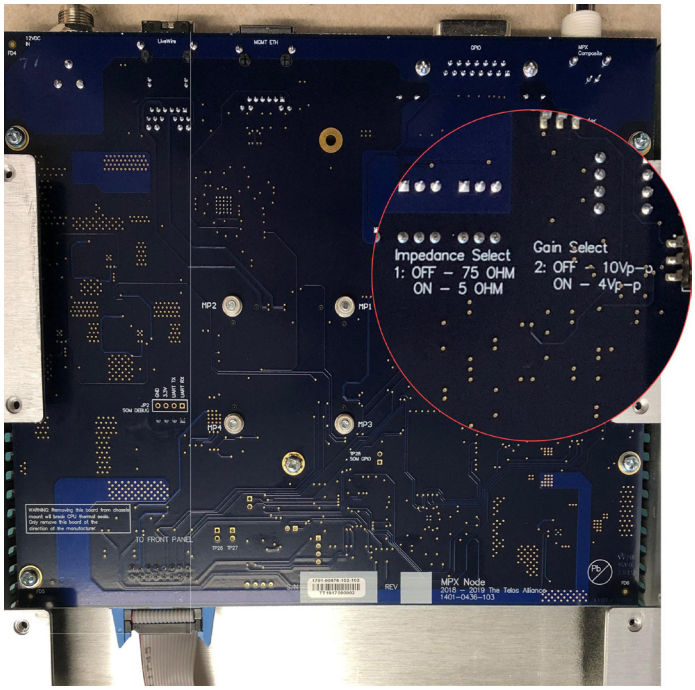


Encode / Decode Mode (Switch bank 1)



When adjusting, we recommend using a magnifying glass and a small flat screwdriver to move switches. This photo depicts an MPX Node set as a Decoder, with switches set 1:Off, 2:On, 3:Off

Impedance / Gain (Switch bank 2)



The Impedance / Gain switches are located under the chassis, and are more challenging to adjust. Magnification is recommended.

Switch 1: Impedance, and is default set to On（5 Ohms）as a factory default

Switch 2: Gain is default set to On（4V）

Switch 3 is not active.

14 Technical Notes

µMPX-Codec Setup Tips & Guidelines

For optimal performance the µMPX-Encoder and Decoder should be set up to match the quality of the IP connection between encoder and decoder.

Please be aware that if the encoder and decoder are not configured to provide enough protection against data stream impairments the MPX-signal will degrade abruptly to an unacceptable level. Should this occur, the decoder's output will be silent for several hundred milliseconds.

The proper encoder and decoder configuration depends on the characteristics of the IP link, in particular on the packet jitter and the packet loss rate

Packet Jitter

Packet jitter occurs if packets reach the receiver in uneven time intervals. Some arrive earlier, others later than expected, sometimes they even get reordered.

Configuration tip:

To address increased packet jitter, the decoder's "Stream delay" buffer must be increased. A value of one second should be sufficient for most cases. Please note that this introduces one second of delay between audio input and output.

Packet Loss

Packet loss occurs if packets are lost in transit. This may happen due to insufficient IP bandwidth or due to packet corruption.

Configuration tip:

To address packet loss, the encoder's error correction level must be increased. This is achieved by turning up the Stream Error correction "Size/delay" and "Overhead" values.

Example: If Size/delay is set to 20 and Overhead to 3 then three lost packets in a window of 20 packets can be reconstructed and will not affect the audio quality.

In general, if bursts of packets are lost only occasionally then both Size/delay and Overhead should be increased. However, the Overhead number should not exceed Size/delay.

On the other hand, if fairly frequently just one or two packets are lost then both Size/delay should be small.

Please note that the data rate increases with increasing values of Overhead and decreasing values of Size/delay. Example: If Size/delay is 20 and Overhead is 3, then every 20 packets 3 error protection packets are generated. As a result the transmitted number of packets increases from 20 to 23 and the resulting data rate by 15%.

Firewall and Security

MPX Node has basic internal firewall functionality which is designed to protect the unit from certain types of network probes and intrusions. It is not meant to replace a properly implemented external firewall or security plan, and it cannot protect any devices other than itself. The firewall blocks certain ports coming into the device to keep system services from becoming potential attack vectors into your LAN. For best results, a properly configured external firewall is recommended.

Tilt Correction

MPX Node is flat and expects to receive a signal that does not require tilt correction.

If either end of your chain requires tilt correction this must be accomplished external to the MPX node. To test if Tilt correction is necessary, feed a square wave through the audio processor into the MPX node, and verify you see a square wave on the meters of the MPX Node.

Cooling

MPX Node's thermal design transports heat through the chassis, to exchange with the outside air. For best results, do not block air vent holes on the top or sides of the unit, and maintain ambient air temperatures below 40C in your rack. As with all electronic equipment, heat ages chips and circuits faster, and cooler environments will prolong equipment life.

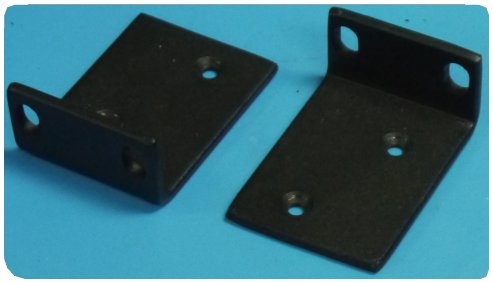
15 Rack Mounting

Omnia MPX Node was built using the same chassis design as Axia xNodes（revision 2）. This means you can co-rack an MPX Node with an Axia xNode, and use common mounting hardware.

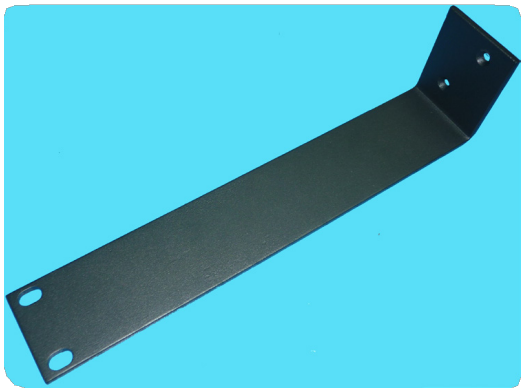
Rack Mount kit

The provided rack mount kit（p/n 2011-00076）provides the ability to secure the MPX Node into an equipment rack.

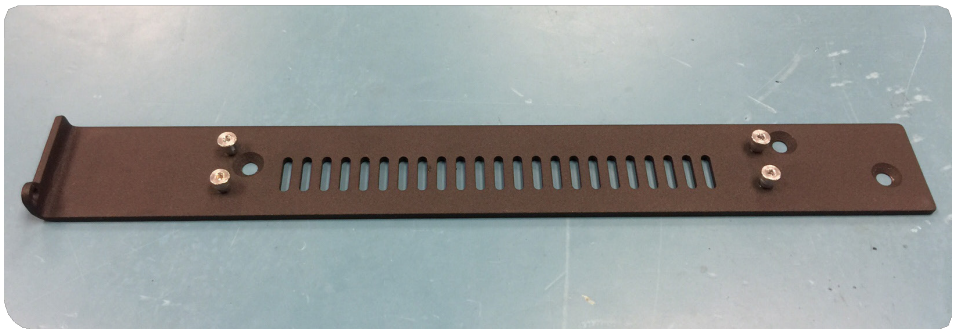
Short rack ear



Long rack ear



Revision 2 "L" bracket (p/n 1771-00128)

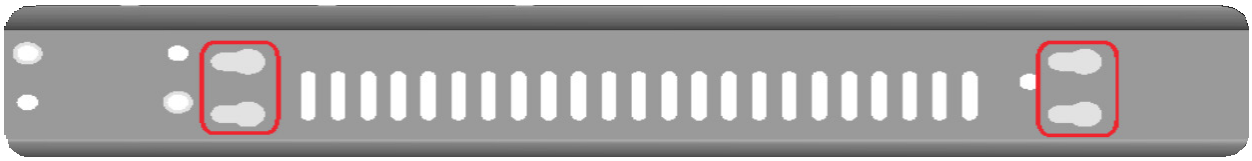


Single MPX Node

Secure the short rack ear to one side of the MPX Node. Secure the long ear to the opposing side of the xNode.

Double MPX Node

Mounting 2 MPX Nodes together is accomplished with the "L" bracket, as all MPX Nodes use a revision 2 chassis design.

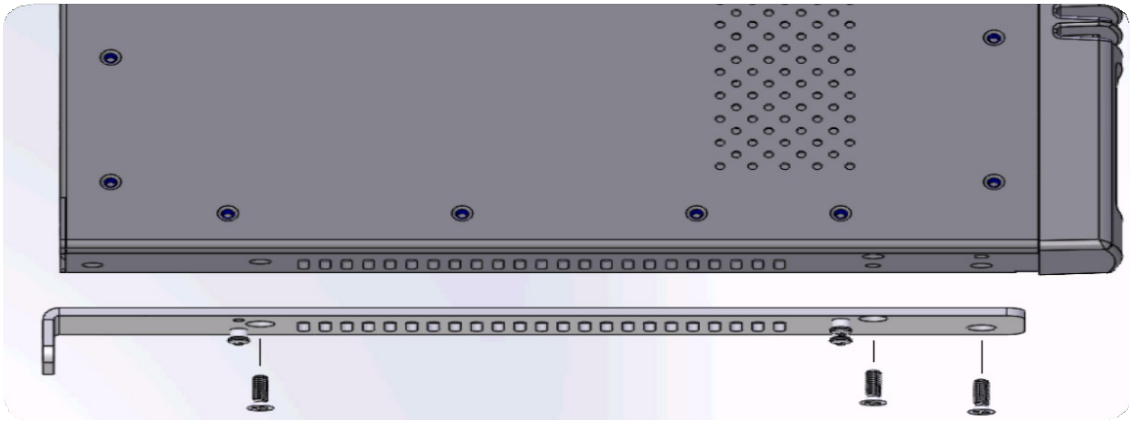


If you are attempting to join an MPX Node to an older Axia xNode, and no keyholes are present on the xNode right side when looking from the front, please skip to the Revision 1 section.

Revision 2 Hardware

Secure the provided bracket to an MPX Node's left side as shown with three provided flat head screws.

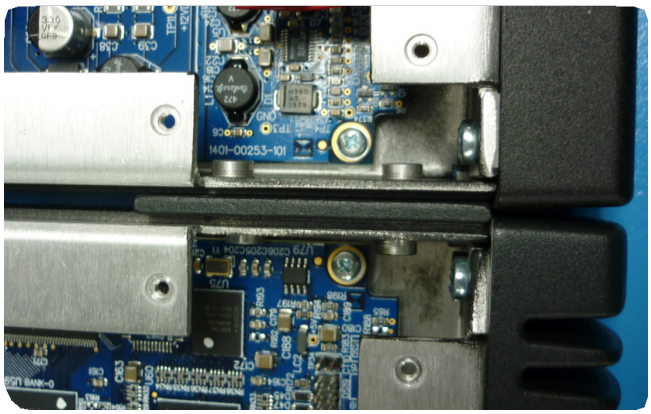
Place the second MPX Node, so that the shoulder screws of the bracket fit into the key-holes. Slide the MPX Node into place. NOTE: The shoulder screws may require adjustment for better fit.



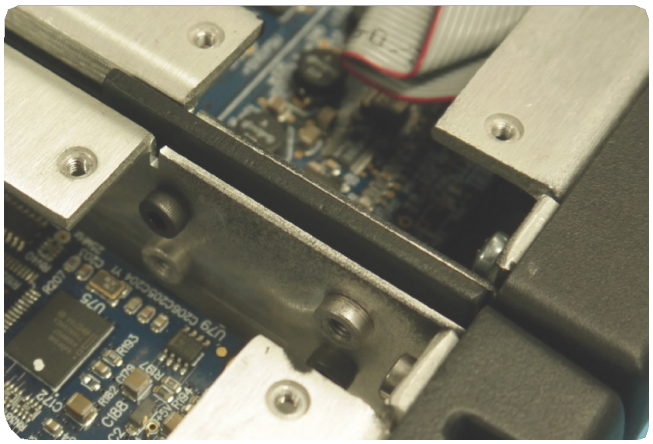
Lock the MPX Node in place with a screw secured to the back.

Revision 1 Hardware

If you are trying to mount an older Axia xNode to an MPX Node（and the keyholes are not present on Axia Node）, you can still connect units with a spacer block（not included with MPX Node）. To join units, remove the top lid from both units and place them side by side. Place the spacer between the two Nodes.



Use the four（4） screws provided with the spacer to secure the two nodes together.



Replace the lids on the Nodes. Secure the short rack ears to either side of the two units.

16 Specifications

External power supply

（Telos part number 1771-00112-100）

Input 100VAC to 240VAC, 50 Hz to 60 Hz, 1.2A

Output 12VDC, 3.4A

Connector Type: 2.5mm Locking DC barrel. Center positive

MPX Node Power Consumption:

12 watts

MPX Node Composite Input/Output:

Connector Type: Female BNC, EMI Suppressed

Max Cable Length: 100ft（30m）RG-58A/U

Composite Out(Source) Impedance: 5 ohms or 75 ohms selectable

Suggested Load Impedance: >50 ohms（Composite output only）

Composite Input Impedance: >/= 100k ohm

Composite Output Level: 4Vpp or 10Vpp selectable

Composite Input Level: 1Vpp to 10Vpp

Pilot Frequency: 19.000kHz +/- 1.9Hz, 9% modulation

Operating Temperatures

0 degree C to +40 degree C, <90% humidity, no condensation

Dimensions and Weight

8.5” (22 cm) wide; two may be mounted side-by-side in a standard 1RU rack space (with accessory mounting kit)

1.72” (4.4 cm) height,

11.75” (30 cm) depth

Shipping Weight: 7 lbs. (3.2 kg.)

Shipping Dimensions: 17” (43.2 cm) length 13” (33 cm) width, 7” (17.8 cm) height

17 Telos Alliance Warranty

Telos Alliance Limited Warranty

For the latest Telos Alliance warranty, visit: telosalliance.com/warranty

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