

## TELOS INFINITY LINK Gateway IP Codec



## INTRODUCTION

Telos Infinity Link enables Infinity systems in remote locations to connect to one another using an embedded, versatile, speech-optimized OPUS codec over the public Internet or private infrastructure.

This Telos Infinity Link Gateway is a dedicated, rack-mounted, hardware platform with dual redundant internal power supplies and dual Gigabit Ethernet ports. It can be configured with either eight or sixteen bi-directional mono codecs, making it an ideal choice for higher density applications.

Infinity Link is also available as licensed software in Infinity Intercom Master Panels, Infinity Expansion Panels, and Infinity Desktop Panels (4 or 8 codecs) and Infinity Beltpacks (2 codecs).

## HARDWARE

### Infinity Link Gateway Front Panel



Figure 1: Front panel

#### PSU 1 LED (A) and PSU 2 LED (B)

The status of each power supply is shown on its respective LED. Green indicates proper operation. Red indicates a fault. No LED indicates power is not being delivered to the supply from the mains source.

#### Status LED (C)

The Status LED is used to show a general fault in the hardware. Green indicates normal operation. Red indicates a fault.

#### Sync LED (D)

When the Link Gateway locks to its reference clock, this LED will be solid green. A blinking green LED indicates the unit is drifting from its reference to some degree, with more rapid blinking indicating more jitter. If the unit cannot locate or sync to a reference signal, this LED will remain dark.

#### Front Panel LCD (E)

The color front panel LCD is used during initial setup and to display basic system information.

#### Navigation Cluster (F)

The navigation cluster consists of five keys: Left, Right, Up, Down, and OK. These keys are used during initial setup and to change between system screens.

## Infinity Link Gateway Rear Panel

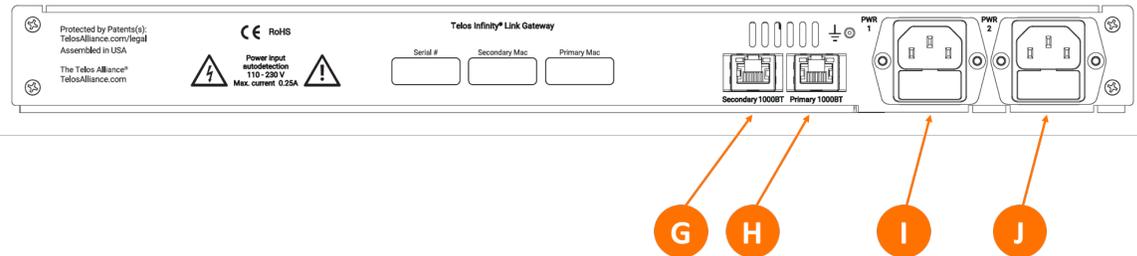


Figure 2: Rear panel

### Network Connections (G, H)

The Primary Ethernet port is used to receive AoIP audio from your LAN side network. The Secondary port should be connected to the network on which you intend to stream. This network should have internet access and **must** be connected to a Gigabit (1000Base-T) port on your router.

### Power Supply Inlets (I, J)

Two redundant internal auto-ranging power supplies are provided with IEC-320 female connections. External access to fuses is provided for each supply.

## INITIAL SETUP

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### Power

Plug the supplied IEC power cords into the Infinity Link Gateway and connect each to different mains power sources. Remember that while redundant supplies do protect against the unit losing power in the event of a PSU failure, the loss of mains supply voltage is a bigger concern. Accordingly, each supply should be fed from a different circuit equipped with adequate surge protection and fitted with an uninterruptable power supply (UPS).

### Boot Up and Splash Screen

The front panel of the unit will remain dark during the boot process, after which an Infinity Link splash screen will appear.



Figure 3: Front panel Splash screen

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## Setting IP Addresses

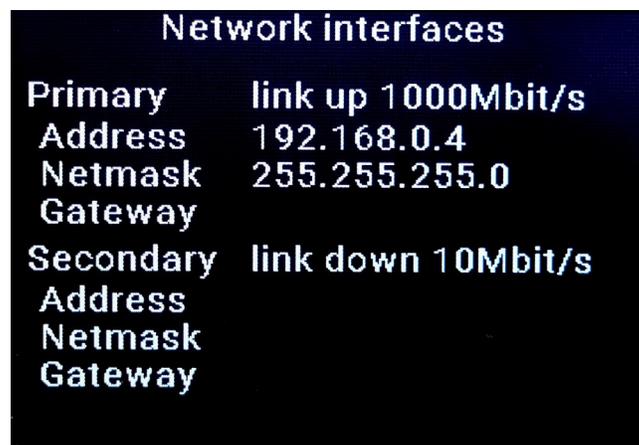
The Primary Ethernet port is used to receive Livewire+ AES67 audio from your LAN side network. The Secondary port should be connected to the network on which you intend to stream which include (but are not limited to) slower Internet, WAN or VPN connections that lack the bandwidth needed to support LW+ AES67. The Secondary port **must** be connected to a Gigabit (1000Base-T) port on the router.

The web-based user interface can be accessed over either port.

By default, Infinity Link Gateway is set up with DHCP enabled so that it will receive an IP address automatically when connected to a network with a DHCP server. DHCP can be disabled and a static address entered if preferred.

Each port contains a field for entering a gateway address, however, both ports will use the most recently entered gateway address. Since the gateway of the Secondary port will be most critical in most applications, it should be entered second.

Pushing the Right arrow on the front panel from the Splash screen will display the Network Interface status screen for both Primary and Secondary networks.



Network interfaces	
Primary	link up 1000Mbit/s
Address	192.168.0.4
Netmask	255.255.255.0
Gateway	
Secondary	link down 10Mbit/s
Address	
Netmask	
Gateway	

Figure 4: Front panel Network Status screen

Pressing the Right arrow key a second time will display the Setup menu for the Primary port, which shows current information and allows front panel network setup. This includes setting DHCP (enabled or disabled), the IP address, the netmask, and the gateway. Pressing the Right arrow again will display the same menu for the Secondary network connection if connected.

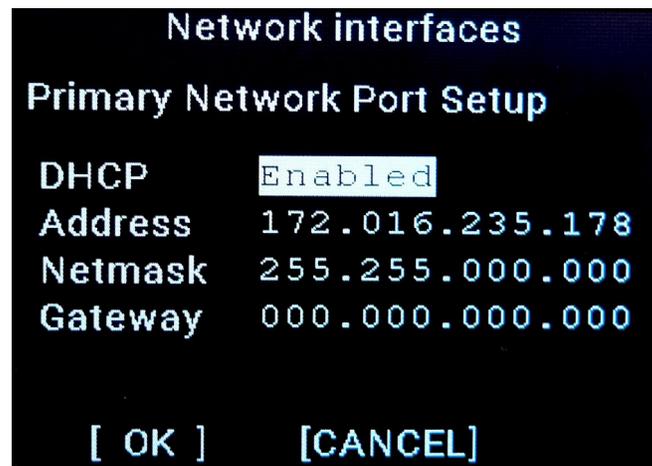


Figure 5: Front panel Network Setup screen

In most cases, a static (fixed) IP address will be desirable, especially on the streaming (Secondary) port. To set a static address in the Primary Network connection:

1. Press the OK button to highlight the DHCP status
2. Press the Up and Down arrows to toggle DHCP on and off
3. With DHCP disabled, press the Right arrow to move the cursor to the first character of the IP address
4. The Up and Down arrows change the value of the selected character
5. The Left and Right arrows move the cursor back and forth between characters
6. Once the IP address is set, press the Right arrow to move the cursor to the netmask field
7. The Up and Down arrows scroll through the available netmask values
8. Once the netmask is set, press the Right arrow to move the cursor to the gateway field; the process for setting the gateway address is the same as setting the IP address
9. Once the gateway is set, press the Right arrow to highlight "OK", then press the OK button to save your changes
10. If you need to back out of this menu without saving any changes, highlight "Cancel" instead and press the OK button

To set a fixed address for the Secondary connection, press the Right arrow twice from the Splash screen and follow the above steps.

## CONNECTING TO THE WEB-BASED USER INTERFACE

Infinity Link Gateway is configured, controlled, and monitored through a web-based user interface. Enter the IP address of either port into the web browser of your choice; once connected, enter the default user name of "user" (minus the quotes). There is no default password, so leave this field blank.

### Home Screen

The Home screen is displayed showing the unit's serial number and software version along with basic networking and PTP clock information and other statistics.

It also displays the Device ID, which by default is a unique value based on the unit's MAC address. We recommend you leave this value unchanged and use the Label field to create an easily-recognized name for the Link Gateway.

If you do elect to change the ID, **it must maintain a unique value among all devices in the system** as this is the field Infinity Dashboard software uses to identify the hardware in its database.

#### Important!

**It is highly recommended that if you intend to change the Device ID, you do so before adding it to your system configuration in Dashboard. If the Gateway has already been added using its original Device ID and the value is then changed, duplicate instances of input and outputs will be created in the database which can result in corrupted paths.**

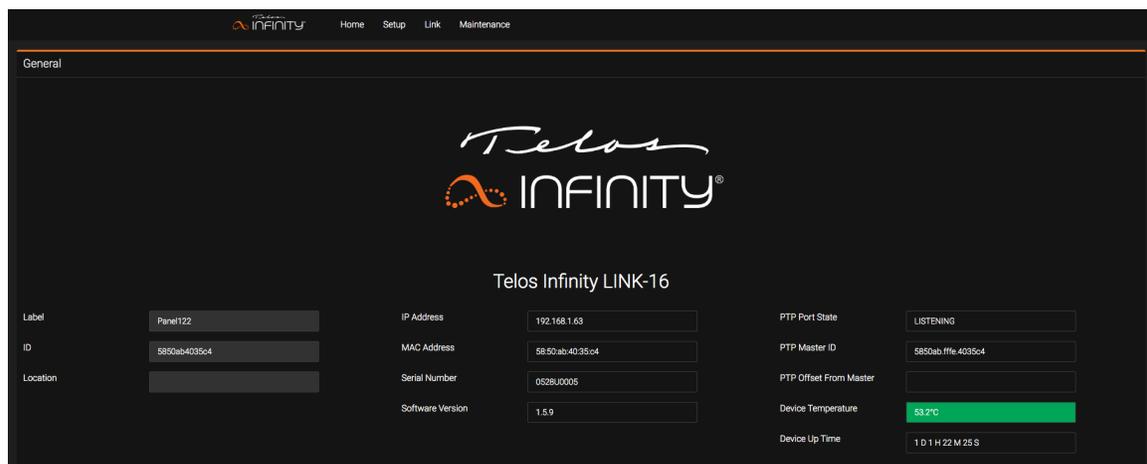
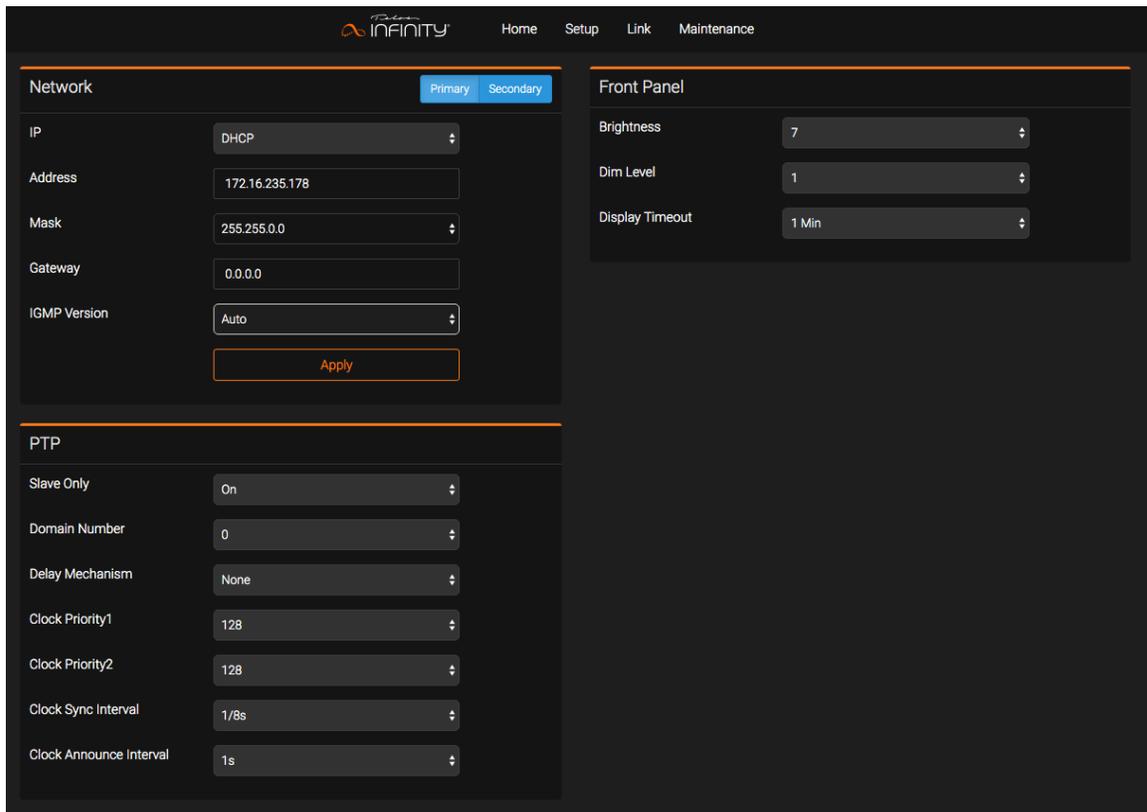


Figure 6: Home screen

## Setup Screen

Detailed configuration of both the Primary and Secondary network connections, configuration of the PTP clock, and front panel display behavior are managed from the Setup screen.



Section	Field	Value
Network (Primary)	IP	DHCP
	Address	172.16.235.178
	Mask	255.255.0.0
	Gateway	0.0.0.0
	IGMP Version	Auto
	Apply	
PTP	Slave Only	On
	Domain Number	0
	Delay Mechanism	None
	Clock Priority1	128
	Clock Priority2	128
	Clock Sync Interval	1/8s
	Clock Announce Interval	1s
Front Panel	Brightness	7
	Dim Level	1
	Display Timeout	1 Min

Figure 7: Setup screen

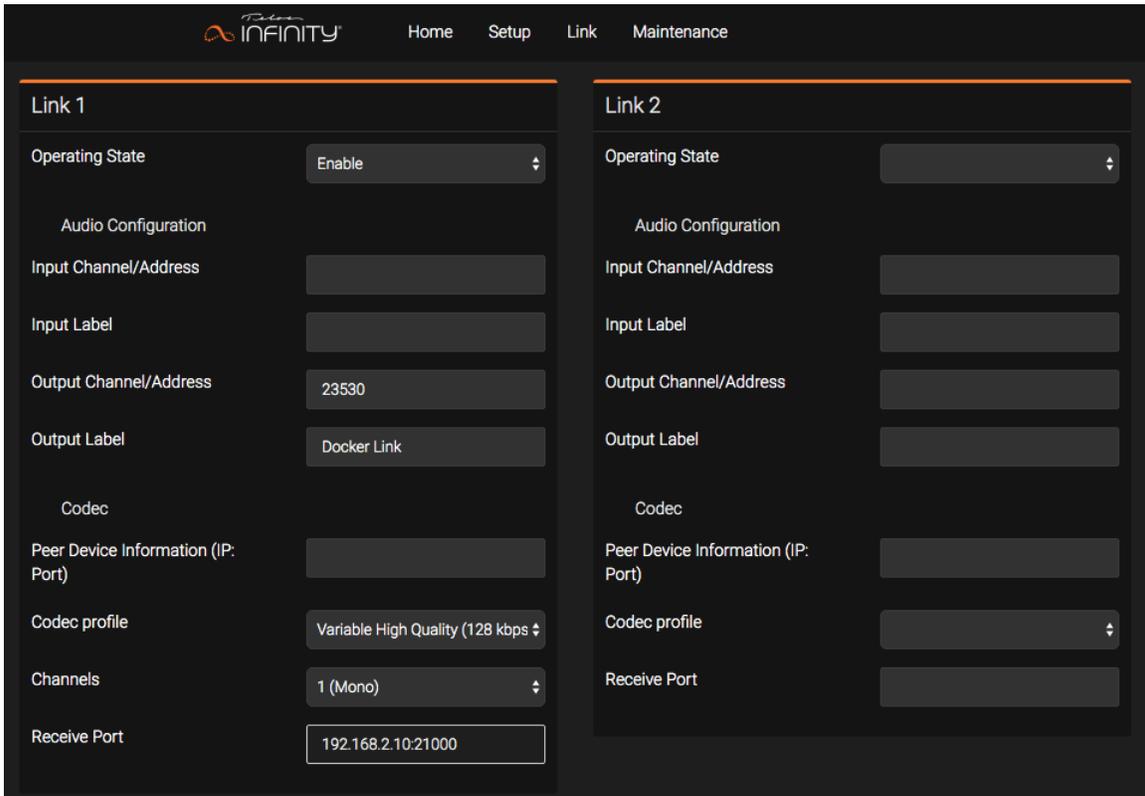
Click on the "Primary" or "Secondary" buttons to select which connection is visible and configurable. After making any changes to the IP settings, click "Apply" to apply and save any changes. Refreshing the browser page to rescan the network may be necessary after doing so.

When the Slave Only mode is "On," Infinity Link Gateway listens for an external PTP clock and can act as a slave. This is the recommended mode. If an external PTP clock is not available, Infinity Link Gateway can be set as an arbitrary (non-GPS) Grand Master clock.

Adjust the front panel brightness, dim level, and display timeout to your liking.

## Link Screen

Each of the available OPUS codecs - a total of eight or sixteen depending upon licensing - is configured in this menu.



The screenshot displays the 'Link' configuration screen in the Telos INFINITY interface. The page has a dark theme with orange accents. At the top, there is a navigation bar with the 'Telos INFINITY' logo and menu items: 'Home', 'Setup', 'Link', and 'Maintenance'. The main content area is divided into two columns, 'Link 1' and 'Link 2'. Each column contains a list of configuration options with corresponding input fields or dropdown menus. For Link 1, the 'Operating State' is set to 'Enable', 'Output Channel/Address' is '23530', 'Output Label' is 'Docker Link', 'Codec profile' is 'Variable High Quality (128 kbps)', 'Channels' is '1 (Mono)', and 'Receive Port' is '192.168.2.10:21000'. Link 2 has several fields that are currently empty or have placeholder text.

Link 1	Link 2
Operating State: Enable	Operating State: [Dropdown]
Audio Configuration: [Section Header]	Audio Configuration: [Section Header]
Input Channel/Address: [Text Field]	Input Channel/Address: [Text Field]
Input Label: [Text Field]	Input Label: [Text Field]
Output Channel/Address: 23530	Output Channel/Address: [Text Field]
Output Label: Docker Link	Output Label: [Text Field]
Codec: [Section Header]	Codec: [Section Header]
Peer Device Information (IP: Port): [Text Field]	Peer Device Information (IP: Port): [Text Field]
Codec profile: Variable High Quality (128 kbps)	Codec profile: [Dropdown]
Channels: 1 (Mono)	Receive Port: [Text Field]
Receive Port: 192.168.2.10:21000	

Figure 8: Link screen

## Maintenance Screen

The Maintenance menu is used to upload new system firmware, choose between installed firmware versions, and upgrade the unit from 8 channels to 16 channels. It also provides a means by which to perform a soft reboot of the unit, execute a self-test, perform a factory reset (with or without retaining the unit's IP address), or download a log file if instructed to do so by customer support.

The current user license is displayed on this screen along with a field into which additional licenses may be entered when adding features or codecs.

### Important!

The current license can also be completely disabled from this screen, but doing so will also remove the license number. If you do not have access to the license number by any means other than the remote interface itself, disabling the license can result in an unusable unit.

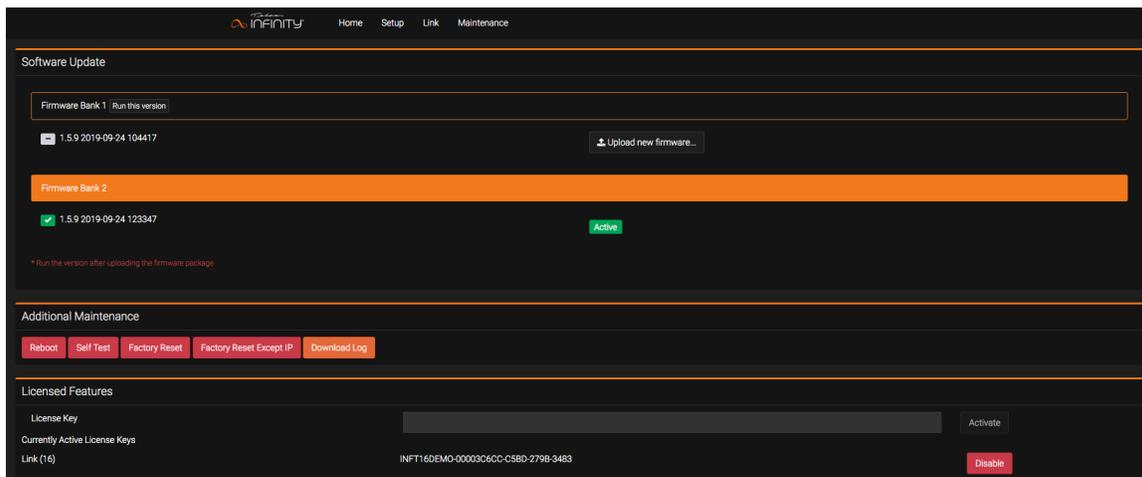
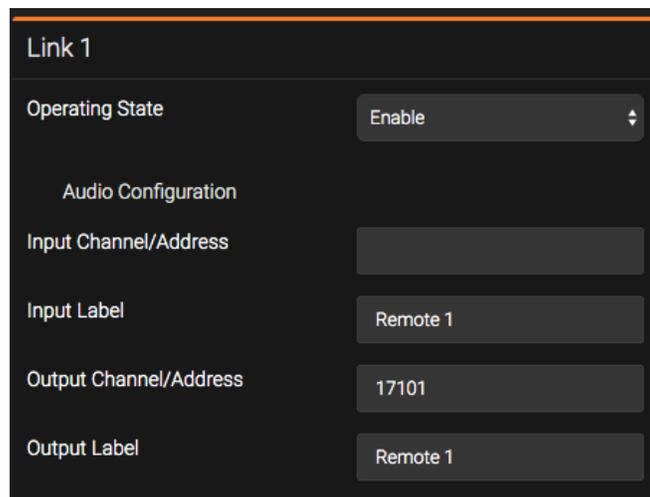


Figure 9: Maintenance screen

## SETTING UP A LINK

To configure a link, set the operating state of a codec to Enable in the Link menu.

Next, connect local audio from the Infinity System to Link. The Input Channel/Address field will be set by the Dashboard software in the next step. However, a “friendly” name should be entered into the Input Label field and will appear in Dashboard.



The screenshot shows a configuration window titled "Link 1". It contains several fields:

- Operating State:** A dropdown menu set to "Enable".
- Audio Configuration:** A section header.
- Input Channel/Address:** An empty text input field.
- Input Label:** A text input field containing "Remote 1".
- Output Channel/Address:** A text input field containing "17101".
- Output Label:** A text input field containing "Remote 1".

Figure 10: Input label

Once the Input Label is set, open Dashboard Basic or Advanced. Navigate to the Output pane and type the Input label into the search box. Drag and drop the output into the Virtual Port or Group you wish to send via Link. It will automatically be assigned a Livewire+ AES67 channel number. Link will also accept multicast addresses in this field.

**Note:**

For an overview of the relationship between Livewire+ AES67 channel numbers and multicast addresses, please see the following section, “Livewire+ Channel Numbers and Multicast Addresses”.

# QUICK-START INSTALLATION GUIDE

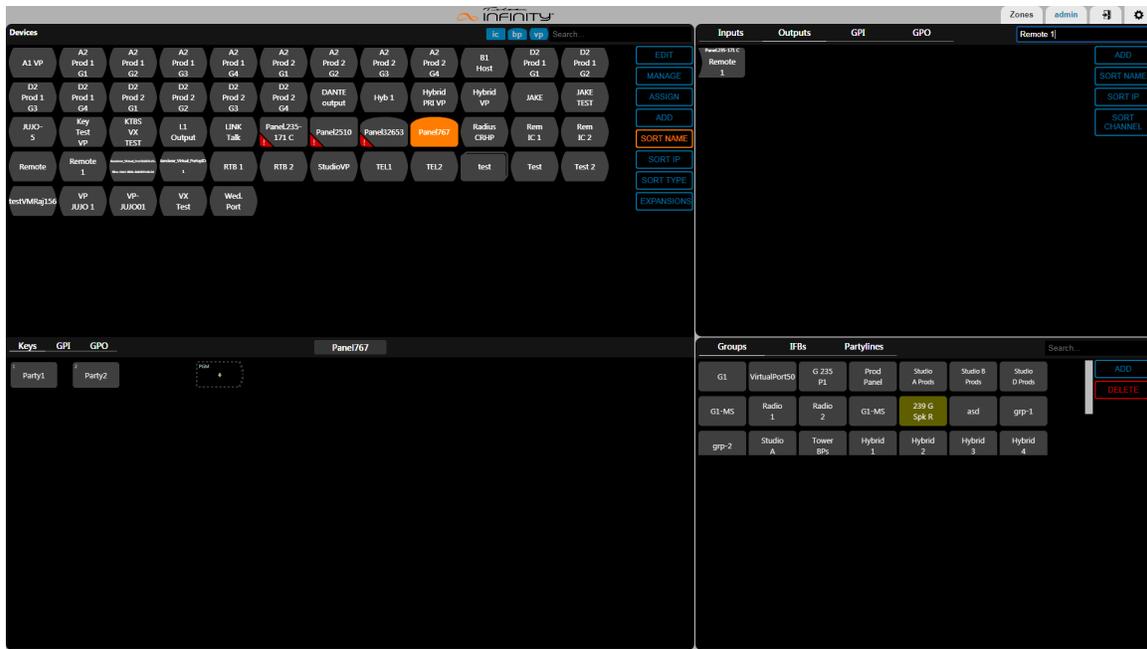


Figure 11: Dashboard output

Type an available Livewire Channel or Multicast Address into the Output Channel/Address field. Add a label to describe the audio source you are receiving in the Output Label field. Below is an example of a fully filled in Audio Configuration section.

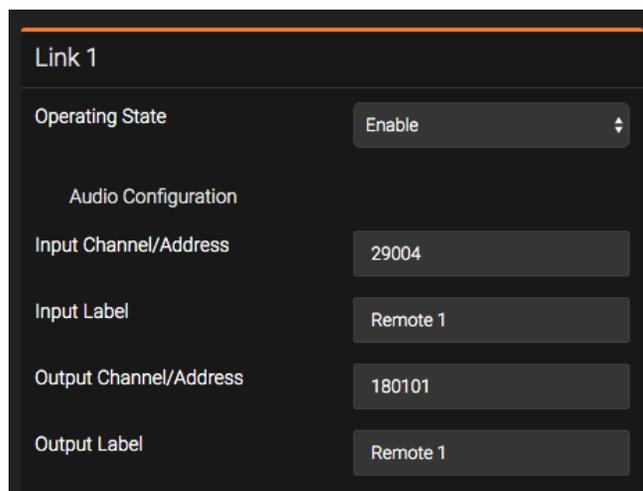


Figure 12: Remote end configured

# QUICK-START INSTALLATION GUIDE



Now that audio can be sent between Link and other Telos Infinity devices, it is time to configure Link to send and receive audio across the WAN connection or internet.

Enter the static IP address and port number of the Telos Infinity Link at the other end of your internet connection in the Peer Device Information field using the format "IP Address:Port Number". Be sure to use a public IP address as FQDN is not supported. The moment you exit the Peer Device Information field, the input will start streaming to peer the Infinity Link.

Select an appropriate bitrate and type from the Codec Profile dropdown menu. Each codec represents a single audio channel, so choosing 2-channel (stereo) from the Channel menu automatically uses the next available codec for the second channel.

Finally, set the Receive Port to the IP address of the interface connected to the Internet and the port number forwarded through your firewall. In general, we recommend a non-standard port starting at 21000.

## Note:

For additional information on router configuration and port forwarding, please see the following section, "Router Configuration and Port Forwarding".

A screenshot of a configuration interface with a dark background. It shows four settings: 'Codec' (empty), 'Peer Device Information (IP: Port)' with a text input field containing '207.89.44.50:21000', 'Codec profile' with a dropdown menu showing 'Variable High Quality (128 kbps)', and 'Channels' with a dropdown menu showing '1 (Mono)'. Below these is 'Receive Port' with a text input field containing '192.168.2.10:21000'.

Codec	
Peer Device Information (IP: Port)	207.89.44.50:21000
Codec profile	Variable High Quality (128 kbps)
Channels	1 (Mono)
Receive Port	192.168.2.10:21000

Figure 13: Peer Device, Receive Port, and Codec setup

## LIVEWIRE+ CHANNEL NUMBERS AND MULTICAST ADDRESSES

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As part of the Telos Infinity family of products, Infinity Link Gateway supports Livewire+ AES67 and receives its output channel information from the Dashboard software as a Livewire+ channel.

Each Livewire+ channel number has a corresponding multicast IP address. Since Livewire+ channels are assigned by Dashboard, their multicast addresses will inherently fall within the available range which is between 1 and 32767. The range of channels available to Infinity can be managed when setting up the Dashboard software (please see the Dashboard user manual for detailed information).

Livewire+ devices on the network will automatically resolve to a Livewire+ channel number while non-Livewire+ AES67 devices will display the multicast address.

Avoiding duplicate addresses and the resulting conflicts is critical, and so knowing how to convert a Livewire+ channel number to a multicast address is handy when determining whether or not non-Livewire+ devices exist on the network with a multicast address that falls within the range assignable by Dashboard.

The first two octets of a standard Livewire+ source will be 239.192. To derive the third octet, divide the Livewire+ channel number by 256, rounding the product to the nearest whole number. To determine the fourth octet, multiply the value of the third octet by 256 and subtract the product from the Livewire+ channel number.

Using Channel 401 as an example:

- Solve for X
  - 239.192.X.Y
  - $401 / 256 = 1.56$
  - $X = 1$
  
- Solve for Y
  - $401 - (1 * 256) = 145$
  - $Y = 145$

The multicast address of Channel 401 is then 239.192.1.145.

## ROUTER CONFIGURATION AND PORT FORWARDING

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While it is impossible to describe in specific detail the steps required to set up every available router to work with Link, the function of the router remains the same and so the same recommendations for basic connectivity, security, and port forwarding apply and certain requirements must be met.

The Infinity Link Gateway can connect to another Link-enabled Telos Infinity device using the public Internet. In this application, we highly recommend keeping the Secondary port behind a router as you would any computer with Internet access. Remember that the Secondary port **must** be connected to a Gigabit (1000Base-T) port on the router.

The Secondary port will have a local IP address (ideally a static address). This is the IP address entered into the Receive Port field in the Link menu. The public IP address entered into the Peer Device field in the Link menu must have a UDP port specified which will need to be forwarded through your router so that audio can be received by link. As mentioned earlier, any port number can be used, but we recommend a non-standard port starting at 21000.

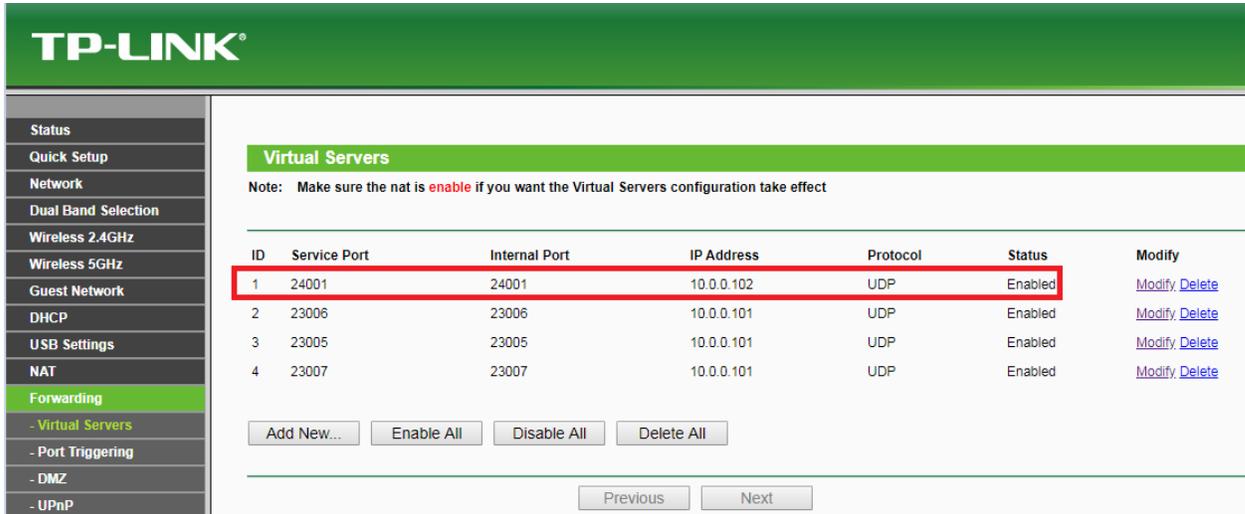
### Some Notes on Port Forwarding

The concept of port forwarding (also known as port mapping) is often misunderstood but critical to making Link work, and so a brief explanation is in order.

Because the IP address in the Peer Device field can be a public Internet address, having a means of allowing certain traffic to penetrate a firewall while preventing other traffic from getting through is required.

Let's use the analogy of mail delivery as an example. A public IP address is akin to the street address of an apartment complex. The port number is like the individual apartment number. The router acts like a mailroom, sorting everything out to ensure your mail gets to you and you alone, and not to your neighbor's apartment.

All routers are slightly different, but in general, logging into your router's web interface and locating the "Port Forwarding" configuration page is the first step. It can be located in a number of different places, but it's usually under a "Security" tab. Some routers will locate it in the "Gaming" tab, or in the case of the example below, in a section called "Virtual Servers." In any case, the page should look something like this:



The screenshot shows the TP-LINK web interface for configuring Virtual Servers. The left sidebar contains a navigation menu with options like Status, Quick Setup, Network, and Forwarding. The main content area is titled 'Virtual Servers' and includes a note: 'Note: Make sure the nat is enable if you want the Virtual Servers configuration take effect'. Below the note is a table with columns for ID, Service Port, Internal Port, IP Address, Protocol, Status, and Modify. The first row is highlighted with a red border, showing ID 1, Service Port 24001, Internal Port 24001, IP Address 10.0.0.102, Protocol UDP, and Status Enabled. Below the table are buttons for 'Add New...', 'Enable All', 'Disable All', and 'Delete All'. At the bottom, there are 'Previous' and 'Next' navigation buttons.

ID	Service Port	Internal Port	IP Address	Protocol	Status	Modify
1	24001	24001	10.0.0.102	UDP	Enabled	<a href="#">Modify</a> <a href="#">Delete</a>
2	23006	23006	10.0.0.101	UDP	Enabled	<a href="#">Modify</a> <a href="#">Delete</a>
3	23005	23005	10.0.0.101	UDP	Enabled	<a href="#">Modify</a> <a href="#">Delete</a>
4	23007	23007	10.0.0.101	UDP	Enabled	<a href="#">Modify</a> <a href="#">Delete</a>

Figure 14: An example of a router's port forwarding page

In this example, we have forwarded port 24001 (UDP) to the local IP address of the Secondary port on our Link Gateway, which is 10.0.0.102. Now when the Link Gateway unit on the far end configures its Peer Device Information as "PublicIPAddress:24001", the router will send any traffic on port 24001 to 10.0.0.102.

## EXAMPLES OF LINK GATEWAY WITHIN AN INFINITY SYSTEM

Below is an example of how to Infinity Link Gateways might connect a studio together with a remote location:

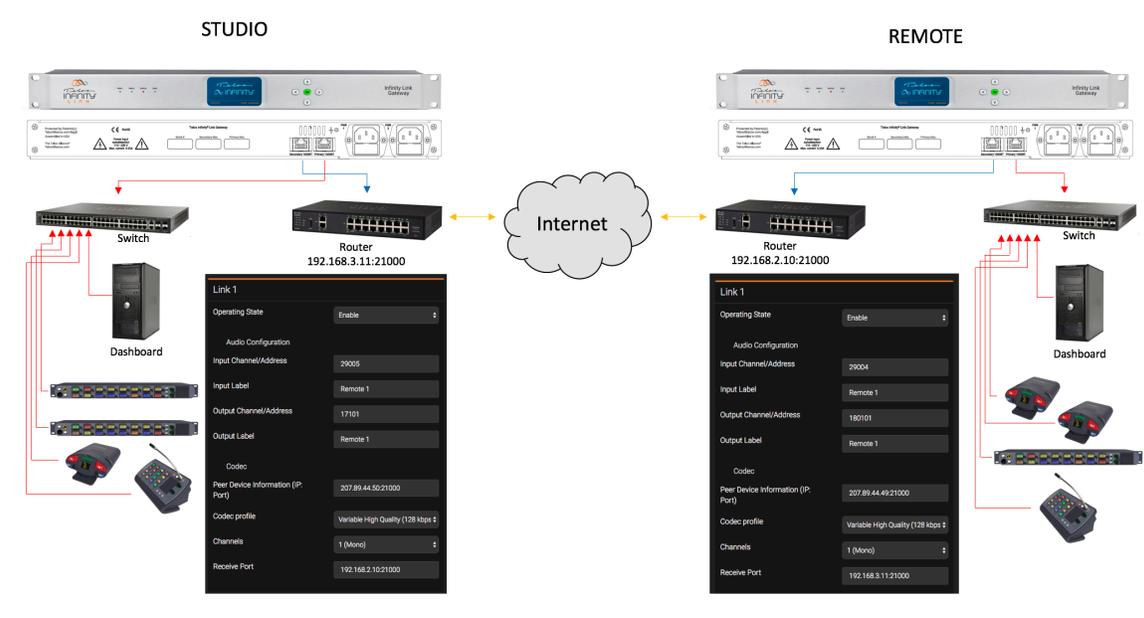


Figure 15: Example with Infinity Link Gateways at both locations

# QUICK-START INSTALLATION GUIDE

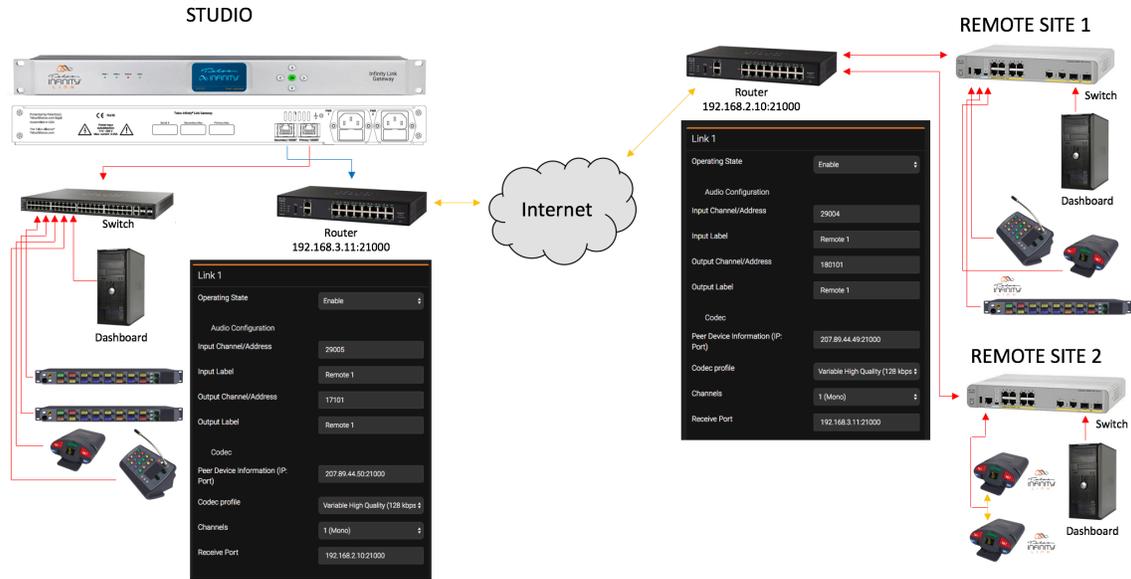


Figure 16: Example with Infinity Link Gateway with Link Gateway studio location only

# QUICK-START INSTALLATION GUIDE



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## QUICK LINKS

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