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Introduction



WELCOME

Thank you for choosing the ADDERLink™ INFINITY (aka ALIF) family of high capacity digital extenders/switches. By encoding high quality video, digital audio and USB data into Internet Protocol (IP) messages, ALIF units offer flexible ways to link peripherals and systems via standard networks.

This guide covers the ALIF102T unit, a highly compact dongle which can be attached to its host computer and transfer high quality video and USB signals across your network. Two variants are available to support either DisplayPort™ or HDMI® video connections.

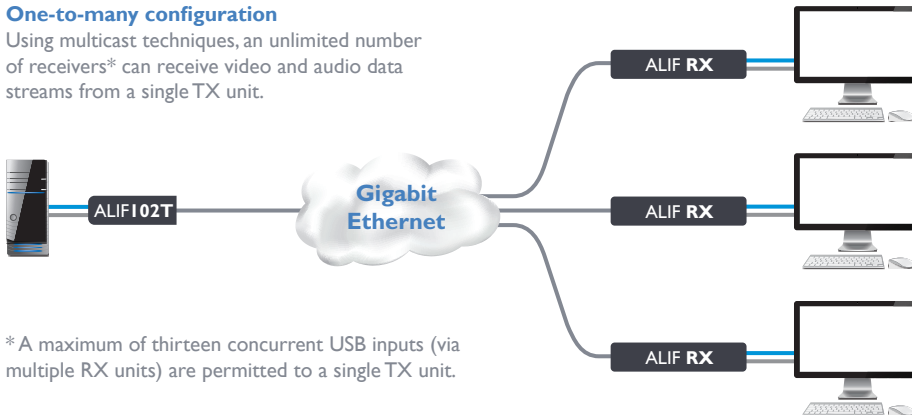
One-to-one configuration

The simplest configuration links one RX unit to a single TX unit, either by a direct link or over much greater distances via a high speed network.



One-to-many configuration

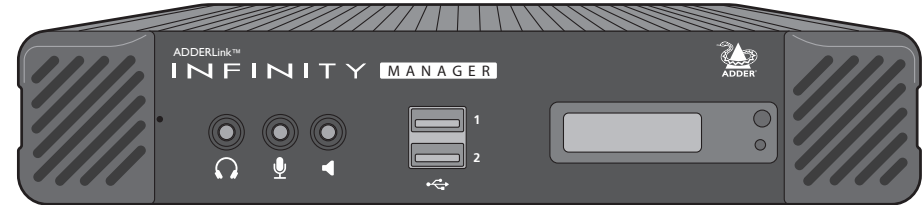
Using multicast techniques, an unlimited number of receivers* can receive video and audio data streams from a single TX unit.



*A maximum of thirteen concurrent USB inputs (via multiple RX units) are permitted to a single TX unit.

ALIF and AIM

Where multiple ALIF units are used on a network, we have developed the ADDERLink INFINITY Management (AIM) server to allow comprehensive and secure central control of all transmitters, receivers and users.



When using an AIM server to configure ALIF units, it is vital that all ALIF units that you wish to locate and control are set to their factory default settings. Otherwise they will not be located by the AIM server. If necessary, perform a factory reset on each ALIF unit - see "Manual factory reset" on page 9.

Note: If you are using one or more ALIF102T transmitters within an installation managed by an AIM server, the AIM server must be running firmware version 5.13 or above.

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TECHNICAL SPECIFICATIONS

Operating/storage conditions

Operating temperature:	0 to 40°C / 32 to 104°F
Storage temperature:	0 to 40°C / 32 to 104°F
Storage and operating relative humidity:	10 to 90% non-condensing
Altitude:	0 to 2000m

Connectors

Computer:	2x USB Type A for signal and power. 1x 8p8c RJ45 CATx port. ALIF102T-DP model: 1x DisplayPort™ video connector. <i>Note: This model supports dual-mode DP++.</i> ALIF102T-HM model: 1x HDMI® video connector.
-----------	---

USB2.0 with class control

Supports USB2.0 devices (low, full and high speed). Security feature allows the blocking of non-HID devices. Extending isochronous devices is not supported (e.g. USB audio or video devices).

Video resolution

The system supports up to 1x 2560x1600@60Hz (or 1920x1080@120Hz), 8-bpc color depth

Audio

USB audio stereo 2-channel 16-bit 48kHz (bi-directional)
Digital stereo 2-channel 16-bit up to 48kHz (uni-directional)

Ethernet

In-built support for 1GbE CATx

Physical

Dimensions:	55mm/2.2" (w) x 110mm/4.3" (d) x 25mm/1" (h)
Weight:	0.2kg / 0.4 lbs

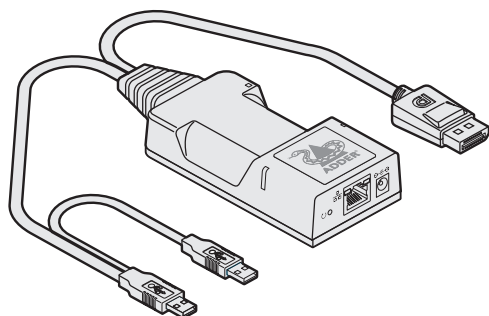
Power consumption

<i>5VDC via USB connection</i>	
Maximum power:	5W
Typical power:	3W

Materials

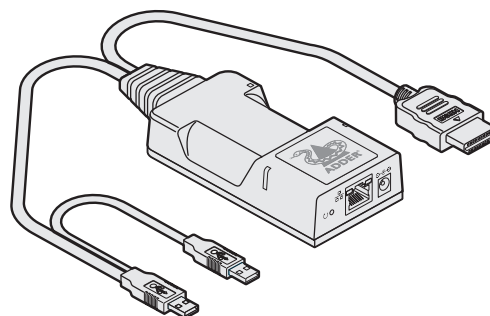
Aluminium, steel and ABS construction

SUPPLIED ITEMS

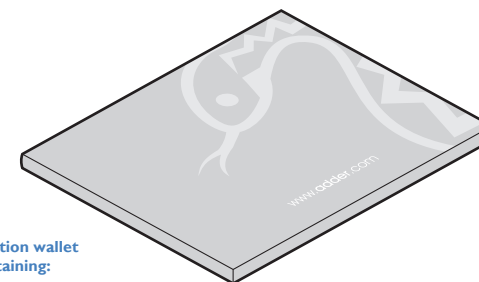


ALIF102T with DisplayPort™ video
Part number: ALIF102T-DP

OR

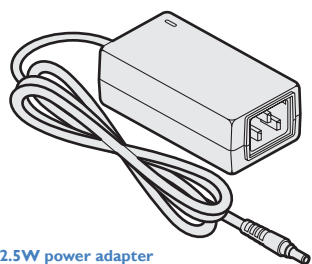


ALIF102T with HDMI® video
Part number: ALIF102T-HM

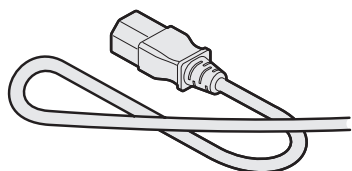


Information wallet
containing:
Four self-adhesive rubber feet
Quick start guide
Safety document

OPTIONAL EXTRAS



12.5W power adapter
Part number: PSU-IEC-5VDC-2.5A



Country-specific power cords
CAB-IEC-AUS (Australia)
CAB-IEC-EURO (Europe)
CAB-IEC-UK (United Kingdom)
CAB-IEC-USA (United States)

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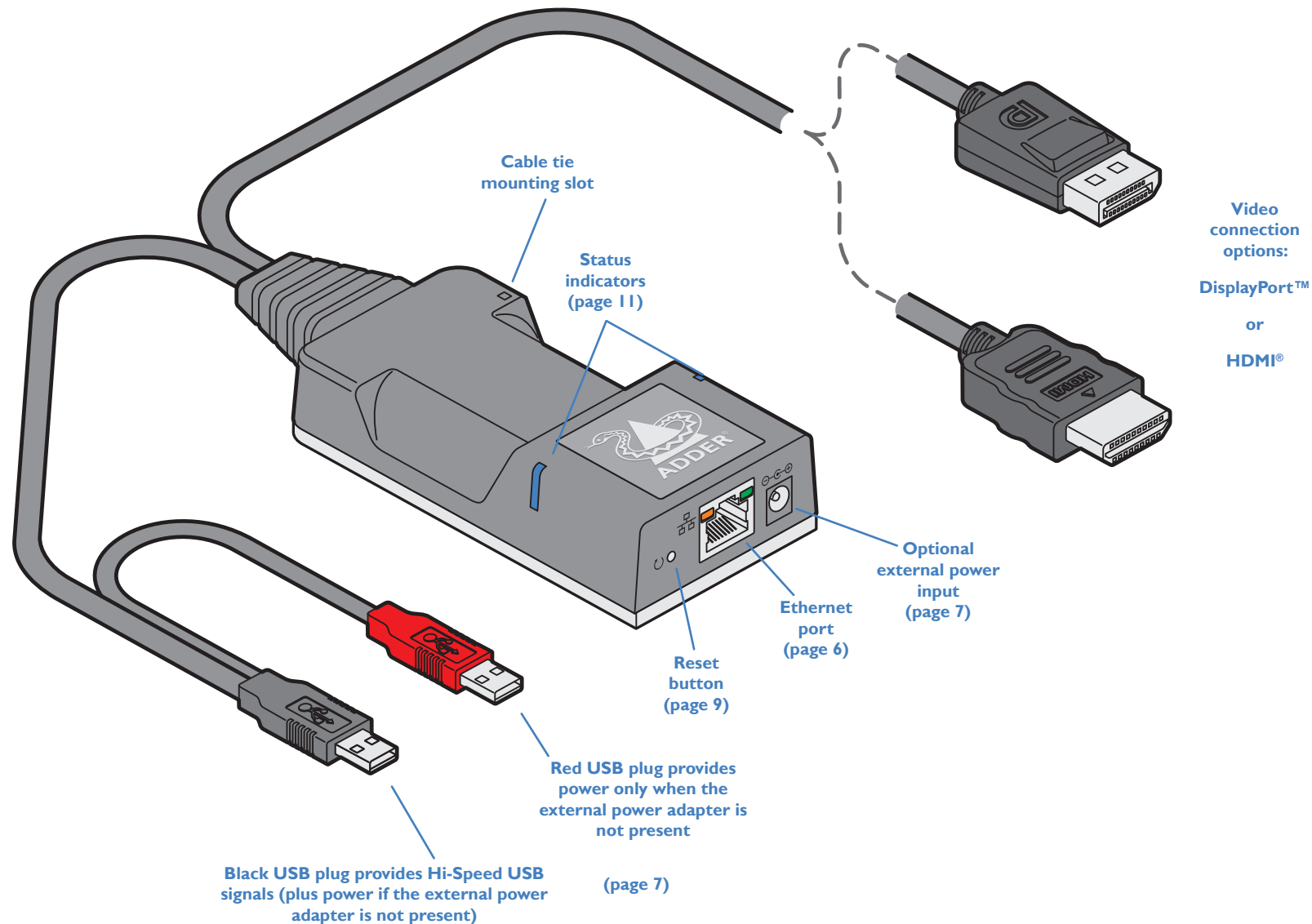


OVERVIEW

Installation involves linking the ALIF102T unit to various ports on the host computer, while the ALIF RX unit is attached to your peripherals:

‘Suitable for installation in Information Technology Rooms in accordance with Article 645 of the National Electrical Code and NFPA 75.

Peut être installé dans des salles de matériel de traitement de l'information conformément à l'article 645 du National Electrical Code et à la NFPA 75.’



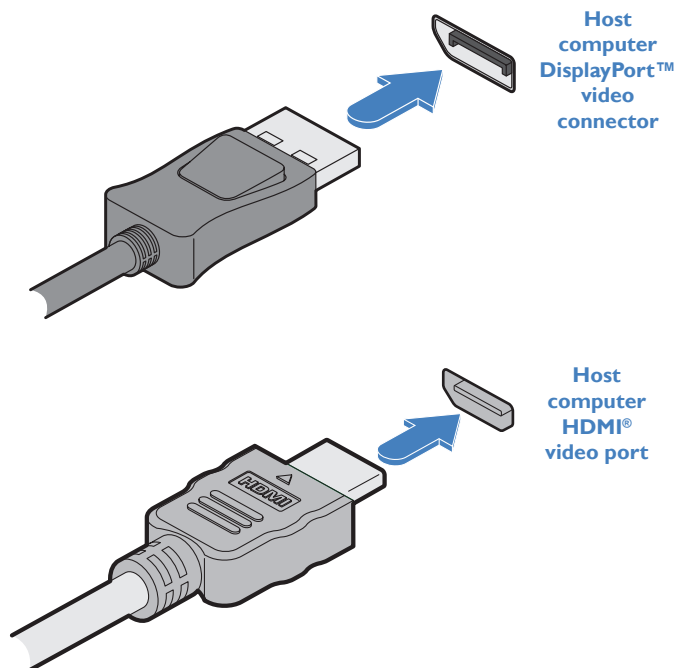
CONNECTIONS

Video link

ALIF102T units are supplied with a single video connector: either DisplayPort™ or HDMI® depending on the chosen variant. Video resolutions up to 2560x1600 @ 60Hz are supported, the highest frame rate is 1920x1080@120Hz.

To make a video link

- 1 Connect the video connector of the ALIF102T to the video socket of the host computer:

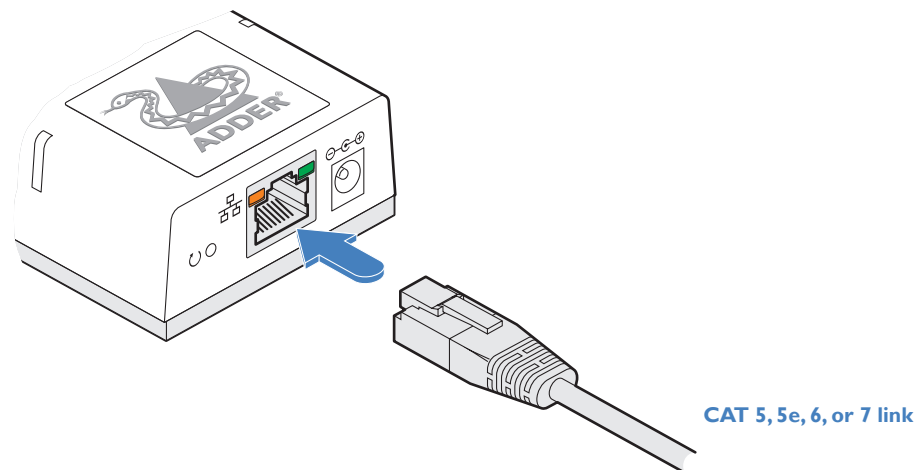


Link connection

Use the network port to join the ALIF102T either directly to an ALIF receiver or via a suitable network switch. It is also possible to connect a computer directly to the network port for configuration purposes.

To make a link connection

- 1 Insert a standard network cable into the socket on the front panel of the ALIF102T.



- 2 Connect the other end of the cable either directly to an ALIF receiver or a suitable network switch.

USB and power connections

The ALIF102T is designed to be as flexible as possible. It can either operate using an optional external power adapter or derive all of its power from its two USB plugs. The main advantage offered by using an external power adapter is that it allows the ALIF102T to be active before the host computer; thus allowing a remote user to access the host's initial boot up and access the BIOS menu, when required.

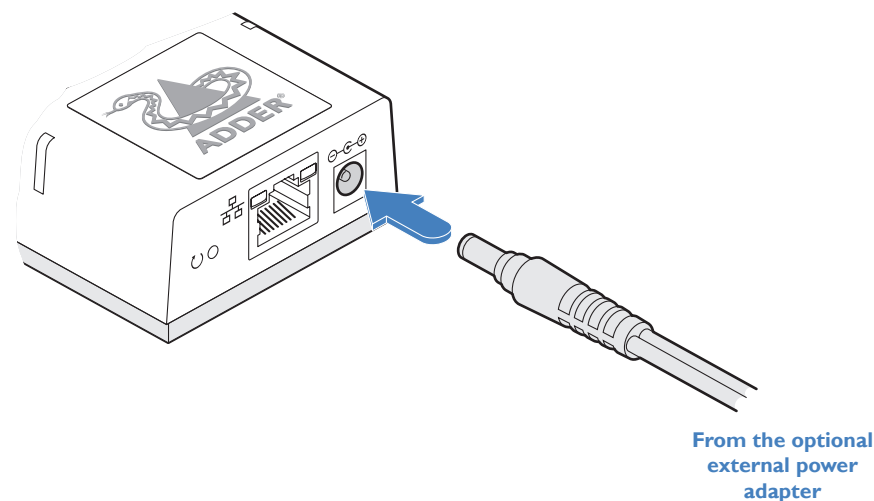
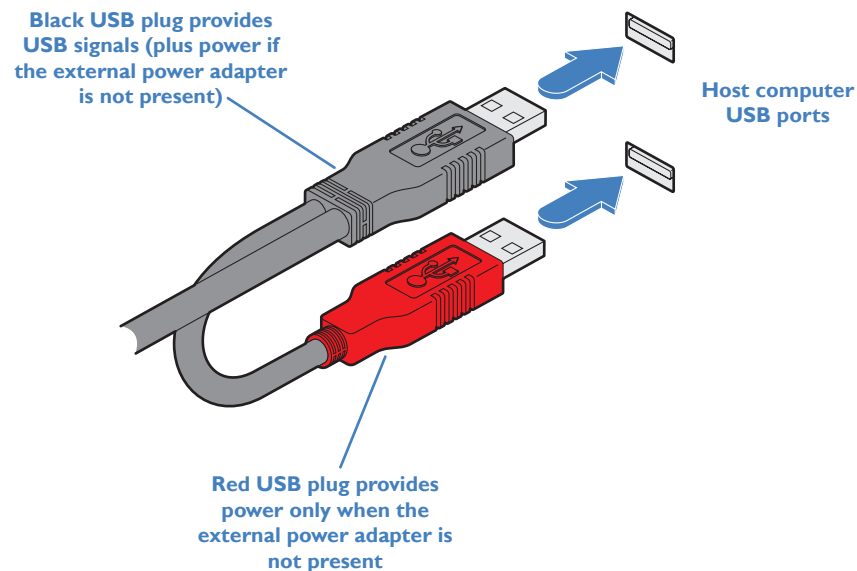
If powered by USB only, then both the black and red USB plugs need to be connected.

If powered by external power adapter, only the black Hi-Speed USB plug needs to be connected, for signal purposes. Whenever, the external power adapter is attached and operating, then power will be taken from it rather than the USB plugs. There is no problem if the red USB plug remains connected while the power adapter is used.

This is summarized as follows:

Power adapter	Black USB	Red USB	Power sourcing behavior
✗	✓	✓	Power taken from both USB plugs.
✓	✓	✗	Power taken from power adapter only.
✓	✓	✓	Power taken from power adapter only, unless it becomes unavailable, in which case power will be taken from both USB plugs after a short interruption.


Note: The USB plugs do not operate as a seamless failover for the external power adapter; there will be a short interruption as operation switches from one power source to the other.



Configuration



ALIF CONFIGURATION VIA WEB PAGES

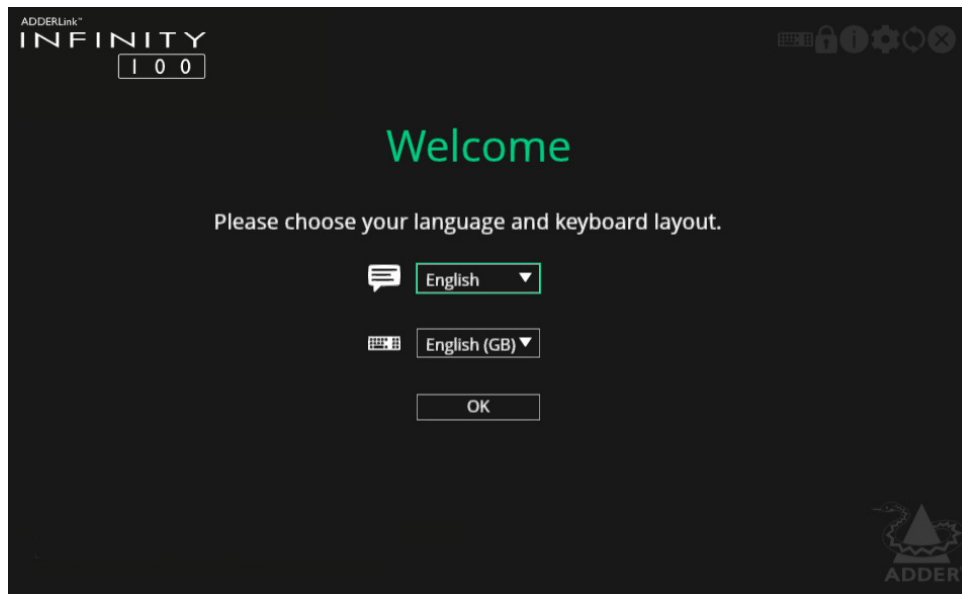
Each ALIF102T unit hosts its own internal set of web pages which contain all configuration details and settings (see also *Start of Life, shown right*). You will need to use a computer connected to the same network as each ALIF unit to access the web pages. Additionally, on the console attached to the ALIF RX unit*, you can access its configuration details via the On Screen Display (OSD) by pressing **CTRL + ALT + C** (or by tapping the  icon on the touchscreen) - see page 12.

To manually configure ALIF units via their web pages

Run a web browser on your computer and enter the IP address of the required ALIF unit:

The default address is <https://169.254.1.33>

The opening page should be displayed:



For explanations of the options within each page, please see [Appendix A](#).

*ALIF receivers that support Mini Matrix mode include:
ALIF102R, ALIF2102R, ALIF2122R, ALIF4001R and ALIF4021R.

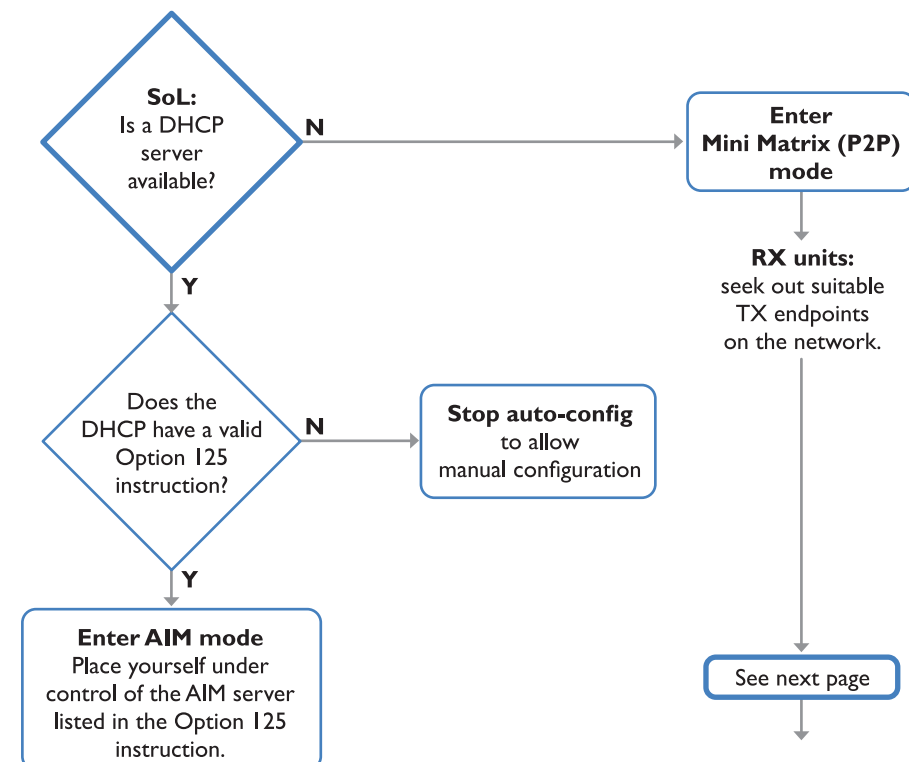
Start of Life: AIM or Point to Point configuration

To streamline initial configuration processes, all ALIF units employ a Start of Life (SoL) procedure when they are in an unconfigured state; either because they are new or because they have undergone a factory reset.

When an unconfigured ALIF unit boots, its SoL procedure will guide it to automatically determine which of two modes it should adopt:

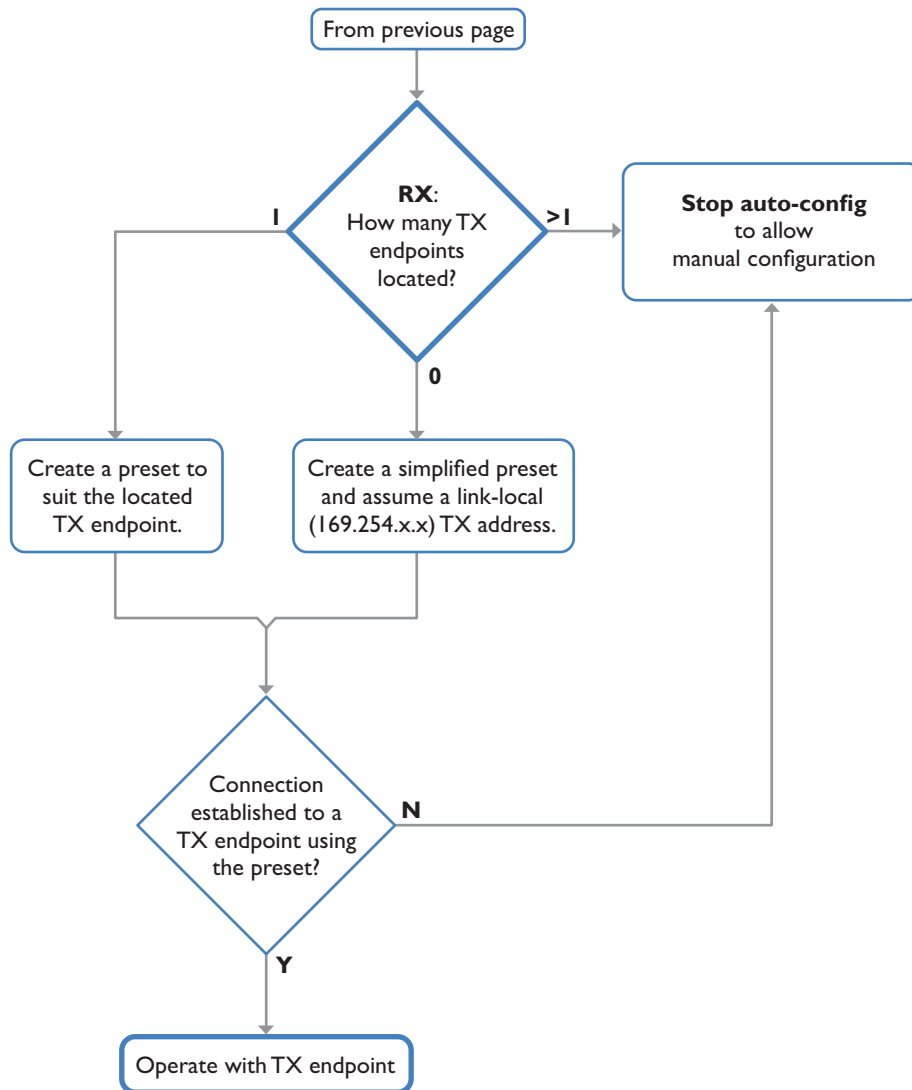
- **AIM mode** - place itself into the control of a specific AIM server on the network, whereupon the ALIF will be assigned suitable configuration details to fit within the network of similar units.
- **Mini Matrix (P2P) mode** - place itself into Mini Matrix (Point to Point) mode to allow manual configuration of links with other ALIF units.

The SoL procedure follows this basic logic flow to determine the correct mode:



Note: If an AIM server is present on the network then the modules don't have to be within SoL procedure for it to be placed under AIM control.

Start of Life configuration (continued)



Once the mode has been set to AIM control, an ALIF will remain operating that way until it undergoes a factory reset. If set to Matrix Mode (P2P), an ALIF will remain thus until it undergoes a factory reset or is discovered by an AIM server.

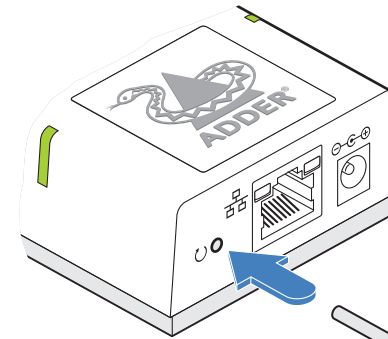
Note: When the modules enter Mini Matrix mode, you can cancel auto-SoL at any point by pressing Ctrl-Alt-C.

MANUAL FACTORY RESET

A factory reset returns ALIF102T unit to its default configuration.

To perform a manual factory reset

- 1 Power on the ALIF102T unit.
- 2 Use a narrow implement (e.g. a straightened-out paper clip) to press-and-hold the recessed reset button on the front panel for roughly fifteen seconds, until the indicators turn **blue** (Note: alternating red/green indications will occur during the fifteen second period while the button is still pressed).



Use a straightened-out paper clip to press the reset button for roughly 15 seconds

- 3 Release the reset switch.

The indicators will remain **blue** for a short while (less than ten seconds) while the unit configures itself and should then change to **green** if all connections are correct; or **orange** if one or more of the video, USB and/or network links are missing.

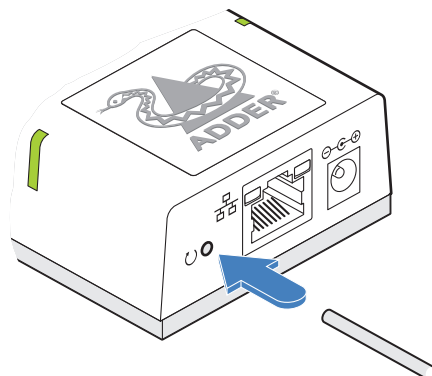
NOTE: If you are performing a factory reset and intend to disconnect the power immediately after the reset, you must wait at least 30 seconds after you have released the reset button for it to complete the process.

PLACING THE UNIT INTO RECOVERY MODE

Recovery mode may allow an ALIF102T to be diagnosed or upgraded in the event of the main mode being non-operational.

To boot the device into recovery mode

- 1 Power on the ALIF102T.
- 2 Use a narrow implement (e.g. a straightened-out paper clip) to press-and-hold the recessed reset button for roughly ten seconds until the indicators flash **green/red**.
- 3 Release the reset switch.

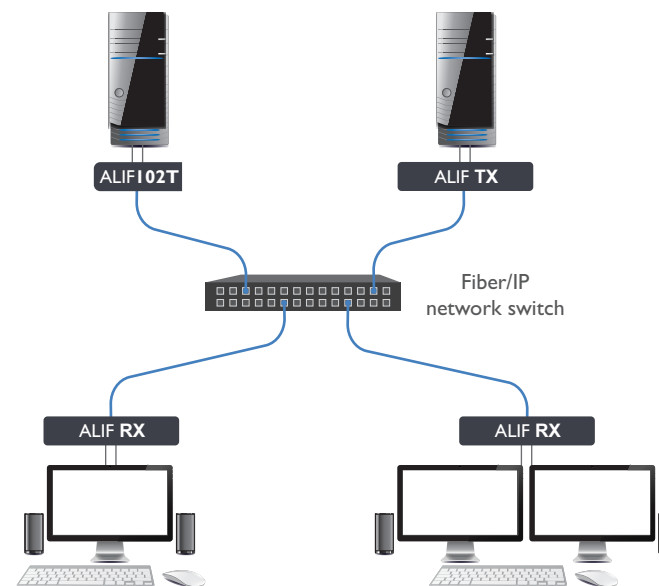


Use a straightened-out paper clip to press the reset button for roughly 10 seconds

- 4 Once complete, the dongle will then continually flash **green/red** signifying that the device is in recovery mode..
- 5 If necessary, perform a software upgrade or reinstate a backup software version.

CREATING AN UNMANAGED MATRIX

Although ALIF units are most often organised and managed by a central AIM server, it is possible to create small networks of ALIF units, most often in matrix arrangements, ie multiple transmitter and receiver units which can freely cross-connect.



This method of connection works well for small numbers of transmitter and receiver units, but will become more difficult to manage as more units are attached. The maximum number of transmitter sources that can be made available to any receiver is sixteen.

To create an unmanaged matrix

- 1 Connect ALIF transmitter and receiver units (with their various hosts and peripherals) to a suitable switch.

Note: If any device was previously managed by AIM, then it will need to be given a factory reset before continuing with this procedure. There must not be an AIM connected on the matrix network otherwise, when such devices undergo a factory reset, they will automatically revert to AIM control.

You now need to perform the following procedure on each ALIF receiver in turn:

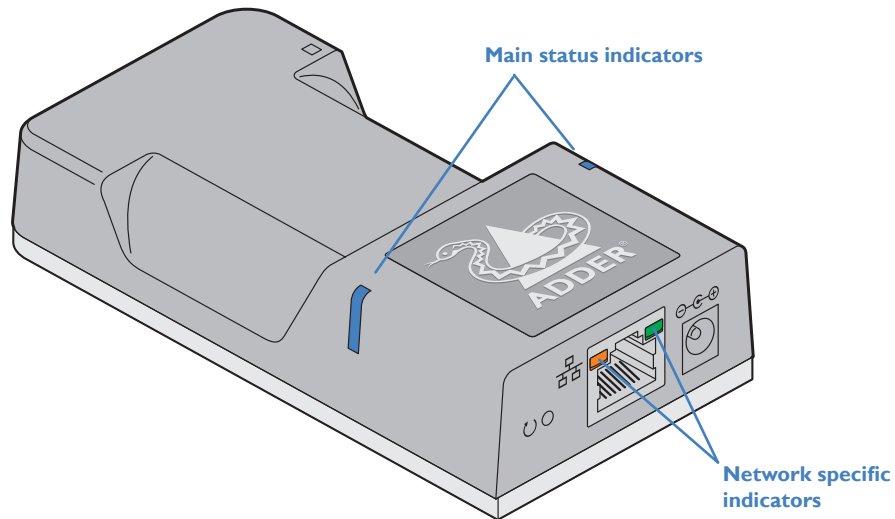
- 2 Access the Configuration pages.
- 3 Click the transmitters option from the list on the left side. This page will list all of the available transmitter units which are not under AIM control.
- 4 Click the Presets option from the list on the left side. Use this page to add each transmitter unit to the list of presets for the receiver that you are editing.

To use the matrix

- On each receiver, use the OSD to access the required transmitter units in the usual manner - see page 12.

STATUS INDICATORS

The two top panel indicators on the ALIFI02T provide a useful guide to operation:



Main status indicators

- Off No power
- Green Operating - Video, USB and network link all present
- Orange Operating - But video, USB and/or network link missing.
- Red (momentarily) Unit is booting up, or (consistently) Unit has failed, try rebooting.
- Red/green flashing Unit is in backup mode.
- Blue Factory reset has been activated.
- Red/blue flashing Unit is in upgrade mode.
- Fast green flash Unit is in identify mode.

Network specific indicators

- Orange Off: No link On: Link established
- Green Off: No link Flashing: Network activity On: Quiescent link

USING THE ON SCREEN DISPLAY

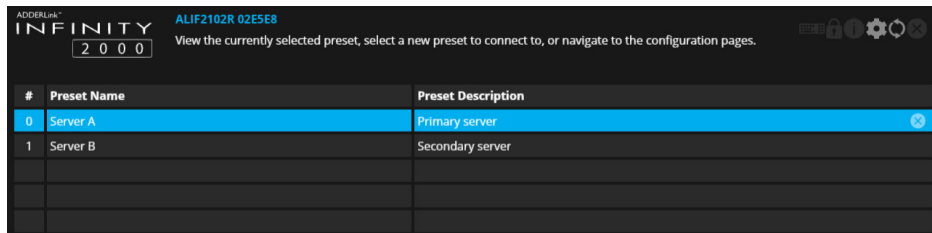
The OSD provides a quick and easy way to access ALIF transmitters as well as configuration details.

To access the OSD

1 On the console of your ALIF receiver*, either:

- Press **CTRL + ALT + C** on the keyboard,
- or
- Tap the  icon* on the touchscreen.

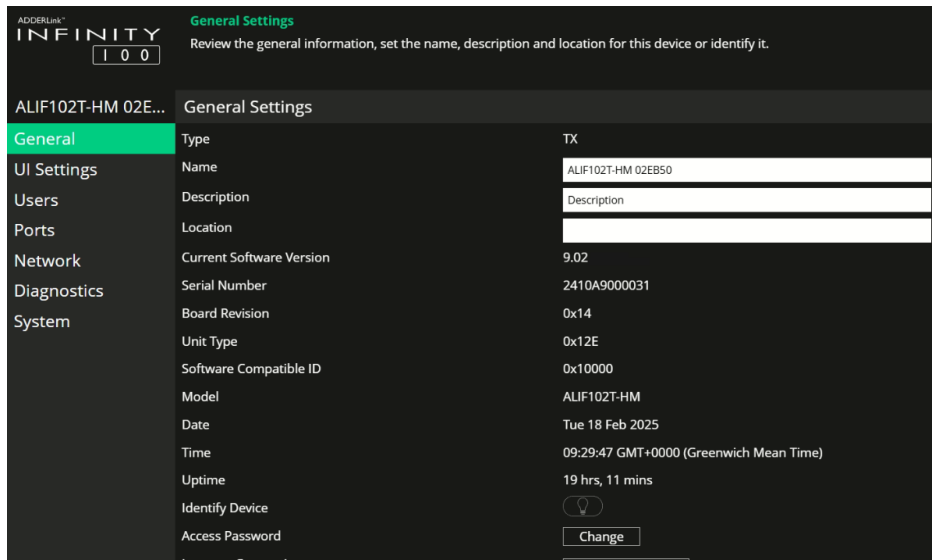
2 The Preset Selection page will be displayed:



3 Click the  icon in the top right corner.

4 Click the **Transmitters** option and then click the  icon for the required ALIF102T.

5 If necessary, click the **General** link:



For explanations of the options within each page, please see [Appendix A](#).

*ALIF receivers that support Mini Matrix mode include:

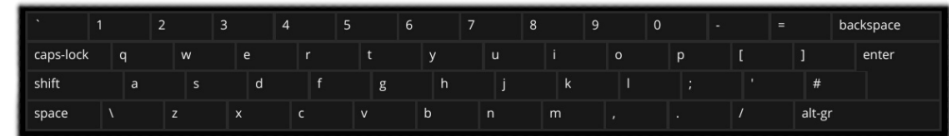
ALIF1102R, ALIF2102R, ALIF2122R, ALIF4001R and ALIF4021R.

To use the OSD keyboard (when using a touchscreen)

1 Access the OSD as discussed left.

2 Tap the  icon in the top right corner:


3 The OSD keyboard will be displayed to assist you when entering text and numerics:



To hide the OSD keyboard

1 Tap the  icon in the top right corner.

To exit the OSD

1 Either press the Esc key or tap the  icon in the top right corner.

*To move the  icon on your touchscreen, tap and hold it until it changes color and then drag it to the best position.

Further information



This chapter contains a variety of information, including the following:

- Getting assistance - see right
- [Appendix A](#) - Configuration pages
- [Appendix B](#) - Support for analog and digital audio
- [Appendix C](#) - Tips for success when networking ALIF units
- [Appendix D](#) - Troubleshooting
- [Appendix E](#) - Glossary
- [Appendix F](#) - Open source licenses

GETTING ASSISTANCE

If you are still experiencing problems after checking the information contained within this guide, then please refer to the Support section of our website:

www.adder.com

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APPENDIX A - Configuration pages




This section covers the web page configuration for the ALIFI02T:

- [General Information](#)
- [UI Settings](#)
- [Users](#)
- [Ports](#)
- [Network](#)
- [Diagnostics and Statistics](#)
- [System](#)


General Information

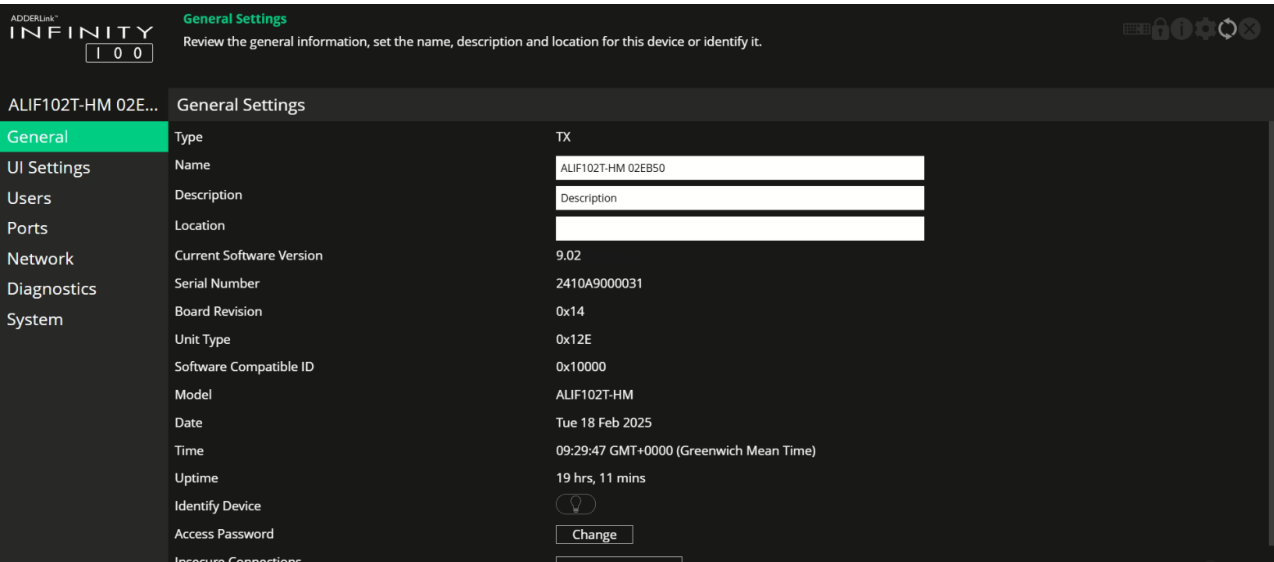
To get here

You can access this page in two ways:

- 1 On the console keyboard attached to the receiver, access the OSD by pressing **CTRL + ALT + C** or tap the touchscreen  icon. The Preset Selection page will be displayed.
- 2 Click the  icon in the top right corner.
- 3 Click the **Transmitters** option and then click the  icon for the required ALIFI02T.
- 4 If necessary, click the **General** link.

OR

- 1 Connect a computer to the same network as the ALIFI02T.
- 2 Run a web browser and enter the IP address of the ALIFI02T: **https://169.254.1.33** (this is the default address).
- 3 Click the  icon in the top right corner.
- 4 If necessary, click the **General** link.



General Information

Type - TX.

Name - Name details that you can alter to distinguish this unit from all others.

Description - Allows you to optionally add a description of the device. Useful when many units are being used.

Location - Allows you to optionally add a description of the device's location. Useful when many units are being used.

Current Software Version - Displays the version number of the currently installed and running internal software (unit can have two different software versions installed at once).

Serial Number - Displays the fixed serial number of the device.

Board Revision - Displays the revision number of the device's main circuit board.

Unit Type - Used for Adder technical support purposes, this entry shows a code depicting the type of the main circuit board.

Software Compatible ID - Used for Adder technical support purposes, this entry shows the software compatible ID of the main circuit board.

Model - Displays the model number of the device.

Date and Time - Displays the current date and time used by the device when this page was last loaded (select refresh icon to update).

Uptime - Shows the time period for which the device has currently been running since the last time this page was loaded (select refresh icon to update).

Identify Device - When clicked, this button will cause the indicators on the top panel of the device to flash to assist with identification when multiple units are installed in the same area. A popup dialog will also be displayed on screen showing all relevant identification details. Click the Cancel button to stop the identification process or click the OK button to close the popup (and then click the Identify Device button when you're ready to cancel this operation).

Access Password - Sets the password that a receiver must provide in order to connect (video, audio, etc) to the ALIFI02T.




Insecure Connections - Controls whether the TX will accept insecure connections from RX devices. Insecure connections are those from older ALIF products where the security credentials are not implemented. Initially, the TX will default to 'Auto' which allows it to decide the setting based on the type of device that first connects to it. Once a device has connected, the setting will be changed to either 'Allowed' or 'Disallowed'.




UI Settings

To get here

You can access this page in two ways:

- 1 On the console keyboard attached to the receiver, access the OSD by pressing **CTRL + ALT + C** or tap the touchscreen  icon. The Preset Selection page will be displayed.
- 2 Click the  icon in the top right corner.
- 3 Click the **Transmitters** option and then click the  icon for the required ALIFI02T.
- 4 If necessary, click the **UI Settings** link.

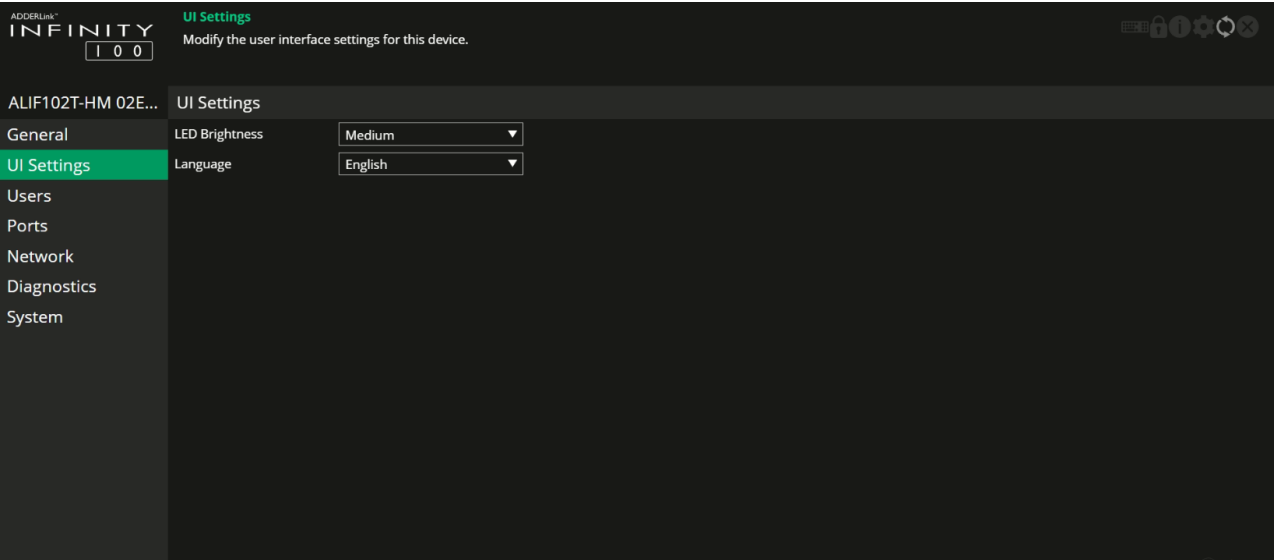
OR

- 1 Connect a computer to the same network as the ALIFI02T.
- 2 Run a web browser and enter the IP address of the ALIFI02T: **https://169.254.1.33** (this is the default address).
- 3 Click the  icon in the top right corner.
- 4 If necessary, click the **UI Settings** link.

UI Settings





LED brightness - Determines the brightness of the LED indicators.

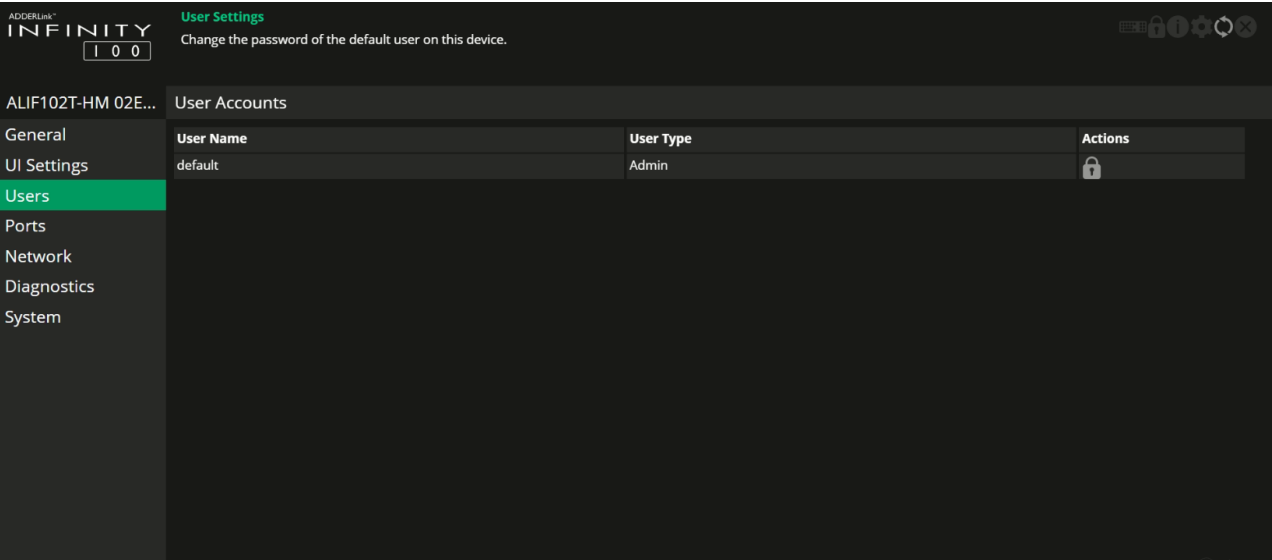
Language - Determines the language used for all text labels within the configuration pages.



Users


To get here

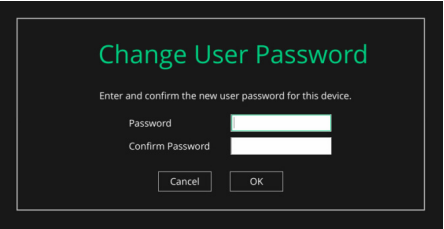
- You can access this page in two ways:
- 1 On the console keyboard attached to the receiver, access the OSD by pressing **CTRL + ALT + C** or tap the touchscreen  icon. The Preset Selection page will be displayed.
 - 2 Click the  icon in the top right corner.
 - 3 Click the **Transmitters** option and then click the  icon for the required ALIFI02T.
 - 4 If necessary, click the **Users** link.
- OR
- 1 Connect a computer to the same network as the ALIFI02T.
 - 2 Run a web browser and enter the IP address of the ALIFI02T: **https://169.254.1.33** (this is the default address).
 - 3 Click the  icon in the top right corner.
 - 4 If necessary, click the **Users** link.



User accounts

This page allows you to change the password for the admin user.

Click the  icon to display the following dialog:






Enter and confirm the current and new admin password and click OK.




Ports

To get here

You can access this page in two ways:

- 1 On the console keyboard attached to the receiver, access the OSD by pressing **CTRL + ALT + C** or tap the touchscreen  icon. The Preset Selection page will be displayed.
- 2 Click the  icon in the top right corner.
- 3 Click the **Transmitters** option and then click the  icon for the required ALIFI02T.
- 4 If necessary, click the **Ports** link.

OR

- 1 Connect a computer to the same network as the ALIFI02T.
- 2 Run a web browser and enter the IP address of the ALIFI02T: **https://169.254.1.33** (this is the default address).
- 3 Click the  icon in the top right corner.
- 4 If necessary, click the **Ports** link.



Video Port

This page provides basic information about the video port located on the ALIFI02T.

Enabled - Confirms whether the video port is enabled or disabled.

Connected - Unsupported feature - will always report 'Connected'.

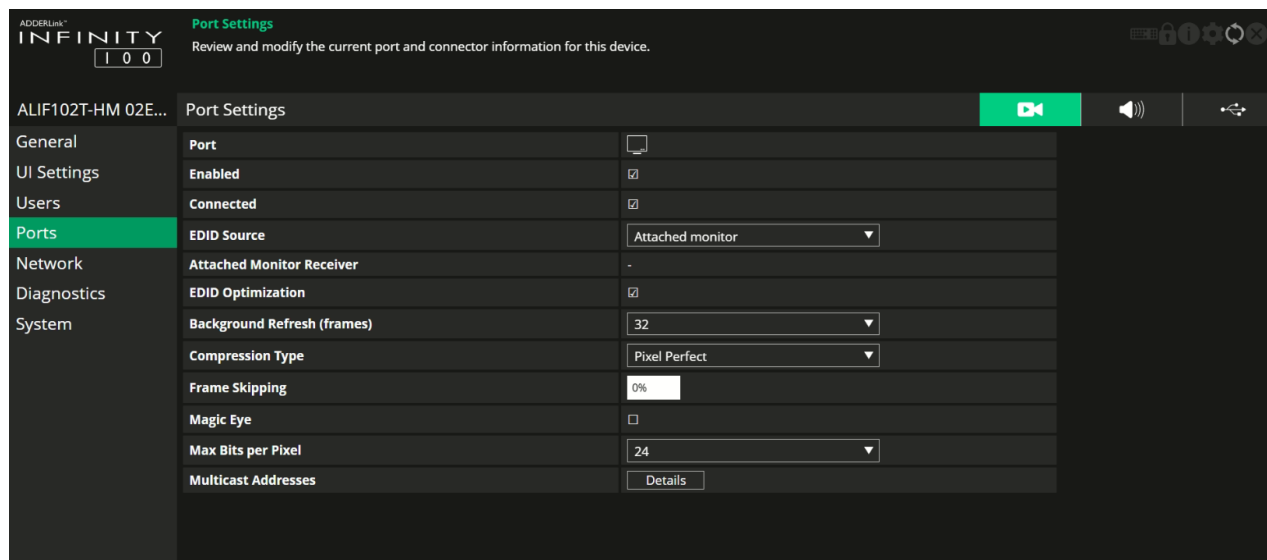
EDID Source - Lists the EDID mode currently being output on the video connector. An option called *Saved attached monitor* is available and will save that first receiver's EDID in persistent storage and use that EDID forever (including over reboot, powercycle, etc) until it is cleared (see below) or a Fixed EDID is selected instead.

To save a monitor EDID and use it for that given video and/or audio port, select the *Saved attached monitor* option. The current Attached monitor EDID will be saved in persistent storage on the ALIFI02T and used from now on by the ALIFI02T until it is cleared (see below).

To clear the saved monitor EDID, either:

- Factory reset the ALIFI02T.
- Select "Attached monitor" EDID on both the video and audio EDID Source settings for the same physical port.

For more information about how video and audio EDID data are derived, see [Support for analog and digital audio](#).



Attached Monitor Receiver - If the 'Attached monitor' option has been selected as the 'EDID Source', then this displays the name of the receiver device that supplied the EDID currently being used.

EDID Optimization - When ticked, and if the *EDID source* option is set to 'Attached monitor', upon connecting with a new receiver, the ALIFI02T will compare the preferred video mode of the new monitor with the current video output from the host PC. Only if they differ will the ALIFI02T present the new monitor's EDID to the host PC. This option speeds up switching as the host PC's graphics card does not have to go through a hotplug detect routine each time a new receiver is connected. If this setting is unticked, the ALIFI02T will always present a new EDID to the host PC.

Background Refresh (frames) - The system will send all changing video as soon as it changes. In addition, it is possible to send unchanging video in the background, to overcome problems of lost network traffic. This control will configure how often a whole frame of video will be sent alongside changing video. In situations of frequently changing video, or high reliability networks, this value can be set to a higher number, or even set to disabled.

Compression Type - Allows you to select the compression method to best suit the nature of the video sources. Settings are: Pixel Perfect, Adaptive, Smoothest Video or Advanced (which allows you to set the maximum and minimum compression levels).

Frame Skipping - Frame Skipping involves 'missing out' video frames between those captured by the ALIFI02T. For video sources that update only infrequently or for those that update very frequently but where high fidelity is not required, frame skipping is a good strategy for reducing the overall bandwidth consumed by the system. Range: 0 to 100%.

Magic Eye - When ticked, this feature increases performance and reduces network traffic if ALIF units are used with host computers that have dithered video output. It also improves performance if the video source is noisy.

Max Bits per Pixel - These settings are fixed at 24bpp (ie, 8bpc) for this model.

Multicast Addresses - This section lists all video multicast IP addresses that have been configured. Setting the field to a blank (empty string) value will cause the system to automatically generate a default multicast address.

Ports (continued)



Audio Port

This page provides basic information about the audio port located on the ALIFI02T.

Enabled - Confirms whether the audio ports (USB and video) are enabled or disabled.

Connected - Unsupported feature - will always report 'Connected'.

EDID Source - Determines which audio EDID should be used:

Attached monitor - use the audio capabilities reported by the monitor.

Saved attached monitor - save the audio capabilities reported by the attached monitor EDID in persistent storage on the ALIFI02T and use them until they are cleared (see below).

None - remove audio support from the EDID presented by the ALIFI02T to the connected PC.

2-Channel - apply a generic stereo audio EDID.

To clear the saved monitor EDID, either:

- Factory reset the ALIFI02T.
- Select "Attached monitor" EDID on both the video and audio EDID Source settings for the same physical DP port.

Attached Monitor Receiver - If the *EDID source* option is set to 'Attached monitor', then this displays the name of the receiver that supplied the EDID currently being used.

EDID Optimization - When ticked, and if the *EDID source* option is set to 'Attached monitor'; upon connecting with a new receiver, the ALIFI02T will compare the preferred audio mode of the new monitor with the current audio output from the host PC. Only if they differ will the ALIFI02T present the new monitor's EDID to the host PC. This option speeds up switching as the host PC's graphics card does not have to go through a hotplug detect routine each time a new receiver is connected. If this setting is unticked, the ALIFI02T will always present a new EDID to the host PC.

Multicast Addresses - This section lists all audio multicast IP addresses that have been configured. Setting the field to a blank (empty string) value will cause the system to automatically generate a default multicast address.

For more information about how video and audio EDID data are derived, see [Support for analog and digital audio](#).



USB Ports

This page provides basic information about the USB ports located on the ALIFI02T.

Type - Identifies the type of the USB port.

Enabled - Confirms whether the USB ports are enabled or disabled.

Connected - Confirms whether a USB host is connected to the black USB cable of the ALIFI02T. *Note: The red USB cable is only for power.*

Rate Limit - Reserved.

Reserved Ports - Allows USB ports to be optionally reserved for use with particular devices.




Present Boot Keyboard - When ticked, the ALIFI02T will report a virtual dummy boot keyboard to the attached PC to ensure that a keyboard is always reported when the PC boots up. The dummy boot keyboard uses one of the 13 USB endpoints, therefore if all 13 endpoints are required elsewhere for USB devices (or a KVM switch only supports two HID devices) then it can be disabled by deselecting this option.

Max Hub Size - Using this option you can select whether the ALIFI02T should report itself as a 13 or a 7 port USB hub. Some USB hosts are only able to support 7 port USB hubs. If this option is set to 7, then only 7 USB devices are supported by the PC.


Security - Controls whether USB data is encrypted. *On* forces always on, *Off* forces always off and *Prefer off* will be off unless the receiver requests it.

To get here

You can access this page in two ways:

- 1 On the console keyboard attached to the receiver, access the OSD by pressing **CTRL + ALT + C** or tap the touchscreen  icon. The Preset Selection page will be displayed.
- 2 Click the  icon in the top right corner.
- 3 Click the **Transmitters** option and then click the  icon for the required ALIFI02T.
- 4 If necessary, click the **Network** link.

OR

- 1 Connect a computer to the same network as the ALIFI02T.
- 2 Run a web browser and enter the IP address of the ALIFI02T: **https://169.254.1.33** (this is the default address).
- 3 Click the  icon in the top right corner.
- 4 If necessary, click the **Network** link.



Port Settings

This page provides numerous network details for each of the installed ports on the ALIFI02T.

Socket - Details the operational network socket.

MAC Address - Displays the unique, fixed hardware identification number for each port.

Link Up - Indicates whether the link state of this network interface is up. This should be the case if the device is connected to a functioning network.

IP Address - This shows the IP address in use, which can be obtained via DHCP, a static IP or a link local (zero-config).

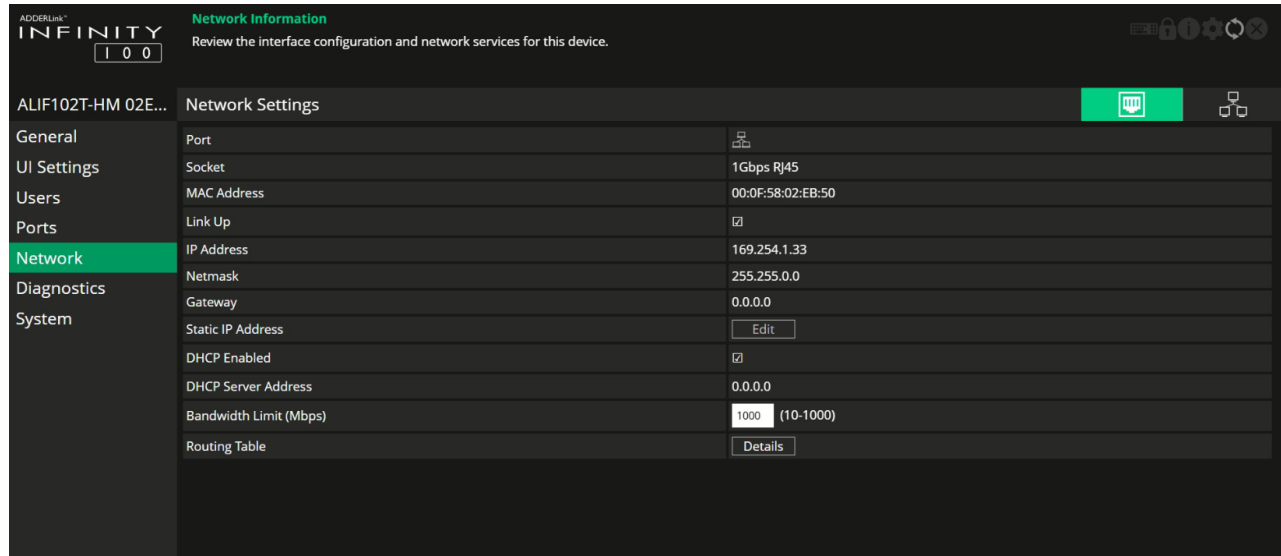
Netmask - The netmask of this network interface. The device can function in a network zero-config state which does not require the setting of a static netmask.

Gateway - The gateway address of this network interface. The device can function in a network zero-config state which does not require the setting of a static gateway.

Static IP Address - When the 'DHCP enabled' option (below) is unchecked, click on 'Edit' to enter/edit a static IP Address, Netmask and Gateway for the unit.

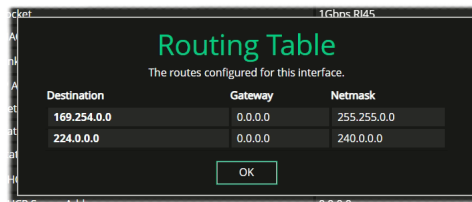
DHCP Enabled - When ticked, the corresponding port will derive its IP Address, Netmask and Gateway details from the DHCP server listed in the field below.

DHCP Server Address - Indicates the server that provided the DHCP details.



Bandwidth Limit - This option can be used to set an upper limit (between 10 and 1000 Mbps aka 1Gbps) to the amount of the network bandwidth used on the physical interface. This could be useful if multiple devices share a common network link upstream; without a limit, the link could become overloaded and drop data.

Routing Table - Click on 'Details' to show the routing table entries corresponding to this network interface. In it are the destination address, gateway and netmask for the routes to particular network destinations:



Destination	Gateway	Netmask
169.254.0.0	0.0.0.0	255.255.0.0
224.0.0.0	0.0.0.0	240.0.0.0



Network Settings

Default Domain - Reserved for future use.

Route of Last Resort - In a multi-interface device such as this, the interface which is ticked will be used as the default whenever it is unclear which interface should be used for network traffic.

Dynamic DNS Servers - List of DNS server addresses obtained via DHCP.

Static DNS Servers - Lists DNS server addresses that have been manually configured.

NTP Enabled - When ticked, the unit will derive its time and date information from a suitable NTP server.

NTP Key ID - The ID of the key used for secure NTP.

NTP Key Value - The value of the key used for secure NTP as a hexadecimal string.

Dynamic NTP Servers - Lists NTP server addresses obtained via DHCP.

Static NTP Servers - Lists NTP server addresses that have been manually configured.

AIM Enabled - Indicates whether server management is enabled for this device.




Dynamic AIM Servers - Lists AIM server addresses obtained via DHCP.

Static AIM Servers - Lists management server addresses that have been manually configured.


Diagnostics and Statistics

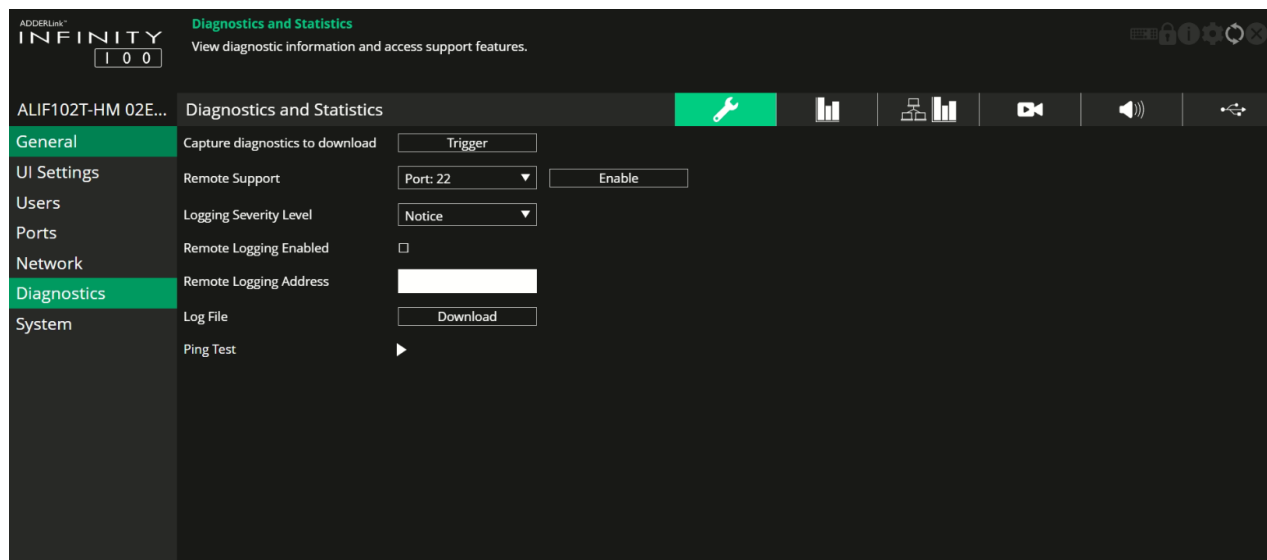
To get here

You can access this page in two ways:

- 1 On the console keyboard attached to the receiver, access the OSD by pressing **CTRL + ALT + C** or tap the touchscreen  icon. The Preset Selection page will be displayed.
- 2 Click the  icon in the top right corner.
- 3 Click the **Transmitters** option and then click the  icon for the required ALIFI 02T.
- 4 If necessary, click the **Diagnostics** link.

OR

- 1 Connect a computer to the same network as the ALIFI 02T.
- 2 Run a web browser and enter the IP address of the ALIFI 02T: **https://169.254.1.33** (this is the default address).
- 3 Click the  icon in the top right corner.
- 4 If necessary, click the **Diagnostics** link.



Log Settings

This page provides numerous key diagnostic log settings.

Capture diagnostics to download - (Only shown when viewing this page using a PC browser). Request generation of a diagnostics dump file. This will then be downloaded by the host computer's browser; this is an encrypted diagnostics file which can be used by technical support to diagnose and fix an issue.

Remote Support - When using the Adder remote server, this option determines which port will be used. Multiple options are offered in case one or more ports are blocked by your firewall. When the Enable button is clicked, it will indicate the password to be used.

Logging Severity Level - Defines the level of messages that will be logged (according to RFC5424). Choosing levels 6 (*Informational*) or 7 (*Debug*) will cause larger numbers of lesser events to also be logged, with a potential impact to overall performance. These levels should only be used if working with the support team to diagnose a specific issue.

Remote Logging Enabled - Tick to send log files to the chosen Remote Logging Address.

Remote Logging Address - Enter a valid IP address for a syslog server on the local network where status logs can be sent.

Log File - If viewing this page using a browser: Click to download the log file to the host computer's browser. If viewing this page via the OSD, the log will be shown as a scrollable list.

Ping Test - Provides a quick and easy way to check the link status to an receiver. You can specify either an IP address or choose the device from a list. Click the Start button to begin; a summary of the results will be displayed.



Basic Graph

This page shows a real time graph with the following entries:



- **Received and transmitted bit rates** - the values of these correspond to the bandwidth axis on the left.
- **Frame rate** - values are labeled when they change and correspond to the axis on the right.
- **Codec** - these represent the compression used: 1 is better than 4.



Network Statistics

This page allows you to view current communication statistics and also to create graphs in real time.

Capture and Graph Statistics - When ticked, the page will create a real time graph plotting Received Bytes alongside Received Packets.

After *Capture and Graph Statistics* is enabled, the *Show Legend* checkbox will show all other items that can be included on the plot. Click an item to tick and include it.



Video Port Status and Statistics

This page provides wide ranging information for support purposes.



Audio Port Status and Statistics

This page provides wide ranging information for support purposes.






USB Port Status and Statistics


This page provides wide ranging information for support purposes.

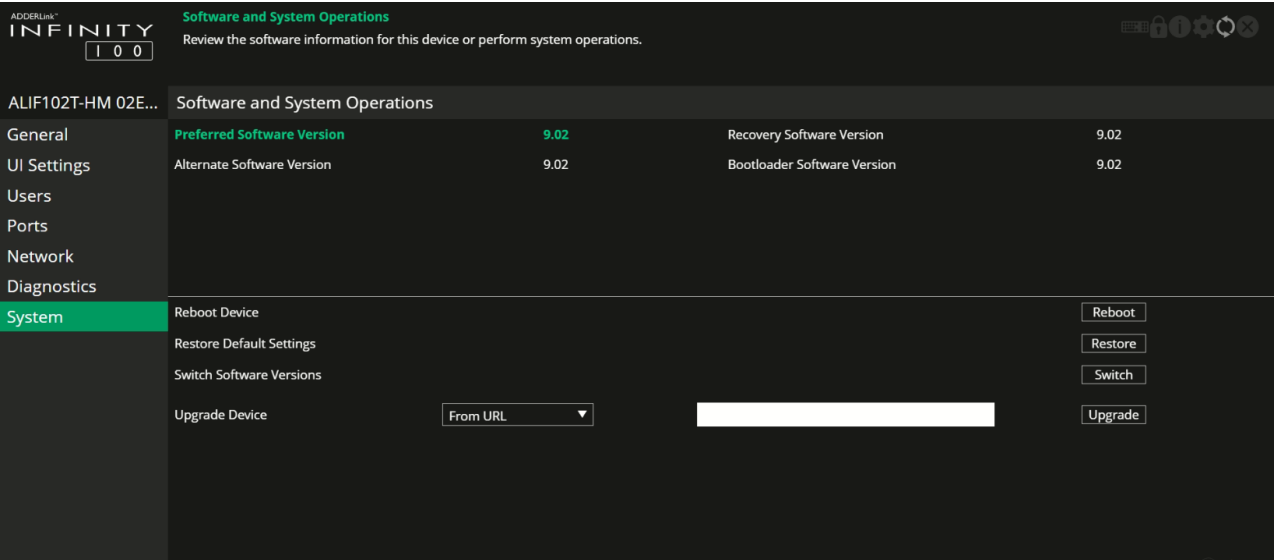
To get here

You can access this page in two ways:

- 1 On the console keyboard attached to the receiver, access the OSD by pressing **CTRL + ALT + C** or tap the touchscreen  icon. The Preset Selection page will be displayed.
- 2 Click the  icon in the top right corner.
- 3 Click the **Transmitters** option and then click the  icon for the required ALIFI02T.
- 4 If necessary, click the **System** link.

OR

- 1 Connect a computer to the same network as the ALIFI02T.
- 2 Run a web browser and enter the IP address of the ALIFI02T: **https://169.254.1.33** (this is the default address).
- 3 Click the  icon in the top right corner.
- 4 If necessary, click the **System** link.



Software and System Operations

This page contains various indications and options related to the internal software of the unit.

Note: The highlighted (and colored) entry is the version of software currently running.

Preferred Software Version - The software version the device will boot into upon a reboot.

Recovery Software Version - The software version the device will boot into if placed into recovery mode.

Alternate Software Version - The other (backup) version of software the device has available.

Reboot Device - Click the Reboot button to Reboot the device.

Restore Default Settings - Click the Restore button to restore the device to factory default settings.

Switch Software Versions - Click to switch to the listed 'Alternative Software Version'.

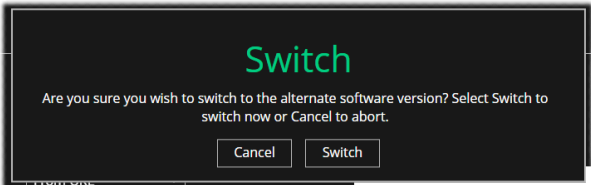
Upgrade Device - Allows you to upgrade the firmware either from a trusted URL or from a locally stored file. Use the field to define the source and then click the Upgrade button.

Switching to an alternate software version

If required you can instruct the ALIFI02T to use a previous (backup) version of its operating software (firmware).

To switch to an alternate software version

- 1 Within the OSD or using a web browser, access the System page for the ALIFI02T (as detailed above left).
- 2 Click the Switch button in the lower right corner of the page to display the following popup:



- 3 Click the Switch button to confirm.
- 4 After a short delay, reboot the ALIFI02T to utilize the alternate software.

APPENDIX B - Support for USB and digital audio

ALIF units benefit from dual digital audio signal streams:

- **Uni-directional digital audio** - via the video connection,
- **Bi-directional digital audio** - via the USB connection (converted to/from analog).

Even though the digital outputs from a particular host PC might be carrying signals that originated from the same audio source, they can never be mixed.

For digital audio derived from the video connection, the host PC needs to know details of the required signal to send out, eg 16-bit, 32, 44.1 or 48kHz sample rate, etc, so a valid definition of the requirement must be sent to the host PC. This is done as an audio sub-set of the EDID definition that is used to declare the video display capabilities/requirements.

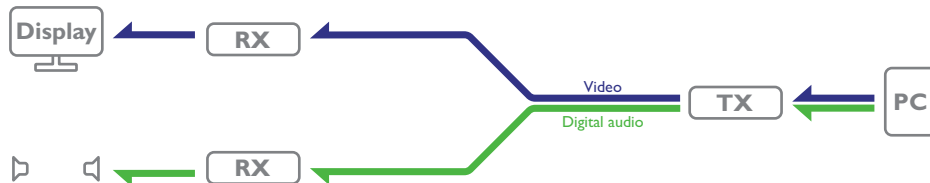
In the diagram below the display and speaker installation send their video and digital audio portions of the EDID (*Extended Display Identification Data*) definition via the receiver and ALIF102T to the host PC:



In response, the host PC begins sending video and audio signals that are appropriate for the receiving peripherals:

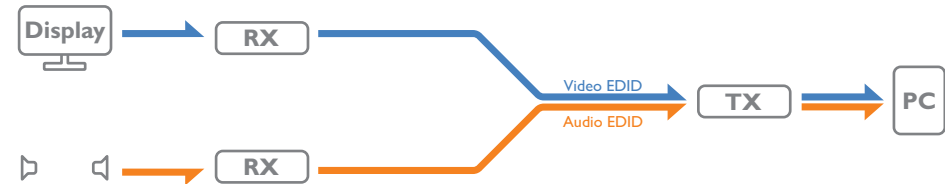


In the above case, the video and digital audio from the host PC are both sent to the same receiver. However, the flexibility of the ALIF system is such that peripherals and hosts can be mixed as required. For instance, the video feed could be sent to one receiver, while the digital audio is used by a set of speakers on a different receiver:



Note: ALIF102T units support only two channel stereo audio and the transmitters will not encode digital audio from a PC with more than 2 channels.

This presents an issue for the host PC and its ALIF102T as they must now respond to separate EDID definitions from the video display on one receiver (which will probably also have its own EDID audio sub-set) and the EDID definition from the digital audio device on the other receiver:



To solve potential conflicts, the ALIF102T uses a set of rules to determine how it mixes different EDID definitions. Firstly, for any connected video or digital audio devices, the ALIF system can consider each one using any of three selectable states:

- **Attached** - ALIF will interrogate the attached video/audio device to ascertain its exact capabilities/requirements.
- **Fixed** - ALIF will use a fixed definition (e.g 1920x1080p60 and 2-channel audio) to represent the video/audio device(s).
- **None** - No representation will be made for the device.

The above states are then combined by the ALIF102T, as connections are made to the different devices, using the following rules:

Video EDID	Audio EDID	Action (taken by the ALIF102T as it feeds info to the PC)
Fixed	Fixed	Merge the video and audio EDID definitions.
Fixed/Attached	None	Send video EDID definition only.
Attached	Attached	Use whichever EDID definition is available first.
Attached/Fixed	Fixed/Attached	Wait for the <i>Attached</i> device to declare and then use its data to modify those of the <i>Fixed</i> device. <i>Note: The video EDID retains precedence for setting general items, such as serial no., manufacturer, etc.</i>

Note: The analog audio is switched entirely separately to the digital audio feed.

Digital audio specifications

- **Digital audio** (DisplayPort™ or HDMI®):
 - Up to 2 audio channels,
 - Three choices of sampling frequencies: 32, 44.1 or 48kHz,
 - Linear Pulse Code Modulation: 16bit.

APPENDIX C - Tips for success when networking ALIF units

ALIF units use multiple strategies to minimize the amount of data that they send across networks. However, data overheads can be quite high, particularly when very high resolution video is being transferred, so it is important to take steps to maximize network efficiency and help minimize data output. The tips given in this section have been proven to produce very beneficial results.

Summary of steps

- Choose the right kind of switch.
- Create an efficient network layout.
- Configure the switches and devices correctly.

Choosing the right switch

[Layer 2](#) switches are what bind all of the hosts together in the subnet. However, they are all not created equally, so choose carefully. In particular look for the following:

- 1 Gigabit ports,
- Support for [IGMP v2](#) (or v3) snooping,
- Support for [Jumbo frames](#) up to 9216-byte size,
- High bandwidth connections between switches, preferably Fiber Channel.
- Look for switches that perform their most onerous tasks (e.g. [IGMP snooping](#)) using multiple dedicated processors (ASICs).
- Ensure the maximum number of concurrent 'snoopable groups' the switch can handle meets or exceeds the number of ALIF transmitters that will be used to create multicast groups.
- Check the throughput of the switch: Full duplex, 1 Gbps up- and down- stream speeds per port.
- Use the same switch make and model throughout a single subnet.
- You also need a [Layer 3](#) switch. Ensure that it can operate efficiently as an [IGMP Querier](#).

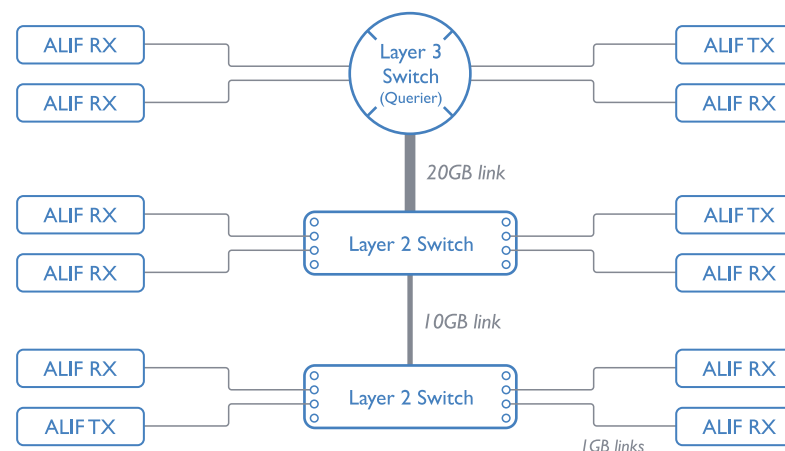
Creating an efficient network layout

Network layout is vital. The use of [IGMP snooping](#) also introduces certain constraints, so take heed:

- Keep it flat. Use a basic line-cascade structure rather than a pyramid or tree arrangement.
- Keep the distances between the switches as short as possible.
- Ensure sufficient bandwidth between switches to eliminate bottlenecks.
- Where the AIM server is used to administer multiple ALIF transceivers, ensure the AIM server and all ALIF units reside in the same subnet.
- Do not use VGA to DisplayPort™ converters, instead replace VGA video cards in older systems with suitable DisplayPort™ replacements. Converters cause ALIF TX units to massively increase data output.
- Wherever possible, create a private network.

The recommended layout

The layout shown below has been found to provide the most efficient network layout for rapid throughput when using IGMP snooping:



- Use no more than two cascade levels.
- Ensure high bandwidth between the two L2 switches and very high bandwidth between the top L2 and the L3. Typically 10GB and 20GB, respectively for 48 port L2 switches.

continued

Configuring the switches and devices

The layout is vital but so too is the configuration:

- Enable [IGMP Snooping](#) on all L2 switches.
- Ensure that [IGMP Fast-Leave](#) is enabled on all switches with ALIF units connected directly to them.
- Enable the L3 switch as an [IGMP Querier](#).
- Enable [Spanning Tree Protocol \(STP\)](#) on all switches and importantly also enable portfast (only) on all switch ports that have ALIF units connected.
- If any hosts will use any video resolutions using 2048 horizontal pixels (e.g. 2048 x 1152, 2048 x 2048), ensure that [Jumbo Frames](#) are enabled on all switches.
- Choose an appropriate forwarding mode on all switches. Use [Cut-through](#) if available, otherwise [Store and forward](#).
- Optimize the settings on the ALIF transmitters:
 - If moving video images are being shown frequently, then leave Frame Skipping at a low percentage and instead reduce the Peak bandwidth limiter.
 - Where screens are quite static, try increasing the Background Refresh interval and/or increasing the Frame skipping percentage setting.

Make changes to the ALIF transmitters one at a time, in small steps, and view typical video images so that you can attribute positive or negative results to the appropriate control.
- Ensure that all ALIF units are fully updated to the latest firmware version.

APPENDIX D - Troubleshooting

Problem: The video image of the ALIF receiver shows horizontal lines across the screen.

This issue is known as *Blinding* because the resulting video image looks as though you're viewing it through a venetian blind.

When video is transmitted by ALIF units, the various lines of each screen are divided up and transmitted as separate data packets. If the reception of those packets is disturbed, then blinding is caused. The lines are displayed in place of the missing video data packets.

There are several possible causes for the loss of data packets:

- Incorrect switch configuration. The problem could be caused by multicast flooding, which causes unnecessary network traffic. This is what IGMP snooping is designed to combat, however, there can be numerous causes of the flooding.
- Speed/memory bandwidth issues within one or more switches. The speed and capabilities of different switch models varies greatly. If a switch cannot maintain pace with the quantity of data being sent through it, then it will inevitably start dropping packets.
- One or more ALIF units may be outputting Jumbo frames due to the video resolution (2048 horizontal pixels) being used. If Jumbo frames are output by an ALIF unit, but the network switches have not been configured to use jumbo frames, the switches will attempt to break the large packets down into standard packets. This process introduces a certain latency and could be a cause for dropped packets.

Remedies:

- Ensure that [IGMP snooping](#) is enabled on all switches within the subnet.
- Where each ALIF unit is connected as the sole device on a port connection to a switch, enable [IGMP Fast-Leave \(aka Immediate Leave\)](#) to reduce unnecessary processing on each switch.
- Check the video resolution(s) being fed into the ALIF transmitters. If resolutions using 2048 horizontal pixels are unavoidable then ensure that [Jumbo frames](#) are enabled on all switches.
- Check the [forwarding mode](#) on the switches. If *Store and forward* is being used, try selecting *Cut-through* as this mode causes reduced latency on lesser switch designs.
- Ensure that one device within the subnet is correctly configured as an [IGMP Querier](#), usually a layer 3 switch or multicast router.
- Try adjusting the transmitter settings on each ALIF to make the output data stream as efficient as possible. See [ALIF transmitter video settings](#) for details.

continued

Problem:The audio output of the ALIF receiver sounds like a scratched record.

This issue is called Audio crackle and is a symptom of the same problem that produces blinding (see previous page).The issue is related to missing data packets.

Remedies:

As per blinding discussed previously.

Problem:AIM cannot locate working ALIF units.

There are a few possible causes:

- This could be caused by Layer 2 Cisco switches that have [Spanning Tree Protocol \(STP\)](#) enabled but do not also have *portfast* enabled on the ports to which ALIF units are connected. Without portfast enabled,ALIF units will all be assigned the same zero config IP address at reboot and AIM will only acquire them one at a time on a random basis.

You can easily tell whether portfast is enabled on a switch that is running STP: When you plug the link cable from a working ALIF unit into the switch port, check how long it takes for the port indicator to change from orange to green. If it takes roughly one second, portfast is on; if it takes roughly thirty seconds then portfast is disabled.

Remedies:

- Ensure that the ALIF units and the AIM server are located within the same subnet because AIM cannot cross subnet boundaries.
- [Manually reset](#) the ALIF units to their zero config IP addresses.
- Enable portfast on all switch ports that have ALIF units attached to them or try temporarily disabling STP on the switches while AIM is attempting to locate ALIF units.

APPENDIX E - Glossary

Internet Group Management Protocol

Where an ALIF transmitter is required to stream video to two or more receivers, multicasting is the method used.

Multicasting involves the delivery of identical data to multiple receivers simultaneously without the need to maintain individual links. When multicast data packets enter a subnet, the natural reaction of the switches that bind all the hosts together within the subnet, is to spread the multicast data to all of their ports. This is referred to as Multicast flooding and means that the hosts (or at least their network interfaces) are required to process plenty of data that they didn't request. IGMP offers a partial solution.

The Internet Group Management Protocol (IGMP) is designed to prevent multicast flooding by allowing [Layer 3](#) switches to check whether host computers within their care are interested in receiving particular multicast transmissions. They can then direct multicast data only to those points that require it and can shut off a multicast stream if the subnet has no recipients.

There are currently three IGMP versions: 1, 2 and 3, with each version building upon the capabilities of the previous one:

- IGMPv1 allows host computers to opt into a multicast transmission using a Join Group message; it is then incumbent on the router to discover when they no longer wish to receive; this is achieved by polling them (see IGMP Querier below) until they no longer respond.
- IGMPv2 includes the means for hosts to opt out as well as in, using a Leave Group message.
- IGMPv3 encompasses the abilities of versions 1 and 2 but also adds the ability for hosts to specify particular sources of multicast data.

ADDERLink™ INFINITY units make use of IGMPv2 when performing multicasts to ensure that no unnecessary congestion is caused.

IGMP Snooping

The IGMP messages are effective but only operate at [layer 2](#) - intended for routers to determine whether multicast data should enter a subnet. A relatively recent development has taken place within the switches that glue together all of the hosts within each subnet: IGMP Snooping. IGMP snooping means these layer 2 devices now have the ability to take a peek at the IGMP messages. As a result, the switches can then determine exactly which of their own hosts have requested to receive a multicast – and only pass on multicast data to those hosts.

IGMP Querier

When IGMP is used, each subnet requires one [Layer 3](#) switch to act as a Querier. In this lead role, the switch periodically sends out IGMP Query messages and in response all hosts report which multicast streams they wish to receive. The Querier device and all snooping Layer 2 switches then update their lists accordingly (the lists are also updated when Join Group and Leave Group (IGMPv2) messages are received).

IGMP Fast-Leave (aka Immediate Leave)

When a device/host no longer wishes to receive a multicast transmission, it can issue an IGMP Leave Group message as mentioned above. This causes the switch to issue an IGMP Group-Specific Query message on the port (that the Leave Group was received on) to check no other receivers exist on that connection that wish to remain a part of the multicast. This process has a cost in terms of switch processor activity and time.

Where ALIF units are connected directly to the switch (with no other devices on the same port) then enabling IGMP Fast-Leave mode means that switches can immediately remove receivers without going through a full checking procedure. Where multiple units are regularly joining and leaving multicasts, this can speed up performance considerably.

Jumbo frames (Jumbo packets)

Since its commercial introduction in 1980, the Ethernet standard has been successfully extended and adapted to keep pace with the ever improving capabilities of computer systems. The achievable data rates, for instance, have risen in ten-fold leaps from the original 10Mbit/s to a current maximum of 100Gbit/s.

While data speeds have increased massively, the standard defining the number of bytes (known as the Payload) placed into each data packet has remained resolutely stuck at its original level of 1500 bytes. This standard was set during the original speed era (10Mbit/s) and offered the best compromise at that speed between the time taken to process each packet and the time required to resend faulty packets due to transmission errors.

But now networks are much faster and files/data streams are much larger; so time for a change? Unfortunately, a wholesale change to the packet size is not straightforward as it is a fundamental standard and changing it would mean a loss of backward compatibility with older systems.

Larger payload options have been around for a while, however, they have often been vendor specific and at present they remain outside the official standard. There is, however, increased consensus on an optional 'Jumbo' payload size of 9000 bytes and this is fully supported by the ADDERLink™ INFINITY (ALIF) units.

Jumbo frames (or Jumbo packets) offer advantages for ALIF units when transmitting certain high resolution video signals across a network. This is because the increased data in each packet reduces the number of packets that need to be transferred and dealt with - thus reducing latency times.

The main problem is that for jumbo frames to be possible on a network, all of the devices on the network must support them.

Spanning Tree Protocol (STP)

In order to build a robust network, it is necessary to include certain levels of redundancy within the interconnections between switches. This will help to ensure that a failure of one link does not lead to a complete failure of the whole network.

The danger of multiple links is that data packets, especially multicast packets, become involved in continual loops as neighbouring switches use the duplicated links to send and resend them to each other.

To prevent such bridging loops from occurring, the Spanning Tree Protocol (STP), operating at [layer 2](#), is used within each switch. STP encourages all switches to communicate and learn about each other. It prevents bridging loops by blocking newly discovered links until it can discover the nature of the link: is it a new host or a new switch?

The problem with this is that the discovery process can take up to 50 seconds before the block is lifted, causing problematic timeouts.

The answer to this issue is to enable the portfast variable for all host links on a switch. This will cause any new connection to go immediately into forwarding mode. However, take particular care not to enable portfast on any switch to switch connections as this will result in bridging loops.

Forwarding modes

In essence, the job of a layer 2 switch is to transfer as fast as possible, data packets arriving at one port out to another port as determined by the destination address. This is known as data forwarding and most switches offer a choice of methods to achieve this. Choosing the most appropriate forwarding method can often have a sizeable impact on the overall speed of switching:

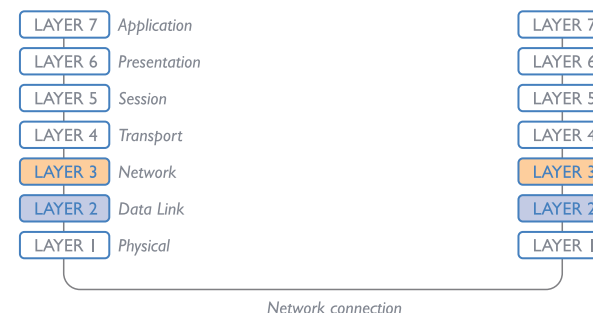
- **Store and forward** is the original method and requires the switch to save each entire data packet to buffer memory, run an error check and then forward if no error is found (or otherwise discard it).
- **Cut-through** was developed to address the latency issues suffered by some store and forward switches. The switch begins interpreting each data packet as it arrives. Once the initial addressing information has been read, the switch immediately begins forwarding the data packet while the remainder is still arriving. Once all of the packet has been received, an error check is performed and, if necessary, the packet is tagged as being in error. This checking 'on-the-fly' means that cut-through switches cannot discard faulty packets themselves. However, on receipt of the marked packet, a host will carry out the discard process.
- **Fragment-free** is a hybrid of the above two methods. It waits until the first 64 bits have been received before beginning to forward each data packet. This way the switch is more likely to locate and discard faulty packets that are fragmented due to collisions with other data packets.
- **Adaptive** switches automatically choose between the above methods. Usually they start out as a cut-through switches and change to store and forward or fragment-free methods if large number of errors or collisions are detected.

So which one to choose? The *Cut-through* method has the least latency so is usually the best to use with ADDERLink™ INFINITY units. However, if the network components and/or cabling generate a lot of errors, the *Store and forward* method should probably be used. On higher end store and forward switches, latency is rarely an issue.

Layer 2 and Layer 3: The OSI model

When discussing network switches, the terms Layer 2 and Layer 3 are very often used. These refer to parts of the Open System Interconnection (OSI) model, a standardized way to categorize the necessary functions of any standard network.

There are seven layers in the OSI model and these define the steps needed to get the data created by you (imagine that you are Layer 8) reliably down onto the transmission medium (the cable, optical fiber, radio wave, etc.) that carries the data to another user; to complete the picture, consider the transmission medium is Layer 0. In general, think of the functions carried out by the layers at the top as being complex, becoming less complex as you go lower down.



As your data travel down from you towards the transmission medium (the cable), they are successively encapsulated at each layer within a new wrapper (along with a few instructions), ready for transport. Once transmission has been made to the intended destination, the reverse occurs: Each wrapper is stripped away and the instructions examined until finally only the original data are left.

So why are Layer 2 and Layer 3 of particular importance when discussing ADDERLink™ INFINITY? Because the successful transmission of data relies upon fast and reliable passage through network switches – and most of these operate at either Layer 2 or Layer 3.

The job of any network switch is to receive each incoming network packet, strip away only the first few wrappers to discover the intended destination then rewrap the packet and send it in the correct direction.

In simplified terms, the wrapper that is added at Layer 2 (by the sending system) includes the physical address of the intended recipient system, i.e. the unique MAC address (for example, 09:f8:33:d7:66:12) that is assigned to every networking device at manufacture. Deciphering recipients at this level is more straightforward than at Layer 3, where the address of the recipient is represented by a logical IP address (e.g. 192.168.0.10) and requires greater knowledge of the surrounding network structure. Due to their more complex circuitry, Layer 3 switches are more expensive than Layer 2 switches of a similar build quality and are used more sparingly within installations.

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- [4] Viraj Bais <vbais@mailman1.intel.com> and [5] Clayton Kirkwood <kirkwood@striderfm.intel.com> port to Windows NT 3.5
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- [56] Jeff Steinman <jss@pebbles.jpl.nasa.gov> Datum PTS clock driver
- [57] Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
- [58] Kenneth Stone <ken@sdd.hp.com> HP-UX port
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- [63] Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic TrueTime clock driver
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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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That's all there is to it!

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- Modules: libunistring gmp nettle
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- Modules: dhcp libjvt
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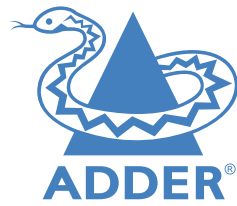
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