AdderLink Infinity { ALIF1000 ALIF2000

User Guide

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Introduction

Thank you for choosing AdderLink Infinity, otherwise known as ALIF. ALIF represents a major advance in the capabilities of digital extenders and switches. By encoding high quality DVI video, digital audio and USB connections into Internet Protocol (IP) messages, ALIF offers highly advanced and flexible signal switching capabilities.

Adder's extensive knowledge of interfacing techniques and high speed networking has allowed us to develop new ways to break the chains of local DVI, USB and audio connections. With ALIF, distance is finally no barrier to high specification, high performance computing. Furthermore, since all signals are now IP, the most elaborate and yet simple-to-use switching and multicast techniques make possible a great variety of uses.

There are two main models within the ALIF family:

- ALIF1000 supports one single link DVI video stream, plus microphone, speakers and up to four USB peripherals. ALIF1000 units are linked using Gigabit Ethernet.
- ALIF2000 supports either two single link DVI video streams or one dual link (very high resolution) DVI video stream. This is in addition to microphone, speakers and up to four USB peripherals. ALIF2000 units can be linked using Gigabit Ethernet or Fibre Optic Links.

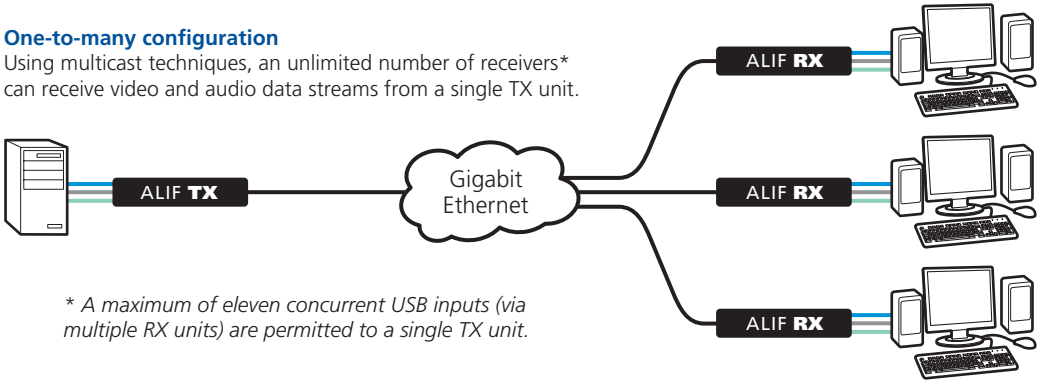
In both model types, there is a TX transmitter and an RX receiver. The former attaches to a single computer; the latter to your DVI video monitor, microphone, speakers and up to four USB peripherals. The distance between them is limited only by the size of your network.

In addition to separating one computer and its peripherals, ALIF promotes sharing. You can arrange for a limitless number of screens and speakers, distributed anywhere across the network, to receive video and audio. You can also switch between any number of transmitter units from a single screen, keyboard and mouse in order to monitor a potentially vast collection of remote systems.

All units feature browser-based configuration utilities to allow quick and easy set up, from near or far.

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 Gigabit (or Fibre) Ethernet 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 eleven concurrent USB inputs (via multiple RX units) are permitted to a single TX unit.*

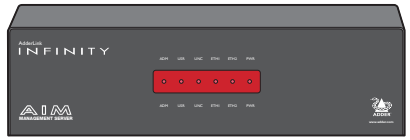
Mixing ALIF1000 and ALIF2000 units

It is possible to mix ALIF1000 and ALIF2000 transmitters and receivers on a network, with the proviso that ALIF1000 units do not support dual link DVI video signals or fibre optic links.

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.

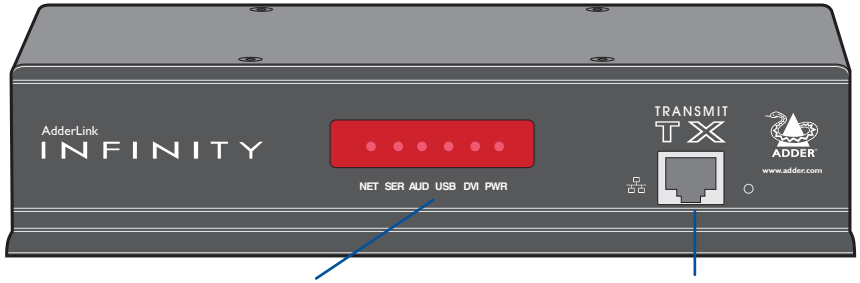


Please also see Appendix A - Tips for success when networking ALIF units

AdderLink ALIF1000T and ALIF1000R unit features

The ALIF1000 units are housed within durable, metallic enclosures with most connectors situated at the rear panel - the Ethernet ports are situated on the front panels. The smart front faces also feature the operation indicators.

ALIF1000T (transmitter) - front



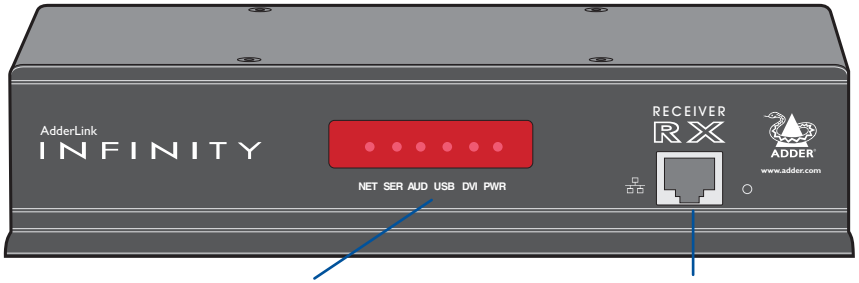
Indicators

Gigabit Ethernet port

These six indicators clearly show the key aspects of operation:

- **NET** On when valid network link is present.
  Flashes when the unit is in error.
- **SER** On when the AUX (serial) port is enabled and active.
- **AUD** On when audio is enabled and active.
- **USB** On when USB is enabled and active.
- **DVI** On when DVI video is enabled.
- **PWR** Power indicator.

ALIF1000R (receiver) - front



Indicators

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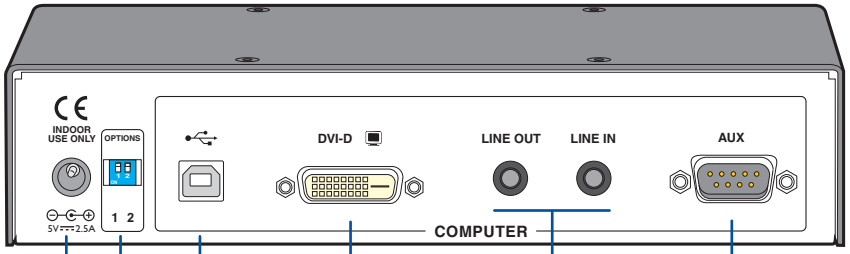
ALIF1000T (transmitter) - rear



Power input

Configuration switches

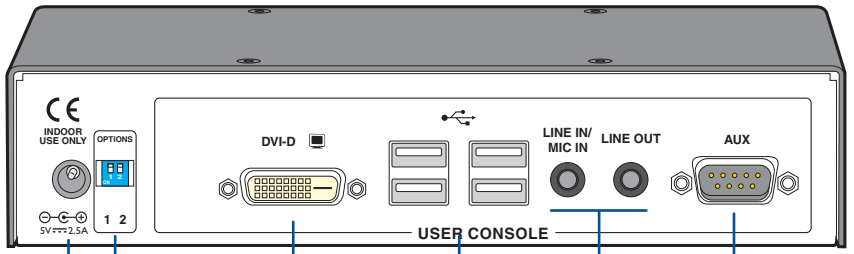
USB port

Video input

Audio line in/out

AUX (serial) port

ALIF1000R (receiver) - rear



Power input

Configuration switches

Video output

USB ports

Audio line in/out

AUX (serial) port

AdderLink ALIF2000T and ALIF2000R unit features

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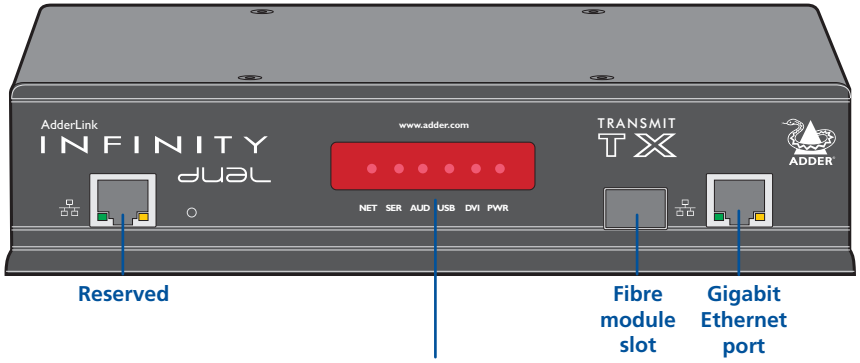
ALIF2000T (transmitter) - front



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- **NET** On when valid network link is present.
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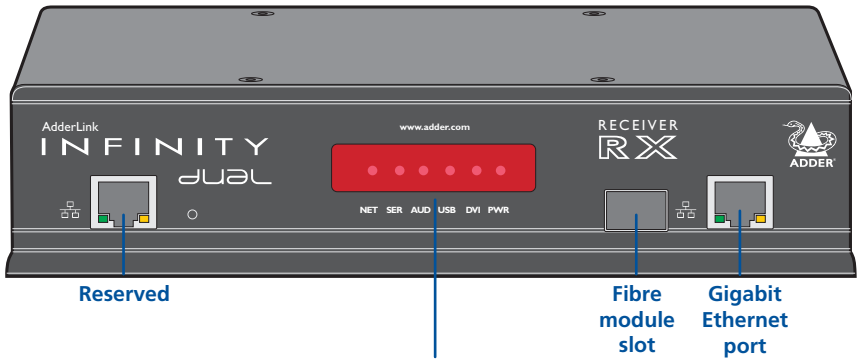
- **SER** On when the AUX (serial) port is enabled and active.
- **AUD** On when audio is enabled and active.
- **USB** On when USB is enabled and active.
- **DVI** On when either or both DVI Video channels are enabled.
- **PWR** Power indicator.

ALIF2000R (receiver) - front



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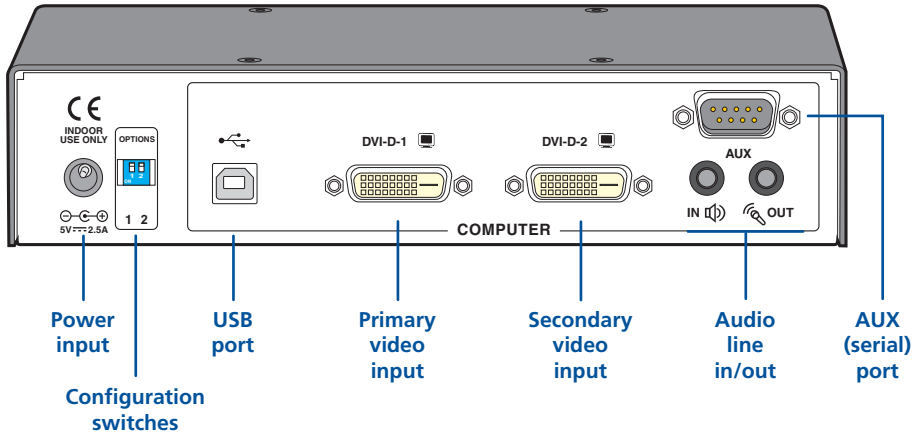
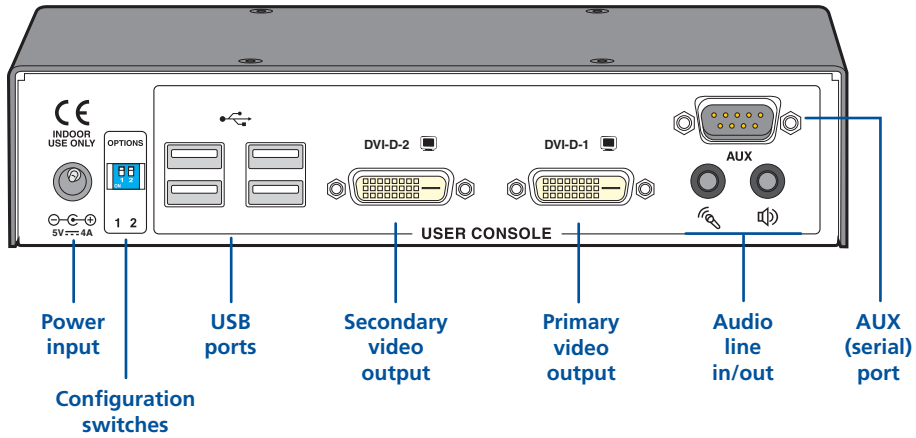
- **DVI** On when either or both DVI Video channels are enabled.
- **PWR** Power indicator.

ALIF2000T (transmitter) - rear



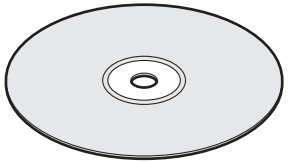
ALIF2000R (receiver) - rear



What's in the box (ALIF1000)

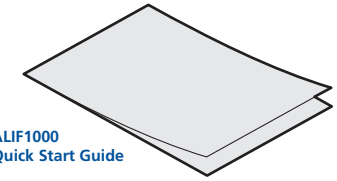
ALIF1000T package

ALIF1000T unit



CD-ROM

Four self-adhesive rubber feet



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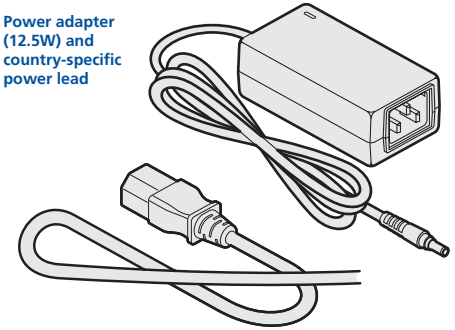
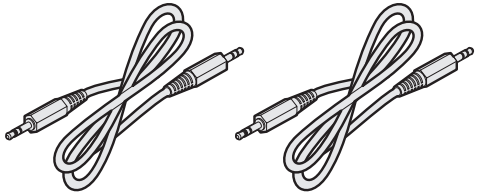
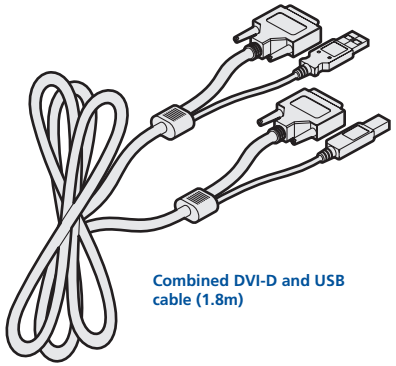
Power adapter (12.5W) and country-specific power lead

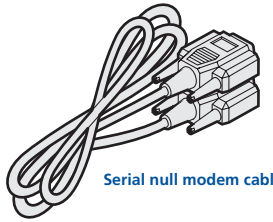




2 x Audio cable 2m
(3.5mm stereo jacks)

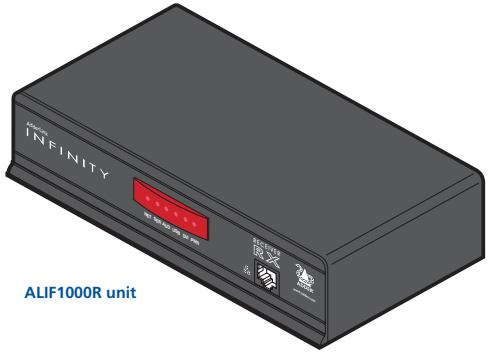


Combined DVI-D and USB cable (1.8m)

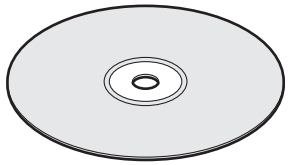


Serial null modem cable 2m

ALIF1000R package



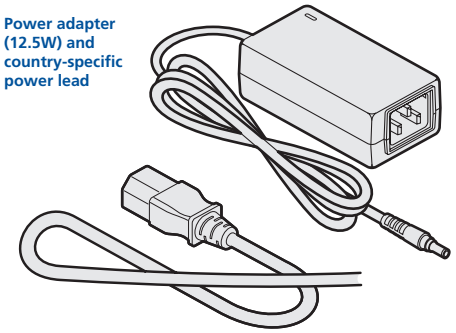
ALIF1000R unit

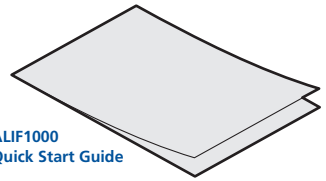


CD-ROM

Four self-adhesive rubber feet

Power adapter (12.5W) and country-specific power lead





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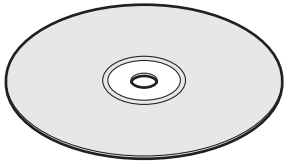
What's in the box (ALIF2000)

ALIF2000T package

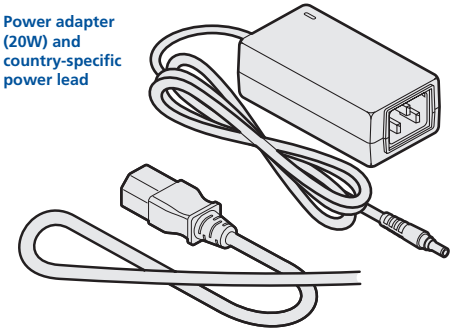
ALIF2000T unit

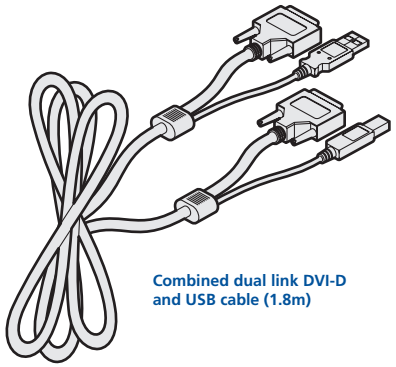


CD-ROM

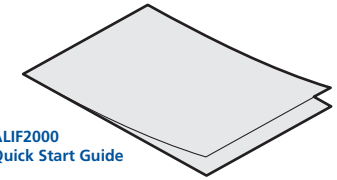
Four self-adhesive rubber feet

Power adapter (20W) and country-specific power lead





Combined dual link DVI-D and USB cable (1.8m)



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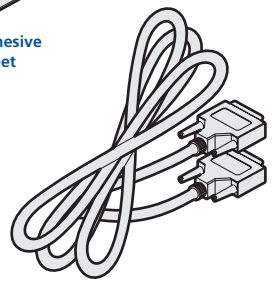
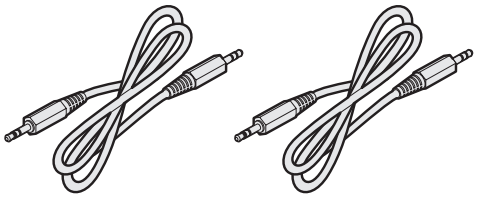
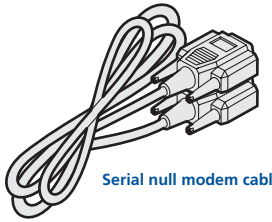


Single link DVI-D to DVI-D video cable

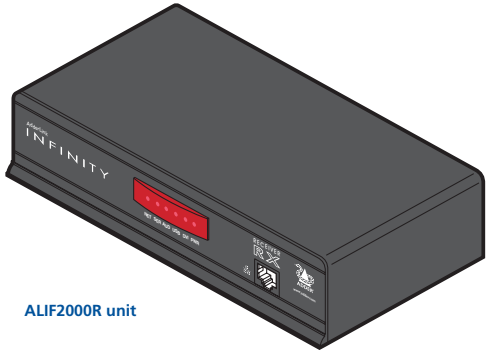


2 x Audio cable 2m
(3.5mm stereo jacks)

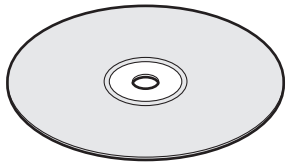


Serial null modem cable 2m

ALIF2000R package



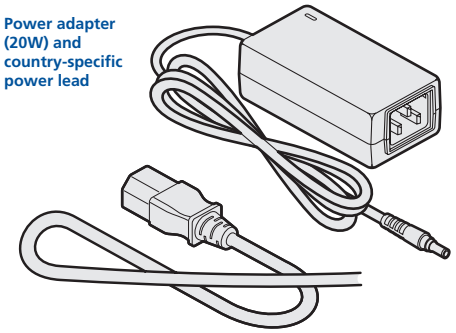
ALIF2000R unit

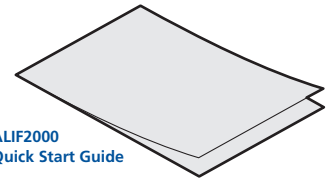


CD-ROM

Four self-adhesive rubber feet

Power adapter (20W) and country-specific power lead





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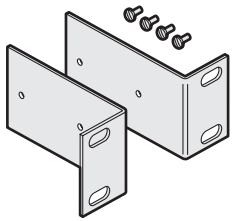
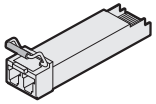
What you may additionally need

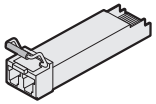


Two 19" rack-mount brackets and four screws
Part numbers:
One unit per 1U rack slot: RMK4S
Two units per 1U rack slot: RMK4D

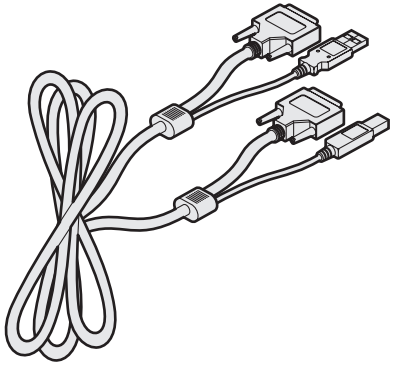


Single mode fibre module (for ALIF2000)
Part number: SFP-SM-LC

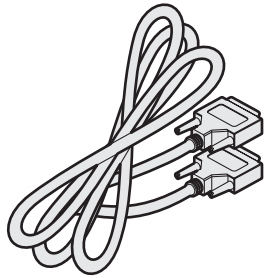
Please refer to the table in Appendix E for information about fibre modules and cables.



Multi mode fibre module (for ALIF2000)
Part number: SFP-MM-LC

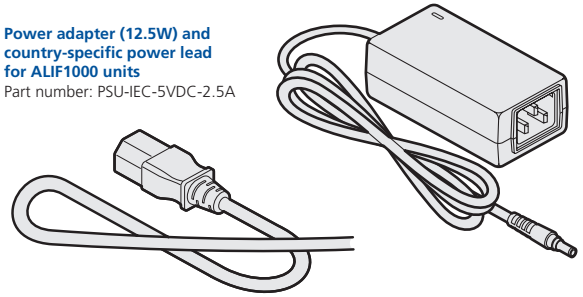


Combined dual link DVI-D and USB (USB type A to B) cable
Part numbers: VSCD3 (1.8m length)
VSCD4 (5m length)

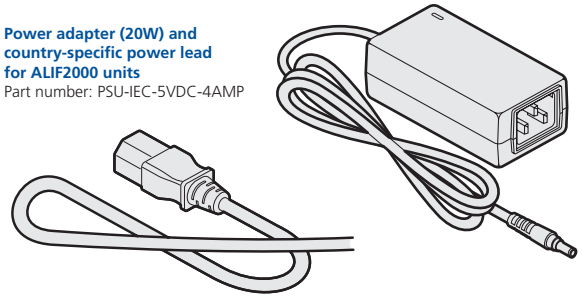


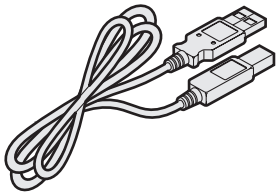
Single link DVI-D to DVI-D video cable
Part number: VSCD1

Power adapter (12.5W) and country-specific power lead for ALIF1000 units
Part number: PSU-IEC-5VDC-2.5A

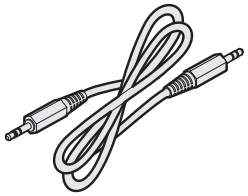


Power adapter (20W) and country-specific power lead for ALIF2000 units
Part number: PSU-IEC-5VDC-4AMP

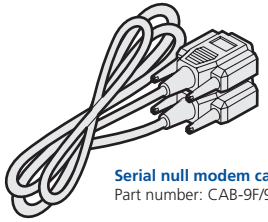




USB cable 2m (type A to B)
Part number: VSC24



Audio cable 2m (3.5mm stereo jacks)
Part number: VSC22



Serial null modem cable 2m
Part number: CAB-9F/9F-NULL-MODEM

Installation

Mounting

There are two main mounting methods for transmitter and receiver units:

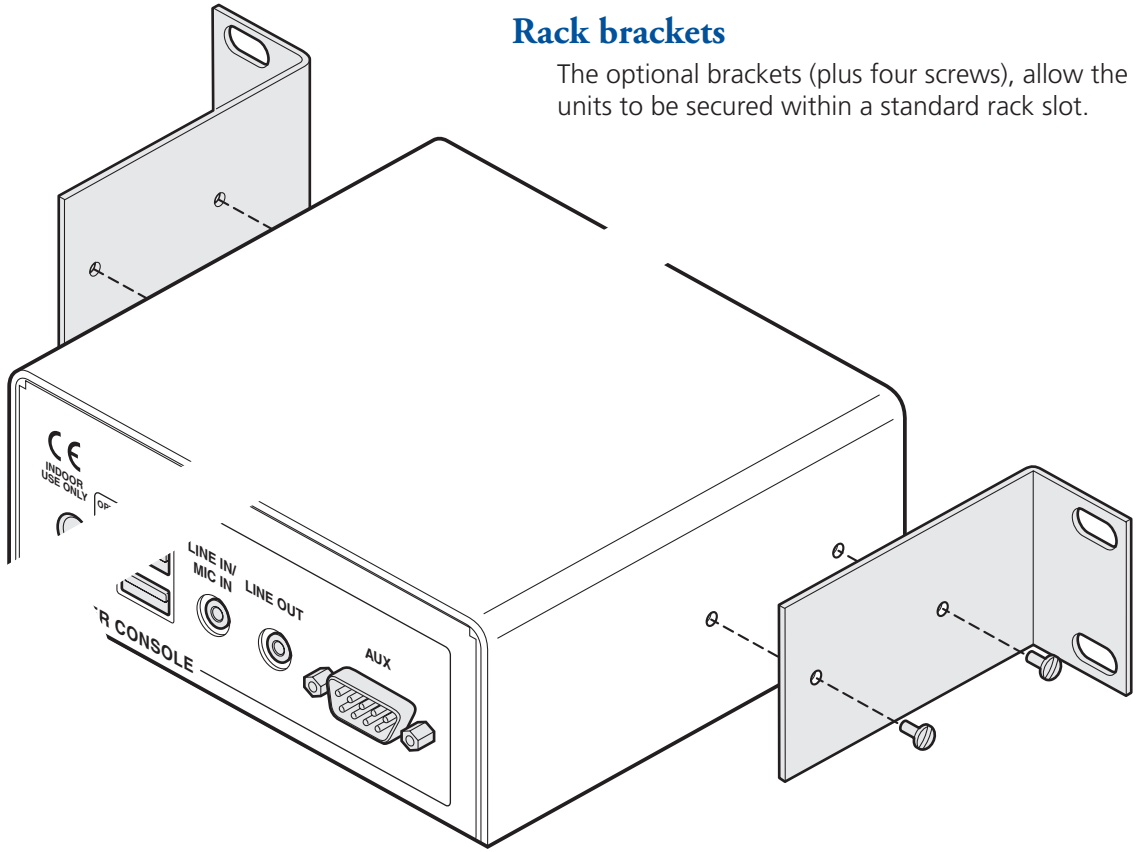
- The supplied four self-adhesive rubber feet
- Optional rack brackets

Connections

Note: The ALIF units and their power supplies generate heat when in operation and will become warm to the touch. Do not enclose them or place them in locations where air cannot circulate to cool the equipment. Do not operate the equipment in ambient temperatures exceeding 40°C. Do not place the products in contact with equipment whose surface temperature exceeds 40°C.

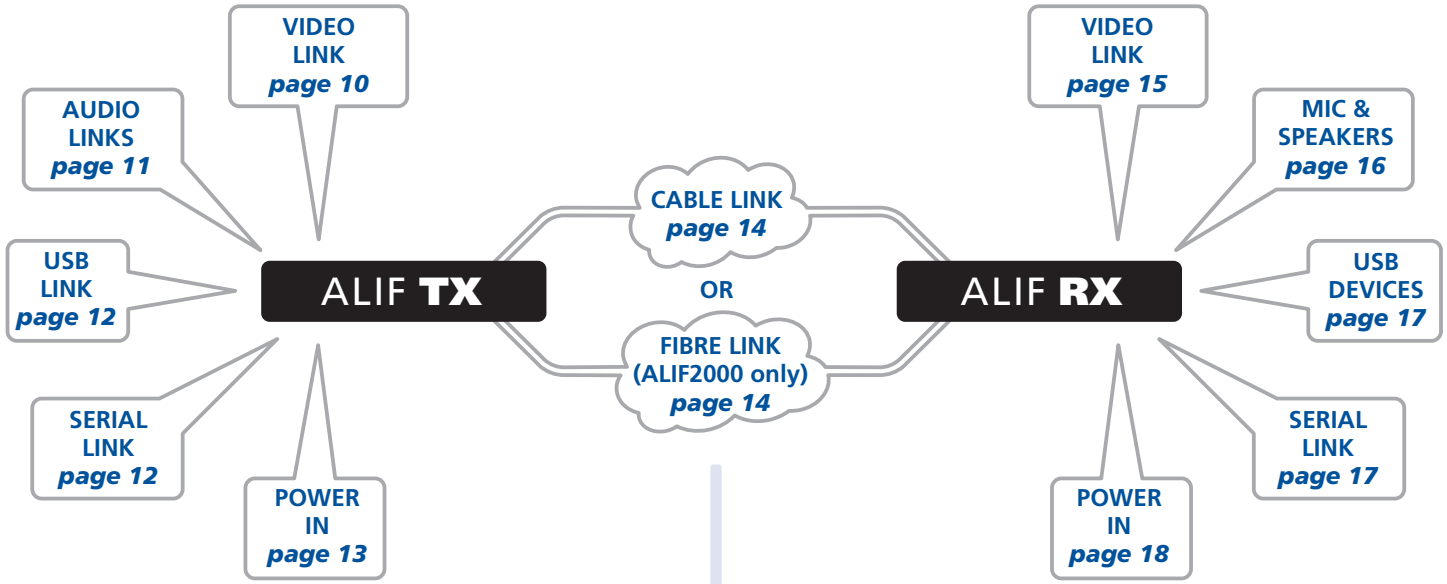
Rack brackets

The optional brackets (plus four screws), allow the units to be secured within a standard rack slot.



Connections

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

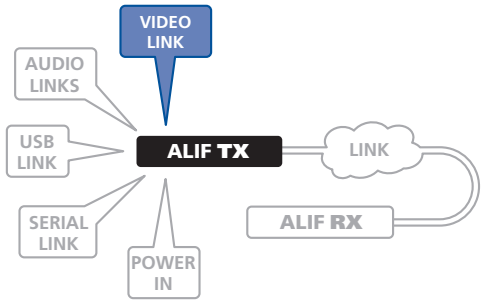


Click a connection to see details

IMPORTANT: When using an AdderLink Infinity Management box 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.

Please also see Appendix A - Tips for success when networking ALIF units

TX video link



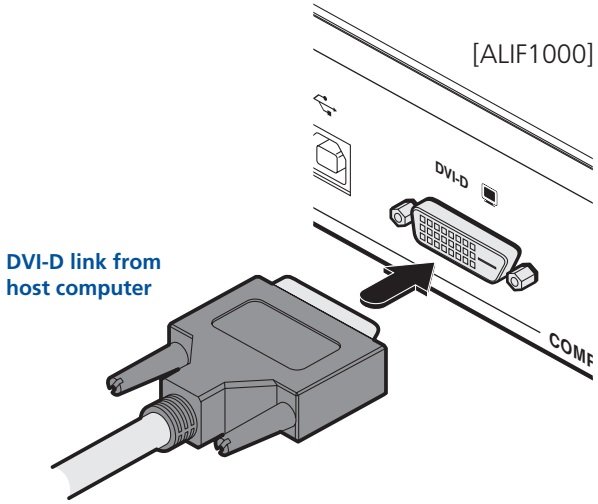
ALIF units support DVI **digital** video signals and so use DVI-D video connectors throughout.

- ALIF1000 models can support a single high resolution DVI-D video display at pixel clocks up to 165MHz (equating to an example display mode of 1920 x 1200 at 60Hz refresh).
- ALIF2000 models can simultaneously support up to two Single Link high resolution video displays at pixel clocks up to 165MHz; or can alternatively support a single Dual Link very high Resolution video display at pixel clocks up to 330MHz (equating to an example display mode of 2560 x 1600 at 60 Hz refresh).

To make a video link

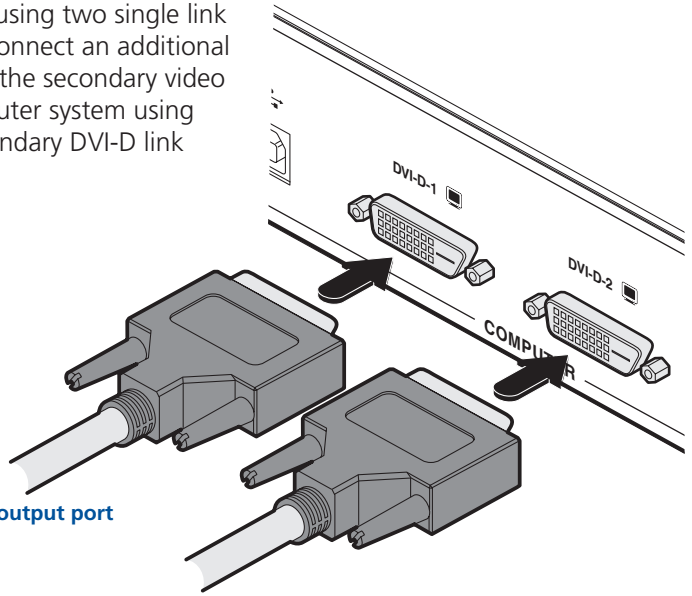
1 Wherever possible, ensure that power is disconnected from the ALIF and the host computer.

2 Connect a digital video link cable to the DVI-D socket (ALIF1000) or DVI-D-1 (ALIF2000) on the TX unit rear panel:

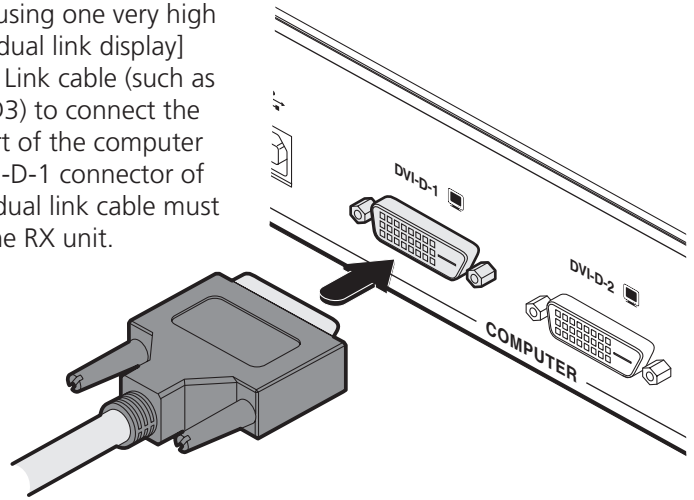


3 Connect the plug at the other end of the cable to the corresponding DVI-D video output socket of the host computer.

[ALIF2000 when using two single link DVI-D displays] Connect an additional video input from the secondary video port of the computer system using the supplied secondary DVI-D link cable.

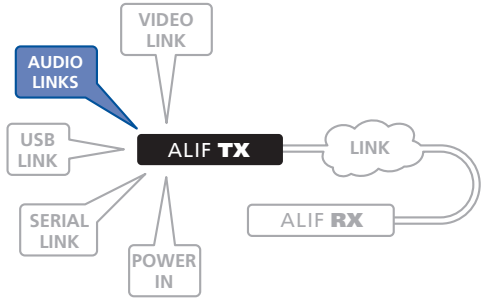


[ALIF2000 when using one very high resolution DVI-D dual link display] Use a DVI-D Dual Link cable (such as Adder part: VSCD3) to connect the primary video port of the computer system to the DVI-D-1 connector of the ALIF2000. A dual link cable must also be used at the RX unit.



TX audio links

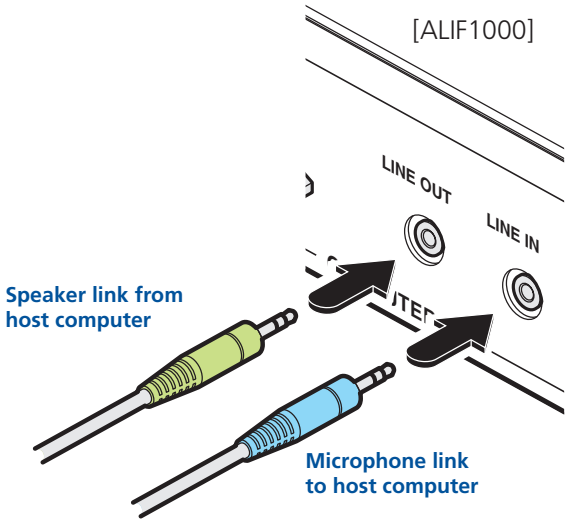
The ALIF units support two way stereo digital sound so that you can use a remote microphone as well as speakers.



To make audio links

1 Connect an audio link cable between the LINE OUT socket on the TX unit rear panel and the speaker output socket of the host computer.

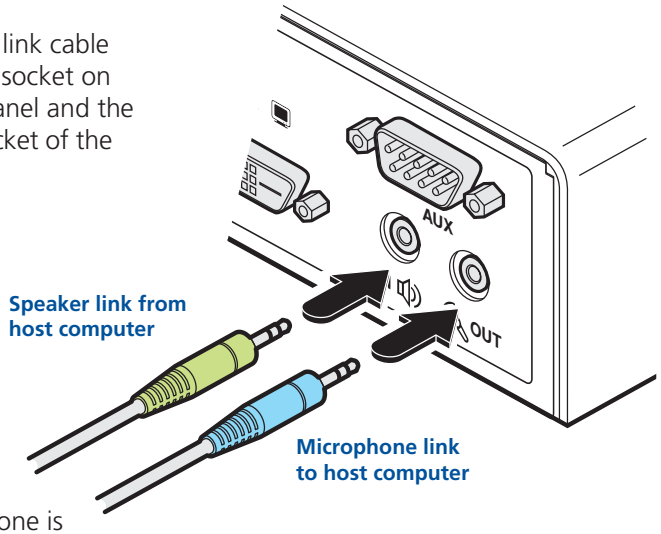
[ALIF1000]



2 [Where a microphone is to be used]: Connect a second audio link cable between the LINE IN socket on the TX unit rear panel and the Line In socket of the host computer.

[ALIF2000]

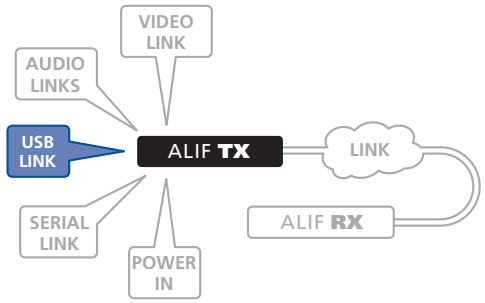
1 Connect an audio link cable between the IN socket on the TX unit rear panel and the speaker output socket of the host computer.



2 [Where a microphone is to be used]: Connect a second audio link cable between the OUT socket on the TX unit rear panel and the Line In socket of the host computer.

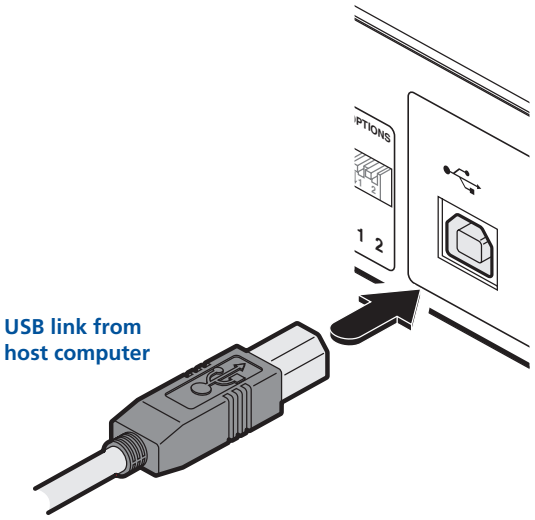
TX USB link

ALIF units act as USB 2.0 hubs and so can provide four sockets at the RX unit with only a single connection at the TX unit.



To make a USB link

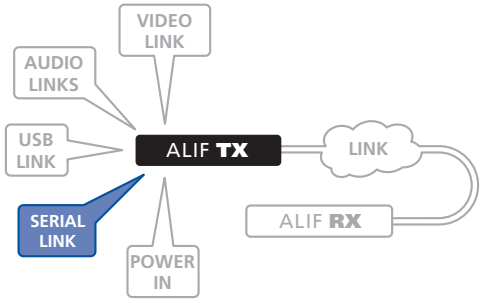
1 Connect the type B connector of the supplied USB cable to the USB port on the TX unit rear panel.



2 Connect the type A connector of the cable to a vacant USB socket on the host computer.

TX AUX port

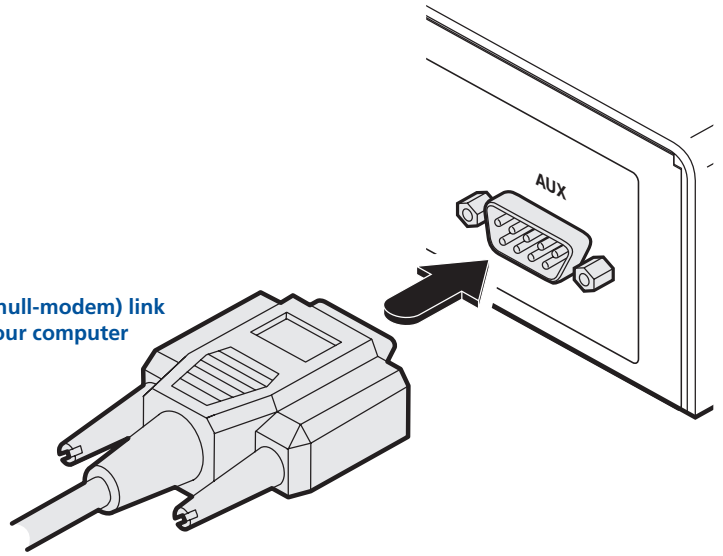
The AUX port is an RS232 serial port that allows extension of RS232 signals up to a baud rate of 115200. The port has software flow control, but no hardware flow control.



To connect the AUX port

1 Ensure that power is removed from the ALIF unit.

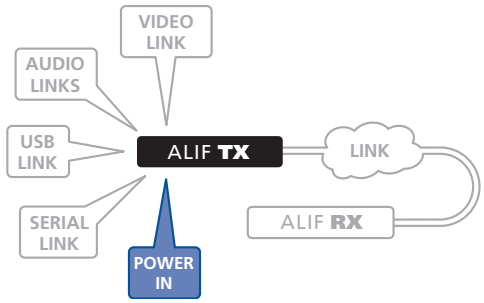
2 Connect a suitable serial 'null-modem' cable (see Appendix D for pin-out) between a vacant serial port on your computer and the AUX port on the right hand side of the ALIF rear panel.



TX power in

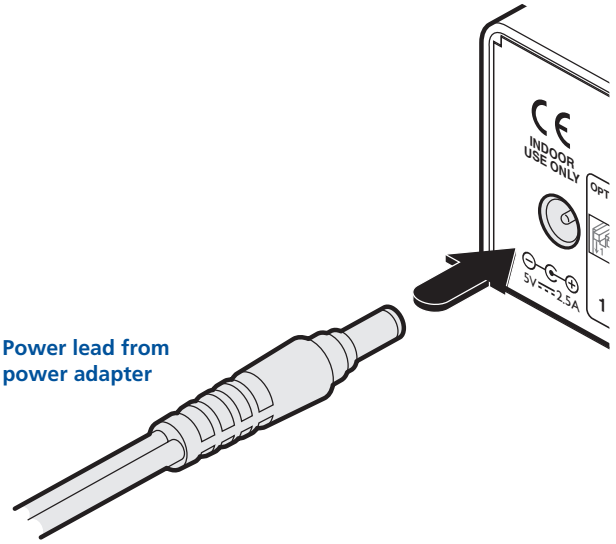
Each ALIF unit is supplied with an appropriate power adapter. When all other connections have been made, connect and switch on the power adapter unit.

Note: Please see Power adapter identification shown opposite.



To apply power in

1 Attach the output lead from the power adapter to the 5V socket on the rear panel of the unit.



Power lead from power adapter

Note: Ensure that Option switches 1 and 2 are both in the 'off' (up) position to enable normal operation of the unit.

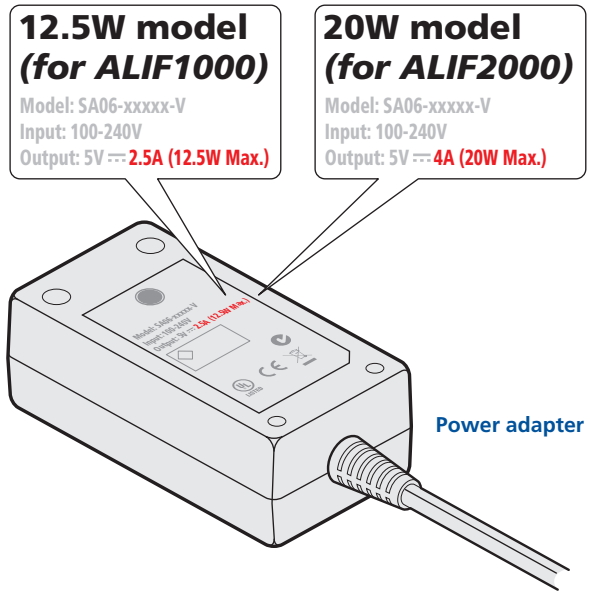
2 Connect the IEC connector of the supplied country-specific power lead to the socket of the power adapter.

3 Connect the power lead to a nearby main supply socket.

Note: Both the unit and its power supply generate heat when in operation and will become warm to the touch. Do not enclose them or place them in locations where air cannot circulate to cool the equipment. Do not operate the equipment in ambient temperatures exceeding 40°C. Do not place the products in contact with equipment whose surface temperature exceeds 40°C.

Power adapter identification

Due to the increased power requirements of the ALIF2000 series, these models are supplied with larger capacity (20W) power adapters. The standard 12.5W and higher power 20W adapters use identical housings, so within installations where both types are used, you need to double check the underside labels to differentiate the two types:



No damage will be caused if the 12.5W adapter and the 20W adapter are used in place of each other on either of the ALIF1000 or ALIF2000 units. However, correct operation of ALIF2000 units can only be guaranteed if a 20W power adapter is used. Always ensure that only ADDER 5-volt power supplies are used to power the units.

TX/RX network link

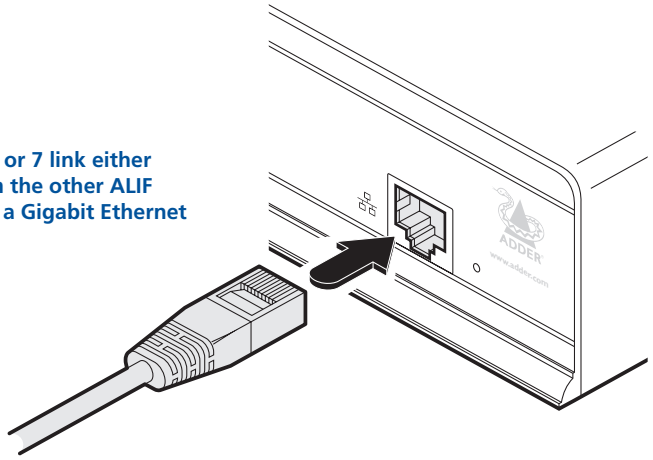
ALIF units can be either connected directly to each other or via a Gigabit Ethernet network. Additionally, ALIF2000 units can be networked by fibre optic links.

For direct links over Ethernet cable, the length of cable should not exceed 100 metres (328 feet). Network cables used for connections may be category 5, 5e, 6 or 7 twisted-pair cable. ALIF TX units have an autosensing capability on their network interfaces, so for direct point-to-point connections, no 'crossover' Ethernet cable is required.

For direct links over fibre optic links, varying distances can be achieved depending on the module and cable types used. Please refer to the table in Appendix E for detailed information. The fibre cable(s) must be crossover cable(s).

To link ALIF units using Gigabit Ethernet

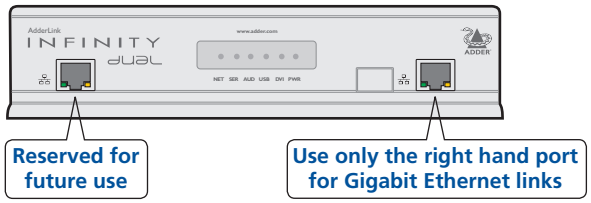
1 Connect a CAT 5, 5e, 6, or 7 cable to the socket on the front panel of the ALIF unit.

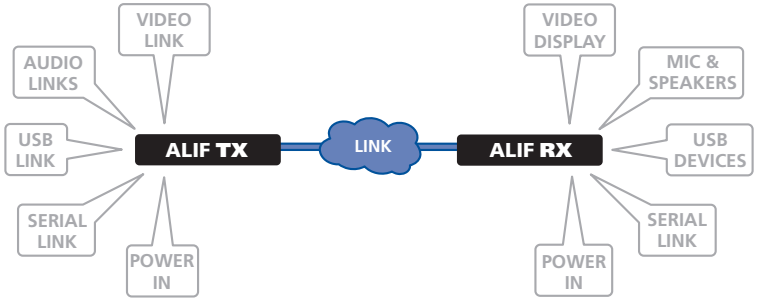


2 Connect the other end of the cable either to the other ALIF unit or to a Gigabit Ethernet switch, as appropriate.

3 [For connections via a network] repeat steps 1 and 2 for the other ALIF unit.

[ALIF2000] When making Gigabit Ethernet links

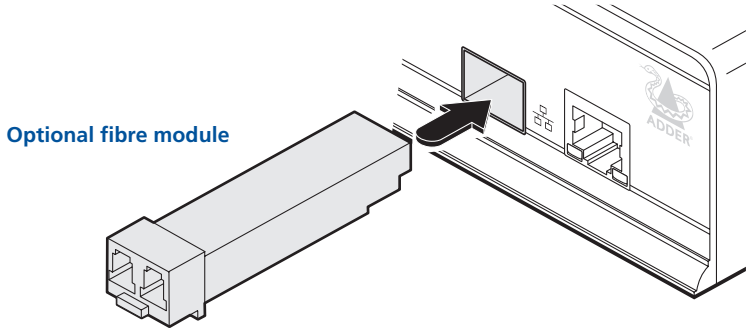




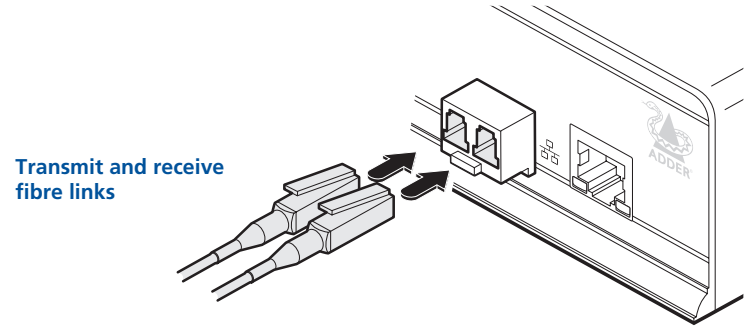
Please see Appendix A for important tips about networking ALIF units.

To link ALIF units using fibre optic links (ALIF2000 only)

1 Insert the optional fibre module (SFP-MM-LC or SFP-SM-LC) into the aperture on the ALIF2000 front panel:

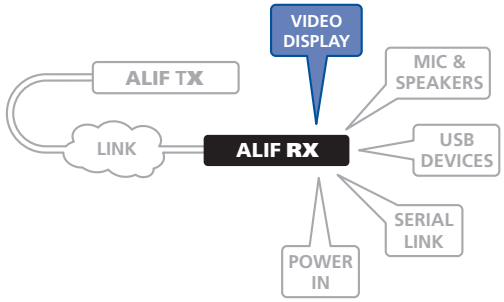


2 Connect the transmit and receive fibre links to the fibre module and close the latch over the link connectors to lock them into place.



3 Connect the other end of the fibre links either to the other AdderLink Infinity unit or to a fibre-equipped Gigabit Ethernet switch, as appropriate.

RX video display



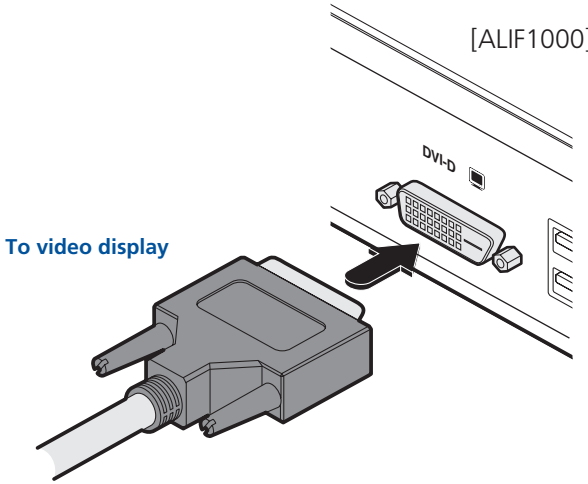
ALIF units support DVI **digital** video signals and so use DVI-D video connectors throughout.

- ALIF1000 models can support a single high resolution DVI-D video display at pixel clocks up to 165MHz (equating to an example display mode of 1920 x 1200 at 60Hz refresh).
- ALIF2000 models can simultaneously support up to two high resolution video displays at pixel clocks up to 165MHz; or can alternatively support one very high resolution video display (at pixel clocks up to 330MHz).

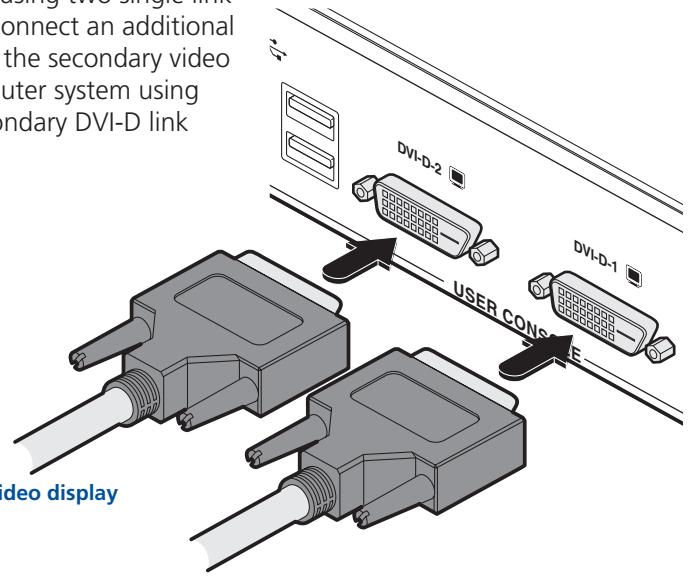
To connect a digital DVI video display

1 Connect the lead from the video display to the DVI-D socket on the rear panel of the ALIF unit.

[ALIF1000]



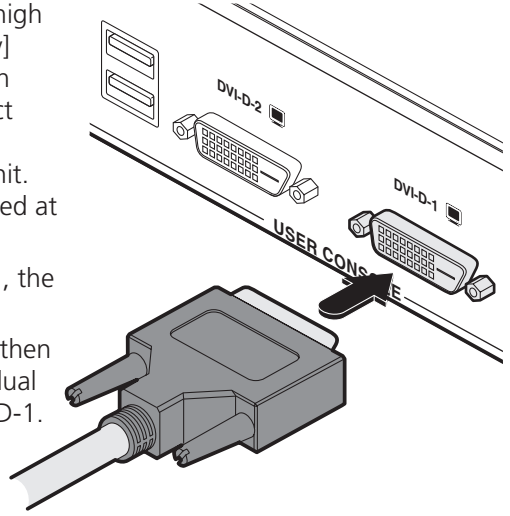
[ALIF2000 when using two single link DVI-D displays] Connect an additional video input from the secondary video port of the computer system using the supplied secondary DVI-D link cable.



[ALIF2000 when using one very high resolution DVI-D dual link display] Use a DVI-D Dual Link cable (such as Adder part: VSCD3) to connect the video display to the DVI-D-1 connector of the ALIF2000 RX unit. A dual link cable must also be used at the TX unit.

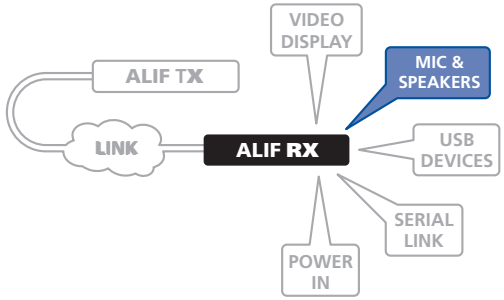
When using dual link on DVI-D-1, the DVI-D-2 port will be disabled.

If DVI-D-2 is already being used, then it must be disconnected before dual link operation can occur on DVI-D-1.



RX microphone & speakers

The ALIF unit can support a microphone as well as speakers providing the necessary connections have been made between the ALIF TX unit and the host computer.

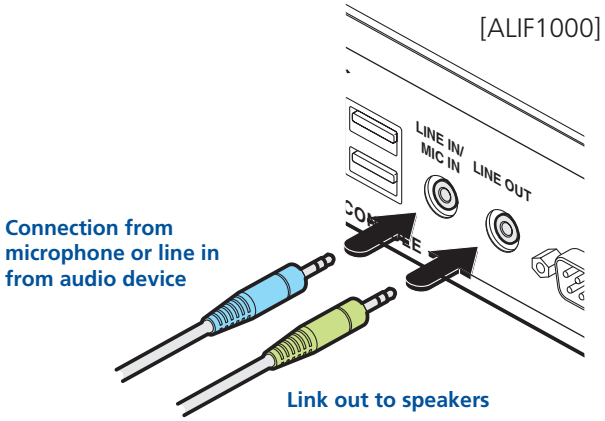


To connect a microphone (or line in) and/or speakers

1 Connect the lead from a mono microphone or, alternatively, a line in connection from an audio device to the 3.5mm socket labelled LINE IN/MIC IN on the rear panel.

2 Connect the lead from stereo speakers to the 3.5mm socket labelled LINE OUT on the rear panel.

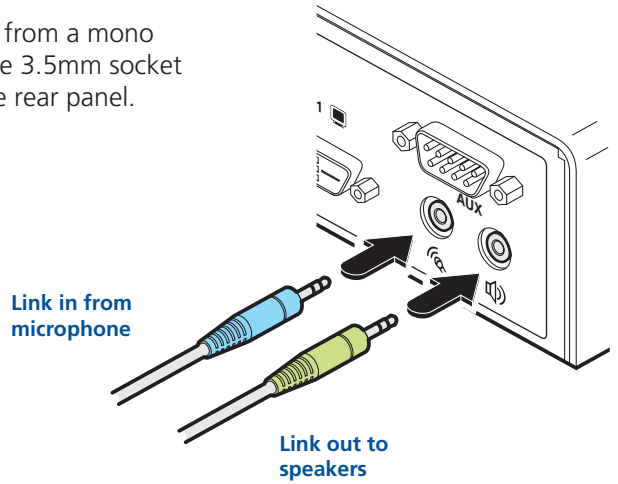
[ALIF1000]



3 Once the unit has been fully connected and powered on, access the RX System Configuration page to check that the *Audio Input Type* setting matches the connection that you have made to the port: *line*, *mic* or *mic boost* (the latter provides +20dB gain).

[ALIF2000]

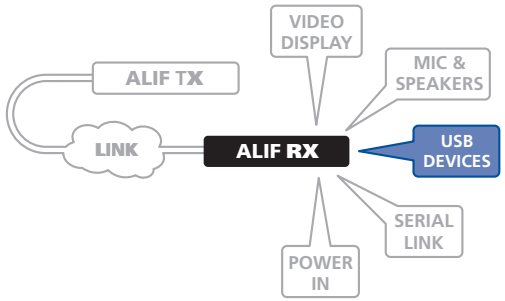
1 Connect the lead from a mono microphone to the 3.5mm socket labelled on the rear panel.



2 Connect the lead from stereo speakers to the 3.5mm socket labelled on the rear panel.

3 Once the unit has been fully connected and powered on, access the RX System Configuration page to check that the *Audio Input Type* setting matches the connection that you have made to the port: *mic* or *mic boost* (the latter provides +20dB gain).

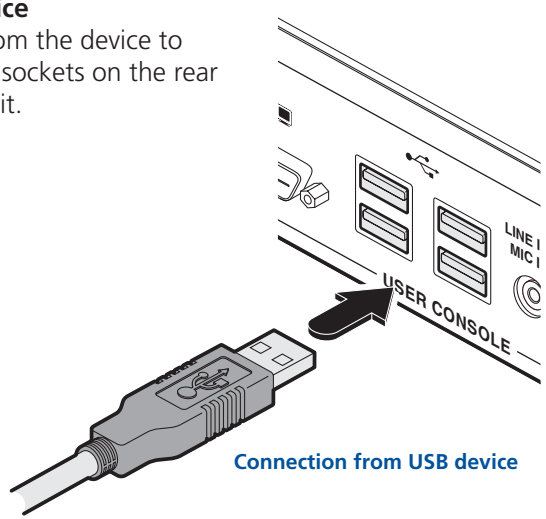
RX USB devices



The ALIF RX unit has four USB ports to which peripherals may be connected. The ports are interchangeable. To connect more than four peripherals, one or more USB hubs may be used. The total current that may be drawn from the USB ports is 1.2A, which should be sufficient for a keyboard, mouse (no more than 100mA each) and any two other devices (500mA maximum each). If more power for USB devices is required, use a powered USB hub.

To connect a USB device

1 Connect the lead from the device to any of the four USB sockets on the rear panel of the ALIF unit.



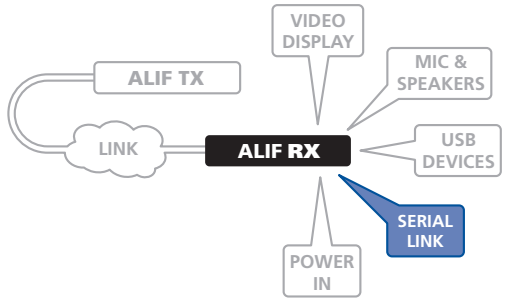
Connection from USB device

Supported USB Devices

USB devices are supported using True Emulation technology. This means that the signals of each USB peripheral are emulated to the computer so that full functionality is available, subject to the following limitations:

- Keyboards, mice and other HID devices are supported.
- Storage devices (i.e. flash drives, USB hard disks, CD-ROM drives) are supported, but they may operate more slowly than with a direct connection.
- Isochronous devices (including microphones, speakers, webcams and TV receivers) are not currently supported.
- Many other devices (such as printers, scanners, serial adapters and specialist USB devices) will work, but due to the huge variety of devices available, successful operation cannot be guaranteed.

RX AUX port

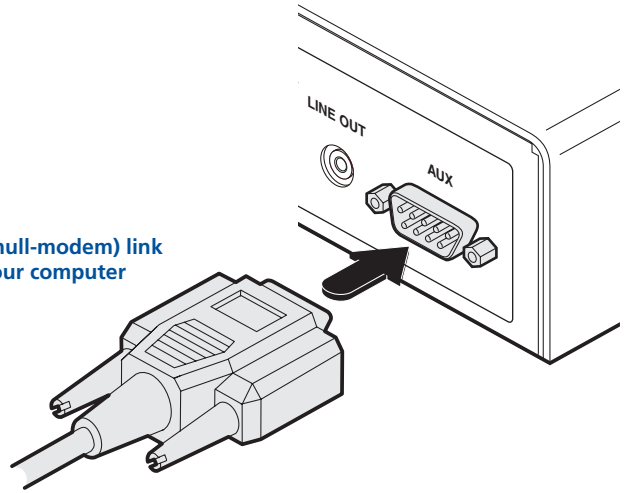


The AUX port is an RS232 serial port that allows extension of RS232 signals up to a baud rate of 115200. The port has software flow control, but no hardware flow control.

To connect the AUX port

1 Ensure that power is removed from the ALIF unit.

2 Connect a suitable serial 'null-modem' cable (see Appendix D for pin-out) between the AUX port on the right hand side of the ALIF rear panel and your remote serial device.

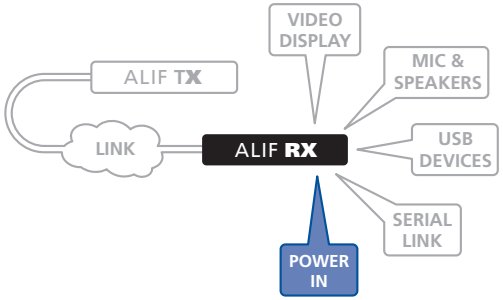


Serial (null-modem) link from your computer

RX power in

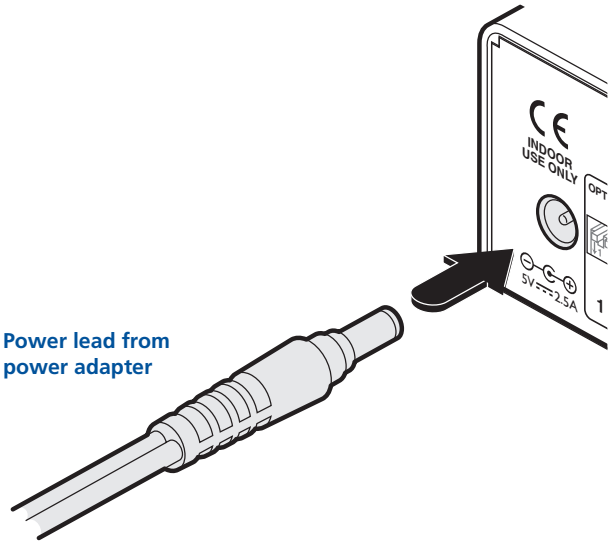
Each ALIF unit is supplied with an appropriate power adapter. When all other connections have been made, connect and switch on the power adapter unit.

Note: Please see Power adapter identification shown opposite.



To apply power in

1. Attach the output lead from the power adapter to the 5V socket on the rear panel of the unit.
2. Connect the IEC connector of the supplied country-specific power lead to the socket of the power adapter.



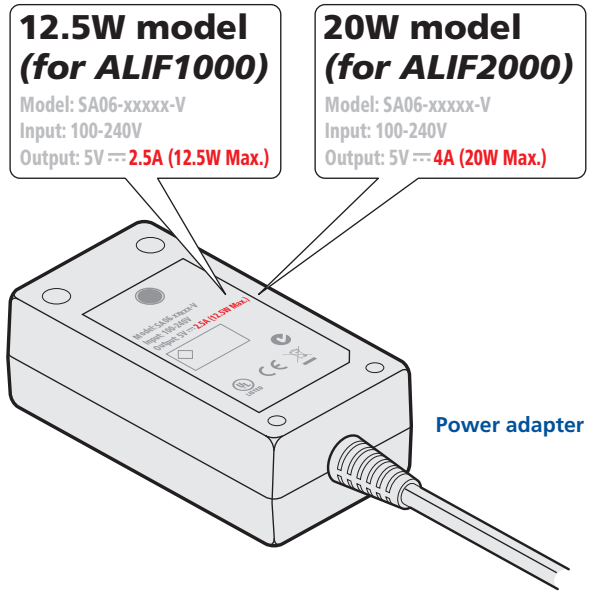
Note: Ensure that Option switches 1 and 2 are both in the 'off' (up) position to enable normal operation of the unit.

3. Connect the power lead to a nearby main supply socket.

Note: Both the unit and its power supply generate heat when in operation and will become warm to the touch. Do not enclose them or place them in locations where air cannot circulate to cool the equipment. Do not operate the equipment in ambient temperatures exceeding 40°C. Do not place the products in contact with equipment whose surface temperature exceeds 40°C.

Power adapter identification

Due to the increased power requirements of the ALIF2000 series, these models are supplied with larger capacity (20W) power adapters. The standard 12.5W and higher power 20W adapters use identical housings, so within installations where both types are used, you need to double check the underside labels to differentiate the two types:



No damage will be caused if the 12.5W adapter and the 20W adapter are used in place of each other on either of the ALIF1000 or ALIF2000 units. However, correct operation of ALIF2000 units can only be guaranteed if a 20W power adapter is used. Always ensure that only ADDER 5-volt power supplies are used to power the units.

Configuration

Initial configuration

ALIF units are designed to be as flexible as possible and this principle extends also to their configuration.

Direct linking

Where an ALIF TX and an ALIF RX are directly linked to each other, no configuration action is required, provided that they have their factory default settings in place. If the standard settings have been changed in a previous installation, you merely need to perform a factory reset on each unit.

Networked linking

Where ALIF units are connected via networked links, you can either configure them individually, or configure them collectively using an AIM server:

- **Configuring networked ALIF units individually** - You need to specify the network addresses of the ALIF units so that they can locate each other. This is done by running the AdderLink Infinity browser-based configuration utility on a computer system linked to the same network as the ALIF units.
- **Configuring ALIF units collectively** - The AdderLink Infinity Management (AIM) server allows you to configure, control and coordinate any number of ALIF transmitters and receivers from a single application.

IMPORTANT: When using AIM 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.

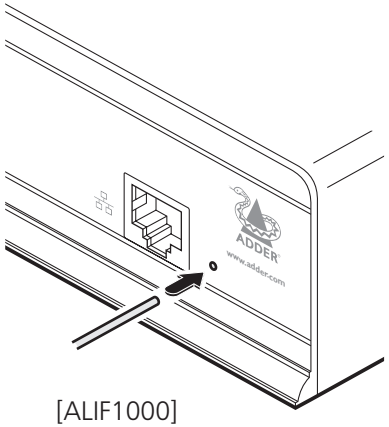
Please also see Appendix A - Tips for success when networking ALIF units

Manual factory reset

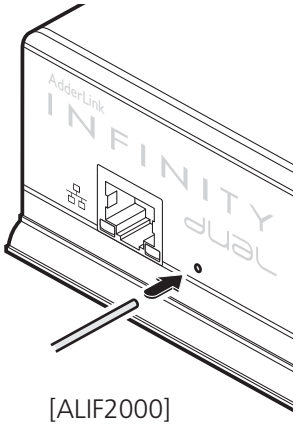
A factory reset returns an ALIF TX or RX unit to its default configuration. You can perform factory resets using the AdderLink Infinity browser-based configuration utility or by using this direct manual method.

To perform a manual factory reset

1. Remove power from the ALIF 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. With the reset button still pressed, re-apply power to the unit and then release the reset button.



[ALIF1000]



[ALIF2000]

Use a straightened-out paper clip to press the reset button while powering on the unit

After roughly eight seconds, when the factory reset has completed, five of the front panel indicators will flash for a period of three seconds to indicate a successful reset operation.

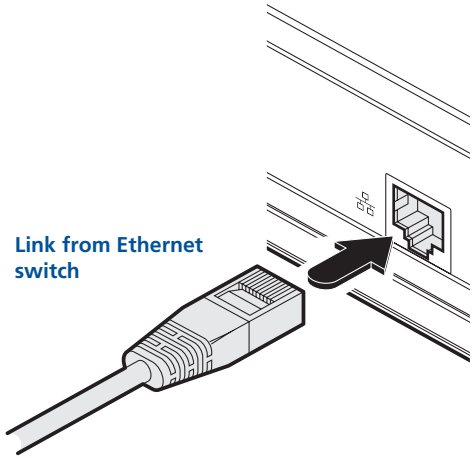
AdderLink Infinity browser-based configuration utility

The browser-based configuration utility within all TX and RX units requires a network connection between the ALIF unit and a computer on the same network. The configuration utility allows you to perform all of the following functions:

- View/edit the IP network address and netmask,
- Configure separate IP network addresses for video, audio and USB,
- Configure multicast settings (on RX units),
- Configure video bandwidth settings (on TX units),
- View the current video output (on TX units),
- Perform a firmware upgrade,
- Perform a factory reset.

To connect a computer system for browser-based configuration

1 Connect a suitable network cable to the Ethernet port on the front panel of the ALIF unit.



[ALIF2000] *Note: Use the right hand Ethernet port.*

2 Connect the other end of the link cable to your network.

3 Similarly, link your computer to the same network. *Note: A Gigabit connection is not essential for configuration purposes.*

4 If not already switched on, power up your computer and the ALIF unit. You are now ready to use the browser-based configuration utility.

To access the browser-based configuration utility

1 Temporarily connect the ALIF unit and a computer via a network, as discussed opposite.

2 Run a web browser on your computer and enter the IP address of the ALIF unit, e.g. *http://169.254.1.33*

The default settings are as follows:

- **TX units** - IP address: **169.254.1.33**
- **RX units** - IP address: **169.254.1.32**

Where the address of a unit is not known perform a manual factory reset to restore the default address.

The opening page of the ALIF configuration utility will be displayed and you can now use on-screen help for details of the functions that you wish to perform.

Performing an upgrade

ALIF units are flash upgradeable using the method outlined here. However, for larger installations we recommend that you use the AdderLink Infinity Manager (AIM) to upgrade multiple ALIF units. When using the method below, the ALIF unit will be upgraded in sequence.

Warning: During the upgrade process, ensure that power is not interrupted as this may leave the unit in an inoperable state.

To upgrade a single unit via network link

1. Download the latest upgrade file from the Adder Technology website.
   Note: There are separate upgrade files for TX and RX units.
2. Temporarily connect the ALIF unit and a computer via a network (see AdderLink Infinity browser-based configuration utility section for details).
3. Run a web browser on your computer and enter the IP address of the ALIF unit to be upgraded.
4. Click the Firmware Upgrade link. Within the Firmware Upgrade page, click the Choose File button. In the subsequent file dialog, locate the downloaded upgrade file - check that the file is correct for the unit being upgraded.
5. Click the Upgrade Now button. A progress bar will be displayed (however, if your screen is connected to the unit being upgraded then video may be interrupted) and the indicators on the front panel will flash while the upgrade is in progress.
6. The indicators should stop flashing in less than one minute, after which the unit will automatically reboot itself. The upgrade process is complete.

Finding the latest upgrade files

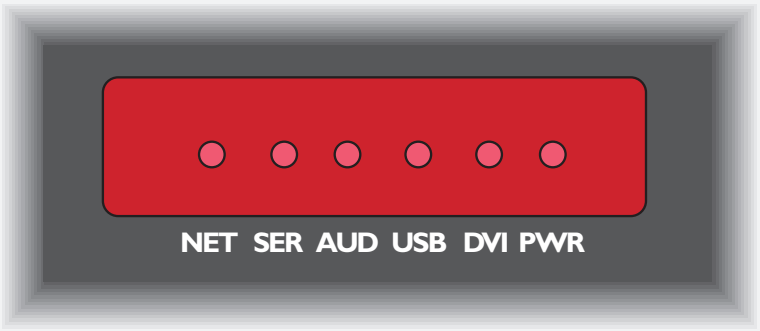
Firmware files for the ALIF units are available from the *Technical Support > Updates* section of the Adder Technology website (www.adder.com).

Operation

In operation, many ALIF installations require no intervention once configured. The TX and RX units take care of all connection control behind the scenes so that you can continue to work unhindered.

Front panel indicators

The six front panel indicators on each unit provide a useful guide to operation:



Indicators

These six indicators clearly show the key aspects of operation:

- **NET** On when valid network link is present. Flashes when the unit is in error.
- **SER** On when the AUX (serial) port is enabled and active.
- **AUD** On when audio is enabled and active.
- **USB** On when USB is enabled and active.
- **DVI** On when either or both DVI Video channels are enabled.
- **PWR** Power indicator.

Further information

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

- Getting assistance - see right
- Appendix A - Tips for success when networking ALIF units
- Appendix B - Troubleshooting
- Appendix C - Glossary
- Appendix D - RS232 'null-modem' cable, General specifications.
- Appendix E - Fibre modules and cables (ALIF 2000 units only)
- Safety information
- Warranty
- Radio frequency energy statements

Getting assistance

If you are still experiencing problems after checking the information contained within this guide, then we provide a number of other solutions:

- Online solutions and updates – www.adder.com/support

  Check the Support section of the adder.com website for the latest solutions and firmware updates.

- Adder Forum – forum.adder.com

  Use our forum to access FAQs and discussions.

- Technical support – www.adder.com/contact-support-form

  For technical support, use the contact form in the Support section of the adder.com website - your regional office will then get in contact with you.

Appendix A

Tips for success when networking ALIF units

ALIF units use multiple strategies to minimise 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 maximise network efficiency and help minimise 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:

- Gigabit (1000Mbps) or faster Ethernet ports,
- Support for IGMP v2 (or v3) snooping,
- Support for Jumbo frames up to 9216-byte size,
- High bandwidth connections between switches, preferably Fibre 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, 1Gbps 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.

Layer 2 (and Layer 3) switches known to work

- Cisco 2960
- Cisco 3750
- Cisco 4500
- Cisco 6500
- Extreme Networks X480
- HP Procurve 2810
- HP Procurve 2910
- H3C 5120
- HuaWei Quidway s5328c-E1 (Layer 3)

For the latest list of switches known to work with ALIF and setup instructions for them, please go to www.adder.com

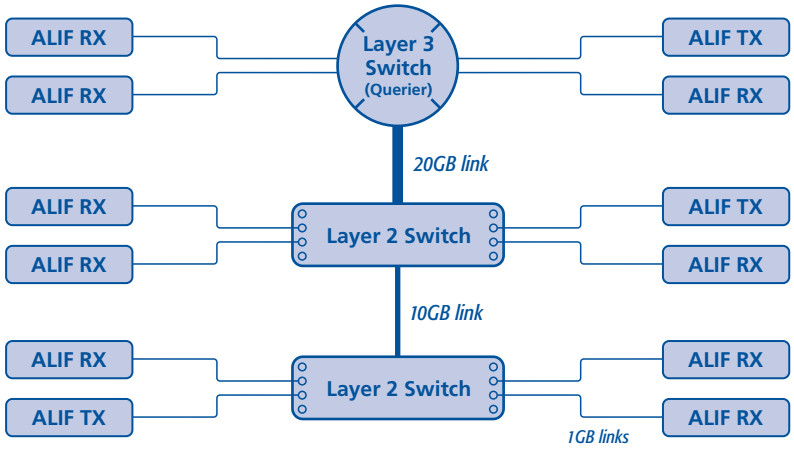
Creating an efficient network layout

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 DVI converters, instead replace VGA video cards in older systems with suitable DVI 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), 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.
- Optimise the settings on the ALIF transmitters:
  - If colour quality is important, then leave Colourdepth at 24 bits and adjust other controls,
  - If moving video images are being shown frequently, then leave Frame Skipping at a low percentage and instead reduce the Peak bandwidth limiter and Colourdepth.
  - 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 (at least v2.1).

Appendix B

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.
- One or more ALIF units may be using an old firmware version. Firmware versions prior to v2.1 exhibited an issue with the timing of IGMP join and leave commands that caused multicast flooding in certain configurations.

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.
- Ensure that the firmware in every ALIF unit is version 2.1 or greater.
- 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 mouse pointer of the ALIF receiver is slow or sluggish when moved across the screen.

This issue is often related to either using dithering on the video output of one or more transmitting computers or using VGA-to-DVI video converters.

Dithering is used to improve the perceived quality and colour depth of images by diffusing or altering the colour of pixels between video frames. This practice is commonly used on Apple Mac computers using ATI or Nvidia graphics cards. VGAto-DVI converters unwittingly produce a similar issue by creating high levels of pixel background noise.

ALIF units attempt to considerably reduce network traffic by transmitting only the pixels that change between successive video frames. When dithering is enabled and/or VGA-to-DVI converters are used, this can have the effect of changing almost every pixel between each frame, thus forcing the ALIF transmitter to send the whole of every frame: resulting in greatly increased network traffic and what's perceived as sluggish performance.

Remedies:

- Linux PCs

  Check the video settings on the PC. If the Dither video box option is enabled, disable it.
- Apple Mac with Nvidia graphics

  Use the Adder utility for Mac's – Contact technical support.
- Apple Mac with ATI graphics

  Use the ALIF 2000 series unit with Magic Eye dither removal feature.
- Windows PCs

  If you suspect these issues with PC's, contact technical support for assistance.
- Replace old VGA adapters on host computers with DVI video cards.

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:

- The ALIF units must be reset back to their zero config IP addresses for AIM discovery. If you have a working network of ALIF's without AIM and then add AIM to the network AIM will not discover the ALIFs until they are reset to the zero config IP addresses.
- 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. 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 C

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 (10Mbits/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.

ALIF transmitter video settings

Each ALIF transmitter includes controls to help you customise how video data is transmitted. When configured correctly for the application, these can help to increase data efficiency.

Background Refresh

The transmitter sends portions of the video image only when they change. In order to give the best user experience, the transmitter also sends the whole video image, at a lower frame rate, in the background. The Background Refresh parameter controls the rate at which this background image is sent. The default value is 'every 32 frames', meaning that a full frame is sent in the background every 32 frames. Reducing this to 'every 64 frames' or more will reduce the amount of bandwidth that the transmitter consumes. On a high-traffic network this parameter should be reduced in this way to improve overall system performance.

Colour Depth

This parameter determines the number of bits required to define the colour of every pixel. The maximum (and default) value is '24 bit'. By reducing the value you can significantly reduce bandwidth consumption, at the cost of video colour reproduction.

Peak Bandwidth Limiter

The transmitter will employ a 'best effort' strategy in sending video and other data over the IP network. This means it will use as much of the available network bandwidth as necessary to achieve optimal data quality, although typically the transmitter will use considerably less than the maximum available.

In order to prevent the transmitter from 'hogging' too much of the network capacity, you can reduce this setting to place a tighter limit on the maximum bandwidth permissible to the transmitter.

Frame Skipping

Frame Skipping involves 'missing out' video frames between those captured by the transmitter. 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.

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:

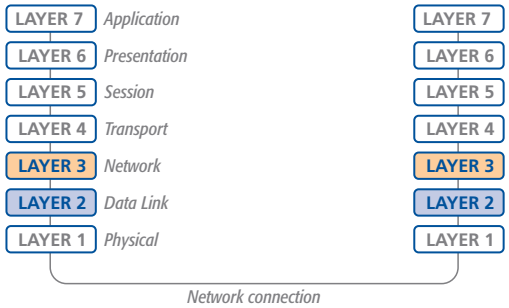
- **Store and forward** is the original method and requires the switch to save each entire data packet to buffer memory, run an error check and then forward if no error is found (or otherwise discard it).
- **Cut-through** was developed to address the latency issues suffered by some store and forward 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 standardised way to categorise 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 fibre, 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.

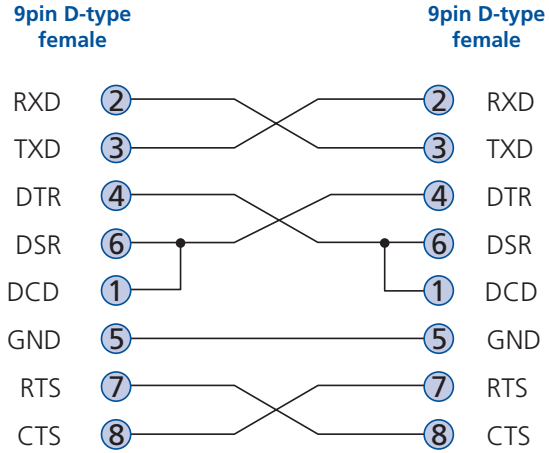
So why are Layer 2 and Layer 3 of particular importance when discussing AdderLink Infinity? Because the successful transmission of data relies upon fast and reliable passage through network switches – and most of these operate at either Layer 2 or Layer 3.

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.

Appendix D

RS232 'null-modem' cable pin-out



Supported video modes

ALIF units support all VESA and CEA video modes.

ALIF 1000 general specifications

Casing (w x h x d):	198mm (7.92") x 44mm (1.76") x 120mm (4.8")
Construction:	1U compact case, robust metal design
Weight:	0.75kg (1.65lbs)
Mount kits:	Rack mount - single or dual units per 1U slot. VESA monitor / wall mount chassis.
Power to adapter:	100-240VAC 50/60Hz, 0.5A,
Power to unit:	5VDC 12.5W
Operating temp:	0°C to 40°C (32°F to 104°F)
Approvals:	CE, FCC

ALIF 2000 general specifications

Casing (w x h x d):	198mm (7.92") x 44mm (1.76") x 145mm (5.7")
Construction:	1U compact case, robust metal design
Weight:	1.11kg (2.44lbs)
Mount kits:	Rack mount - single or dual units per 1U slot. VESA monitor / wall mount chassis.
Power to adapter:	100-240VAC 50/60Hz, 0.8A,
Power to unit:	5VDC 20W
Operating temp:	0°C to 40°C (32°F to 104°F)
Approvals:	CE, FCC

Appendix E

Fibre modules and cables (ALIF 2000 units only)

To suit your installation layout, two fibre modules are available for the ALIF 2000 units to suit various fibre optic cables. The specifications for all are summarised in the table below:

Fibre Type	Fibre size	Fibre Type	Colour Code			Distance at 1Gbps	Adder part number for SFP module	Bar colour	Conn. type
			Normal Applications	Military Applications	Suggested Print Nomenclature				
OM1	(62.5/125)	Multimode (TIA-492AAAA)	Orange	Slate	62.5/125	220m	SFP-MM-LC	Black	LC
OM2	(50/125)	Multimode (TIA-492AAAB)	Orange	Orange	50/125	550m	"	"	"
OM3	(50/125)	Multimode (850 nm Laser-optimised) (TIA-492AAAC)	Aqua	Undefined	850 LO 50 /125	550m	"	"	"
OM4	(50/125)	Multimode (850 nm Laser-optimised) (TIA-492AAAC)	Aqua	Undefined	850 LO 50 /125	550m	"	"	"
OS1 and OS2	(9/125)	Single-mode (TIA-492C000 / TIA-492E000)	Yellow	Yellow	SM/NZDS, SM	10Km	SFP-SM-LC	Blue	LC

Warranty

Adder Technology Ltd warrants that this product shall be free from defects in workmanship and materials for a period of two years from the date of original purchase. If the product should fail to operate correctly in normal use during the warranty period, Adder will replace or repair it free of charge. No liability can be accepted for damage due to misuse or circumstances outside Adder's control. Also Adder will not be responsible for any loss, damage or injury arising directly or indirectly from the use of this product. Adder's total liability under the terms of this warranty shall in all circumstances be limited to the replacement value of this product.

If any difficulty is experienced in the installation or use of this product that you are unable to resolve, please contact your supplier.

Safety information

- For use in dry, oil free indoor environments only.
- Warning - live parts contained within power adapter.
- No user serviceable parts within power adapter - do not dismantle.
- Plug the power adapter into a socket outlet close to the module that it is powering.
- Replace the power adapter with a manufacturer approved type only.
- Do not use the power adapter if the power adapter case becomes damaged, cracked or broken or if you suspect that it is not operating properly.
- If you use a power extension cord with the units, make sure the total ampere rating of the devices plugged into the extension cord does not exceed the cord's ampere rating. Also, make sure that the total ampere rating of all the devices plugged into the wall outlet does not exceed the wall outlet's ampere rating.
- Do not attempt to service the units yourself.

Radio Frequency Energy

A Category 5 (or better) twisted pair cable must be used to connect the units in order to maintain compliance with radio frequency energy emission regulations and ensure a suitably high level of immunity to electromagnetic disturbances.

All other interface cables used with this equipment must be shielded in order to maintain compliance with radio frequency energy emission regulations and ensure a suitably high level of immunity to electromagnetic disturbances.

European EMC directive 2004/108/EC

This equipment has been tested and found to comply with the limits for a class A computing device in accordance with the specifications in the European standard EN55022. These limits are designed to provide reasonable protection against harmful interference. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions may cause harmful interference to radio or television reception. However, there is no guarantee that harmful interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference with one or more of the following measures: (a) Reorient or relocate the receiving antenna. (b) Increase the separation between the equipment and the receiver. (c) Connect the equipment to an outlet on a circuit different from that to which the receiver is connected. (d) Consult the supplier or an experienced radio/TV technician for help.

FCC Compliance Statement (United States)

This equipment generates, uses and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a class A computing device in accordance with the specifications in Subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Canadian Department of Communications RFI statement

This equipment does not exceed the class A limits for radio noise emissions from digital apparatus 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 la classe A prescrites dans le règlement sur le brouillage radioélectriques publié par le ministère des Communications du Canada.

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Documentation by: CORPORATE TEXT & DESIGN www.ctxd.com

Part No. MAN-ALIF • Release 2.3c

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