FlightTransport® Systems

FlightLite® 100/100E

Installation and Maintenance

LIGHTPOINTE™

505-016300-00000 Rev A

2004-07

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Table of Contents

List of Figures

List of Tables

Safety

Cautions and Warnings

The following symbols are used in this manual to indicate that the installer should take particular caution to prevent injury or damage to the equipment.

Exercise caution when you see this symbol. It indicates actions that could be harmful to the installer or to the equipment.

Exercise extreme caution when you see this symbol. It indicates potentially lethal voltages!

Note: There are no serviceable parts within the units and the link heads should not be opened in the field.

Observe Standard Precautions

All persons having access to this equipment must observe all standard precautions as defined in applicable national statutory health and safety legislation.

Qualified Personnel

There are hazardous circuits within this product. Qualified personnel who understand and are trained to work with these hazards must perform all repair, modification, reconfiguration, and upgrading operations.

Note: Power the system down before removing the link head.

Warranty

LightPointe warrants this product against faulty materials or workmanship under the terms of our current Standard Warranty And Support Agreement provided that the product was purchased directly from us or from one of our authorized resellers. Please visit http://www.lightpointe.com/downloads/support/LIGHTPOINTE_StandardWarranty_v11.pdf for specifics on our Warranty. The warranty registration form was included with your system.

Contacting LightPointe

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Using This Manual

This manual describes how to install and maintain the FlightLite 100 Optical Wireless transmission system.

Step-by-step procedures describe:

- Performing a site review
- Preparing an installation site
- Performing a physical installation
- Performing system connection and alignment
- Checking the system for proper operation
- Performing troubleshooting procedures

Section	Contents
1. System Overview	System functional and physical overview
2. System Installation and Alignment	Detailed step-by-step installation and alignment procedures
3. Maintenance	Minimal activities to maintain the system
4. Troubleshooting and Diagnostics	Resolving operational problems
5. Specifications	Physical and electrical specifications
6. Index	Keyword index

Additional Resources

Refer to the following documents for additional information about the LightPointe system.

Document Number	Title
Not numbered	Field Engineering and Planning Guide


LIGHTPOINTE

1. System Overview

This chapter covers the following main topics:

- The LightPointe system
- Link head devices
- Laser safety

1.1. The LightPointe FlightLite System

1.1.1. Free-Space Optical Transmission

LightPointe wireless optical systems communicate using single or multi-beam infrared light transmission (invisible to the human eye). The systems require true line-of-sight between locations or relay locations (hopping points) and operate in high and ultra-high bandwidths.

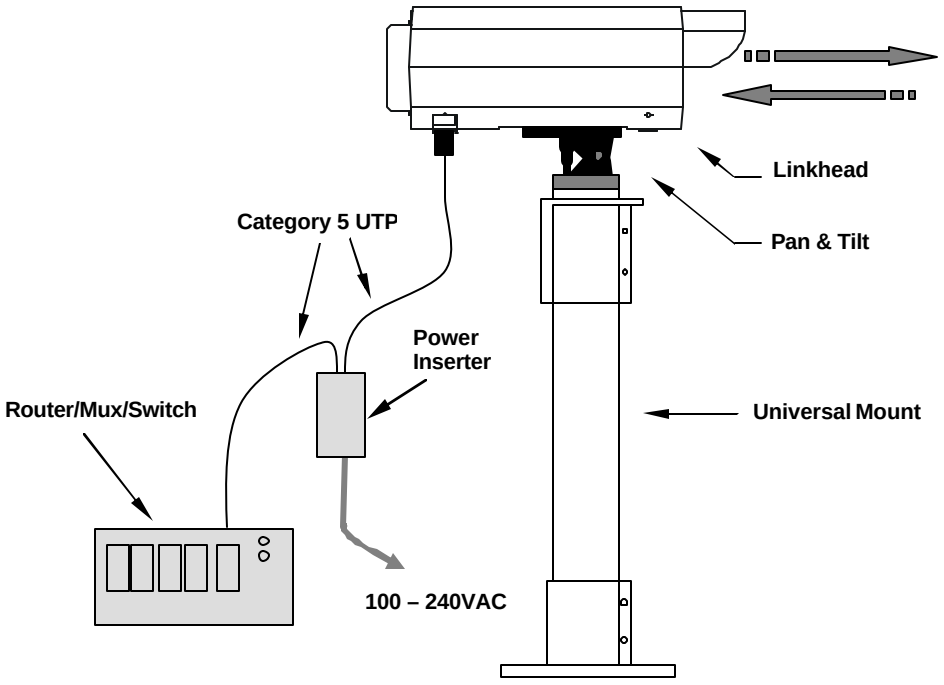


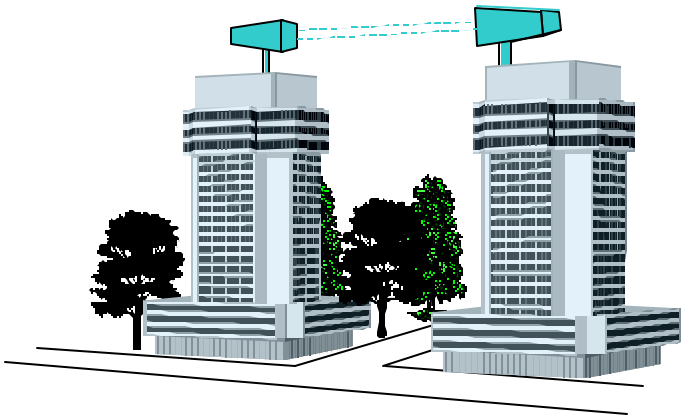
Figure 1-1: Typical FL 100 / 100E Installation and Connections

The link head on the transmission side transmits a narrow infrared light beam carrying the data received from the network interface. The link head on the opposite side receives the beam, filters the optical signal, and places it on the network interface on the opposite end. The system is capable of operating in a full-duplex mode, transmitting and receiving the entire bandwidth of data simultaneously.

1.1.2. Typical Applications

Typical system applications include the following:

- LAN Extension
- 10/100 Ethernet connectivity



1.1.3. Network Interface Connectivity

The LightPointe FlightLite 100 / 100E can support any current network architecture using Ethernet or Fast Ethernet Unshielded Twisted Pair cabling.

1.1.4. Transmission Method

The FlightLite 100 / 100E systems use a single transmitter and a single receiver for bidirectional full data rate transmission through space. The system operates as a “piece of fiber” through the air.

Transmitter Components

The linkhead receives electrical $10/100_t$ data traffic from the network. The electrical signal is used to modulate a high power laser source that transmits an infrared beam into free-space.

Receiver Components

The receive amplifier converts the infrared signal coming from free-space into an electrical signal by using a highly sensitive photo diode. This amplified receive signal is sent to the opposite network device interface on a standard RJ 45 Category 5/6 cable connection.

1.1.5. FlightLite 100 / 100E Operating Parameters

Table 1-1: FlightLite 100 Operating Parameters

Bit rate	10 or 100 Mbps		
Calculated distances, in meters, at LightPointe recommended Fade Margins	20 dB	15 dB	5 dB
	400	600	1300
Protocol	802.3 10h/10f or 100h/100f		
Beam Divergence	5 mrad		
Transmit Power	15 mW (+11.8 dBm)		
Receiver Sensitivity	-40 dBm		
Temperature Range	-35º C to +65º C		

FlightLite 100E Operating Parameters

Bit rate	10 or 100 Mbps		
Calculated distances, in meters, at LightPointe recommended Fade Margins	20 dB	15 dB	5 dB
	800	1000	1600
Protocol	802.3 10h/10f or 100h/100f		
Beam Divergence	5 mrad		
Transmit Power	15 mW (+11.8 dBm)		
Receiver Sensitivity	-40 dBm		
Temperature Range	-35º C to +65º C		

Link Head Devices

1.1.6. The FlightLite 100 / 100E Link Heads

The FlightLite products utilize a single transmitter laser and lens and a single Photodiode optical receiver and receive lens.

Figure 1-2: FlightLite 100/100E Link Head

The FlightLite 100 features:

- Front protective window with heater/lens defroster
- Internal telescope for coarse alignment of the system
- Receive amplifier with avalanche photo diode (APD)
- Transmitter amplifier with Vertical Cavity Surface Emitting Laser (VCSEL)
- Standard Power over Ethernet power inserter supply
- Optional local Power supply with external connectors
- Back panel with system status display and optical level meter
- Four FSO Receive Power indicators that are visible from a distance to aid in alignment

1.2. Laser Safety

LightPointe optical systems use semiconductor lasers as transmission sources. You must be aware of corresponding laser safety regulations and take the necessary precautions to avoid close direct exposure to the laser beam. The infrared laser beam is invisible and has the potential to penetrate to the retina and cause thermal damage.

The FlightLite optical laser communication systems use a Class 1M laser in accordance with the international laser safety standard IEC/EN 60825-1 A2:2001.

Familiarize yourself with laser safety regulations and strictly enforce all necessary precautions.

Warning: Do not look directly into the laser aperture from a short distance. Never use any optical instruments to view the laser beam.

When using the built-in telescope, you must be aware of the appropriate safety distance (refer to Table 1-2). For distances below the safety distance the operator must wear appropriate eye-protective laser safety glasses. These distances assume an exposure of more than ten seconds.

Table 1-2: Safe Distances for Telescope Operation

Link head	Naked Eye safety distance	Telescope* safety distance
FlightLite 100 / 100E	0	0
*Internal telescope contains a safety filter		

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Caution: This is a Class 1M Free Space Optical Communication System (FSOCS) transmitter and may be installed in *unrestricted, restricted* or *controlled* locations. For additional details, please refer to IEC 60825: SAFETY OF LASER PRODUCTS Part 12: Safety of free space optical communication systems used for transmission of information.

Unrestricted locations are those areas that are normally accessible to the public (e.g., unrestricted areas of rooftops, public areas at ground level, open areas of offices and industrial premises, etc.). To install a LightPointe Communications FSO system in an *unrestricted* location, the link head must be installed 3 meters high or higher above the surface of the *unrestricted* area or must be 1 meter or closer to the edge of the *unrestricted* area. If a LightPointe Communications FSO system is installed in an *unrestricted* area, a warning sign must be posted that states "**Do not use binoculars, telescopes or other optical aids to view the FSO link heads."**

Restricted locations are those areas that are normally inaccessible by the general public (including workers, visitors, and residents in the immediate vicinity) by means of any administrative or engineering control measure but that is accessible to authorized personnel (e.g. maintenance or service personnel including window cleaners in exterior locations) that may not have laser safety training. There are no special requirements for a LightPointe Communications FSO system installed in a *restricted* area.

Controlled locations are those locations where any kind of engineering or administrative control measure is introduced to make it inaccessible except to authorized personnel with appropriate laser safety training (e.g., tower-mounted terminals, fenced/secure areas of rooftops, locked rooms with strictly-controlled access, etc.). There are no special requirements for a LightPointe Communications FSO system installed in a *controlled* area.

The laser system shall be installed in accordance with ANSI Z136.1 control measures (engineering, administrative, and procedural controls).

1.2.1. Laser Safety Labels

All relevant labels are affixed to the inside of the link head near the laser aperture.

The warning labels are affixed to the outer shell of the link head.

Caution: Do not modify this certified laser product.

2. System Installation and Alignment

This chapter covers the following main topics

- Major system components
- Recommended installation tools and test equipment
- Site review
- Site installation preparation
- Installation
- Link head alignment

2.1. Major System Components

2.1.1. Universal Mounting Kit

The universal mount is used for pedestal or wall mounting of the link head in external environments. The mounting must be ordered with the Medium Pan and Tilt assembly as described in the next section.

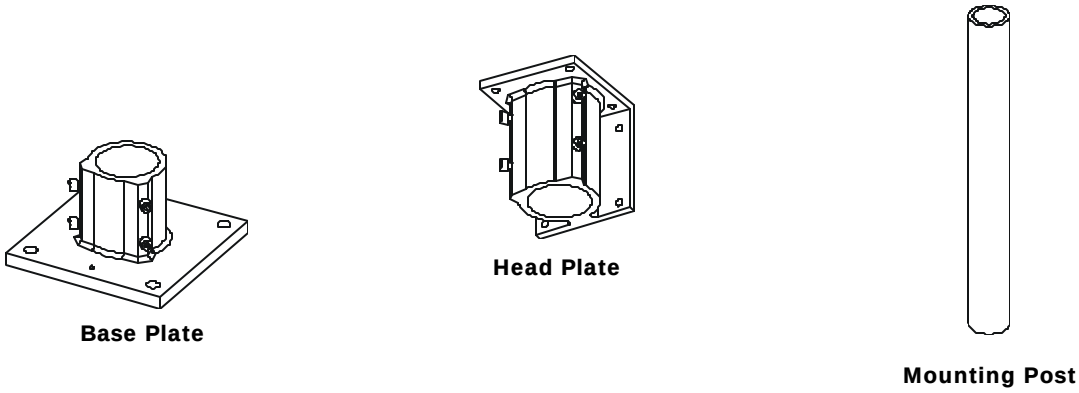
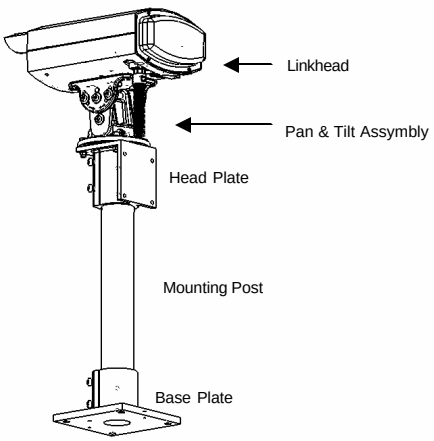


Figure 2-1: LightPointe Universal Mounting Kit



2.1.2. Medium Pan and Tilt Assembly

The pan and tilt hardware is used for coarse alignment of the link head and mounts to the Universal Mounting Kit described above.

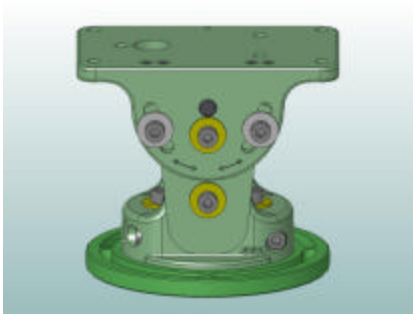


Figure 2-2: Medium Pan and Tilt assembly

2.1.3. Optional Indoor FlightLite Wall-Mount Arm

The FlightLite mounting arm may be used for wall mounts in an indoor or protected location. The arm mount is not fully rated for longer term or extended exposure to the outdoor environment. The Pan and Tilt Assembly is not required for the Indoor Wall Mounting Arm assembly.

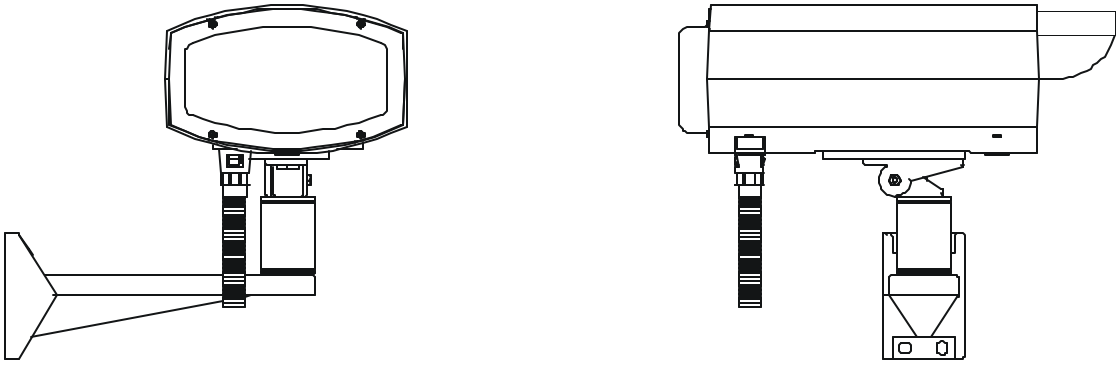


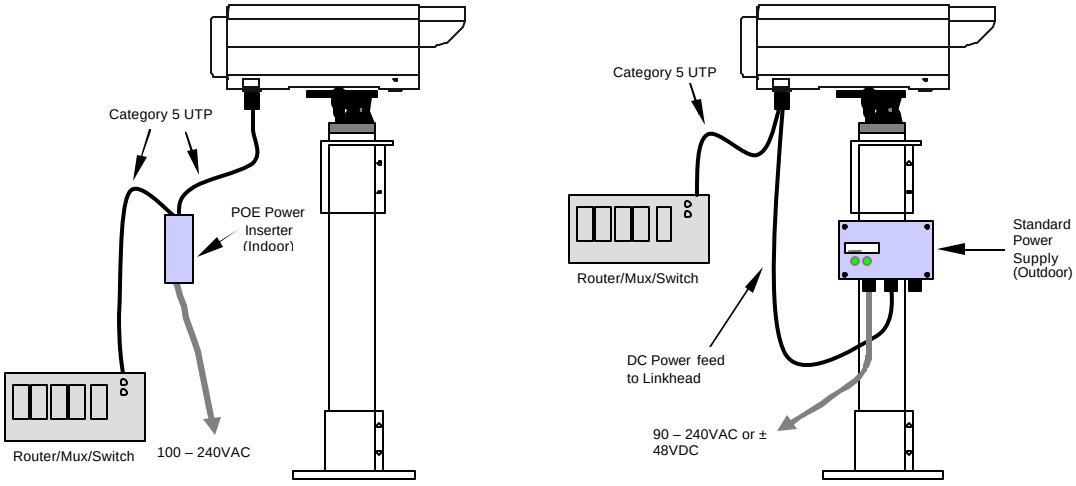
Figure 2-3: Indoor FlightLite Wall-Mount Arm

2.1.4. Three methods to power the FL 100

Table 2-1: FlightPower Power Supply Options

Power Supply	Description
LPS-APOE	LightPointe Power Over Ethernet PSE Adaptor
LPL-A12	LightPointe Standard Ruggedized AC Power Supply 90 – 240 VAC, 50/60Hz supplying 12 VDC to the linkhead
Direct ±12 to ±48V DC	The linkhead will accept any DC input voltage from 12 to 48 Volts. If there is a local DC power supply, UPS or battery plant, power the linkhead from the input pins on the rear panel using the connector supplied with the linkhead

The most straightforward way to power the linkhead is with the Power Over Ethernet power inserter. This eliminates the need for AC power run to the mounting location of the linkhead – often on the roof of the building.



Power Over Ethernet Powering

LightPointe Standard Power Supply Powering

Figure 2-4: FL 100 Powering Options

2.1.5. Power Over Ethernet Powering Method

The FPW PSE FL100 Power Over Ethernet injector consists of the following components:

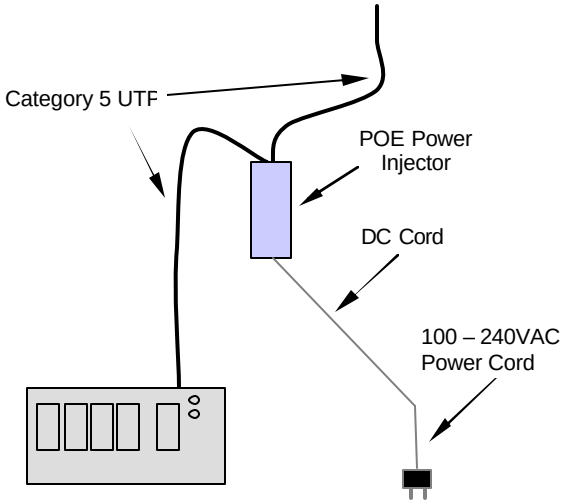


Figure 2-5: Power Over Ethernet Power Supply components

The Power Injector is equipped with a powered and a non-powered RJ Port. Use the Non-Powered port to connect data into the Network Equipment, hub, switch or router. The Injector is plugged into commercial AC. The Injector places power over up to 100 meters of Cat 5/6 Unshielded Twisted Pair wiring to power the linkhead from the powered RJ Port.

2.1.6. Local AC Power Supply at linkhead

A weatherproof outdoor local power supply may be provisioned at the linkhead mounting location in place of the POE injector:

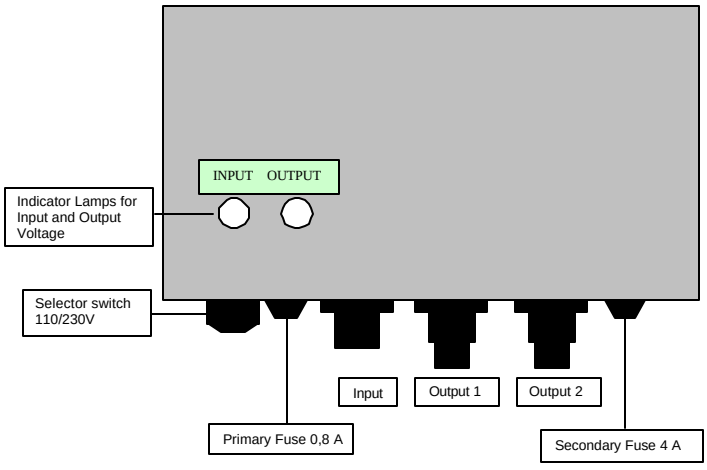


Figure 2-6: FlightLite100 (LPL-A12) Power Supply Assembly

This assembly provides:

- Capability to power the linkhead using 90-240 VAC 50/60Hz power.
- Dual power outputs to power one or two link heads
- Input and output power LED indicators

2.1.7. Link Head Assembly

The link head and pan and tilt hardware are mounted on the head plate assembly.

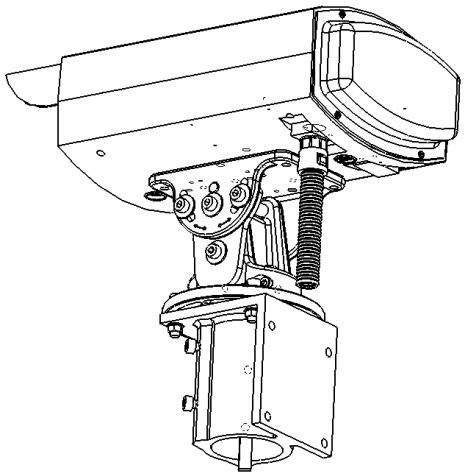


Figure 2-7: Link Head and Pan and Tilt Assemblies

The link head assembly consists of:

- A waterproof linkhead rear cover
- A 10/100 copper interface for data connections and power
- An optional connector for local alarms and powering
- Optics, Laser Transmit, and Receive assembly
- An alignment telescope
- User Interface back panel with a full set of local diagnostics and status indicators.

The linkhead is the smallest replaceable component.

In the event of failure, there are no replaceable parts inside the linkheads- return the entire linkhead unit in the original shipping container.

Empty shipping boxes are available.

2.2. Recommended Survey and Installation Tools

The following tools and supplies may be needed for survey, installation, testing, and maintenance of the LightPointe system hardware.

Site Surveys:

- Accurate scaled map for locating sites and doing rough distance calculations
- Laser range finder binoculars with 1000 meter range (as used by golfers, hunters and target shooters) or GPS for accurate distance measurement
- Binoculars to assist in installation
- Sketch pad to make rough drawings and notes (recommend using LightPointe Field Engineering Guide)
- Tape measure to determine approximate short distance fiber, power runs, etc.
- Camera (digital recommended) to photograph installation sites to reduce need for return visits to sites (optional)

Installations:

- Standard electro-mechanical tool kit with pliers, screwdrivers, wire cutters, wire strippers, etc.
- Two-way radio or cell phones to communicate when aligning link heads
- Plastic tie wraps to secure flexible conduits, etc.
- Two each 6mm hex (Allen) wrenches to supplement wrenches shipped with the equipment
- 13mm socket or open end wrench for mounting bolts
- Electrical tape for securing and fastening
- Measuring level to evaluate flatness of mounting surfaces
- The tape measure and camera from the site survey can also be helpful in completing and documenting site installations
- Category 5/6 cabling integrity tester

The following items may also be needed for installation and/or service, depending on the location and type of installation:

- ❑ Digital volt meter to check electrical systems
- ❑ Power drill or power hammer with appropriate bits to securely install the link head mounting platforms
- ❑ Step or extension ladder for access to elevated locations
- ❑ High quality rope to use for hoisting materials and/or to be used in conjunction with a safety harness to ensure installer safety when appropriate
- ❑ Exterior rated extension cord (50' or longer recommended)

2.3. Site Review

For customer supplied preliminary installation assessment data and detailed site review instructions refer to the LightPointe Field Engineering & Planning Guide. Use this guide to check the proposed installation against actual LightPointe installation standards.

Step 1 Determine the appropriate system to meet the needs of each specific location:

- ❑ Measure point-to-point distance using a laser range finder or GPS
- ❑ Confirm that the distances are within the recommended operating guidelines in table 1-1. If the physical distance of the link heads is longer than the maximum transmission distances the system will not perform well in poor visibility conditions.

Step 2 Ensure true, free line-of-sight.

- ❑ Confirm that signs, buildings, trees, or other obstacles in the line of sight cannot interrupt the connection.
- ❑ Determine if there is a possibility of work activity, foot traffic or maintenance activities that could interfere with the transmission of data.
- ❑ Avoid all air handling exhaust vents, equipment that gives off steam/water vapor and smoke stacks
- ❑ Avoid shooting low over long dark or reflective roofs, parking lots, tarmac or any source that will absorb and radiate the heat of the sun into the path between the linkheads.

Step 3 Ensure transmission security.

- ❑ Place the linkhead in a visible location if you are concerned about security. It is usually not a concern as the transmission beam is narrow and invisible, making it impossible to reflect to beam or to in any way tap into the beam without interrupting the system.
- ❑ Ensure that equipment mounted behind the link heads to intercept the transmission beam would be difficult to hide.

Step 4 Evaluate the mounting location – it must be very rigid and solid.

- ❑ FSO requires a stable and vibration-free mounting platform
- ❑ The foundation at the mounting location cannot be susceptible to movement due to humidity or temperature changes or the sun shining on the mount.
- ❑ Evaluate the need for a lightning protection system
- ❑ Use the standard LightPointe Universal Mount if possible. It has been tested and proven in years of use.

Step 5 Evaluate the locations for access.

- ❑ Easy access to link heads
- ❑ Stable location/platform for mounting
- ❑ Safety considerations for installers and maintainers of the system in windy, snowy or cold conditions.

Step 6 Evaluate mounting locations for reliability

- ❑ Near roof edge to avoid interruptions of transmission
- ❑ Near roof edge to minimize heat (shimmer) effects
- ❑ Weather protected location if possible

Step 7 Consider the mount's foundation (refer to Section 0).

- ❑ Concrete or other solid structural building member
- ❑ Avoid wood, crumbling brick, stucco and metal panels
- ❑ Interior floor behind window

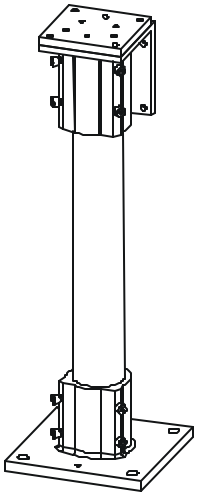
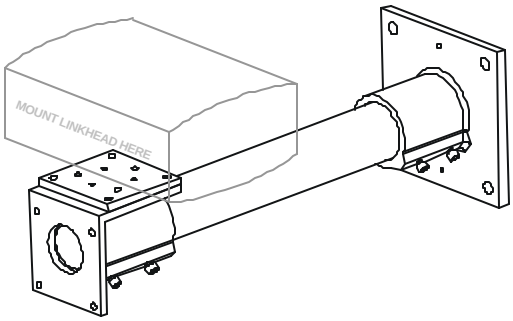
Step 8 Consider mount type (refer to Section 0).

- ❑ Universal mount used vertically or horizontally
- ❑ Other specialized mounts
- ❑ LightPointe indoor mount

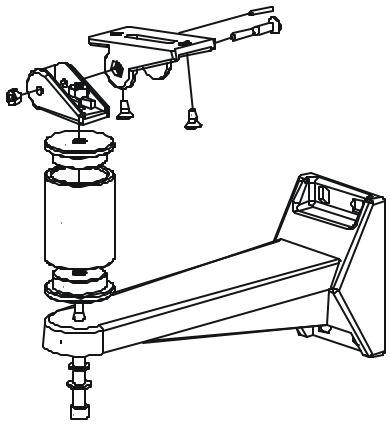
2.3.1. Typical Mounting Locations and Platforms

Refer to the following table for examples of different mounting kits and details regarding their use.

Table 2-2: Link Head Mounting

Mount Style	Description
	**Universal Mount** Use the Universal Mount for upright installations using large anchor bolts or through bolts at the base plate. If possible, cut the mounting pole to a shorter length to provide additional stability. Only place the mount on solid and structurally sound material. **Tighten all bolts hand tight with the hex/allen wrench provided.** **Tighten all anchor bolts using appropriate wrenches and tools.**
	**Universal Mount used horizontally** You may also use the Universal Mount in horizontal installations. Be sure that the base plate is mounted into a wall surface using penetrating anchor bolts or through bolts. The wall material must be solid and deep enough to accommodate the bolts. If it is used for the installation, mount the Standard Power Supply box with cables exiting at the bottom. **Tighten all bolts hand tight with the hex/allen wrench provided.**

Caution: For indoor installations where people may be present, the linkhead(s) should be installed close enough to the window to prohibit looking into the transmitter beams. Avoid linkhead angles of 50 degrees or less measured from the window glass.



Indoor Wall-Mount Arm

Use this mount when the linkhead is mounted indoors or in a protected outdoor location free from wind and rain. The mount is designed for horizontal mounting on a solid and stable wall structure.

2.4. Site Preparation prior to installing the linkheads

Please refer to the LightPointe Field Engineering & Planning Guide for detailed site survey instructions.

Step 1 Check space requirements.

- ❑ Multiple link heads can be co-located at the same site. Multiple link heads should be spaced appropriately if they are pointed in the same direction. There are no restrictions for link heads pointed in different directions.

Step 2 Prepare the surface for mounting.

- ❑ Inspect the surface to ensure that it is a solid material that can be penetrated by bolts.
- ❑ Make sure the surface is not cracked or broken
- ❑ Check the surface to ensure that it is rigid.

Step 3 Check the available power if using the local power supply. If using the Power Over Ethernet injector, no AC power is required at the linkhead location.

- ❑ Ensure that the power receptacle is weatherproof and near the linkhead location
- ❑ Employ a professional electrician to be certain that all local Electrical codes are being met.
- ❑ Also be aware of local building code requirement
- ❑ The systems use low power lasers and are completely safe for the human eye. There are no Laser Safety considerations with the FL 100.

Step 4 Check the network interface connections.

The number of connections varies depending on system type and redundancy requirements. *Always pull double the amount of required cables.*

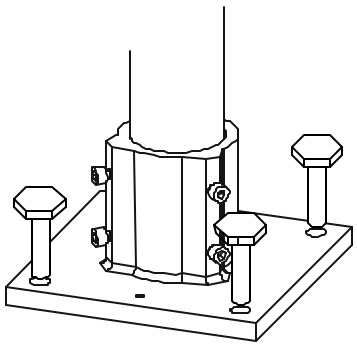
- ❑ Determine the cable type which is required. There are no special requirements for the interface other than standard Category 5/6 UTP cabling
- ❑ If the cable is exposed, use a cable with a jacket that is outdoor rated.
- ❑ If the cable runs through air handling areas, use a properly rated jacket which will not outgas at high temperatures.

Step 5 Confirm the proper performance of the cable with a standard Ethernet cable tester.

2.5. The installation process

It is possible for one person to perform all installation and alignment procedures. However, installation will always be done more effectively and safely with two people. This is especially true at the alignment phase which is the most critical part of the installation process.

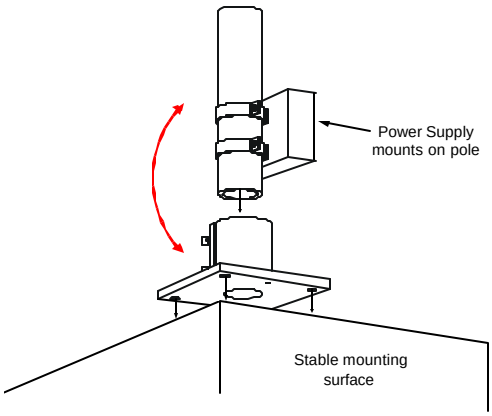
2.6. Assemble and Mount the System Hardware



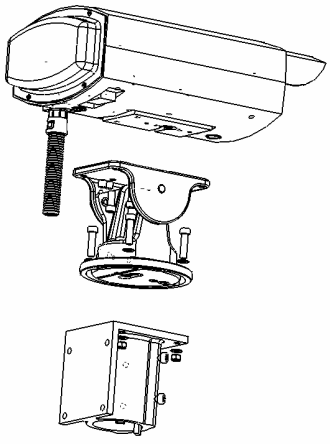
Step 1 Install the mounting base plate to a solid platform using 12 mm (1/2") screws.

- ❑ Anchor the mount in wall or concrete (recommend M12-screws)
- ❑ Use bolts of hardness class not less than 6.6

To ensure stability, keep the mounting post as short as possible. The maximum allowable mounting pole lengths are 110 cm.



Step 2 Attach and fasten the mounting post assembly to the base plate using the supplied fastening screws. Do not over tighten the mounting screws.



Step 3 Mount the linkhead and Pan and Tilt assembly to the Head Plate using the hardware supplied by LightPointe. Fasten the head plate to the mounting post using the supplied fastening screws.

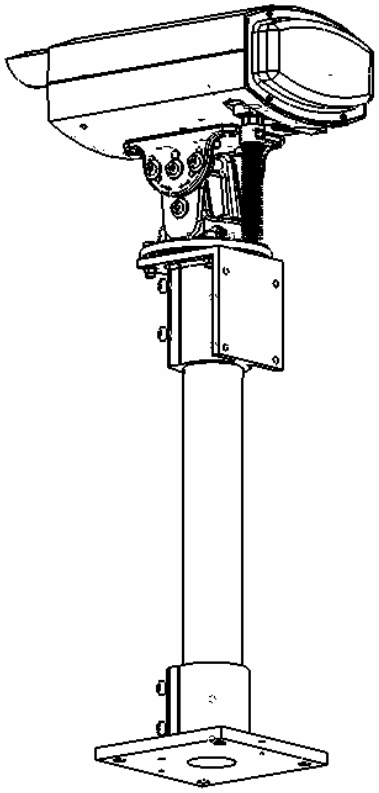


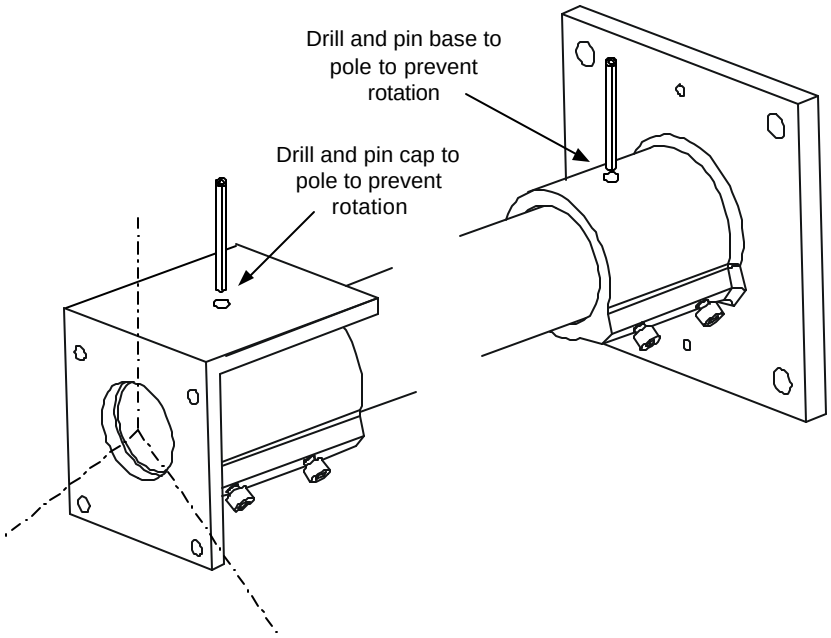
Figure 2-8: Completed Mounting assembly

Caution: The base plate and head plate should be pinned to the mounting post when the base plate is mounted in a horizontal position. Do this to prevent rotation and misalignment from wind.

Extra security for Horizontal mounting situations

To pin the base plate and head plate to the mounting post when used in a horizontal mount:

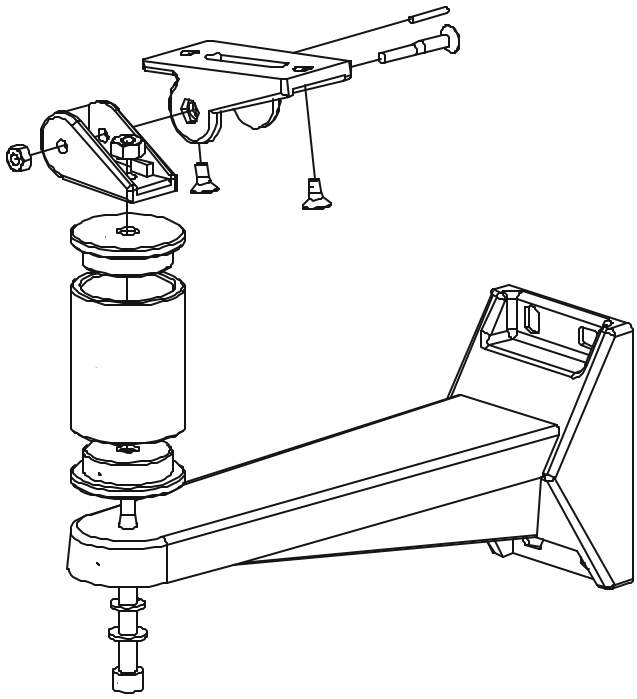
- ❑ Drill an 8 mm hole through the cylinder wall of the base plate and the mounting post and pin the assemblies together using 8 mm grooved pins or 3/8 x 1 inch screws.
- ❑ Drill an 8 mm hole through the cylinder wall of the head plate and the mounting post and pin the assemblies together using 8 mm grooved compression fit pins or 3/8 x 1 inch stainless steel screws.
- ❑ Position the pins at the opposite side of the cap and base from the tensioning screws. This will assure that the mount does not rotate and cause system misalignment.



Horizontal Wall Mount Arm

To mount the FL 100 indoors on the FlightLite wall Mount Arm assembly

- ❑ Position four anchor bolts into a solid surface wall that will have proper line of sight and is a secure location.
- ❑ Anchor and tighten the wall mount
- ❑ Position the linkhead and mount the linkhead to the integrated Pan and Tilt assembly which is included in the Mount Arm
- ❑ Tighten all bolts hand-tight using the 6mm allen wrench supplied with the units.



Position the linkhead in a place that is secure and safe. Do not place the linkhead in an area that will draw attention to it. Be careful to use the proper anchor bolts and fasteners for the mounting surface that you have chosen.

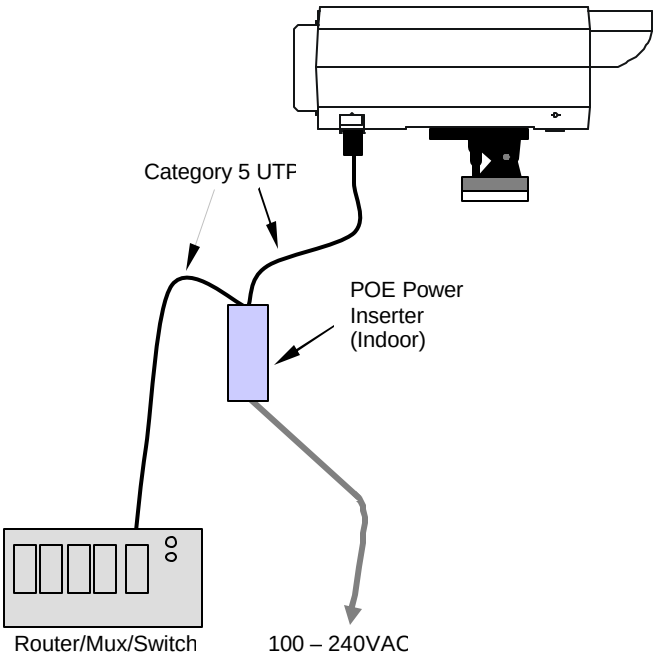
A standard metal or wood framed drywall partition will USUALLY NOT provide enough stability.

2.7. Install the Power Over Ethernet Injector

(This is an Optional arrangement – System may also be powered using a LightPointe standard power supply at the linkhead)

If the Power Over Ethernet PSE adaptor is to be used:

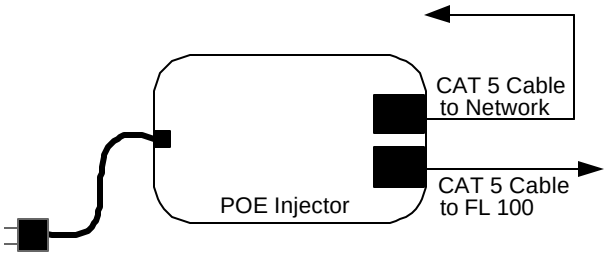
Step 1 Connect the DC power adaptor to the injector and plug the adaptor into the commercial AC wall socket.



POE Injector components and interconnections

Step 2 Connect the Injector's built-in RJ-45 Cat 5 Ethernet cable to your network.

Step 3 Connect the RJ-45 Cat 5 Ethernet cable from the Linkhead to the POWER AND DATA OUT RJ-45 jack on the injector.



2.8. Assemble and Mount the Local Power Supply

(This is an Optional arrangement – System may also be powered using a Power Over Ethernet power injector system)

Step 1 If the power supply will be used with the standard LightPointe universal mount, use the two round, insulated clamps provided with the power supply to attach the unit to the pole.

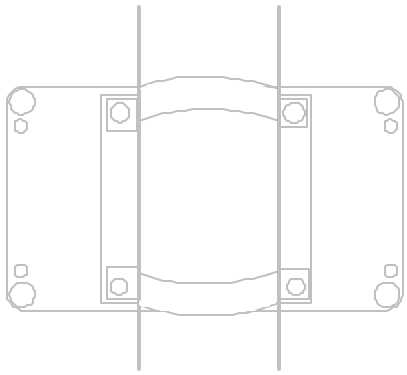


Figure 2-9: Vertical Power Supply Mounting

If the power supply will be mounted with the pole in a horizontal position, turn the back plate by removing the four sets of nuts, rotating the plate and then re-securing the back plate.

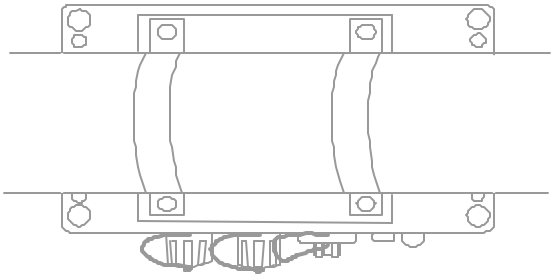


Figure 2-10: Horizontal Power Supply Mounting

If the power supply is to be mounted to a surface other than the standard LightPointe pole, the power supply may be secured using the two metal brackets provided with the system. The mounting brackets are secured to the power supply as indicated, and the system should then be attached to a solid surface with the appropriate type of mounting screws.

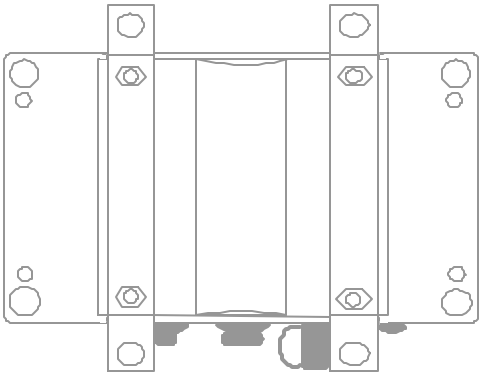


Figure 2-11: Wall Power Supply Mounting

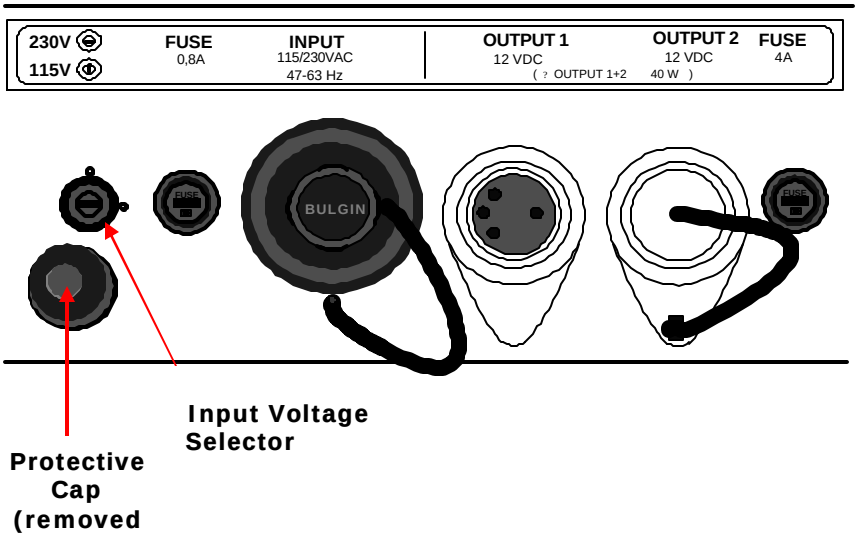
Note: The maximum recommended distance between the power supply box and the linkhead is 3 meters.

Caution: Disconnect main power before connecting electrical cables.

Step 2 There is a 3-meter power cord provided with the standard AC power supply. The connector on the cord is pre-wired, and the cord tail provides three labeled wires (Hot, Neutral and Ground) that must be properly terminated (junction box, electrical plug, etc.) for connection to an electrical power source. LightPointe recommends that the power cord be hard-wired into a dedicated circuit.

Once the power cord is properly connected to an electrical source, the power cord connector should be secured to the AC Input connector on the power supply.

Warning: Ensure that the correct power cable is used. Exercise extreme caution when affixing the wires to the connector; incorrect wiring at the connector can pose personnel hazards and may cause damage to the equipment that is NOT covered under warranty.



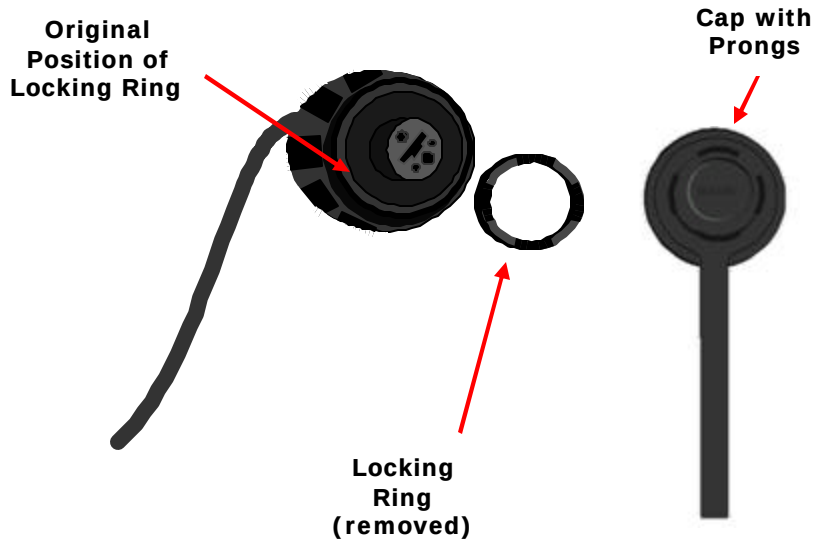
Step 3 Set the power supply input selector switch to the correct position. The power supply is preset at the factory to an input voltage of 230 VAC. To reset the input voltage to 115 VAC, remove the input selector switch cover protective cap, turn the selector switch to the vertical position and replace the protective cover.

Caution: Ensure that the correct power input voltage is selected BEFORE applying power to the power supply.

- **Do not set the power supply to 115 VAC and then apply 230 VAC – this will damage the power supply.**
- **If the power supply is set to 230 VAC and then connected to 115 VAC, the output from the power supply will not be high enough to operate the linkhead.**

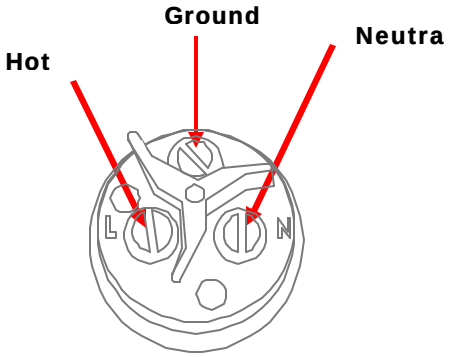
The power supply input selector switch should NEVER be changed while power supply is connected to its primary power source.

If it is necessary to lengthen the power cord, another longer cord may be retrofit to the existing input connector. Open the power connector by removing the locking ring from the connector. The prongs on the caps of the protective cover of the cord can be used to remove the locking ring.



Step 4 Loosen the strain relief on the connector to release the power cord and detach the power cord wires from the connector.

Place the strain relief over the new power cord, thread the power cord through the connector and connect the wires of the power cable to the correct pins of the terminal connector as indicated on the connector and in the following picture. The power cord cable outer sheath diameter must be between 5 and 10.25 mm (.19 to .38 inches) in diameter, and the individual wire connections at the connector plug must be between .75 mm^2 and 3.31 mm^2 (18 AWG to 12 AWG).



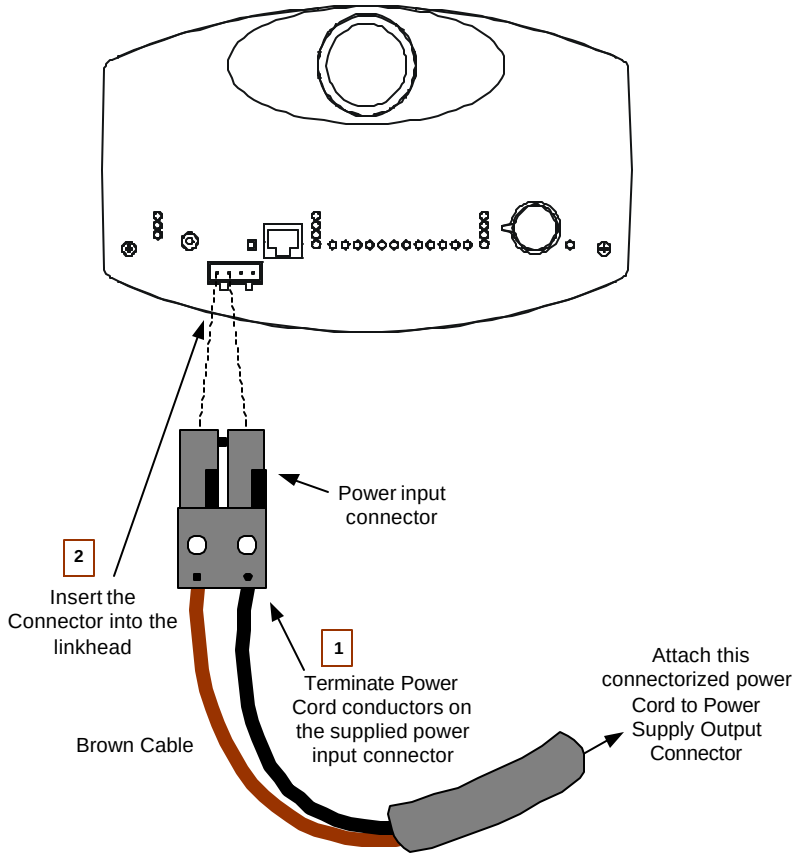
Once the wires have been connected, reassemble the input power connector. Ensure that the key slot on the terminal block is properly aligned with the key tab on the connector. Replace and tighten the locking ring, then connect the power cord to the AC Input connector.

Step 5 Connect the 12 VDC cable to the link head by first removing the cable entrance tube at the bottom of the link head.

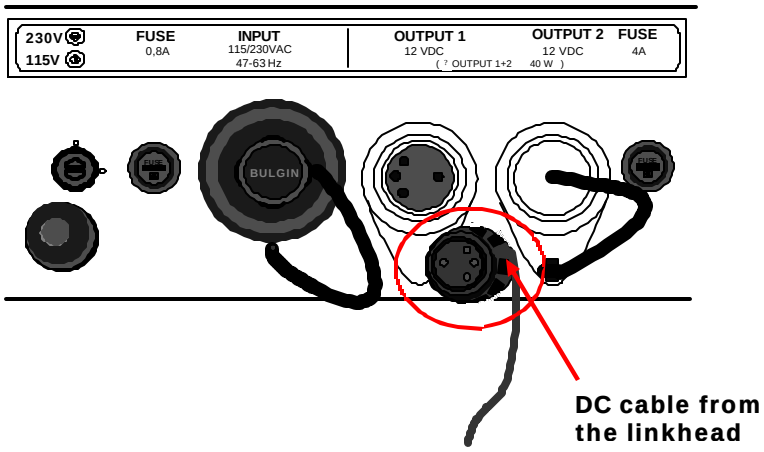
Insert the power cord through the entrance.

Terminate the power cord conductors into the power input connector using the screw lug connectors.

Insert the power connector into the two power input pin connectors on the back of the linkhead.



Step 6 Connect the DC cable from the linkhead to the power supply (one 3 meter cord provided with each power supply) to the power supply by unscrewing the cap from the Output 1 port and securing the connector into the plug.



Note: The second power output port (Output 2) from the power supply can be used to connect to a second linkhead.

Note: If redundant power supplies are desired, a separate (back-up) power supply and cable to interconnect two power supplies may be ordered from LightPointe. The LPS-00-R "Y" Cable should be ordered.

Step 7 Repeat these steps at the second linkhead.

Step 8 Apply power to both linkheads by connecting the input power cable from its AC source into the Input connector on the power supply. Make sure that both the "Input" and "Output" indicator lights on the power supply are illuminated. Turn the linkhead power switch to the "1" (on) position.

Step 9 Repeat these steps at the second link head.

2.7.2. LED BAR GRAPH – OPTICAL INPUT LEVEL

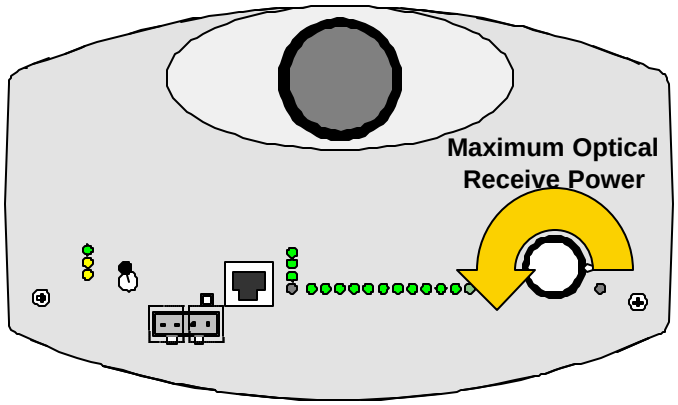
The bar graph is used to align the link head by giving a quick indication of the received power at the linkhead.

- One “bar of power” is equal to one green LED on the rear panel Received Optical Power indicators
- The bars are counted from left to right and there are ten bars
- The number of bars of received power will depend on the distance between the link heads and the actual weather conditions
- The number of bars should be approximately equal when both link heads are correctly aligned, and the Power Adjustment Knob (see below) is set to the same level on each side

2.7.3. POWER ADJUSTMENT KNOB

The power adjustment knob is used to set the optimum received power level once the units are aligned. This avoids saturating the receiver with too much power. This allows the links to be installed at close ranges as low as 10 meters apart.

- During the initial alignment, turn the Power Adjustment Knob anticlockwise (wide open) to the Maximum Receive Power (minimum attenuation) position (see picture below).
- Leave the knob in this position during alignment with the telescope and power bars. Once the alignment procedure is complete, check the reading on the LED Bar Graph. If the reading is 9 bars or less, then the power does not need to be adjusted.
- If the reading is more than 9 bars or the Overload LED is illuminated, turn the Power Adjustment Knob clockwise until the LED Bar Graph reads 8-9 bars.



When the alignment process is performed under clear weather conditions, and the link heads are no further apart than the recommended optimal distance, the bar indicator should illuminate between 5 and 9 bars. If the Overload LED is illuminated, then turn the Power Adjustment Knob as described above.

Note: The system will operate when the bar graph indicator shows only one bar of power. This should only occur during times of poor visibility, fog, etc.

2.9. Link Head Alignment

The following are the alignment procedures for the FL 100.

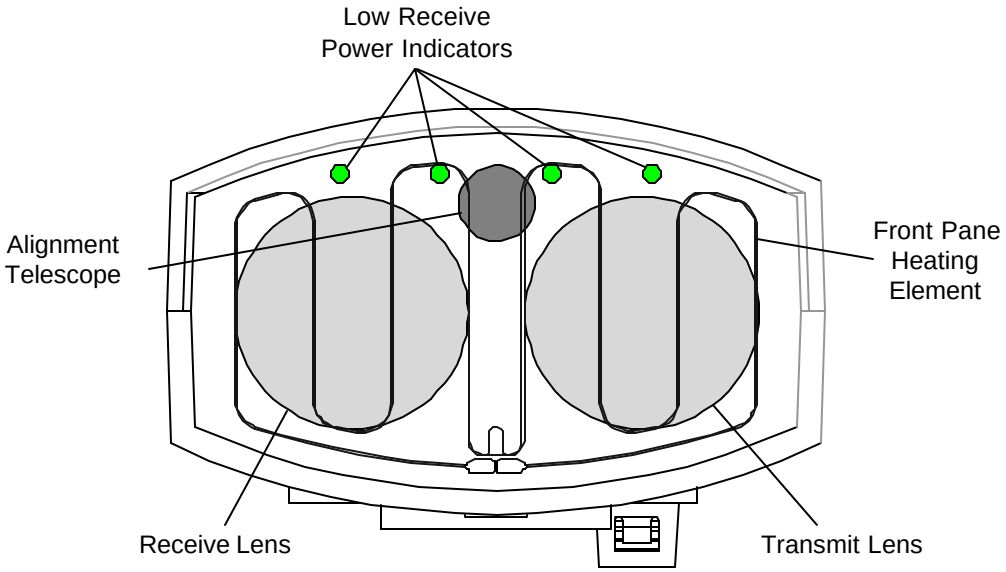


Figure 2-12: Front of Link Head showing operational features

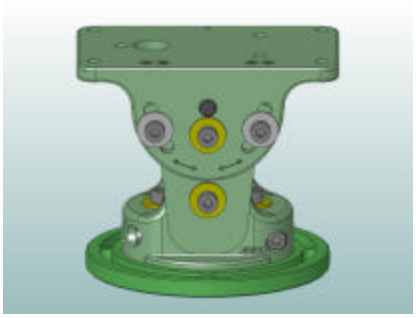
2.9.1. Alignment Procedure

A single person will have much difficulty in performing link head alignment. Two people are virtually mandatory. The only tools required to perform system alignment are the Allen wrenches (metric #6) that are provided with the system.

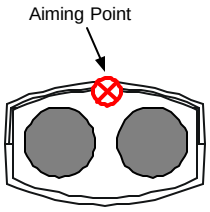
Perform the following steps moving only one linkhead at a time:

Step 1 Remove the back cover protective plate from the link head and the lens covers from the telescopes.

Step 2 Loosen the locking screws at both pan and tilt assembly. Adjust the pan and tilt locking screws so that smooth, controlled movement is possible for fine alignment.



Step 3 Center the telescope crosshairs on the opposite link head at an aiming point slightly above the linkhead TX and RX lenses.



Caution: Before applying power to the link heads, make sure the input power selector switch is in the correct position.

Step 4 Connect the Cat 5/6 copper data cables from the network interface to the RJ connector on the back of the link head or otherwise provide power to the linkhead.

Step 5 Set the power switch on the linkhead to the Test position (down). Confirm that the power LED illuminates. The system is now transmitting power over the Free Space link.

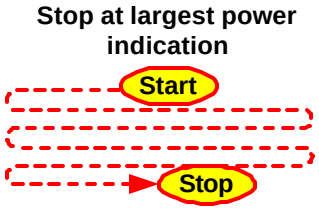
The linkheads may be aligned well enough to "see" each other with only the telescope alignment. But this is rare and further alignment is almost certainly required.

Observe the Low Power Receive indicators on the far-side linkhead. These indicators are used to confirm coarse alignment from one end of the link observing the far end.

These indicators on the face of the linkheads are bright enough to be visible from your end of the link. These indicators are illuminated green when the received FSO power at the OTHER linkhead is lower than three bars – which is too low for proper operation.

When the lights go out, you have some amount of power being received between the linkheads. If the lights are on, you need to continue to adjust the alignment.

Step 6 Slowly move **<u>one linkhead at a time</u>** in a small back and forth pattern. If no power indication is seen, turn the tilt adjuster screw 1/8 turn and repeat the back and forth pattern. Do this until the low Receive Power indicators on the front panels go off and you see more than 6 bars of power on the rear panel indicators on both linkheads.



Once you have end-to-end connectivity, adjust the alignment until you get the maximum number of power bars on both ends.

NOTE: Both ends should have almost the same power level readings – usually within one bar of each other. If both are not equal, continue to adjust the alignment.

Step 7 Carefully tighten all locking screws on the Pan and Tilt or Arm Assembly very tight using the hex wrench supplied.

The number of bars that can be seen at the back panel signal strength meter should not be lower after the locking screws have been fastened. Repeat the alignment process if the number of bars is significantly lower on one end of the system, or if the power indications change as you tighten the Pan and Tilt or mounting arm assembly.

The alignment procedures are now completed.

2.10. Network Connections

Step 1 If not already connected as part of the alignment process (as when using the local power supply) connect the Cat 5/6 copper data cables from the network interface to the RJ connector on the back of the link head.

Note: The receive power levels may drop approximately 1 bar when the network interface fiber optic cables are attached. This is normal and is not a malfunction.

Step 2 Place the Power Switch to the “ON” Position – up. This will turn off the test signal generation and begin actual data transmission across the Free Space link.

Step 3 Confirm that the operational panel indicators are normal with no alarms or red alarm indications. Refer to Table 2.4.

Step 4 Replace both rear covers and tighten all screws to weatherproof the units.

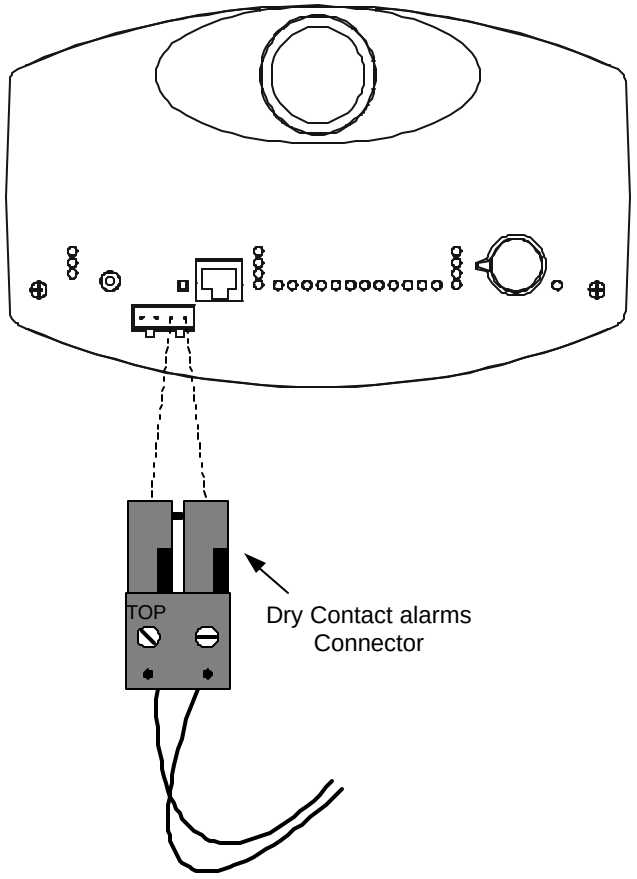
The connection procedures are now completed.

2.10.1. Dry Contact Alarm outputs

The FL 100 offers an optional alarm output to drive a relay or other device upon system failure. The alarm relay has dry contacts which are rated for a maximum of 200 mA. The alarm relay forms a “Make” (Normally Open) connection between the two pins on any of the following conditions:

- Loss of power to the linkhead
- Too much received power from Free Space (Overload)
- Too low received power from Free Space (Beam is Blocked)

The dry alarm output pins are accessed with the same screw-type connector that is used for the local power supply arrangement.



2.10.2. User Interface Key to back panel indicators

Figure 2-13: shows the displays, controls, and indicators on the back panel of the link head. Table 2-3 describes these components.

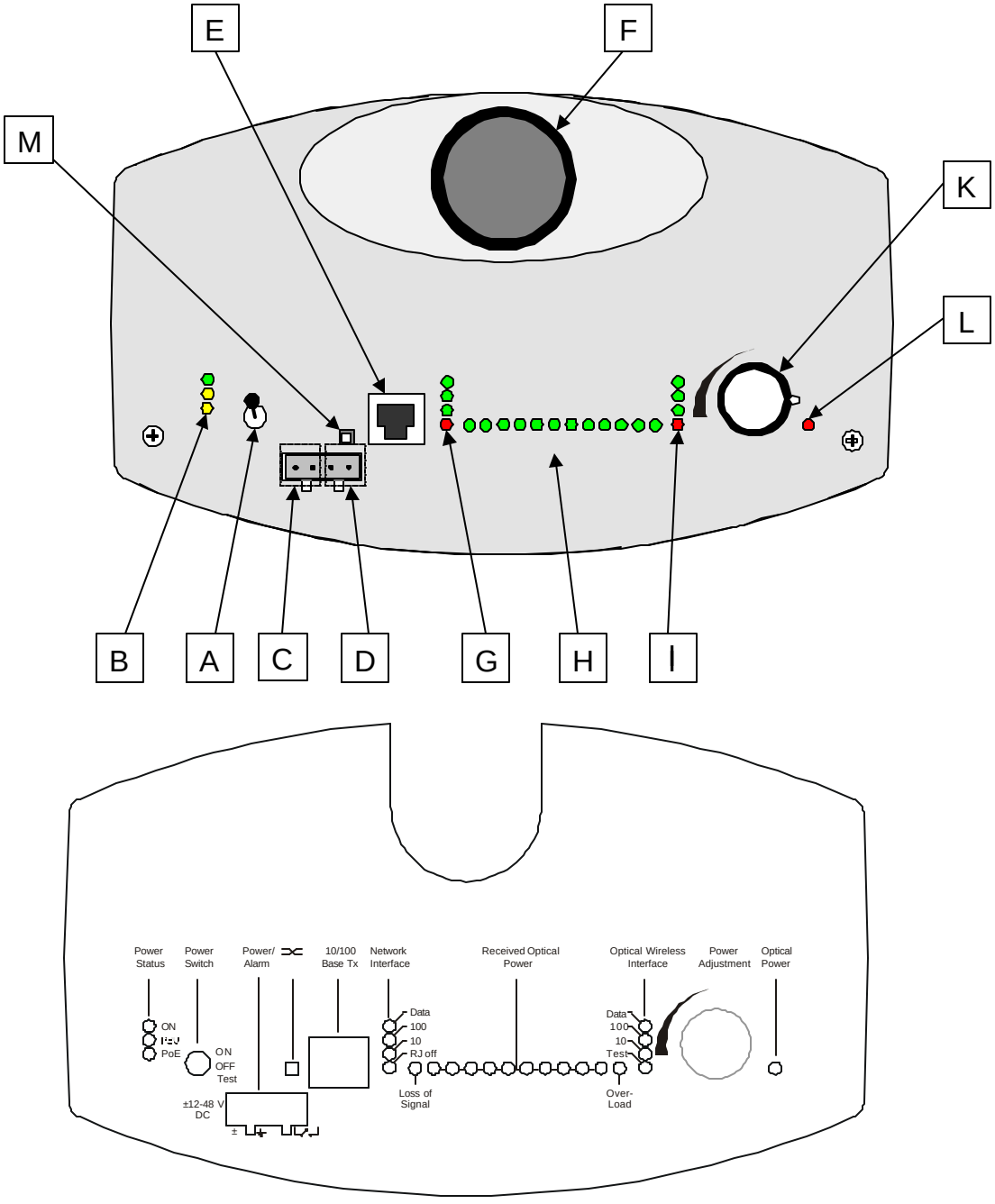
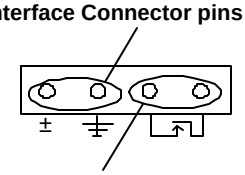


Figure 2-13: Link Head Back Panel Key and labeling scheme

Table 2-3: Link Head Back Panel Displays, Controls, and Indicators

Back Panel Item		Description
A Power Switch	Up	On - Normal Position
	Center	Off
	Down	Test signal Generated over Free Space (alignment only)
B Power Indicator LED		Green when Power supply is turned on
		Yellow when Local AC/DC Power is present
		Yellow when PoE is present
C Power Interface Connector pins  **D Alarm Relay Connector Pins**		For external (non POE) power supply Alarms which trigger relay contact closure output 1. Loss of Power to Linkhead 2. Too much FSO Power (overload) 3. Too little FSO power for operation (Loss Of Signal)
E Copper Interface		For connection with 10/100$_t$ cable (RJ-45 connector)
F Telescope		To Use for Coarse Alignment
G Twisted Pair Data Indicators (Network Interface)		Green (normal) when Network Data is active
		100 Mbps, green when 100 Mbps data present OR
		10 Mbps, green when 10 Mbps data present
		Red when no Data out - Network data link unavailable
H Free Space Optics receive power		Current receive power level (optimum range 6 to 10 bars)
I FSO (Free Space) Indicators (Optical Wireless Interface)		Green (normal) when Free Space Optics portion is active
		100 Mbps, green when auto negotiate to 100 Mbps OR
		10 Mbps, green when auto negotiate to 10 Mbps
		Test mode, red if in Test mode
K Power Adjustment Knob		Adjusts received power level to optimum range of operation at close distances
L Optical Power LED		Red when either of two modes of failure detected 1. Too much FSO power overload 2. Too little FSO Power received 3. Linkhead is in test mode
M Crossover push button		One-push button for (MDI/MDI-X) crossover IN: MDI OUT: MDIX (normal position)

Check for normal operation of the link head system by observing the LEDs and bar graph displays on the back panel of each link head. Check the following displays for normal operational status:

Table 2-4: Bar graph and LED Operational Checks

Back Panel Item		Description
A	**Power Switch**	Up — On
B	**Power Indicator LED**	 Green when Power supply is turned on  Yellow when Local AC/DC Power is present OR  Yellow when PoE is present
G	**Twisted Pair Data Indicators (Network Interface)**	 Green (normal) when Network Data is active  100 Mbps, green when 100 Mbps data present OR  10 Mbps, green when 10 Mbps data present
H	**Free Space Optics receive power**	6 to 9 bars steadily illuminated - one bar flickering OK
I	**FSO (Free Space) Indicators (Optical Wireless Interface)**	 Green (normal) when Free Space Optics portion is active  100 Mbps, green when auto negotiate to 100 Mbps OR  10 Mbps, green when auto negotiate to 10 Mbps
K	**Power Adjustment Knob**	Adjusted to no more than 9 bars with flickering 10th bar
L	**Optical Power**	Dark

Please contact your distributor or LightPointe Technical Support if one of the red LEDs is illuminated and if you cannot fix the problem by using troubleshooting procedures.

System installation and alignment procedures are now completed. The system should be fully operational.


LIGHTPOINTE

3. Maintenance

3.1. Scheduled Maintenance

The FlightTransport systems are relatively maintenance free. There are no annual adjustments or maintenance routines required.

The most important parameter is always Received Power. If the Received Power level has dropped, the system should be manually checked to determine the cause.

3.2. Annual Maintenance

The front window of the link heads should be cleaned with a soft moist cloth once a year using water or a commercial glass cleaning solution. In a dusty, smoky or polluted environment the window may need to be cleaned more often. A continuous drop in Received Power levels (averaged over a period of 48 hours) will indicate the need to clean the glass or re-align the system.

During this annual maintenance, check the link heads for good alignment. The mount may have settled. Assuming that the weather is clear, the Receive Level Bars should display the same level which you noted during the installation. Check for obstructions in the transmission path such as growing trees, mechanical equipment or new construction. Check all electrical connectors for corrosion, moisture or other damage. Check all optical cables for damage or changed routing.

REMEMBER - On single beam systems you may be interrupting the beam for a fraction of a second as you wipe the glass clean. If you are cleaning a multiple beam system, this is not a problem -- all four beams are transmitting the same information and the momentary interruption of up to three beams will have no affect on your users.

WARNING - Do not stare (look) directly into the front of the link head from close range. Do not attempt to open the housing, there are no user-serviceable parts inside.

The power level should be logged at initial installation. If the power level begins to drop, there is a chance that the front window has become dirty. It is also possible that something in the Line Of Sight has changed (leaves, new construction, heating or cooling equipment, smokestack) that has lowered the power levels in some way and should be corrected.


LIGHTPOINTE

4. Troubleshooting and Diagnostics

This chapter covers the following main topics

- Failure types
- Troubleshooting methods
- Technical support information
- RMA procedures

The link heads can be thought of as nothing more than fiber optic cable through the air. No processing of data occurs within the link heads. The linkheads do not frame, buffer or in any way rob payload data. If the link heads are aligned and data is moving between them (i.e. Test Mode), the problem is usually outside the system.

The first step in troubleshooting is usually to go to the roof and confirm that the linkheads are both receiving adequate power over the Free Space link. Many times the linkheads will be blocked, misaligned, unplugged or have other simple problems. Go to the roof.

4.1. Failure Types

Three different kinds of failures can affect system performance:

- Failures caused by attached network components
- Failures caused by the environment
- LightPointe system failures

Caution: If a failure is found in the power supply unit, please remember that only authorized technical personnel may conduct checks of the emergency OFF switch and fuse. In all cases, the system must be disconnected from the AC or DC power supply in advance.

4.1.1. Network Component Problems

There are a number of network-related problems that can cause the optical transport systems to malfunction.

Table 4-1: Networking Equipment Problems

Network Problem	Effect on the Optical System
Bad network input signal	System failure or high BER
Data paths reversed	Data In/Out can be reversed in cabling or patch panels feeding into the linkhead
Cat 5/6 Cable length violation – limit is 100 meters (300 feet)	Low signal and power strength at the link head. High Error Rate will result.
New network equipment	Network equipment and/or network software added or changed making the interface or signals incompatible with link head Network administration changes causing the network to fail for a reason unrelated to the FSO system.
Network connection damaged	No signal at the link head due to damaged feeder cables
Free-space optical signal weak	Link failure
Auto negotiation / loss of sync	Units will have an audible click and signal strength will fluctuate rapidly.
Back to back Linkheads	All linkheads must interface to a network element in order to autonegotiate the data rate. Two FL 100s will not work in a back to back manner. Add a switch or other network element between the linkheads.

4.1.2. Low Free Space Power level between the linkheads

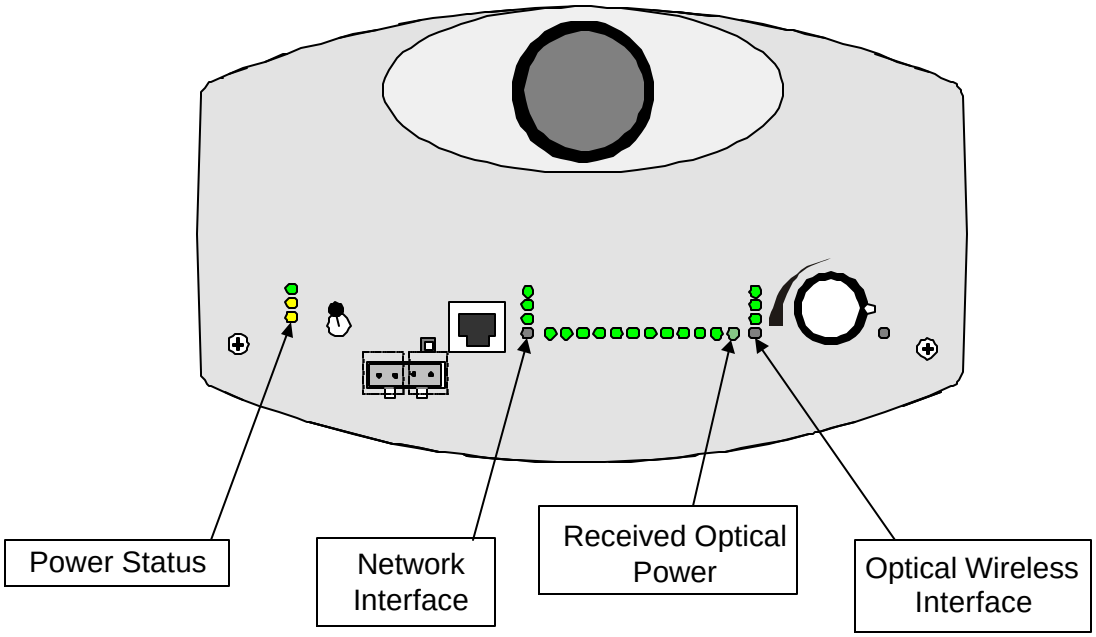
There are a number of environmental problems that can cause the optical transport systems to malfunction:

- Fog, snow, or heavy rain
- Linkhead has been bumped out of alignment
- Something is blocking the Line of Sight between the units
- Smoke , vapor or other emissions
- Heat turbulence (shimmer) during the heat of the day

4.1.3. Troubleshooting

Operational Check

An operational link head will display the following status at the back panel.



Checking Data IN/OUT LEDs

The Data Out (Transmit) and Data In (Receive) LEDs can be used to identify data transmit and receive problems.

Table 4-2: LED Operational Checks

Function Monitored	LED Label	Normal State
Power Status	ON	**Green**
	PSU or PoE	One or the other lit **Yellow**
Network Interface	Data	**Green**
	100 or 10	One or the other lit **Green**
Received Optical Power		3 to 10 bars lit **Green**
Optical Wireless Interface	Data	**Green**
	100 or 10	One or the other lit **Green**
No other indicators should be lit		

Figure 4-1: Normal Back Panel Display

4.2. Additional Troubleshooting Methods

4.2.1. Ping Test Setup

The following equipment and software are required to perform a ping test. A ping test is a fast way to determine if the network is operational

- Laptop with Ethernet card
- Ethernet cable with RJ45 connectors

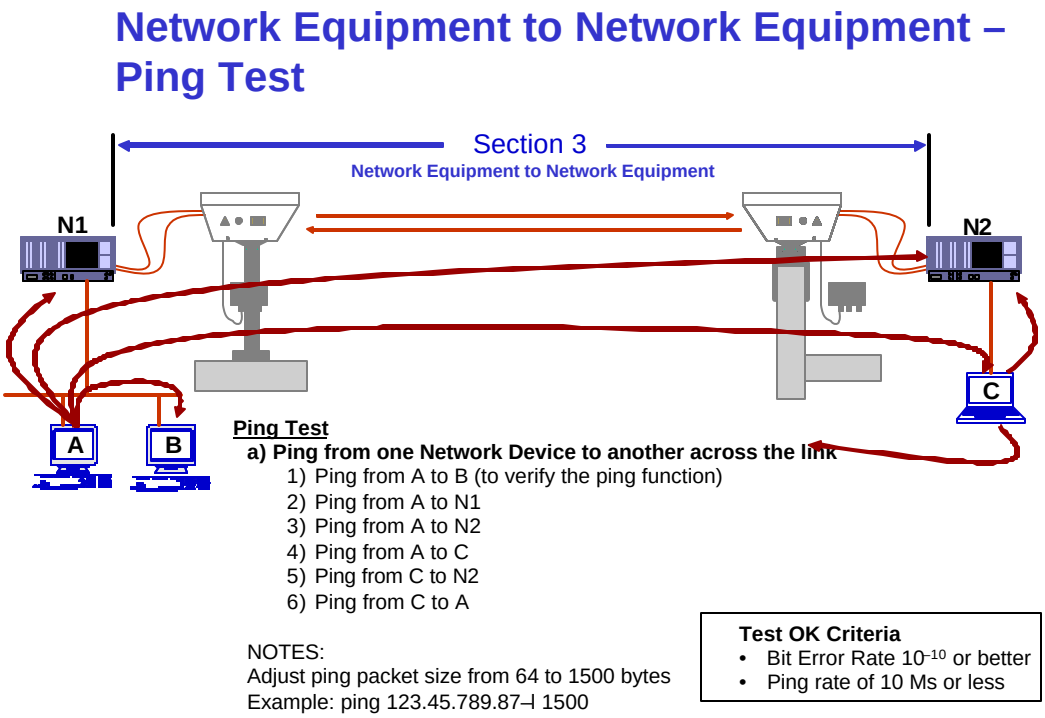


Figure 4-2: Ping Test Setup

4.3. Technical Support

- ❑ Did you complete the steps in the Fault Isolation Troubleshooting Tree?

4.3.1. Checklist Before You Call Technical Support

- ❑ Be sure to fill out the following checklist before contacting LightPointe Technical Support.

General Information	Your Installation
❑ Application (Protocol)?	
❑ Distance?	
❑ How long has system been in operation?	
❑ POE or Local Power supply?	
How does the error show up?	
❑ Bursty errors, dropped packets, etc?	
❑ Is error observed for the first time?	
How was the weather when error showed up?	
❑ What time of day?	
❑ Weather (fog, snowfall)	
❑ Outside temperature (moisture on entrance window)	
Status of Back Panel LEDs	
❑ Are all red LEDs off?	Yes/No
❑ Receive LEDs are flashing	Yes/No
❑ How many bars does the bar graph indicator show?	3 to 10 with no LOS or Overload indications
Status of Back Panel Indicators	
❑ Connection to network	
❑ Failure of endpoint equipment	
What type of system is installed?	
❑ Serial Numbers	
❑ Warranty Registration submitted	
❑ Model number	

4.4. Return Material Authorization (RMA) Procedure

Please contact LightPointe before returning any system components for repair or replacement.

RMA products include:

- Link head
- Standard power supply

Contacting LightPointe

Corporate Office

10140 Barnes Canyon Road, San Diego, CA 92121
P: 858.643.5200, F: 858.643.5201

Technical Support

(U.S.) 858.643.5299
Website: www.lightpointe.com

Email: techsupport@lightpointe.com


LIGHTPOINTE

5. Specifications

Table 5-1: System Specifications

	FlightLite 100 / 100E
Outdoor Unit	
Description	One TX, One RX System
Dimensions	215x200x400 mm (8.5x7.9x15.75 in)
Weight	4.5 kg (9.9 lbs)
Linkhead input voltage	±12 to 48V DC
Power consumption	Max. 15 W
Operating temperature	-35° to +65° C
Relative humidity	Up to 95% (non-condensing)
Free-space Path (Free Space Transceivers)	
Bandwidth	100 Mbps
Operating Distance	See Table 1.2
Optical transmitter	VCSEL
Output wavelength	850 nm
Beam divergence	FL 100 - 5.0 mr and FL 100E – 2.0 mr
Laser Output Power	15 mW (+11.8 dBm)
Receiver Sensitivity	-40 dBm
RX Dynamic Range	30 dB
Network Interface (Data Transcievers)	
Protocol	CSMA/CD
Interface	1 x 10/100 Mbps RJ-45 for UTP/STP Category 5 or better
Speed	10/100 Mbps at half or full duplex

LightPointe FlightSpectrum products are certified eye-safe in accordance with IEC/EN 60825-1 A2:2001 Class 1M

	Power Over Ethernet Adapter
Indoor Unit	
Description	Injector/Power Over Ethernet PSE Adapter
Dimensions	89x47x30 mm
POE Output voltage	± 48V DC @ 0.4A
POE Input voltage	100 - 240 VAC (50/60 Hz) @ 0.6A
EMC Certification	FCC Class B, CE
Operating temperature	0° to +40° C
Operating Humidity	20% to 90% (relative humidity, non-condensing)
Max distance to linkhead	100 meters (328 feet)
Protocol	CSMA/CD
Standards	IEEE 802.3af
Ports	1 x 10/100 Mbps RJ-45 for UTP/STP Category 5 or better
Speed	10/100 Mbps at half or full duplex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6. Index