

AFL3430

Antenna Fiber Optic Link



User Manual

AFL3430

Fiber Optic Link User Manual

Preface

Thank you for purchasing the AFL3430 Fiber Optic Link. Your new AFL3430 is fabricated using the highest quality materials and manufacturing processes available today, and will give you years of troublefree service.

About EndRun Technologies

EndRun Technologies is dedicated to the development and refinement of the technologies required to fulfill the demanding needs of the time and frequency community.

Our innovative engineering staff, with decades of experience in the research and development of receiver technology for the Global Positioning System (GPS), has created the most precise, stable, and reliable GPS-derived time and frequency equipment in the world. These instruments have been selected as the timing reference for such rigorous applications as computer synchronization, research institutions, aerospace, network quality-of-service monitoring, satellite earth stations, and calibration laboratories.

EndRun Technologies is committed to fulfilling your precision timing needs by providing the most advanced, reliable and cost-effective time and frequency equipment available in the market today.

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January 2018

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About This Manual

This manual will guide you through simple installation and set up procedures.

Introduction – The AFL3430, where to use it and its main features.

Basic Installation – How to connect, configure and troubleshoot your AFL3430.

Specifications – A detailed listing of all the pertinent specifications.

If you detect any inaccuracies or omissions, please inform us. EndRun Technologies cannot be held responsible for any technical or typographical errors and reserves the right to make changes to the product and manuals without prior notice.

Warranty

This product, manufactured by EndRun Technologies, is warranted against defects in material and workmanship for a period of one year from date of shipment, under normal use and service. During the warranty period, EndRun Technologies will repair or replace, at its option, products which prove to be defective.

For warranty service or repair, this product must be returned to EndRun Technologies. Buyer shall prepay shipping charges to send product to EndRun Technologies and EndRun Technologies shall pay shipping charges to return product to Buyer. However, if returned product proves to be operating normally (not defective) then Buyer shall pay for all shipping charges. If Buyer is located outside the U.S.A. then Buyer shall pay all duties and taxes, if any.

Products not manufactured by EndRun Technologies but included as an integral part of a system (e.g. peripherals, options) are warranted for ninety days, or longer as provided by the original equipment manufacturer, from date of shipment.

Limitation of Warranty

The foregoing express warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer or User, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

TO THE EXTENT PERMITTED BY LAW, THIS WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, REMEDIES AND CONDITIONS WHETHER ORAL OR WRITTEN, STATUTORY, EXPRESS, OR IMPLIED. AS PERMITTED BY APPLICABLE LAW, ENDRUN SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Warranty Repair

If you believe your equipment is in need of repair, call EndRun Technologies and ask for a customer service agent. It is important to contact us first as many problems may be resolved with a phone call.

Please have the serial number of the unit and the nature of the problem available before you call. If it is determined that your equipment will require service, we will issue an RMA number. You will be asked for contact information, including your name, address, phone number and e-mail address.

Ship the unit prepaid in the original container or a container of sufficient strength and protection to EndRun Technologies. EndRun will not be responsible for damage incurred during shipping to us. Be sure the RMA number is clearly identified on the shipping container. Our policy is to fix or repair the unit within 5 business days. If it is necessary to order parts or if other circumstances arise that require more than 5 days, an EndRun service technician will contact you.

Loaner units are not included as part of the standard warranty.

Repair After Warranty Expiration

If the warranty period has expired, we offer repair services for equipment you have purchased from EndRun. Call and ask for a customer service agent. It is important to contact us first as many problems may be resolved with a phone call. Please have the serial number of the unit and the nature of the problem available before you call. If it is determined that the equipment has failed and you want EndRun to perform the repairs, we will issue you an RMA number.

Ship the unit prepaid in the original container or a container of sufficient strength and protection to EndRun Technologies. EndRun will not be responsible for damage incurred during shipping to us. Customer is responsible for shipping costs to and from EndRun Technologies. Be sure the RMA number is clearly identified on the shipping container. After the equipment has been received we will evaluate the problem and contact you with the cost to repair (parts and labor) and an estimate of the time necessary to complete the work.

Limitation of Liability

The remedies provided herein are Buyer's sole and exclusive remedies. EndRun Technologies shall not be liable for any direct, indirect, special, incidental or consequential damages, whether based on contract, tort or any other legal theory.

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Chapter One

Introduction

The AFL3430 Antenna Fiber Optic Link provides a secure, low-loss means of connecting a standard EndRun Technologies GPS antenna to GPS-based time and frequency products. It can be used in applications where electrical isolation is required, for example when the antenna connection must traverse a data security boundary, and where the antenna location necessitates an extremely long cable run.

Main Features

The fiber optic link is a high-performance broadband downlink consisting of a fiber optic transmitter in a stainless steel enclosure (or 1U rackmount enclosure), an interconnecting single-mode fiber optic cable and a fiber optic receiver in a 1U rackmount enclosure. The fiber optic transmitter has a GPS antenna input and is powered by an internal universal AC power supply. The fiber optic receiver, also universal AC powered, has an RF output that provides the recovered GPS signal to the antenna input of the attached timing equipment. The stainless steel fiber optic transmitter enclosure is suitable for a dry industrial environment as supplied. It is suitable for wet and weather-exposed locations when installed with liquid-tight conduit fittings.

CHAPTER ONE

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Chapter Two

Basic Installation

*This chapter will guide you through the most basic checkout and physical installation of your AFL3430 Antenna Fiber Optic Link. For details on establishing a successful link between one transmitter and one to four receivers see **Appendix A - Fiber Optic Link Configuration**.*

Checking and Identifying the Hardware

Unpack and check all the items using the shipment packing list. (Note that the AFL3430 Antenna Fiber Link receiver and transmitter may be shipped in separate boxes.) Contact the factory if anything is missing or damaged. The AFL3430 shipment typically contains:

AFL3430 Fiber Optic Transmitter in one of the following configurations:

Stainless steel enclosure (part# 3430-0004-000), or

1U rackmount enclosure (part# 3430-0005-000)

AFL3430 Fiber Optic Receiver in 1U rackmount enclosure (part# 3430-0003-000)

AFL3430 User Manual (part# USM3430-0000-000)

Transmitter power cord, US, 1 per transmitter

AFL3430 Fiber Optic Receiver Cable Kit (part# 0648-0004-001), one per receiver:

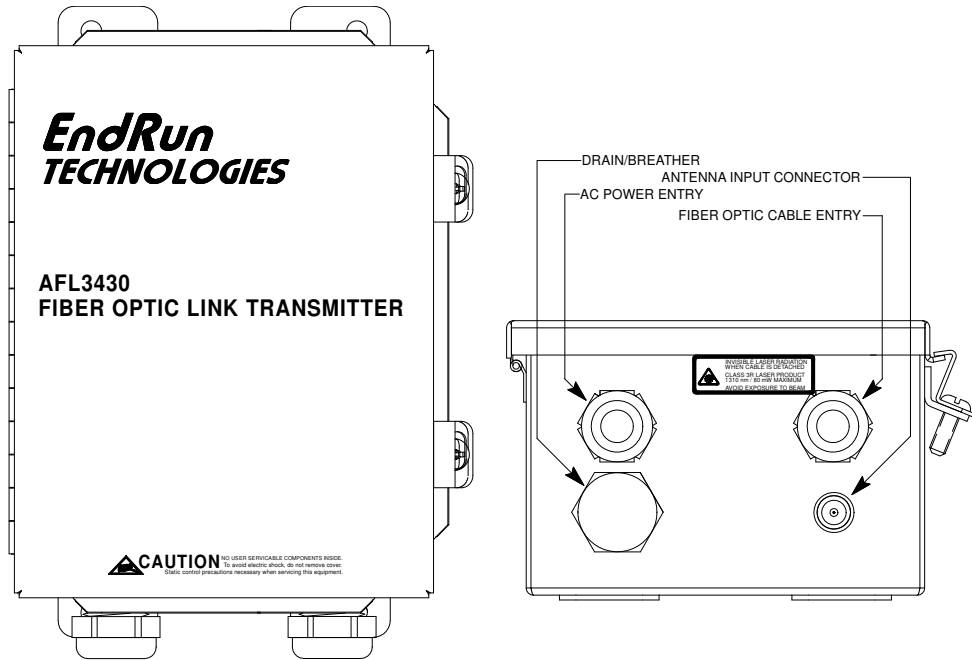
Receiver power cord, US.

Fiber Optic Cable Warning Tag (attach per installation instructions).

Fiber Optic Starter Kit (part# 0608-0005-000), one per shipment:

Fiber Optic Cable, single-mode 8/125 um, FC/APC, 1 m (optional interconnect)

Receiver RF Interconnect TNC/TNC cable, 3 ft., one per shipment (optional interconnect)



FRONT VIEW

BOTTOM VIEW

FIBER OPTIC TRANSMITTER - 6" X 8" X 4" DEEP SS NEMA 4X ENCLOSURE

NEMA Transmitter Physical Description

Environment	Transmitter is intended to be installed indoors or outdoors. Enclosure complies with NEMA 4X requirements (IP54) when installed with conduit using Listed LIQUID TIGHT fittings.
Drain/Breather	This provides continuous pressure equalization, preventing seepage at gasket interface and allowing any accumulated condensation to drain from enclosure.
Antenna Input	This TNC connector is the 50 ohm RF input from the GPS antenna. It also provides DC power for the antenna.
AC Power Entry	The unit is shipped with a strain relief for use in dry locations with the supplied power cord or a similar 1/8" (3.2mm) to 3/8" (9.5mm) diameter power cord. For wet locations, the strain relief must be removed and replaced with 1/2" trade size Listed LIQUID-TIGHT fittings, with a conduit connection means that is suitable for the environmental conditions (such as weather, UV exposure), and complies with all applicable local regulations and practices, such as the use of a Ground Fault Circuit Interrupter (GFCI).

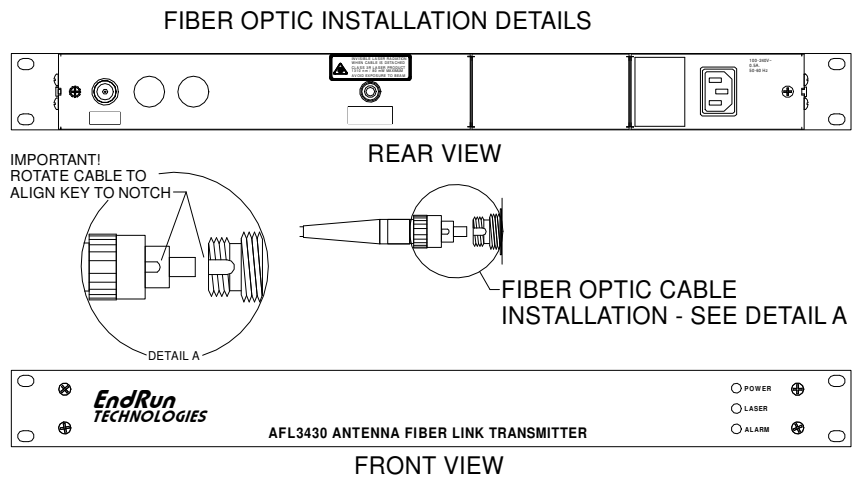
When the product is connected to the AC mains with the use of conduit (i.e. permanently wired and not cord-connected), a readily accessible disconnect device for removing power during servicing must be incorporated in the building's branch circuit during installation.

BASIC INSTALLATION

Fiber Optic Cable Entry

This is for the transmit fiber optic cable. The unit is shipped with a strain relief for use with fiber optic cable in dry locations. Note that the internal FC/APC connector has an integrated strain relief to support the fiber optic cable and the function of the external strain relief is to provide a dust-tight entry point, when installed properly. To install properly, tighten the bushing to 18 in-lbs (2 Nm), which is generally hand tight. For wet locations, the strain relief provided as shipped with the product must be removed and replaced with a 1/2" trade size Listed LIQUID-TIGHT fitting, with appropriately-sized, liquid-tight conduit employed for the fiber run, to properly maintain the enclosure's resistance to the ingress of water.

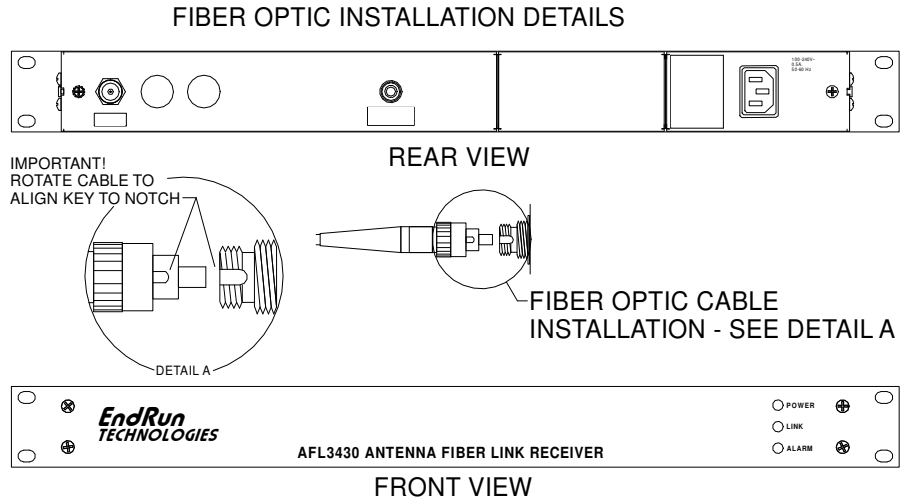
Rackmount Transmitter Physical Description



FIBER OPTIC TRANSMITTER - 1U RACKMOUNT ENCLOSURE

Environment	Rackmount transmitter is intended to only be installed indoors.
AC Power Entry	This is a standard IEC power connector.
Antenna Input	This TNC connector is the 50 ohm RF input from the GPS antenna. It also provides DC power for the antenna.
Fiber Optic Output	This FC/APC connector is the fiber optic output to the fiber optic receiver.

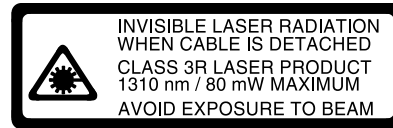
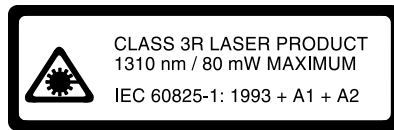
Receiver Physical Description



FIBER OPTIC RECEIVER - 1U RACK-MOUNT ENCLOSURE

Environment	Receiver is intended to only be installed indoors.
AC Power Entry	This is a standard IEC power connector.
RF Signal Output	This TNC connector is the 50 ohm RF output that provides the recovered downlink signal for the antenna input of the associated timing equipment. This output provides a simulated GPS antenna load to the timing equipment as long as the fiber optic receiver detects a good downlink optical signal. Thus the loss of optical downlink will trigger an antenna fault in the timing equipment. Note that a fault with the actual GPS antenna connected to the fiber optic transmitter will result in the loss of recovered RF signal at the receiver output, but will not trigger an antenna fault alarm.
Fiber Optic Input	This FC/APC connector is the fiber optic input from the fiber optic transmitter.

BASIC INSTALLATION



CAUTION - USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

Warning: Class 3R Laser Product. Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures. This warning applies to the transmitter fiber optic cable entry while the fiber optic cable is not installed (or broken) and it applies to the fiber optic cable itself when it is not installed in the receiver fiber optic input connector.

Note: The Fiber Optic Transmitter normally emits at Class 1 levels (2-4 mW, 15 mW MAX.), but could emit at Class 3R levels (80 mW MAX.) under fault conditions.

Complies with 21 CFR Chapter 1, Subchapter J, Part 1040.10; and IEC 60825-1: 1993, A1: 1997, A2: 2001; IEC 60825-2: 2000

Installing the AFL3430 Fiber Optic Link

Since it involves work with precision fiber optic components and potentially dangerous power circuits, AFL3430 installation should be performed by qualified personnel only.



To avoid potential eye injury, install both ends of optic cable prior to applying AC power to Fiber Optic Transmitter. Prior to applying power to transmitter, attach the Fiber Optic Cable Warning Tag to the fiber optic cable at or near the connector on the receiver end of the cable.

Mount the Fiber Optic Receiver

1. Using standard 19" rack mounting hardware, mount the unit in the desired location. It would typically be located adjacent to the timing equipment that will use the recovered GPS signal. Due to the risk of exposure to invisible radiation emitted from an unconnected fiber optic cable, the rear panel must be located such that engineering or administrative control make it inaccessible, except to authorized personnel with appropriate laser safety training.
2. Connect the fiber optic receiver RF Output to the Antenna Input of the timing equipment using the supplied RF interconnect cable or equivalent 50 ohm cable with TNC connectors.
3. Plug one end of the supplied AC power cord into the AC input connector on the chassis rear panel of the Fiber Optic Receiver.
4. When ready to power up, plug the other end into an 85-264 VAC grounded outlet.

CAUTION

Ground the unit properly with the supplied power cord.

The socket outlet should be installed near the equipment and be easily accessible.

Power cord is used as a disconnection device. To de-energize equipment, disconnect the power cord.

Do not install the Fiber Optic Receiver where the operating ambient temperature might exceed 122°F (50°C).

Install the Fiber Optic Transmitter (1U Rackmount) and GPS Antenna

1. Mount the antenna on the roof using the supplied mounting hardware. The antenna must be installed with a minimum external (outdoor) cable run and the lowest antenna mounting height that allows an unrestricted view of the sky. Make sure that any large metallic objects within 3 ft (1 m) of the antenna do not block the view.



Follow these guidelines to eliminate exposure to electrical service wiring and to minimize the potential for lightning strikes. Installations subject to lightning strikes should employ a lightning arrestor installed at the transmitter's enclosure for outside installations or at the building entrance for installations with the transmitter mounted indoors and the antenna mounted outdoors. A lightning arrestor suited for this application is available through EndRun Technologies. The arrestor must be installed according to the manufacturer's instructions.



Do NOT route the antenna wiring near or with AC wiring (Class 1 circuits per the NEC), nor mount the antenna wiring where it may become energized by nearby AC wiring or components should they fall.

2. Using standard 19" rack-mounting hardware, mount the unit in the desired location. Ideally, the transmitter would be located close enough to the GPS antenna for a maximum 50 ft (15 m) cable run between the unit and the antenna. The unit, as shipped, is intended for this installation. It is recommended that an inline amplifier be used for any coax cables runs exceeding 50 ft (15 m), but in no case should the outdoor exposed run be in excess of 140 ft (43 m). The transmitter location must also take into account the maximum fiber optic cable length as specified for the AFL3430.
3. Route antenna cable and connect to RF Signal Input.
4. Plug one end of the supplied AC power cord into the AC input connector on the chassis rear panel of the Fiber Optic Receiver.
5. When ready to power up, plug the other end into an 85-264 VAC grounded outlet.

CAUTION

Ground the unit properly with the supplied power cord.

The socket outlet should be installed near the equipment and be easily accessible.

Power cord is used as a disconnection device. To de-energize equipment, disconnect the power cord.

Do not install the rackmount Fiber Optic Transmitter where the operating ambient temperature might exceed 122°F (50°C).

Install Fiber Optic Cable (Rackmount Transmitter)

1. Verify that the fiber optic cable is correct for this application by comparing its characteristics to those listed in *Appendix B - Specifications*. Note: Keep protective caps on all unmated fiber optic cable ends to prevent scratching and dust accumulation.
2. Route cable between receiver and transmitter, keeping bend radius greater than 1" to avoid damaging internal fiber.
3. Route cable up to the rear of the transmitter and receiver chassis. Fit cable connector into bulkhead connector making sure that the guide on the cable connector is aligned with the slot in the bulkhead connector, then tighten.



Prior to applying power to transmitter, attach the Fiber Optic Cable Warning Tag to the fiber optic cable at or near the connector on the receiver end of the cable.

Power up Fiber Optic Link (Rackmount Transmitter)

1. Apply power to Fiber Optic Transmitter and verify illumination of POWER LED and LASER LED. Verify that ALARM LED is off.
2. Apply power to Fiber Optic Receiver. Verify illumination of POWER LED and LINK LED. Verify that ALARM LED is off.

Troubleshooting the Fiber Optic Link after Initial Power Up (Rackmount Transmitter)

SYMPTOM	ACTION
Transmitter POWER LED Off	Verify 85-264VAC @ power outlet. If voltage is OK, contact factory.
Transmitter LASER LED Off	Contact factory.
Transmitter F/O ALARM On	Contact factory.
Receiver POWER LED Off	Verify 85-264VAC @ power outlet. If voltage is OK, contact factory.
Receiver LINK LED Off	Verify proper installation of FC/APC fiber optic connectors at the transmitter and receiver. Verify non-kinked, intact fiber cable. Verify cable is single-mode fiber per specification. Verify maximum 5 km fiber run.
Receiver ALARM LED On	Verify proper installation of FC/APC fiber optic connectors at the transmitter and receiver. (See drawing details in <i>Receiver Physical Description</i> section and <i>Rackmount Transmitter Physical Description</i> section.) Verify non-kinked, intact fiber cable. Verify cable is single-mode fiber per specification. Verify maximum 5 km fiber run.

Install the Fiber Optic Transmitter (NEMA Stainless Steel) and GPS Antenna

1. Mount the antenna on the roof using the supplied mounting hardware. The antenna must be installed with a minimum external (outdoor) cable run and the lowest antenna mounting height that allows an unrestricted view of the sky. Make sure that any large metallic objects within 3 ft (1 m) of the antenna do not block the view.



Follow these guidelines to eliminate exposure to electrical service wiring and to minimize the potential for lightning strikes. Installations subject to lightning strikes should employ a lightning arrestor installed at the transmitter’s enclosure for outside installations or at the building entrance for installations with the transmitter mounted indoors and the antenna mounted outdoors. A lightning arrestor suited for this application is available through EndRun Technologies. The arrestor must be installed according to the manufacturer’s instructions.



Do NOT route the antenna wiring near or with AC wiring (Class 1 circuits per the NEC), nor mount the antenna wiring where it may become energized by nearby AC wiring or components should they fall.

2. Determine the best mounting location for the fiber optic transmitter enclosure. Ideally, the transmitter NEMA 4 enclosure would be located in a dry environment such that it is close enough to the GPS antenna for a maximum 50 ft (15 m) cable run between the enclosure and the antenna. The unit, as shipped, is intended for this installation. It is recommended that an inline amplifier be used for any coax cables runs exceeding 50 ft (15 m), but in no case should the outdoor exposed run be in excess of 140 ft (43 m). The transmitter location must also take into account the maximum fiber optic cable length as specified for the AFL3430. The NEMA 4 enclosure can be installed in a dusty or dirty environment (Pollution Degree 3 per IEC60664-1) using the factory-installed strain reliefs; however, the fiber optic strain relief and the power cord are not suitable for wet locations, as shipped.



When installing the enclosure in a wet location, replace existing strain reliefs with ½” trade size Listed LIQUID-TIGHT fittings. For proper operation of the drain/breather, the enclosure **MUST** be mounted vertically with cable fittings facing down when installed in a wet location (Refer to FIBER OPTIC TRANSMITTER - CABLE INSTALLATION DETAILS drawing at the end of this section for proper enclosure orientation.).

3. Route antenna cable and connect to TNC connector. The TNC connector is suitable for all installations.

4A Install with Strain Relief. When using the supplied power cord or equivalent, loosen the strain relief outer nut to fully expand the internal grommet to a 3/8” hole (Refer to FIBER OPTIC TRANSMITTER - CABLE

INSTALLATION DETAILS drawing at the end of this section.). Push the power cord through and connect the ring terminals (or bare wires) according to terminal strip label and color code:

GND		Green
N		Blue or White
L		Brown or Black

Tighten the terminal block screws to the torque specified on the product’s labeling.

Tighten outer nut of strain relief bushing (18 in-lbs, 2 Nm) to firmly capture rubber jacket of power cord. When ready to power up, plug power connector into 85-264 VAC grounded outlet.

CAUTION

Ground the unit properly with the supplied power cord.

The socket outlet should be installed near the equipment and be easily accessible.

Power cord is used as a disconnection device. To de-energize equipment, disconnect the power cord.

4B Install with Conduit. When using conduit, remove the strain relief and replace it with a ½” trade size conduit fitting (Listed LIQUID-TIGHT if wet location). Power is to be supplied via a maximum 20 A branch circuit with its circuit breaker acting as a service disconnecting means, or other readily accessible disconnecting means. Connect 85-264 VAC power wiring to terminal strip as noted and install plastic cover on terminal strip:

GND	Safety Ground
N	Neutral
L	Line

Install Fiber Optic Cable (NEMA Transmitter)

1. Verify that the fiber optic cable is correct for this application by comparing its characteristics to those listed in *Appendix B - Specifications*. Note: Keep protective caps on all unmated fiber optic cable ends to prevent scratching and dust accumulation.
2. Route cable between receiver and transmitter, keeping bend radius greater than 1” to avoid damaging internal fiber.

3A Install with Strain Relief. For NEMA 4 enclosure, when using factory supplied strain relief, remove outer nut of strain relief, separate components and thread fiber optic cable as shown (Refer to *Fiber Optic Transmitter - Cable Installation Details* drawing at the end of this section.). The shoulder washer and rubber grommet in this strain relief have been modified so they can be used with the fiber optic connector. The shoulder washer is split in half and the rubber grommet is cut on one side so that they can be installed directly onto the fiber optic cable without interference with the connector.

Fit cable connector into bulkhead connector making sure that the guide on the cable connector is aligned with the slot in the bulkhead connector, then tighten. Reassemble strain relief components and tighten outer nut until inner grommet is snug around jacket of fiber optic cable. Note that the working range of the strain relief is 1/8” to 3/8” and the typical fiber optic cable jacket is slightly less than 1/8”. If necessary, the cable can be built up with electrical tape to support a tighter grip. However, the entry point is only intended to be dust-tight and the FC/APC connector is designed to support the cable, so it is sufficient that the grommet merely seal the entry point rather than grip the cable.

3B Install with Conduit. For NEMA 4 enclosure, when using conduit, route cable through conduit to internal bulkhead connector. Fit cable connector into bulkhead connector making sure that the guide on the cable connector is aligned with the slot in the bulkhead connector, then tighten.

4. Route cable up to the rear of the receiver chassis. Fit cable connector into bulkhead connector making sure that the guide on the cable connector is aligned with the slot in the bulkhead connector, then tighten.



Prior to applying power to transmitter, attach the Fiber Optic Cable Warning Tag to the fiber optic cable at or near the connector on the receiver end of the cable.

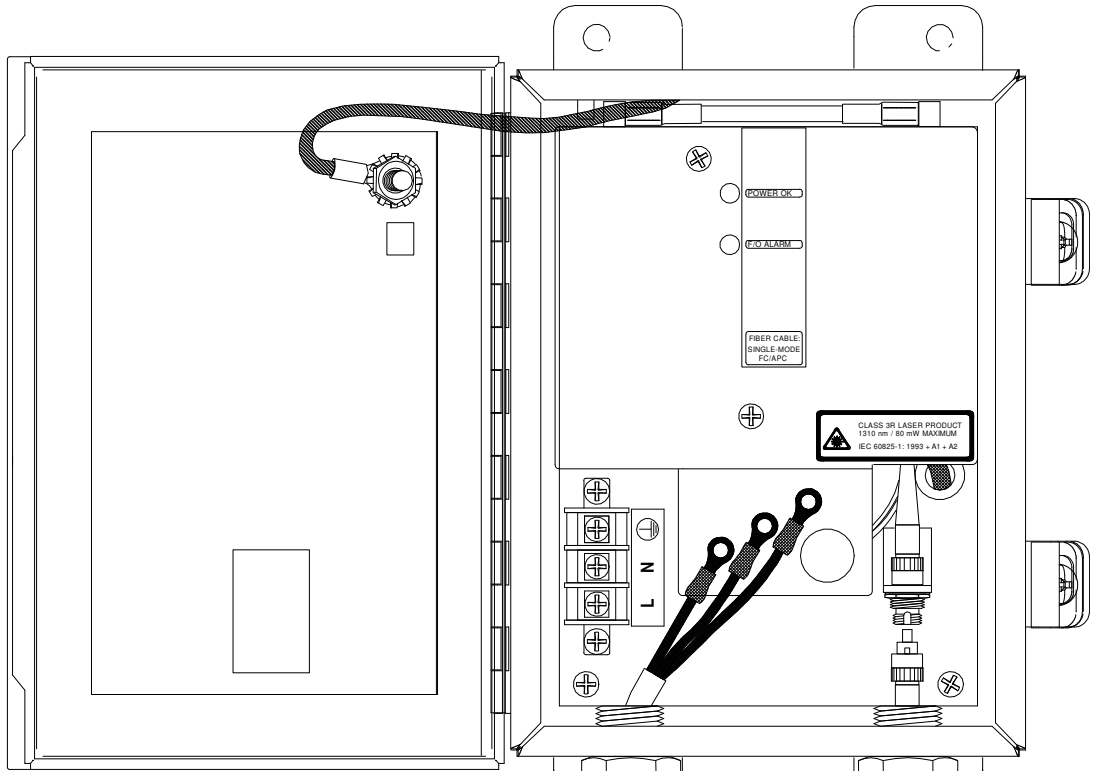
Power up Fiber Optic Link (NEMA Transmitter)

1. Prior to sealing door on NEMA 4 enclosure, apply power to Fiber Optic Transmitter and verify activation of Green POWER LED. Verify that Red F/O ALARM LED is off. Close door and tighten clamps.
2. Apply power to Fiber Optic Receiver. Verify illumination of POWER LED and LINK LED. Verify that ALARM LED is off.

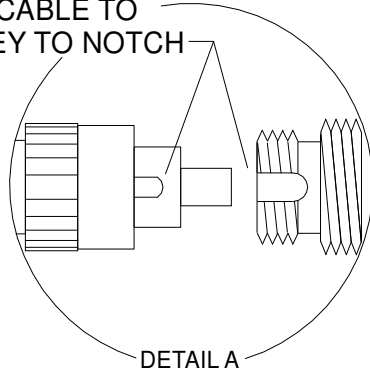
Troubleshooting the Fiber Optic Link after Initial Power Up (NEMA Transmitter)

SYMPTOM	ACTION
Transmitter POWER LED (Green) Off	Verify 85-264VAC @ Terminal Strip. If voltage is OK, contact factory.
Transmitter F/O ALARM (Red) On	Contact factory.
Receiver POWER LED Off	Verify 85-264VAC @ power outlet. If voltage is OK, contact factory.
Receiver LINK LED Off	Verify proper installation of FC/APC fiber optic connectors at the transmitter and receiver. Verify non-kinked, intact fiber cable. Verify cable is single-mode fiber per specification. Verify maximum 5 km fiber run.
Receiver ALARM LED On	Verify proper installation of FC/APC fiber optic connectors at the transmitter and receiver. (See drawing details in <i>Receiver Physical Description</i> section and <i>NEMA Fiber Optic Transmitter Cable installation Details</i> on the following page.) Verify non-kinked, intact fiber cable. Verify cable is single-mode fiber per specification. Verify maximum 5 km fiber run.

NEMA
Fiber Optic Transmitter
Cable Installation Details

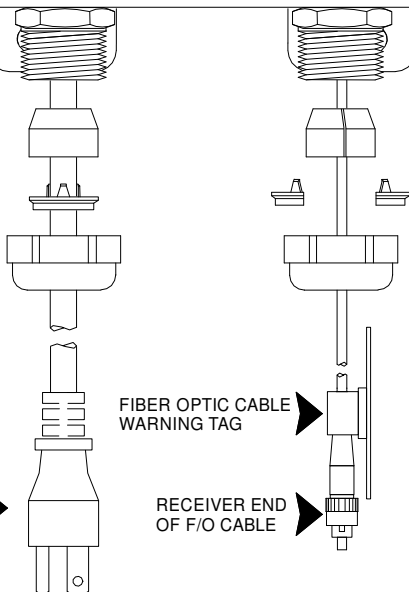


IMPORTANT!
ROTATE CABLE TO
ALIGN KEY TO NOTCH



DETAIL A

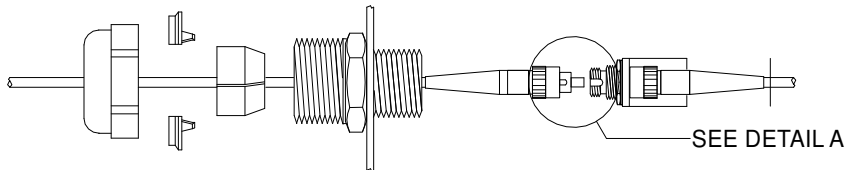
US POWER CORD SHOWN



FIBER OPTIC CABLE
WARNING TAG

RECEIVER END
OF F/O CABLE

FIBER OPTIC TRANSMITTER - CABLE INSTALLATION DETAILS



SEE DETAIL A

CHAPTER TWO

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Appendix A

Fiber Optic Link Configuration

The AFL3430 transmitter can be configured to work with one, two, three or possibly four receivers, thus saving you the expense of multiple transmitters. The ability of the transmitter to work with multiple receivers depends on the cable configuration. This appendix details factors you need to know to successfully implement the link with one or more receivers.

Requirements for Successful Link

Referring to the diagram on the next page, there are three constraining factors to implement the AFL3430 link successfully:

1. The net RF gain applied to the GPS signal seen at the AFL3430 transmitter input must be greater than $(31 + 2 * \text{OpticalLoss})$ dB, i.e.:

$$\text{AntGain} - \text{CopperLoss1} + \text{G-LNA2Gain} - \text{CopperLoss2} > 31 \text{ dB} + (2 * \text{OpticalLoss}) \text{ dB}$$

2. The net Optical Loss, which includes the Fiber Loss and installed Splitter Loss, between the AFL3430 transmitter and receiver must be less than 12 dB, i.e.:

$$\text{OpticalFiberLoss} + \text{OpticalSplitterLoss} < 12 \text{ dB}$$

3. The net RF gain applied to the GPS signal seen at the GPS receiver input must be greater than +15 dB, i.e.:

$$\text{AntGain} - \text{CopperLoss1} + \text{G-LNA2Gain} - \text{CopperLoss2} + \text{LinkGain} - (2 * \text{OpticalLoss}) + \text{G-LNA2Gain} - \text{InterConnectCopperLoss} > 15 \text{ dB}$$

APPENDIX A

Example Configuration

This example meets the requirements listed above. The configuration includes a G-LNA2 pre-amplifier in the antenna download path, with 1-foot and 100-foot Belden 9104 download cables, along with 5 km of fiber and a 2:1 optical splitter. There is also a 3-foot Belden 9104 interconnect cable between the AFL3430 receiver output and the GPS receiver:

Gain Elements:

Antenna Gain	=		=	+40 dB,
AFL3430 Link Gain	=		=	+22 dB
First G-LNA2 Gain	=		=	+26 dB
Second G-LNA2	Not Installed			

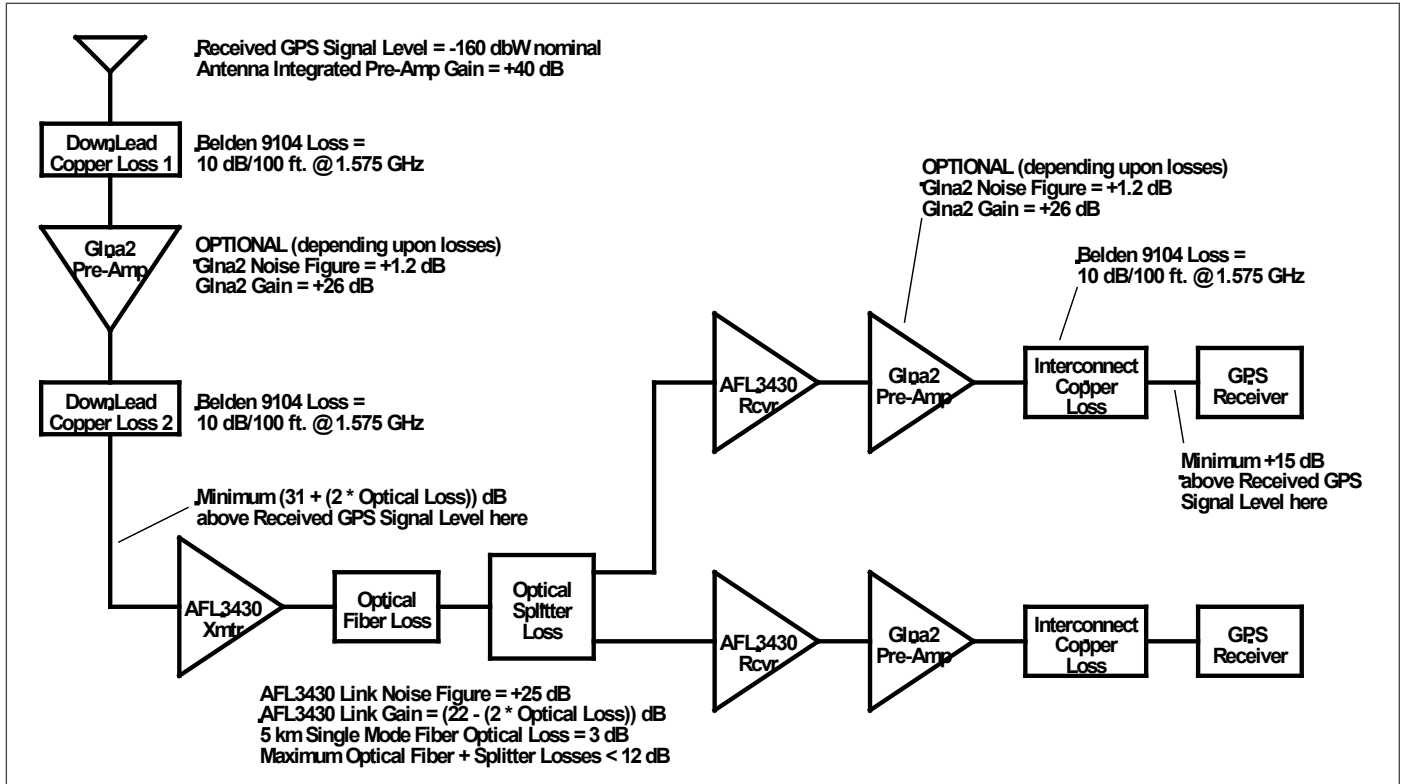
Loss Elements:

DownLead Copper1 Loss	=	1 ft.	=	-0.1 dB
DownLead Copper2 Loss	=	100 ft.	=	-10 dB
Optical Fiber Loss	=	5 km	=	-3 dB
Optical Splitter Loss	=	2:1	=	-4 dB
InterConnect Copper Loss	=	3 ft.	=	-0.3 dB

Rule 1: $40 - 0.1 + 26 - 10 = 55.9$ dB, which is $> 31 + (2 * (3 + 4)) = 55$ dB \checkmark

Rule 2: $3 + 4 < 12$ dB \checkmark

Rule 3: $40 - 0.1 + 26 - 10 + 22 - (2 * (3 + 4)) - 0.3 = 63.6$ dB which is > 15 dB \checkmark



AFL3430 GPS Antenna Fiber Optic Link Characteristics and Requirements

Appendix B

Specifications

FIBER OPTIC LINK SPECIFICATIONS

Link Gain: 15 dB, minimum, 300 MHz - 2500 MHz.

Typical Gain Characteristic:

30 dB @ 300 MHz

22 dB @ 1500 MHz

17 dB @ 2500 MHz

Link Noise Figure: 25 dB, nominal.

Input 1dB Compression (IP1dB): -23 dBm, minimum.

Typical IP1dB Characteristic:

-23 dBm @ 300 MHz

-20 dBm @ 1500 MHz

-18 dBm @ 2500 MHz

Link Delay: 16 nanoseconds typical through FOL, plus 1.5 nanoseconds per foot of fiber cable.

Fiber Optic Cable

Simplex 8/125um single-mode fiber.

FC/APC connectors.

5 km (3 miles) maximum cable length; no minimum cable length.

Receiver F/O Connection: Rear panel bulkhead FC/APC Connector.

Transmitter F/O Connection: Internal FC/APC connector.

Transmitter F/O Cable Entry: Via strain relief with 1/8" to 3/8" cable diameter range.
(Strain Relief can be replaced with 1/2" trade size conduit fitting.)

NEMA4 FIBER OPTIC TRANSMITTER SPECIFICATIONS

RF Input (Antenna)

Female TNC Jack, $Z_{in} = 50$ ohms, 10 dB return loss, 300 MHz-2500 MHz.

DC Power for GPS Antenna: 5V @ 50 mA, short circuit protected.

Maximum RF Input: -24 dBm at 300 MHz.
 -18 dBm at 1500 MHz.
 -12 dBm at 2500 MHz.

Optical Output Signal Characteristics

Optical Wavelength: 1310 nm.

Optical Power Output: 2-4 mW.

Primary Power

90-264VAC, 50/60Hz.

4W Typical, 6W Maximum.

3-position screw terminal block inside enclosure

(suitable for 12-18 AWG (3.31mm²-0.823mm²) stranded wire or ring lugs).

Cable entry via strain relief with 1/8" (3.2mm) to 3/8"(9.5mm) cable diameter range.

Strain Relief can be replaced with 1/2" trade size conduit fitting.

Environmental, NEMA 4 Enclosure

Operating Temperature: -30°C (-22°F) to +60°C (+140°F).

Storage Temperature: -40°C (-40°F) to +85°C (+185°F).

Humidity, using strain reliefs: 0 to 95%, non-condensing.

Humidity, using LIQUID-TIGHT fittings: 0 to 100%.

Size and Weight

Type: NEMA 4 Stainless Steel.

Enclosure: 8.0" H x 6.0"W x 4.0"D (20.3 cm x 15.2 cm x 10.2 cm).

Mounting Holes: 0.31" DIA. (7.9 mm).

Mounting Hole Pattern: 8.75" x 4.0" (22.2 cm x 10.16 cm).

Weight: 7 lb. (3.2 kg.).

RACKMOUNT FIBER OPTIC TRANSMITTER SPECIFICATIONS

RF Input (Antenna)

Female TNC Jack, $Z_{in} = 50$ ohms, 10 dB return loss, 300 MHz-2500 MHz.

DC Power for GPS Antenna: 5V @ 50 mA, short circuit protected.

Maximum RF Input: -24 dBm at 300 MHz.
 -18 dBm at 1500 MHz.
 -12 dBm at 2500 MHz.

Optical Output Signal Characteristics

Optical Wavelength: 1310 nm.

Optical Power Output: 2-4 mW.

Primary Power

90-264VAC, 50/60Hz.

5W Typical, 8W Maximum.

3 pin IEC 60320 connector on rear panel.

Environmental, Rackmount Enclosure

Operating Temperature: 0° to +50°C.

Storage Temperature: -40°C (-40°F) to +85°C (+185°F).

Humidity: 0 to 95%, non-condensing.

Size and Weight

Type: Rackmount.

Chassis: 1.75”H x 17.15”W x 10.8”D (4.4 cm x 43.6 cm x 27.4 cm).

Weight: 5 lb. (2.2 kg.).

FIBER OPTIC RECEIVER SPECIFICATIONS

RF Output

Impedance: 50 ohms, >10 dB return loss, 300 MHz-2500 MHz.

Simulated Antenna Load (during non-fault conditions):

3430-0002-000 Fiber Optic Receiver: 18 mA @ 5V.

3430-0003-000 Fiber Optic Receiver: 18 mA @ 5-12V.

Optical Input Signal Characteristics

Optical Wavelength: 1310 nm.

Maximum Optical Input: 4 mW.

Primary Power

90-264VAC, 50/60Hz.

5W Typical, 8W Maximum.

3 pin IEC 60320 connector on rear panel.

Environmental, Rackmount Enclosure

Operating Temperature: 0° to +50°C.

Storage Temperature: -40°C (-40°F) to +85°C (+185°F).

Humidity: 0 to 95%, non-condensing.

Size and Weight

Type: Rackmount.

Chassis: 1.75"H x 17.15"W x 10.8"D (4.4 cm x 43.6 cm x 27.4 cm).

Weight: 5 lb. (2.2 kg.).



DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer's Name: **EndRun Technologies**



Manufacturer's Address: **1360 North Dutton Avenue
Santa Rosa, CA 95401, U.S.A.**

DECLARES THAT THE PRODUCT

Product Name: **AFL3430 Fiber Optic Link**

Model Number: **AFL3430**

CONFORMS TO THE FOLLOWING EUROPEAN DIRECTIVES

***RTTE Directive 99 / 5 / EC
Low Voltage Directive 73 / 23 / EC
EMC Directive 89 / 336 / EC
With Amendment 93 / 68 / EC***


Supplementary Information:

Safety : **EN 60950:2000 (3rd Edition)**
EMC: **EN 55022:1988 Class B; VCCI (April 2004) Class A FCC Part 15
Subpart B Class A; ICES-003 Class A; EN55024:1998(w/A1:2001
& A2:2003); EN61000-3-2:2000**

Year Mark First Applied: **2006**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directives and Standards.

Place: **Santa Rosa CA USA**

Signature: 

Date: **November 30, 2006**

Full Name: **David J. Lobsinger**

Position: **V.P. Engineering**

APPENDIX B

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EndRun
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