Multi-Polarity Fiber Solutions with Data Management & Control

6-Channel

Installation and User Guide

Israel Corporate HQ, 16 Hataasia Street, Har Tov A Ind. Zone, Beit Shemesh 99052. Tel: +972-2-589-9888 Fax: +972-2-589-9898
US Sales Office, 1315 Outlet Center Drive, Smithfield, North Carolina 27577. Tel: 609-514-1800 Fax: 609-514-1881
sales@foxcom.com / www.foxcom.com

Table of Contents

1. General 4
   1.1. Abbreviations 4
   1.2. Note, Caution, Hazard Legend 4
   1.3. Health and Safety Precautions 5
      1.3.1. Personal Safety 5
      1.3.2. Equipment Safety 5
   1.4. Warranty and Repair Policy 6
      1.4.1. General Warranty 6
      1.4.2. Specific Product Warranty Instructions 6
      1.4.3. Limitations of Liabilities 6
   1.5. Reporting Defects 7
      1.5.1. Returns 7
   1.6. About this Manual 7
2. Introduction to the 6-Channel BsmarTV™ System 8
   2.1. Overview 8
   2.2. Typical BsmarTV™ Applications 9
      2.2.1. CWDM Optical Output to an Optical Splitter Network 9
      2.2.2. Receiver Block Diagram 10
      2.2.1. Transmitter Block Diagram 11
   2.3. DIRECTV MFH2 Applications 12
      2.3.1. Node Distribution System Diagram 12
      2.3.2. House/Apartment Distribution System 13
3. BsmarTV™ Fiber Optic Components 13
      3.1.1. Single Mode Fiber (SMF28) 13
      3.1.2. Fiber Optic Splicing: Fusion Splicing 14
      3.1.3. Fiber Optic Connectors: Angle Polished Connectors (APC) 14
      3.1.4. Maintenance of Fiber Optic Connectors 14
      3.1.5. Coax Cable and Connectors 15

4. CWDM Fiber Optic Receivers and Transmitters 15
4.1. BsmarTV™ AL6T-66 Transmitter 15
4.2. AL6T-66 Transmitter Specifications 15
4.3. BsmarTV™ AL6R-66 Receiver 16
4.4. AL6R-66 Receiver Specifications 17
4.5. AL6R-66 CWDM Distribution Platform 18
5. Installation of CWDM Compact Fiber Optic Receiver / Transmitter 19
5.1. Installing Compact TX Head End 19
5.2. Adjusting RF input 19
5.3. Verifying Optical Levels 20
5.4. Verifying Total Optical Power 20
5.5. Installing Compact Receiver 21
6. Optical Passive Components 22
6.1. FPL-LGX Housing Units 22
6.1.1. Installing FPL-LGX-12 Rack Mount Shelf 22
6.1.2. Installing FPL-LGX-3 Wall Mount Housing 24
7. Fiber Optic Connector and Port Cleaning 25
7.1. General Maintenance 25
7.2. Cleaning Methods 25
7.2.1. Dry Method 25
7.2.2. Wet and Dry Method 26
7.2.3. Cleaning Bulkheads 27
7.2.4. Compressed Air Method 28

1. General

1.1. Abbreviations

Abbreviation	Definition
APC	Angle Polished Connectors
APC Connector	Angled Physical Contact Connector
CWDM	Course Wave Division Multiplexers
EMI Filter	Electromagnetic Interference Filter
FC	Fiber Connector
IEC	International Electro-technical Commission
LNB	Low Noise Block
OADM	Optical Add Drop Multiplexers
OPM	Optical Power Meters
OTDR	Optical Time Domain Reflectometers
SC/APC	Sam Charlie/Angle Polished Connectors
SMF	Single Mode Fiber
UPC	Ultra-Polished Connectors

1.2. Note, Caution, Hazard Legend

Notes describe information for the user.

Cautions contain information regarding situations or materials which could damage your product.

Hazards describe an event that could pose a threat to life, health, property or environment.

1.3. Health and Safety Precautions

1.3.1. Personal Safety

OPTICAL RADIATION

Applying power to the transmitter unit will create a laser energy source operating in Class I as defined by IEC 825-1. Use AN infrared viewer, optical power meter or fluorescent screen for optical output verification.

AC POWER HAZARD

The rack mount power supply line is EMI filtered. The chassis is connected to the protective earth ground in compliance with safety requirements. Always use the 3-prong AC plug with the protective earth ground to avoid the possibility of electrical shock hazard to personnel.

1.3.2. Equipment Safety

To avoid damaging your product, observe the following:

1. Fuses: The AL6T/R-66 power supply does not have fuses.
2. The input of the transmitter has an optional built-in bias for inserting DC power and 22 KHz signaling up the coax to the LNB. Make certain any equipment or test equipment connected to the transmitter input can withstand this bias.
3. The output of the AL6R-66 receiver is AC coupled and can withstand the bias from a satellite receiver or similar distribution service up to 25 VDC. **Do not exceed 25V DC bias**.
4. Do not allow any dirt or foreign material to get into the optical connector bulkheads. This may cause damage to the polished optical connector end faces.
5. The optical fiber jumper cable bend radius is 3 cm. Smaller radii can cause excessive optical loss and/or fiber breakage.
6. Always ensure there is a good airflow around the AL6T/R-66 unit.
7. **Failure to install, use or properly maintain the BsmarTV™ components as shown in this document, or use of any such products if damaged, may result in nullification of the product warranty.**

1.4. Warranty and Repair Policy

Foxcom performs testing and inspection to verify the quality and reliability of our products. Foxcom uses every reasonable precaution to ensure that each unit meets specifications before shipment. Customers are asked to advise their incoming inspection, assembly, and test personnel as to the precautions required in handling and testing our products. Many of these precautions are to be found in this manual. The products are covered by the following warranties:

1.4.1. General Warranty

Foxcom warrants to the original purchaser all standard products sold by Foxcom to be free of defects in material and workmanship for 24 months from date of shipment from Foxcom. During the warranty period, Foxcom will repair or replace any product that Foxcom proves to be defective. This warranty does not apply to any product that has been subject to alteration, abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use, storage, transportation or handling.


Do not open the unit(s): Opening a unit will void the warranty.

1.4.2. Specific Product Warranty Instructions

All Foxcom products are warranted against defects in workmanship, materials and construction, and to no further extent. Any claim for repair or replacement of units found to be defective on incoming inspection by a customer must be made within 30 days of receipt of shipment, or within 30 days of discovery of a defect within the warranty period. This warranty is the only warranty made by Foxcom and is in lieu of all other warranties, expressed or implied. Foxcom sales agents or representatives are not authorized to make commitments on warranty returns.

1.4.3. Limitations of Liabilities

Foxcom's liability on any claim, of any kind, including negligence for any loss or damage arising from, connected with, or resulting from the purchase order, contract, quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contact, shall in no case exceed the purchase price of the device which gives rise to the claim. Except as expressly provided herein, Foxcom makes no warranty, expressed or implied, with respect to any goods, parts and services provided in connection with this agreement including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Foxcom shall not be liable for any other damage including, but not limited to, indirect, special or consequential damages arising out of or in connection with furnishing of goods, parts and service hereunder, or the performance, use of, or inability to use the goods, parts and service. The Company's exclusive warranty and the remedy provided for breach thereof shall not apply to:

- Any Product used or operated other than pursuant to the Company's written instructions

- Damage or deficiencies resulting from accident, alteration, modification, misuse, tampering, negligence, improper maintenance, installation or abuse
- Use of any Product other than at the Installation Site
- Use of any Product that is defective or damaged due to misuse, accident, or neglect, or due to external electrical stress, lightning or other acts of nature
- Use of any Product by a person who is not any authorized employee of the Customer
- Use of any Product other than as explicitly authorized in writing by the Company

1.5. Reporting Defects

The units were inspected before shipment and found to be free of mechanical and electrical defects. Examine the units for any damage that may have been caused in transit. If damage is discovered, file a claim with the freight carrier immediately. Notify Foxcom as soon as possible.

 Keep all packing material until you have completed the inspection.

1.5.1. Returns

In the event that it is necessary to return any product against above warranty, the following procedure shall be followed:

1. Return authorization is to be received from Foxcom prior to returning any unit. Advise Foxcom of the model, serial number, and discrepancy. The unit may then be forwarded to Foxcom, transportation prepaid. Devices returned collect or without authorization may not be accepted.

2. Prior to repair, Foxcom will advise the customer of our test results and any charges for repairing customer-caused problems or out-of-warranty conditions, etc.

3. Repaired products are warranted for the balance of the original warranty period, or at least 90 days from date of shipment.

1.6. About this Manual

This manual describes the basic installation and operating parameters of the BsmarTV™ Fiber Optic Distribution System. It is suggested that the installer read the entire contents before attempting to install or operate the equipment. Several topics build on material presented in earlier sections. The information presented assumes the reader/installer has a basic knowledge of fiber optic components and an intermediate to advanced level of understanding and experience with commercial DBS/L-Band, SMATV/CATV coax-based RF distribution systems and active Ethernet systems, including the use of related test equipment. This manual assumes that the installer has a working knowledge of and employs commonly accepted commercial practices for the installation of the equipment. This manual deals only with the fiber optic portion of the deployment and the typical interface connections with related RF and

Ethernet equipment. It is not the intent of this manual to serve as a design or architectural guide for new or existing deployments nor is it intended to address all applications that may arise. For additional assistance, contact Foxcom Technical Support.

2. Introduction to the 6-Channel BsmarTV™ System

2.1. Overview

The Foxcom compact AL6T/R-66-CWDM compact, cost-effective solution boasts a large optical input window and linear performance, enabling it to distribute up to 6 high-quality, L-Band (200-2400MHz) TV signals to multiple dwelling units.

The AL6T-66-CWDM transmits multiple satellite TV signals to multiple homes over a single optical fiber and is capable of supporting a variety of satellite television platforms. This transmitter is equipped with 6 dedicated DFB lasers to ensure stability and integrity of the signal.

The Foxcom compact AL6R-66-CWDM receiver converts incoming signals from Foxcom's optical AL6T-66-CWDM transmitter into 6 RF outputs.

The BsmarTV™ fiber-optic product line addresses the latest advances in multi-polarity DBS RF video and active Ethernet delivery for the MDU, private cable operator market including CATV programming over a single wire distribution system and any service provider in the last-mile-access market.

Foxcom's line of BsmarTV™ products affords the user all the benefits and features of utilizing fiber for signal distribution including:

- Extended distances from centralized headend; over 5+ kilometers
- Elimination of "Dish per Building" in garden style complexes
- RFI, EMI and lightning immunity
- Enhanced security and theft of service prevention
- Multi-polarity and/or DBS multiple orbital locations Ka, Ku and FSS satellites reception
- Delivery of HD
- Automatic Gain Control
- Compatibility with existing deployments and legacy Foxcom equipment

The BsmarTV™AL6T/R-66 series of L-Band/DBS fiber-optic transmitters and receivers, respectively, meet the increasingly demanding DBS/DTH multi-band distribution needs. At the top of the spectrum, the series offers up to six channels of bandwidth from 200-2400MHz MHz and are specifically designed to accommodate multiple satellite stacking capability and distribution for most global operational needs.

The BsmarTV™ series of transmitters are presented in a compact style enabling easy expansion and future upgrades. The small size of the BsmarTV™ fiber-optic receivers enable them to be conveniently located in an IDF closet or similar space restricted areas.

The BsmarTV™ series kits include:

- 1 TX
- 1 LGX Shelf
- 8, 16 or 32 way splitters
- Fiber jumpers to connect
- Receivers (ordered separately)

2.2. Typical BsmarTV™ Applications

BsmarTV™ products can be used in a variety of different setups. The diagrams in the following pages illustrate a few of the many possibilities.

2.2.1. CWDM Optical Output to an Optical Splitter Network

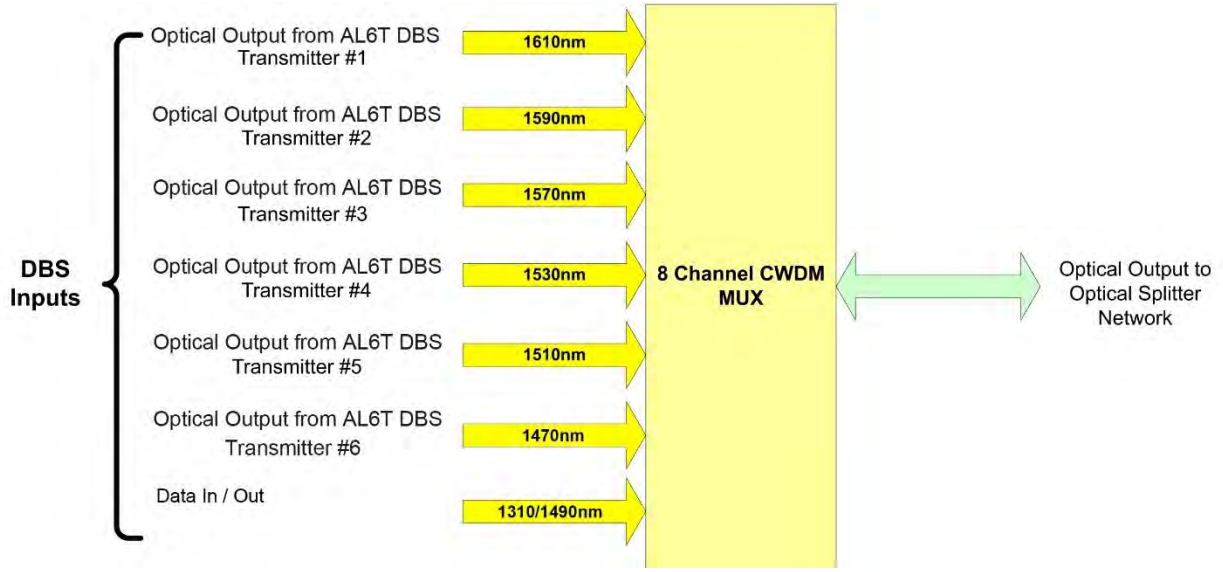


Figure 1: 2.2.1. CWDM Optical Output to an Optical Splitter Network

2.2.2. Receiver Block Diagram

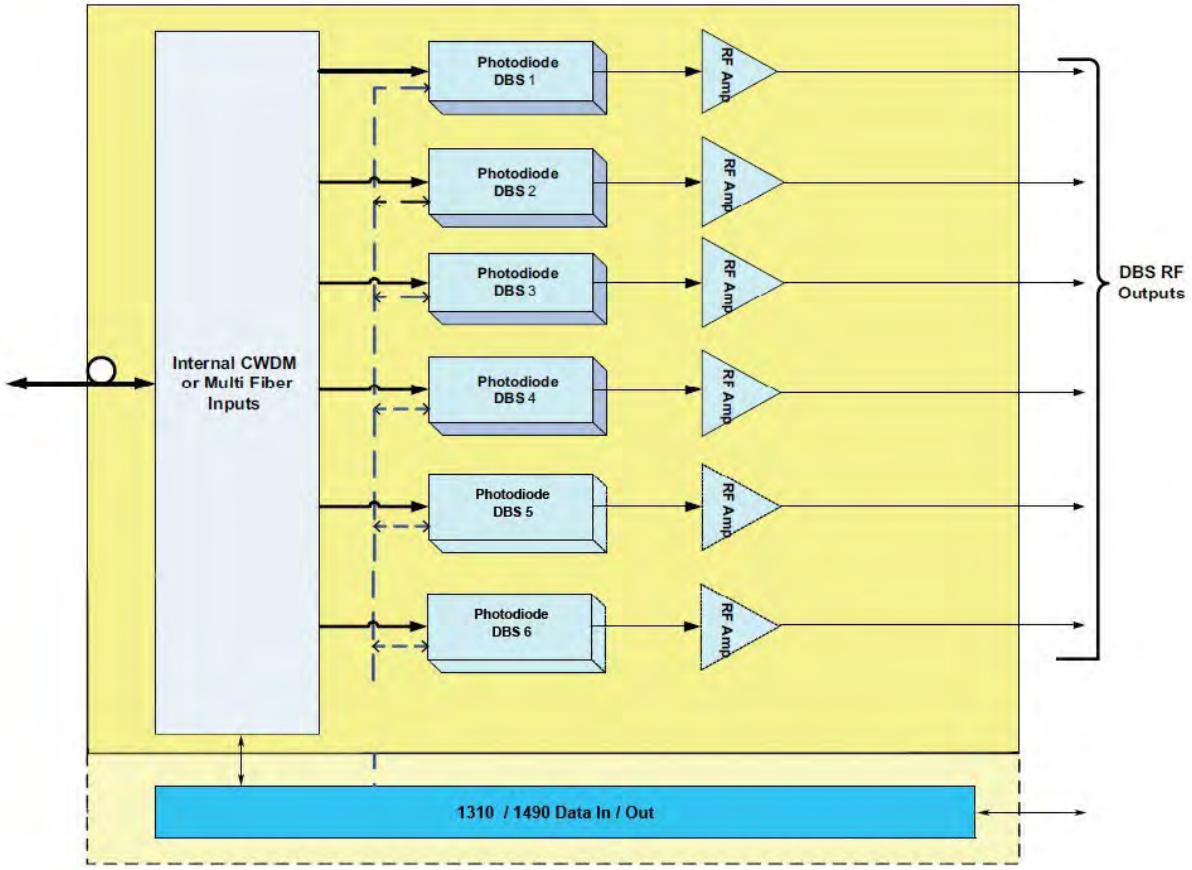


Figure 2: Receiver Block Diagram

2.2.1. Transmitter Block Diagram

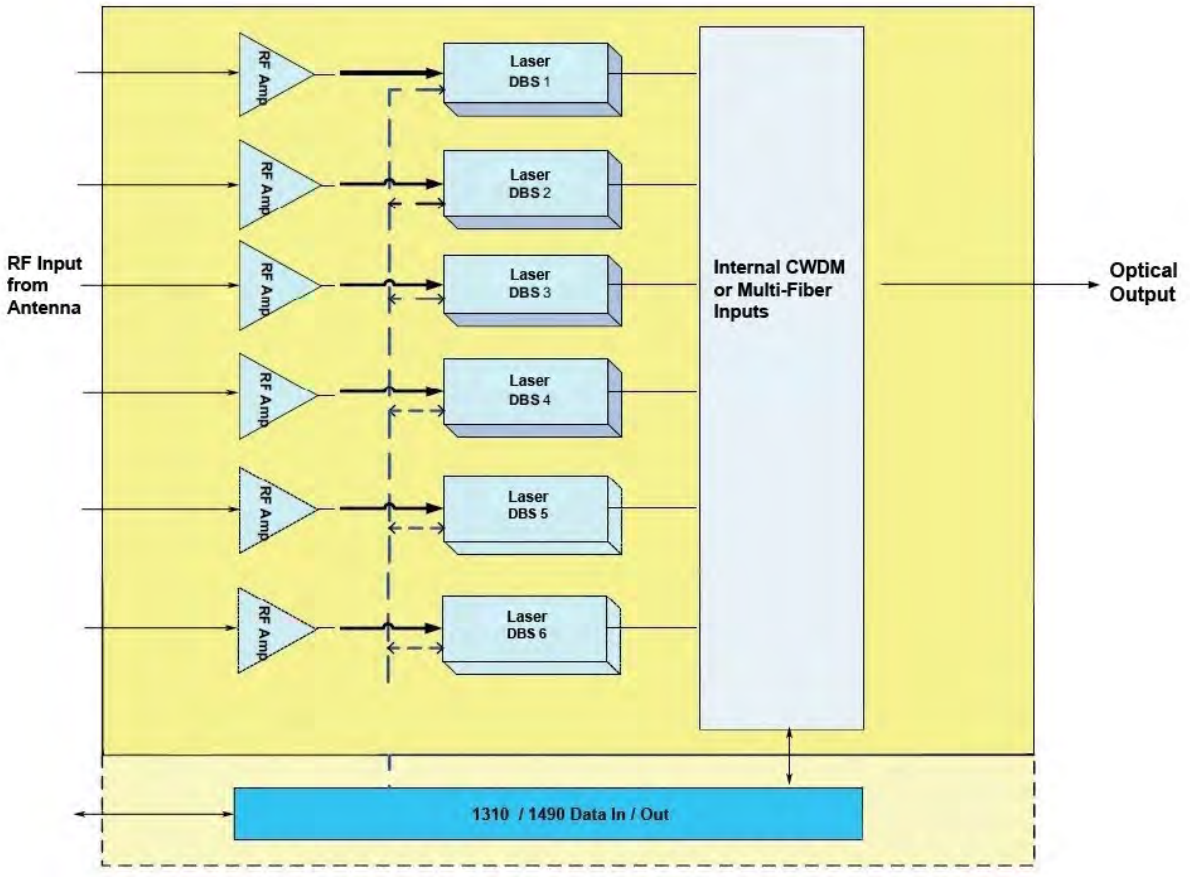


Figure 3: Transmitter Block Diagram

2.3. DIRECTV MFH2 Applications

2.3.1. Node Distribution System Diagram

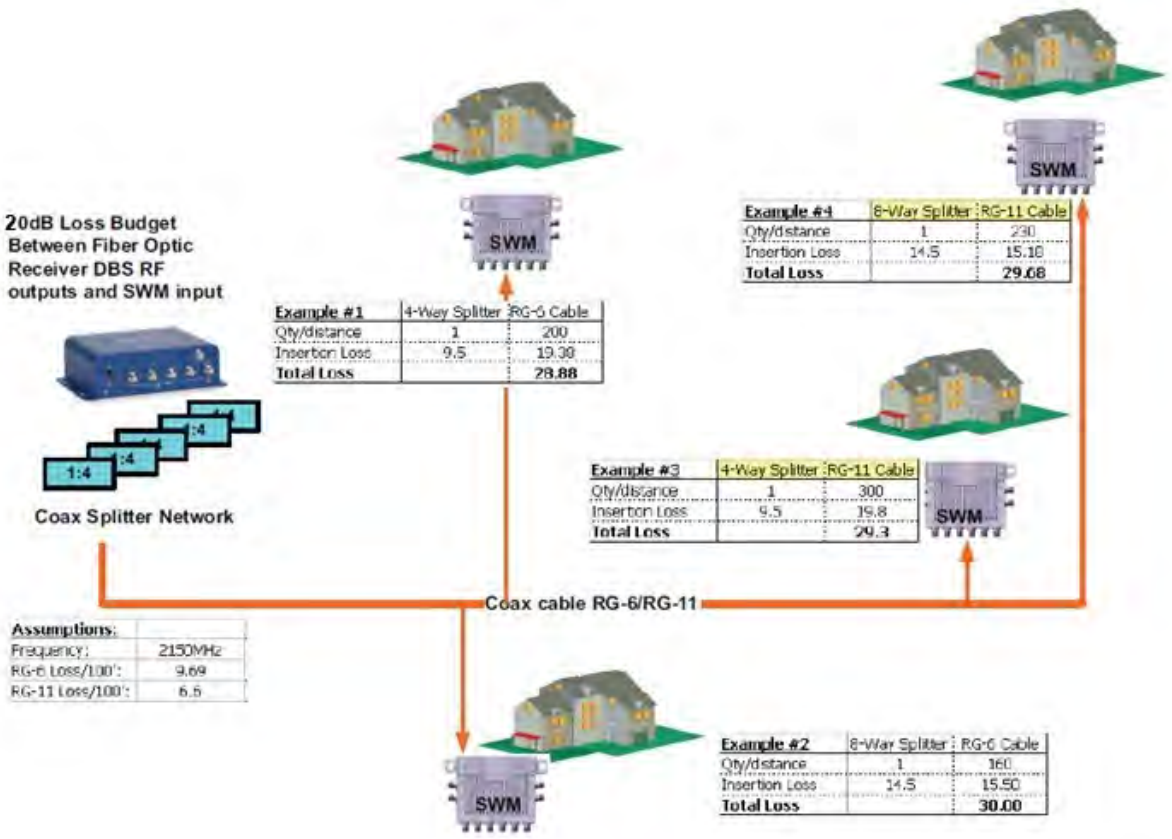


Figure 4: Node Distribution System Diagram

2.3.2. House/Apartment Distribution System

The house/apartment distribution system is presented in the following diagram.

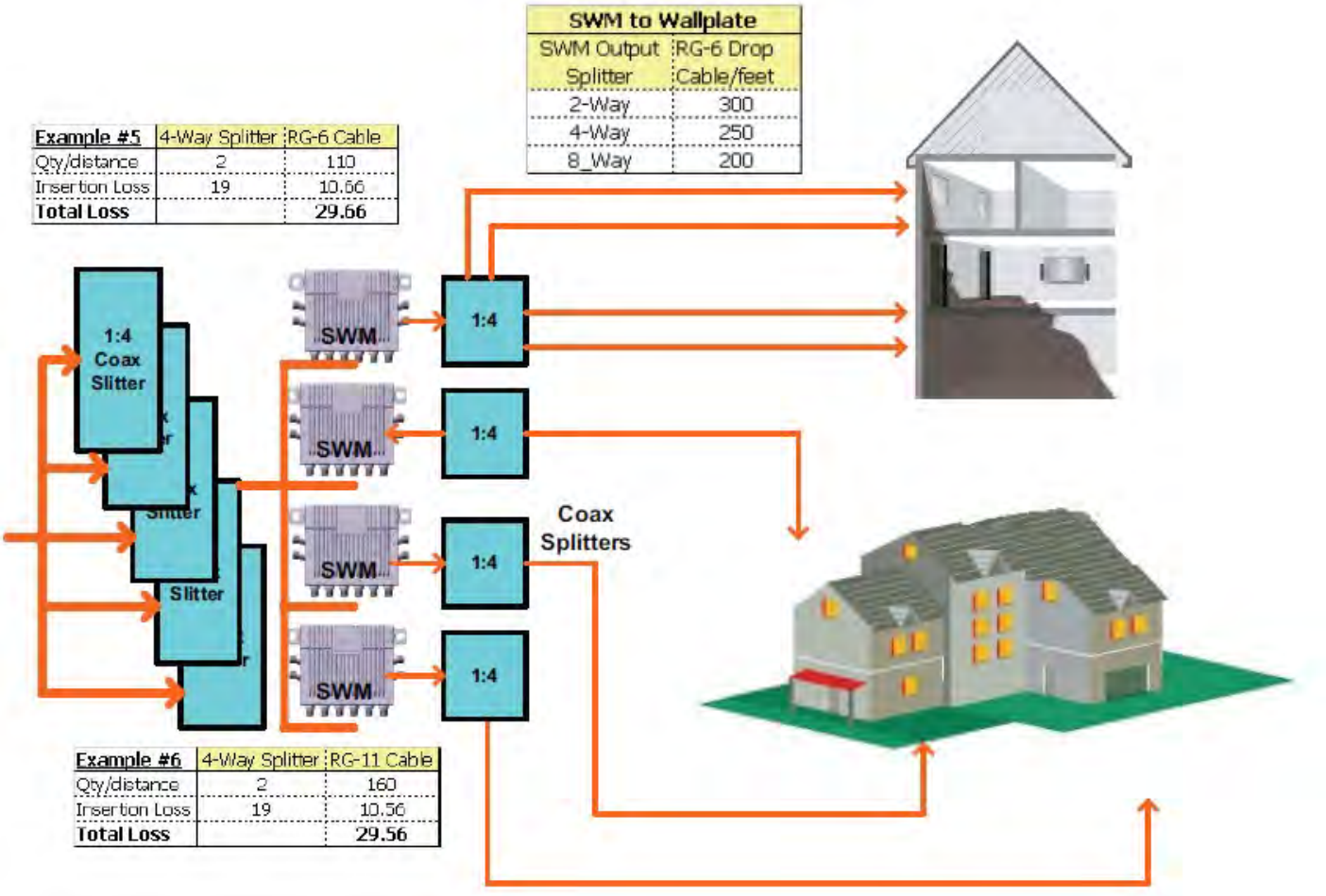


Figure 5: House/Apartment Distribution System

3. BsmarTV™ Fiber Optic Components

3.1.1. Single Mode Fiber (SMF28)

Due to the nature of the transmission, it is imperative that the BsmarTV™ RF video fiber distribution system utilize **Single Mode Fiber**, commonly referred to as SMF-28 or the equivalent. In recent years, several advancements have been made in the design and manufacture where performance exceeds the original offerings. The diameter of the fiber is 9/125 microns, core/cladding. **Multi-Mode (MM) type fiber, typically used in low to mid-range speed Local Area Networks, will not function properly**, if at all, in RF video systems. As a general rule, core diameters are larger in MM fiber and are typically, but not always, color

coded in orange jackets. SMF typically has yellow colored jacketing. Fiber in sold in multi-strand configurations of varying counts, typically 2, 4, 6, 12, 24, 48, etc. Various type of products are available for all deployments; riser, plenum, underground, etc. If you have any concerns about the proper type, use or application of fiber, always contact the vendor before purchasing or installing any fiber. Always install the equipment and any cabling in compliance with local, national or regional construction and fire codes and consult with the appropriate authorities before proceeding.

3.1.2. Fiber Optic Splicing: Fusion Splicing

To insure proper performance and long term reliability of the fiber optic plant, any and all fiber splices should be made with a high quality fusion splicer. With the exception of emergency repairs for temporary purposes, mechanical or epoxy type field splices should be avoided. Cost effective fusion splicers are available for purchase or short term rental with user friendly operation and training. Alternatively, an experienced contractor can be arranged to perform the splicing and facilitate the project. Prior to the release and operation of the fiber optic plant, a qualified technician should be available to sweep and test the fiber with appropriate test equipment including optical sources, Optical Power Meters (OPM), Optical Time Domain Reflectometers (OTDR), etc. Measurements should be recorded and compared against the design parameters.

3.1.3. Fiber Optic Connectors: Angle Polished Connectors (APC)

Due to the nature of the transmission, it is imperative that the RF video distribution utilize Angle Polished Connectors (APC) to terminate any fiber strands or patch cables. APC connectors have a slight angle taper on their finish to provide the best insertion and return loss specifications over alternative types. The use of PC (Polished Connector) or UPC (Ultra-Polished Connector) will severely degrade system performance likely beyond acceptable operational levels. As a general rule, but not always true, APC connectors have a green, color coded housing and/or boot. PC or UPC is typically coded blue. Furthermore, never try to mate an APC with a PC or UPC connector. The most common type of APC connectors is SC/APC (or “Sam Charlie”/APC). Foxcom BsmarTV™ equipment comes standard with SC/APC connectors on all optical ports. With over hundreds of millions now deployed in the telecom industry, the SC/APC offers the best return loss figures available. The keyed, positive insertion click insures proper mating over hundreds of insertions and is void of rotational vibration.

3.1.4. Maintenance of Fiber Optic Connectors

To insure proper and trouble-free operation of the system, it is imperative that all fiber optic connectors be kept clean and free of any debris or damage. Fiber optic connectors should be cleaned thoroughly upon initial installation and any type a connectors is removed for repair or test. Once cleaned, fiber optic connectors will provide excellent and trouble free operation over the life of the installation. A brief outline procedure for cleaning fiber optic connectors is included in the appendices. See Fiber Optic Connector and Port Cleaning.

3.1.5. Coax Cable and Connectors

All coax cable used in the system should be a quality 75 ohm impedance product, typically RG-6 or RG-11, with solid copper (SC) center conductor and a minimum of 60% braid shield terminated with compression type F-Connectors. Use of inferior cable, connectors or poor craftsmanship can cause the system to operate below performance specifications. Use of a copper coated steel (CCS) center conductor may cause voltage drop issues and damage the precision F-Type connectors on the equipment. Always install the equipment and any cabling in compliance with local, national or regional construction and fire codes and consult with the proper authorities before proceeding.

4. CWDM Fiber Optic Receivers and Transmitters

The CWDM compact BsmarTV™ solution consists of an AL6T-66 Transmitter and an AL6R-66 Receiver.

4.1. BsmarTV™ AL6T-66 Transmitter

The AL6T-66-CWDM transmits multiple satellite TV signals to multiple homes over a single optical fiber. This compact solution, which boasts 6 expanded L-band (200-2400MHz) inputs, is capable of supporting a variety of satellite television platforms. This transmitter is equipped with 6 dedicated DFB lasers to ensure stability and integrity of the signal. The internal multiplexer enables the installer to deliver all 6 L-band signals over a single fiber. The transmitter is designed to be used with a Foxcom optical splitter in point-to-multi-point applications. Depending on design requirements, the AL6T-66-CWDM can be used with the AL6R-66-CWDM.

4.2. AL6T-66 Transmitter Specifications

Parameters	AL6T-66-CWDM
RF Input	
Operating Frequency Range (MHz)	200-2400
Minimum RF Input Power	-50dBm

Maximum RF Input Power	-20dBm
Flatness	±1.0dB
CNR (Min. dBc)	45dB (@ 36MHz)
IMD (Max dBc)	40
RF Input Connector	F-type Female
RF Input Impedance	75 Ohm
RF Input Return Loss (Min.)	-10dB
Gain Control	AGC
Optical Output	
Optical Wavelengths	Video 1470, 1510-1610 Data 1310/1490
Optical Output Power (per wavelength)	+3dBm
Optical Output Connector Type	SC/APC
General	
Power Connector	Round 2 pin 1.9mm DC power (male)
Supply Voltage (VDC)	12V 2A
Maximum Current Drain (mA)	1.1A
Operating Temperature (ºC)	-10 - +55
Storage Temperature (ºC)	-45 - +85
Dimensions (W x H x D) mm	230 x 130 x 58

4.3. BsmarTV™ AL6R-66 Receiver

The Foxcom compact AL6R-66-CWDM receiver converts incoming signals from Foxcom's optical AL6T-66-CWDM transmitter into 6 RF outputs. This cost-effective solution boasts a large optical input window and linear performance, enabling it to distribute up to 6 high-quality, L-Band (200-2400MHz) TV signals to multiple dwelling units. The receiver is designed with internal CWDM to provide optimum, quality satellite TV signals in point-to-multi-point applications. Optical connectors are provided for data communication using 1310 and 1490nm. The AL6R-66-CWDM compact design and low power consumption enables it to be easily integrated in any MDU environment.

Figure 6: AL6R-66 Receiver

4.4. AL6R-66 Receiver Specifications

Parameters	**AL6R-66-CWDM**
RF Output	**Channels 1 – 6**
	L-band (SAT-IF)
Output Power	-30dBm / to @ Pin = -10dBm optical for 48 transponders
Operating Frequency (MHz)	200-2400
Output Return Loss	-9dB
RF Output Impedance	75 Ohms
RF Connector Type	F-type female
Optical Input	
Optical Wavelengths (nm)	Video 1470, 1510-1610 Data 1310/1490
Maximum Input Power (per wavelength)	+2dBm[1]
Minimum Input Power (per wavelength)	-16dBm[2]
Return Loss	-45dB
Fiber Type	SMF-28 (or equivalent)
Optical Connector	SC/APC
General	
Power Connector	Round 2 pin 1.9mm DC power (male)
Supply Voltage (VDC)	12V 2A
Maximum Current Drain	500mA
Operating Temperature	-10ºC - +55ºC
Storage	-45ºC - +85ºC
Dimensions	230 x 131 x 58

1. Total optical power for 6 wavelength: -6dBm
2. Total optical power for 6 wavelength: -16dBm

4.5. AL6R-66 CWDM Distribution Platform

The following is an example of the AL6R-66 CWDM Distribution Platform diagram.

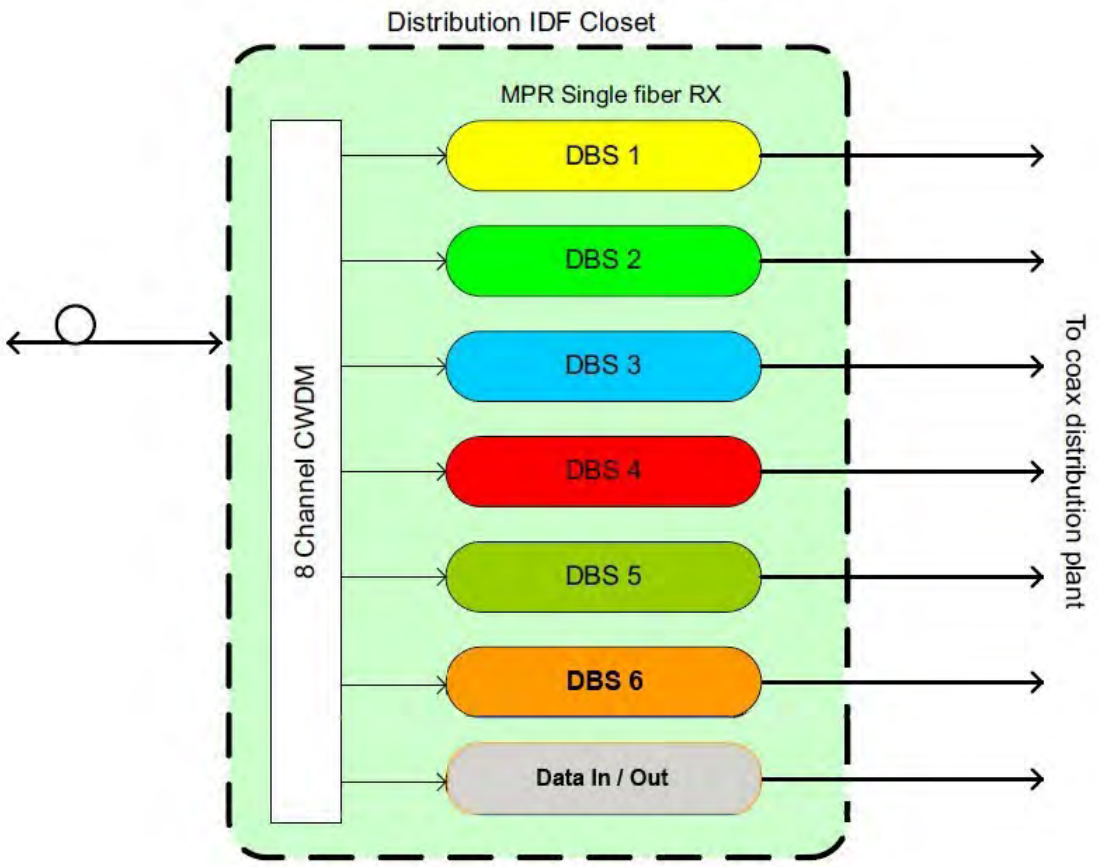


Figure 7: AL6R-66 CWDM Distribution Platform diagram

The following color coded table describes optical wavelengths.

TX Input	RX Output	Optical Wavelength	Color Code
Input #1	DBS #1	1610nm	
Input #2	DBS #2	1590nm	
Input #3	DBS #3	1570nm	
Input #4	DBS #4	1530nm	

Input #5	DBS #5	1510nm	
Input #6	DBS #6	1470nm	
In/Out	Data	1310/1490nm	

5. Installation of CWDM Compact Fiber Optic Receiver / Transmitter

This installation refers to 6 L-band satellite signals using AL6T/R-66 with internal CWDM.

The AL6R-66 fiber optic receiver converts the light energy back to RF in the inverse function as it was presented to the fiber optic transmitter at the headend. Each fiber strand is terminated at an IDF closet within the MDU building. All fiber plant fiber strands that route to the IDF closets should be SMF-28 or equivalent and be terminated with a quality SC/APC connector using pre-manufactured fiber pig-tails fusion spliced onto the strand.

1. Mechanical or other forms of splicing or termination can cause poor insertion and return loss giving poor system performance. The use of mating adapters, i.e., SC-FC, UPC-APC, etc., is also discouraged for similar reasons.
2. In addition, un-switched, properly conditioned AC Power Mains need be available in close proximity to the equipment for the connection of various power adapters required. Alternatively, local power can be obtained via coaxial cable into Port One of the receiver with the use of commercial power inserters and adapters.
3. In all applications, installations must meet all local, regional and national compliance codes for power distribution and grounding requirements. If there are any questions, check with the appropriate authorities before proceeding.

5.1. Installing Compact TX Head End

a. Mount the AL6T-66 and LGX-4 in an appropriate location using the mounting holes on the units and the appropriate fasteners for installation.
b. Mount splitter modules into the LGX-4 using “clips”
c. Connect TX to AC mains using the provided power supply.
d. Opt. LED should be green to verify proper laser operation.

5.2. Adjusting RF input

a. Install satellite dish(s) according to provider’s specifications.
b. Connect satellite LNBs to power inserter/polarity locker as required, such as the PI-6S or HRPID-1422 [the AL6T-66 **does not** supply LNB powering].
c. Block voltage from output of power inserter(s) using Voltage Blocking Couplers. **DO NOT INSERT POWER INTO TX**.

d. Verify proper signal strength and quality using an appropriate satellite signal strength meter.
    i. Signal strength should be between –20 and –40dBm per transponder.
    ii. RF LED should be green to verify proper input levels.
    iii. Record signal strength and quality for future reference.
e. Using coax jumpers [18" minimum, compression fitted F-connecters] connect power inserter to the input of the AL6T-66.

5.3. Verifying Optical Levels

a. Set an appropriate optical power meter to 1550nm. Measure and record optical output of the AL6T-66 in dBm. TX output should be a minimum of 9±1 dBm.


This accounts for the TOTAL power for all 6 lasers as measured at 1550nm.

b. Connect AL6T-66 to the input of the appropriate splitter.
c. Set the optical power meter to 1550nm. Measure and record the output power from each port of the optical splitter and verify that they are within the system design parameters as follows: (You will now be reading total cumulative power.)
    i. Power from 8-way splitter; output of TX minus 10.5dB
    ii. Power from 16-way splitter; output of TX minus 13.5dB
    iii. Power from 32-way splitter; output of TX minus 16.5dB
d. Compact head end is now ready to be connected to distribution. All fibers used should be SC/APC SMF-28 or equivalent.


1x32 splitter requires **duplex SC/APC connectors** on front side

5.4. Verifying Total Optical Power

a) With an optical power meter set on the appropriate wavelength, measure and record the optical power of each terminated fiber strand to be connected to the BsmarTV™ AL6R-66 receiver.
b) Estimate the losses in the fiber plant from the headend and the outputs of the optical splitters.
c) The typical optical insertion loss for:
- One kilometer of SMF-28 fiber is 0.3 dB at 1550 nm
- One kilometer of SMF-28 fiber is 0.4 dB at 1310 nm
- One fusion splice is 0.1 dB
- One SC/APC connector is 0.4 dB

Example: A fiber strand of 2.5 kilometers length with 6 fusion splices and two SC/APC connectors operating at 1550 nm yields an insertion loss of
(2.5 × 0.3) + (6 × 0.1) + (2 × 0.4) = 2.15 dB

d) Compare the optical power measured with the calculated values using the measurements taken at the output ports of the optical splitter.
The values measured should be within ±1.0 dB of the calculated value and each port should be within 0.5 dB of each other.

Nominal Optical Power from Optical Splitter Output Port	-7.5 dBm
Insertion Loss of Fiber Optic Plant Strand	-2.15 dB
Nominal Optical Power at IDF Closet/Input to Receiver	-9.65 dBm

Large difference in the measured values versus the calculated values can indicate defective, improper type, pinched or excessively bent cable, poor or non-fusion type fiber splicing, mis-seated, dirty, damaged or incorrect SC/APC connectors, which can impair system performance.

e) Correct any discrepancies before proceeding. Label and document all fibers.

5.5. Installing Compact Receiver

a. Mount the AL6R-66 in an appropriate location using the mounting holes on the unit and the appropriate fasteners for the installation within the distribution box or IDF closet. Make sure there is easy access to incoming fiber strands and any coax distribution equipment within the deployment.

Environmental control within the IDF closet should allow for temperature and humidity requirements within the operating specifications of the equipment, typically, 0° to 50°C, 85% RH, or better.

In instances where receive equipment must be mounted in an outdoor application such as the side wall of an MDU building, care should be taken to use weather-proof enclosures that meet all of the space and environmental conditions.

b. Connect RX to AC mains using the provided power supply.
c. Verify optical power level on fiber at each location. Power levels should be level from 3d above, minus distribution losses; fiber, splices, connectors, etc.
d. After cleaning fiber connector, insert into RX. RF and OP lights should be green.
e. Using satellite meter, confirm F-connector outputs and compare to readings taken in Adjusting RF input, #d.
f. RX is now ready to be connected to coax distribution.
g. Output signals correspond directly to the inputs of the TX.
h. Connect the DC plug from the supplied BsmarTV™ power adapter into the power jack on the AL6R-66 receiver. Plug the line cord of the power adapter into the AC mains.

OR

As an alternative, insert a DC Voltage between +13 and +18 Volts into RF F-Type connector for RF Port 1 using commercial available power inserters, power passing taps or splitters, self-powered multi-switches, etc.

i. Any devices connected to the RF port on the receiver must be of minimum insertion loss and be rated for the appropriate bandwidth to pass the transmitted RF signal; i.e., 5–2500 MHz, 200–2500 MHz, etc.
ii. Only Port 1 of the receiver is available for powering the unit. All other RF ports are DC Voltage blocked.
iii. If the receiver is powered from the supplied power adapter and Port 1 is connected to a power passing device such as a powered multi-switch, place a DC voltage block on Port 1 to prevent any voltage contention issues.

6. Optical Passive Components

The BsmarTV™ suite includes a full range of optical passive components including optical splitters, Course Wave Division Multiplexers [CWDM] and optical splitters with integrated Optical Add Drop Multiplexers [OADM], to enable users to deploy different fiber counts, configurations and architectures. These components are available in industry-standard LGX housing and may be either rack or wall mounted.

6.1. FPL-LGX Housing Units

The FPL-LGX housing units are designed to house all the passive optical components in the BsmarTV™ system. The units comes in two sizes:

The **FPL-LGX-12**: a 12-slot, 4RU shelf, 19 inch rack mount

The **FPL-LGX-3**: a 3-slot wall mount enclosure

The units can accommodate any combination of the following units:

- A 1 × 8 optical splitter occupies 1 LGX slot
- A 1 × 16 optical splitter occupies 2 LGX slots
- A CWDM occupies 1 LGX slot

6.1.1. Installing FPL-LGX-12 Rack Mount Shelf

To install the FPL-LGX-12:

1. Using the hardware supplied, install the mounting ears on the sides of the shelf. Mount the shelf into a 19” rack using 4, 10-32 screws. Ensure that there is at least 1 RU clearance above and below the shelf to allow room for the routing of optical cables and proper ventilation to any adjacent active equipment.
2. Carefully remove the protective film from the Plexiglas front panel. Rotate the locking tabs on the top corners of the front panel to the vertical position. Lower the front panel, remove and store until installation is complete. Slide the shelf drawer out to a position of easy access. On the rear of the shelf, rotate the tabs on the upper corners of the door and lower. The hinged rear door may also be removed and set aside.
3. To install an optical splitter, pull out the locking pins on the top and bottom of the unit to the open position. Position the unit vertically to one slot on the drawer and insert the locking pins into the holes on the drawer. Push the pins firmly in place to secure the unit to the drawer. Repeat this for all units needed for the installation.

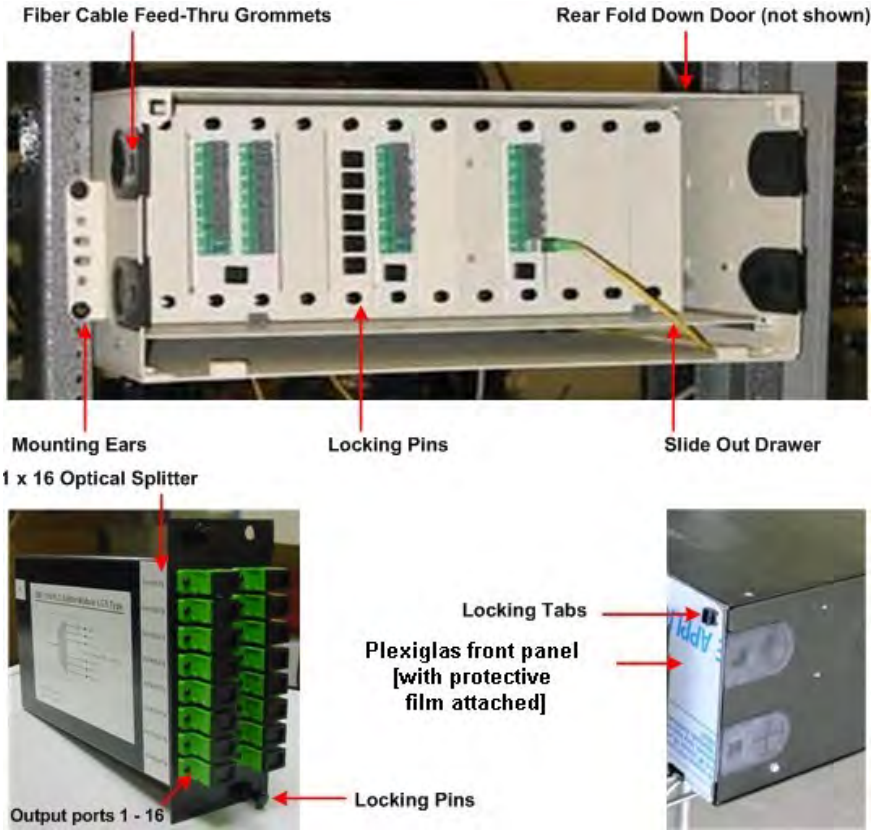
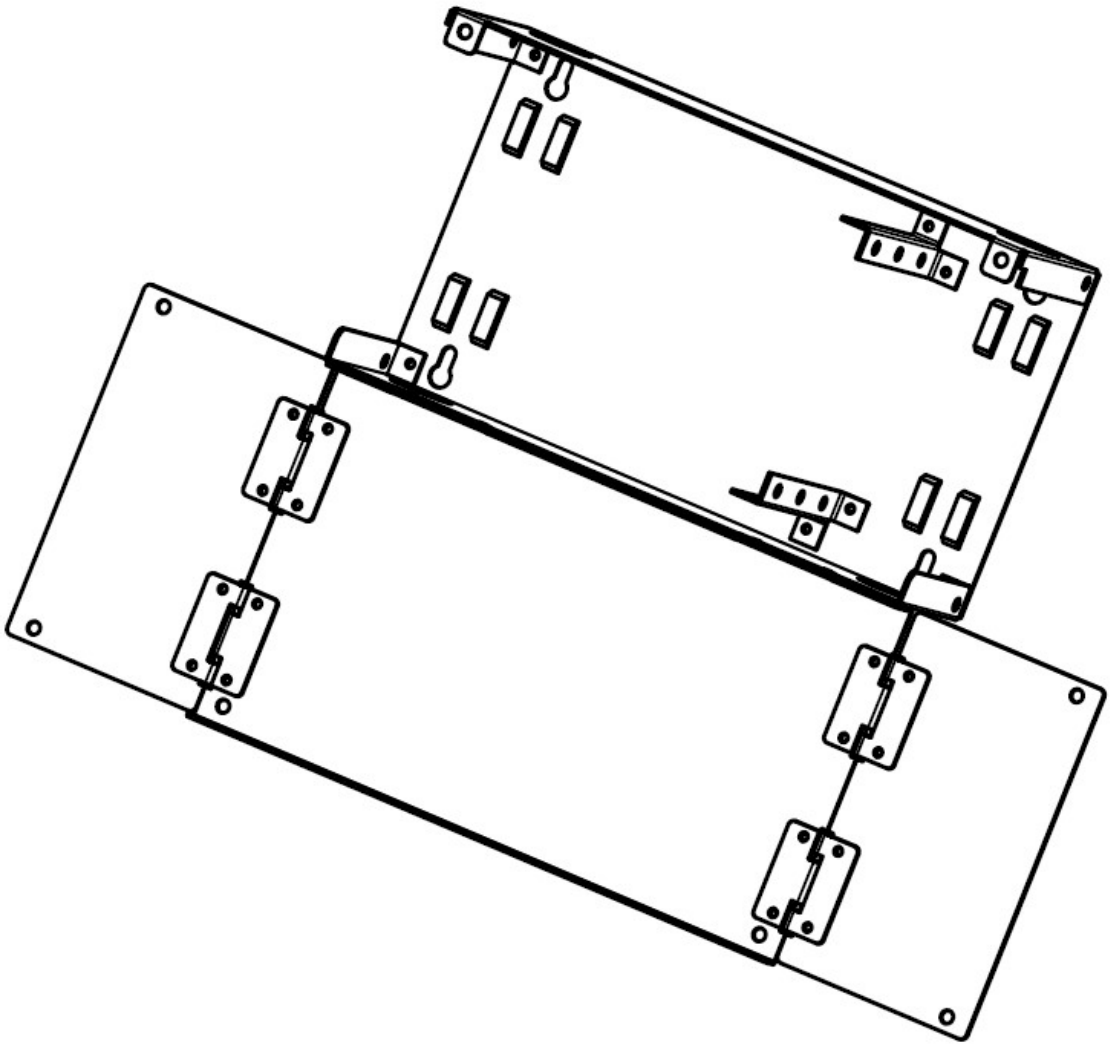


Figure 8: FPS-LGX Shelf and Optical Splitters

4. Connect an SC/APC to SC/APC fiber optic jumper cable from the output in the rear of each AL6T-66 fiber optic transmitter to the input in the rear of each fiber optic splitter. As needed, cut a hole in the rubber grommets on the FPL-LGX shelf with a knife or small

screwdriver to enable routing of the cable between the two. Be careful not to damage the cable or connector in doing so.

6.1.2. Installing FPL-LGX-3 Wall Mount Housing



To install the FPL-LGX-3:

1. Mount the unit on the wall using four screws.
2. Insert up to three LGX cards into the housing slots.
3. Use the fiber management I/O holes to strain relieve the fiber cables.
4. Close the panels to product the LGX cards against dust and dirt.

7. Fiber Optic Connector and Port Cleaning

7.1. General Maintenance

Most RF over Fiber equipment has an SC/APC angle polished optical connector for very high optical return loss performance. The units are specified into single mode fiber, i.e. 9/125 micron core diameter. The smallest particles of dust or other contaminants can vastly affect performance. All connectors should be properly cleaned prior to initial installation and at any time after a connector is removed for test and measurement purposes. Once properly done, fiber optic connectors require no maintenance and offer years of trouble-free operation. Unused optical ports and connectors should always remain covered to prevent damage or contamination and for safety reasons.

Applying power to the transmitter unit will create a laser energy source operating in Class I as defined by IEC 825-1. Use an infrared viewer, optical power meter or fluorescent screen for optical output verification. Never use a microscope to examine a fiber optic cable that is connected to a transmitter.

- **Never** look directly into a fiber optic port or connector. Always keep unused optical ports covered.
- **Never** turn on the transmitter before a fiber optic cable is connected to the output port.
- **Always** disconnect power to the transmitter before making connections for testing or operational purposes.

In troubleshooting, if there is low/no signal or noisy signal from a FO TX or point downstream, the connectors should be cleaned. Even if optical power levels seem nominal, poor return loss performance caused by contaminated connector surfaces can cause optical reflections, standing waves and signal degradation if only at certain portions of the bandwidth utilized.

There are many quality offerings from reputable sources available for fiber optic connector cleaning. For best results, always consult with the manufacturer for the most recent updates and details on proper use.

Many suppliers offer complete, prepackaged kits with all the items necessary for fiber optic connector and port cleaning.

7.2. Cleaning Methods

7.2.1. Dry Method

Fiber optic connectors should be cleaned using one of several commercially available products on the market specifically designed for the task. The dry method of cleaning involves using a lint free material such as a **Kimwipe™** or **Cletop™**. The wipe may be held in the hand or placed on a smooth, pliable

surface. The connector is held at a slight angle to match the taper on the APC. Rotating the connector in a figure eight pattern a few times will usually suffice. Always use a clean wipe for each connector.

Figure 9: Use a wipe to gently wipe the end face surface of the connector

The Cletop™ mechanism contains a lint-free fabric. Opening the slide exposes a clean, unused piece of fabric. As before, the connector can be rotated across the surface. Releasing the slide closes the Cletop™ to insure against contamination and prepares the reel for the next application. The connector end face is wiped across the material in the cassette opening.

Figure 10: Cletop™ Cassette Type Connector Cleaner

7.2.2. Wet and Dry Method

The wet and dry method involves the use of wipes and a commercially available solution, such as **Chemtronics QbE™** wipes and **ElectroWash PX™** solution. In this method, a small amount of solution is placed on the wipe as it is stretched across the platen. The connector is then moved from the wet area to the dry area a few times for cleaning. An advantage of the wet-dry method is the solution will also help remove other substances, such as human oils or other organic chemicals. These commercial, specially prepared solutions have high degrees of purity and fast rates of residue free evaporation. The use of alcohol for cleaning is not recommended. Solutions can be used in combination with wipes for the wet/dry method.

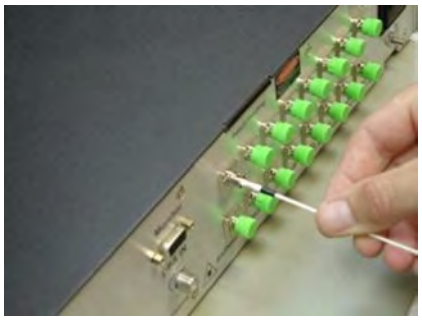
Figure 11: ElectroWashPX™ Connector Cleaner Solution

7.2.3. Cleaning Bulkheads

The input and output optical ports of fiber optic equipment are known as bulkhead ports. Bulkheads are essentially a mechanical adapter that will accurately and reliably hold two fiber optic connectors together so their core mating surfaces are in contact and in near perfect alignment. Since one half of the connector pair is usually located within a device, such as a fiber optic transmitter or receiver, optical splitter, etc., in most cases, it is impractical and not recommended to disassemble the device for cleaning.

Figure 12: 2.5 mm cleaning swabs for optical ports

To clean bulkhead ports, specially designed cleaning swabs are available for this purpose. The SC/APC connector port uses a 2.5 mm cleaning swab. The swab is designed with a lint-free, soft material tip to clean the connector-end face. Use a clean fiber optic cleaning swab, gently wipe out the optical port. Discard the swab after use.



As with standard connector end face cleaning, dry or wet/dry products are available. The swab is inserted in the port opening and gently rotated. In the case of wet/dry, first slightly dampened with solution, than with a dry swab. Always use a new swab for each port. Never use household product swabs or insert other utensils in the port opening. Doing so may permanently damage the port. Only clean equipment ports when there is evidence of reduced performance or contamination.

7.2.4. Compressed Air Method

The use of compressed air is **not** recommended for fiber optic cleaning. In many environments, compressed air will actually increase the amount of dust on a surface. In some cases, specially packaged and purified compressed air can be used to clean away dust from around the outside of the bulkhead while the connector is inserted or the port is covered or within receptacles. Never use shop or machine air as they contain oil or other contaminants. Always clean the connector surface after using compressed air in this manner.