Mini Node ONU 8702

Reference & Installation Manual

Section 1. Introduction

Netwave ONU8702 optical mini node performs lightwave-to-RF and RF-to-lightwave signal conversions in an optical transmission link. This product supports a wide variety of advanced hybrid-fiber/coaxial network topologies.

As broadband communication systems continue to evolve, the demand increases for optical links that carry the signal further into the transport system. These systems require additional features and functionality such as digital compression and alternative access at significantly lower costs. Fully configured, the ONU 8702 supports these next-generation telecommunication networks. It also supports a variety of single and two-way broadband network applications such as broadcast video, interactive video, telephony, and data.

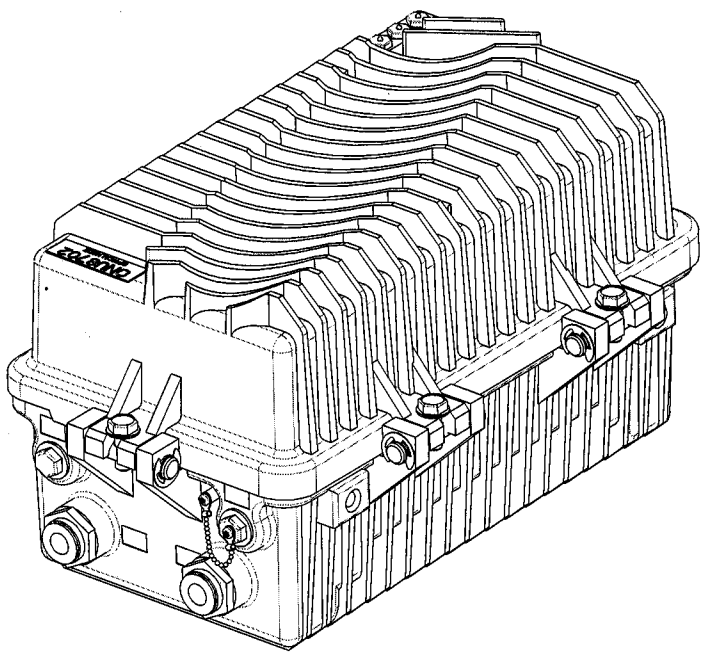


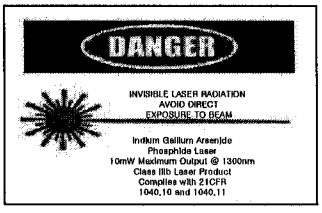
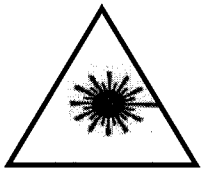
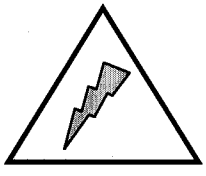
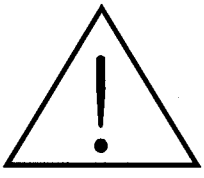
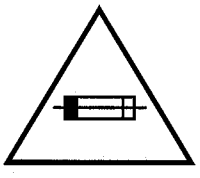
Figure 1-1 ONU8702 node-closed

Caution

These servicing instructions are for use by qualified personnel only. To reduce the risk of electrical shock, do not perform any servicing other than that contained in the installation and Troubleshooting instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

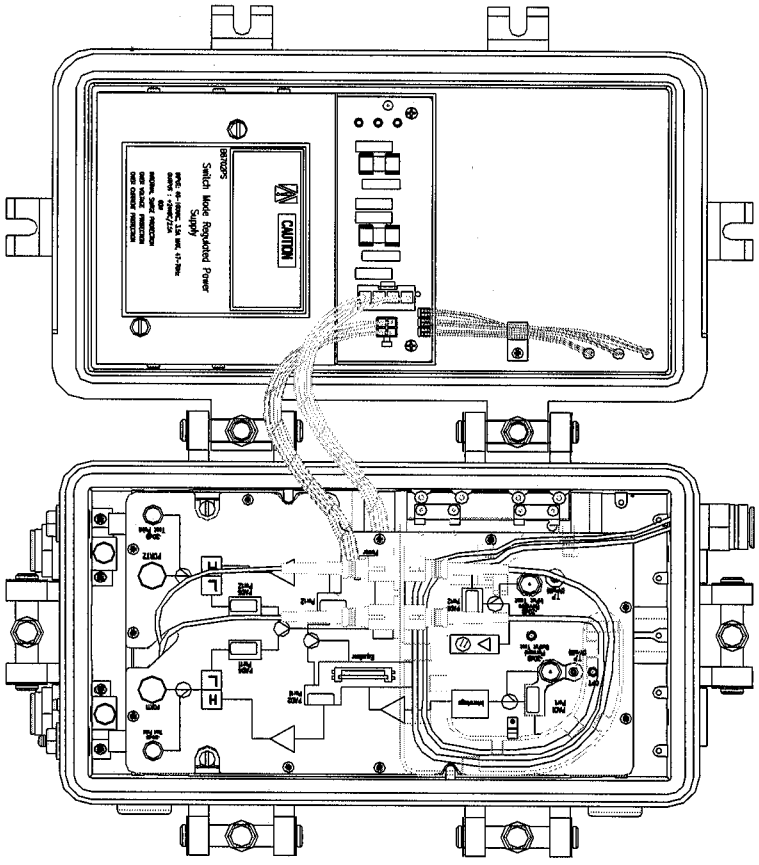
NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER"S AUTHORITY TO OPERATE THE EQUIPMENT.

Special Symbols That Might Appear on the Equipment

	This is a class 1 product that contains a class IIIb laser and is intended for operation in a closed environment with fiber attached. Do not look into the optical connector of the transmitter with power applied. Laser output is invisible. And eye damage can result. Do not defeat safety features which prevent looking into the optical connector.
	This product contains a class IIIb laser and is intended for operation in a closed environment with fiber attached. Do not look into the optical connector of the transmitter with power applied. Laser output is invisible, and eye damage can result. Do not defeat safety features which prevent looking into the optical connector.
	This symbol means that dangerous voltage levels are present within the equipment. These voltages are not insulated, and may be of sufficient strength to cause serious bodily injury if touched. The symbol may also appear on schematics.
	The exclamation point, within an equilateral triangle, is intended to alert the user to the presence of the presence of important installation, servicing, and operating instructions in the documents accompanying the equipment.
	For continued protection against fire, replace all fuses only with fuses having the same lectrical ratings marked at the location of the fuse.

Contents

Figure 1-2 ONU8702 node open



Features

* 870MHz forward bandwidth
* Built-in optical receiver
* Two RF output
* 15 amp power passing
* Modular plug-in diplex filters and equalizers
* Support for low, standard, and high slope options
* 60 / 90 volt powering
* SC/APC or FC/APC connectors
* Gas tube or Fast Trigger Electronic Crowbar (FTEC) surge protection
* Silicon or Gallium Arsenide (GaAs) output hybrid
* Non-Isolated distributed feedback (DFBT), Non-Isolated Fabry-Perot(FPT)
* User-friendly fiber management

Section 2. Overview

The Netwave ONU 8702 is the newest addition to the next generation of telecommunications optical nodes. It provides a low cost solution to support evolving fiber-deep networks. It meets the latest demands of a single and two-way broadband network application including broadcast video, telephony and data.

Configured with one optical receiver, two high-level RF outputs, and an optional return-path module, the node offers low-cost flexibility. Modular design enables system upgrades and component replacement with minimal system interruption.

2.1 Specifications

2.2 Housing

2.3 Power Supply

2.4 Forward RF Path

2.5 Return RF Path

2.1 Specifications

Optical (Receiver / Transmitter)				
parameter	Units	Receiver	Transmitter	Notes
Optical Wavelength	nm	1550±30 or 1310±30	1310 ± 10	
Optical Output Power (nominal)	mW		1 / 2	FP / DFB LD
Optical Input Range	dBm	-1.0 to +2.0		
Optical Input Return loss	dB	45 or more		
Sensitivity	pA/Hz	7		
Indicators (Voltage)	V/mW	1	1	
Fibertype		Single Mode 9/125um	Single Mode 9/125um	

Electrical				
parameter	Units	Forward	Reverse	Notes
PassBand	MHz	54 - 870	5 - 42	
Frequency Response	dB	± 0.5	± 0.5	
Return Loss (Minimum)	dB	16 (54 ~ 870MHz)	16 (5 ~ 42MHz)	@ 75ohm
RF Output level (Maximum)	dBmV	50		@Optical input 0dBm
Test Point Loss	dB	20 ± 1.0	20 ± 1.0	
Impedance	ohm	75		
AC Input Power Voltage	VAC	60 to 90		@ 47 to 70 Hz
Operation Input Power Voltage Range	VAC	40 ~ 100		
Power Passing	A	15		
Operating Efficiency	%	85		Minimum
Power supply Rating	A	2.5		@ 24Vdc

Environmenntal			
parameter	Units	Forward Tx	Notes
Operating Temperature Range	C	-40 to +65	
	F	-40 to +149	
Storage Temperature Range	C	-40 to +70	
	F	-40 to +158	
Humidity Range	%	0 to 95	

Mechanical			
parameter	Units		Notes
Depth	mm	190	
Width	mm	367	
Height	mm	229	
Weight	kg	7.5	

Distortion Performance (NTSC 79 Ch / NTSC 116 ch)					
Parameter	Unit	Min.	Typ.	Max.	Notes
Carrier to Noise (79 /116)	dB	-	52 / 51	-	1,2,3,4
Composite Triple Beat (79 /116)	dB	-	-67 / -65	-	1,2,4
Composite Second Order (79 /116)	dB	-	-65 / -63	-	1,2,4
Cross Modulation (79 /116)	dB	-	-65 / -64	-	1,2,4

Notes

1 . 12dB Slope, 79 Channels Specified at + 40 dBmV output, 116 Channels Specified at + 42 dBmV output.

2 . Channel loading is NTSC 79 Channels and NTSC 116 Channels. (simulated by CW 6 MHz carriers)

3 . Carrier-to-Noise Ratio : NTSC 79 @4 MHz noise bandwidth

NTSC 116 @4 MHz noise bandwidth

4 . Link : Distribution Link, 20 Km of fiber plus Passive Loss.

@ Optical Input level : 0 dB

@ Total link loss : 8.5 dB

2.2 Housing

ONU 8702 optical node is furnished in an aluminum housing that protects the electronics from weather and dissipates internally generated heat.

Figure 2-1 illustrates the ONU 8702 housing:

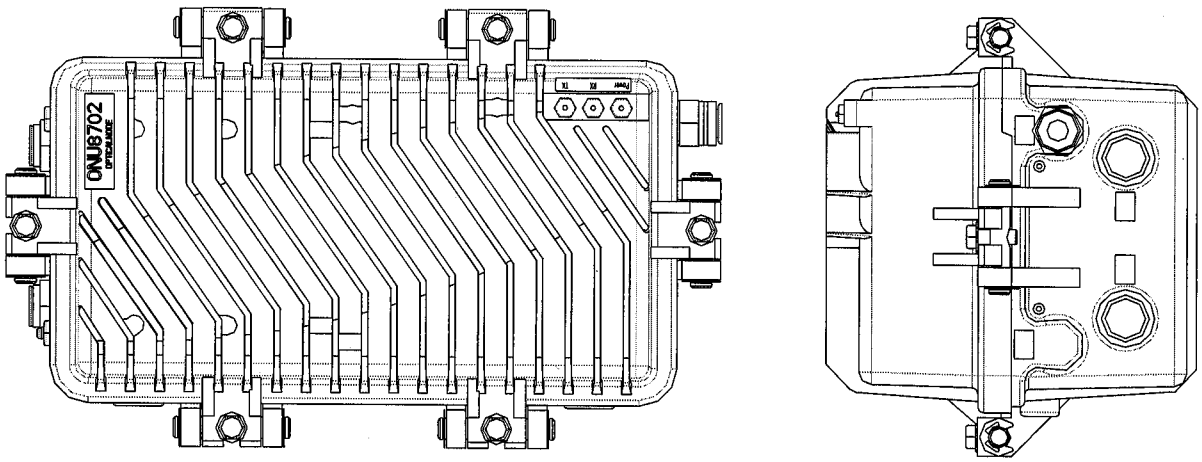


Figure 2-1 ONU8702 housing outline (front & side view)

Coaxial cable connections to the housing are made with conventional 5/8 inch –24-thread, stinger-type connectors. For strand mounting, two clamps are located at the top of the housing and are secured with 5/16 - 18 stainless steel bolts.

Port Locations

The housing provides three cable connections (two RF ports and one optical-fiber port). You can also use the RF return-output port as a power-input port. All ports are protected by factory-inserted threaded plugs or plastic cap plugs. Discard these plugs when you install the cable connectors.

Gaskets

Each housing is equipped with a woven-wire RF gasket and a silicone-rubber weather gasket to provide a seal between the housing base and lid. These gaskets provide efficient ground continuity, RF shielding, and weather protection. Both gaskets must be in place and in good condition to ensure proper operation and protection of the station. The weather gasket should be lightly coated with silicone grease each time the node is opened. Replace this gasket if it becomes damaged or deformed.

Figure 2-2 illustrates a front and end view of the closed housing and the port locations:

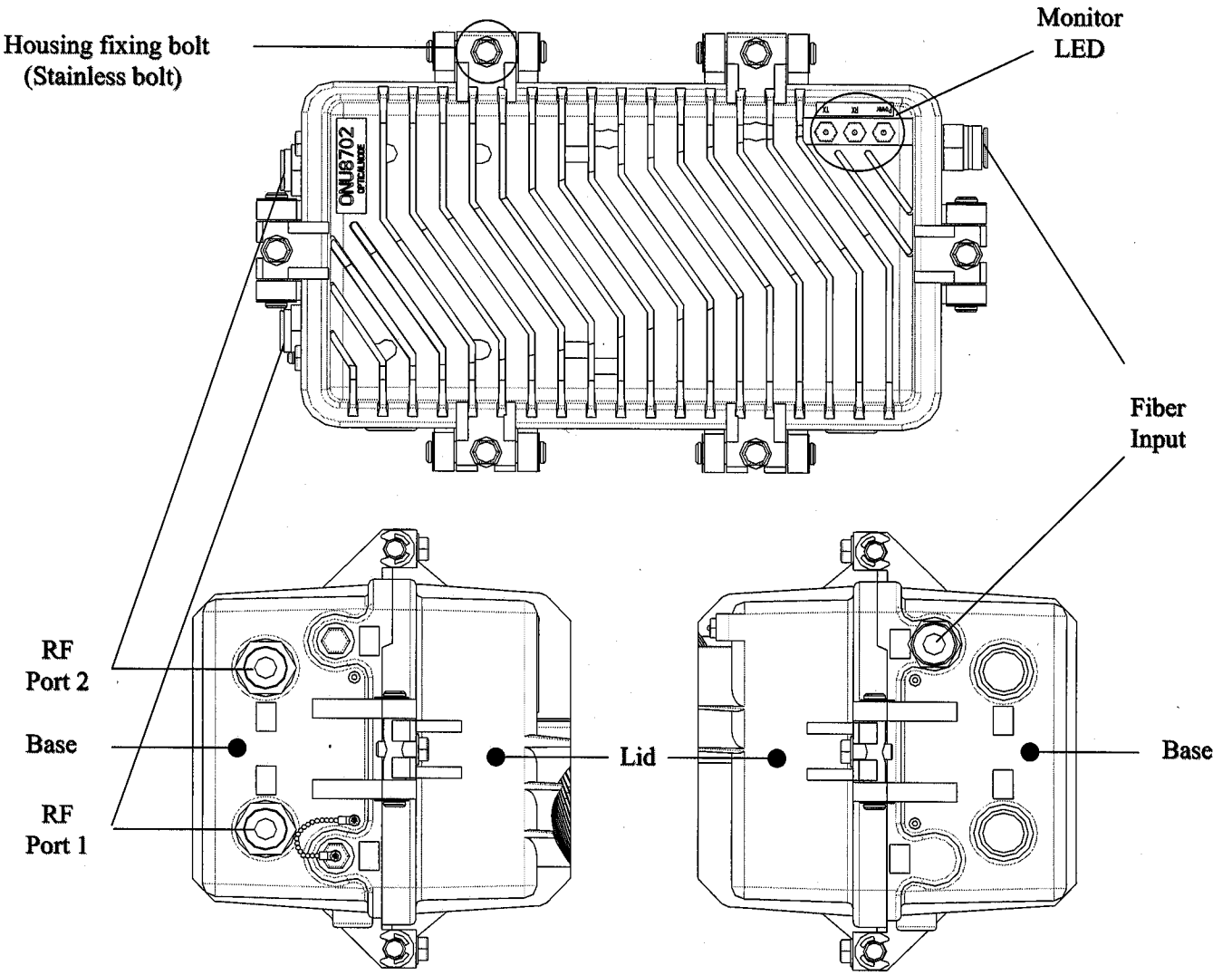


Figure 2-2 ONU8702 Port location

Figure 2-3 illustrates the housing gaskets:

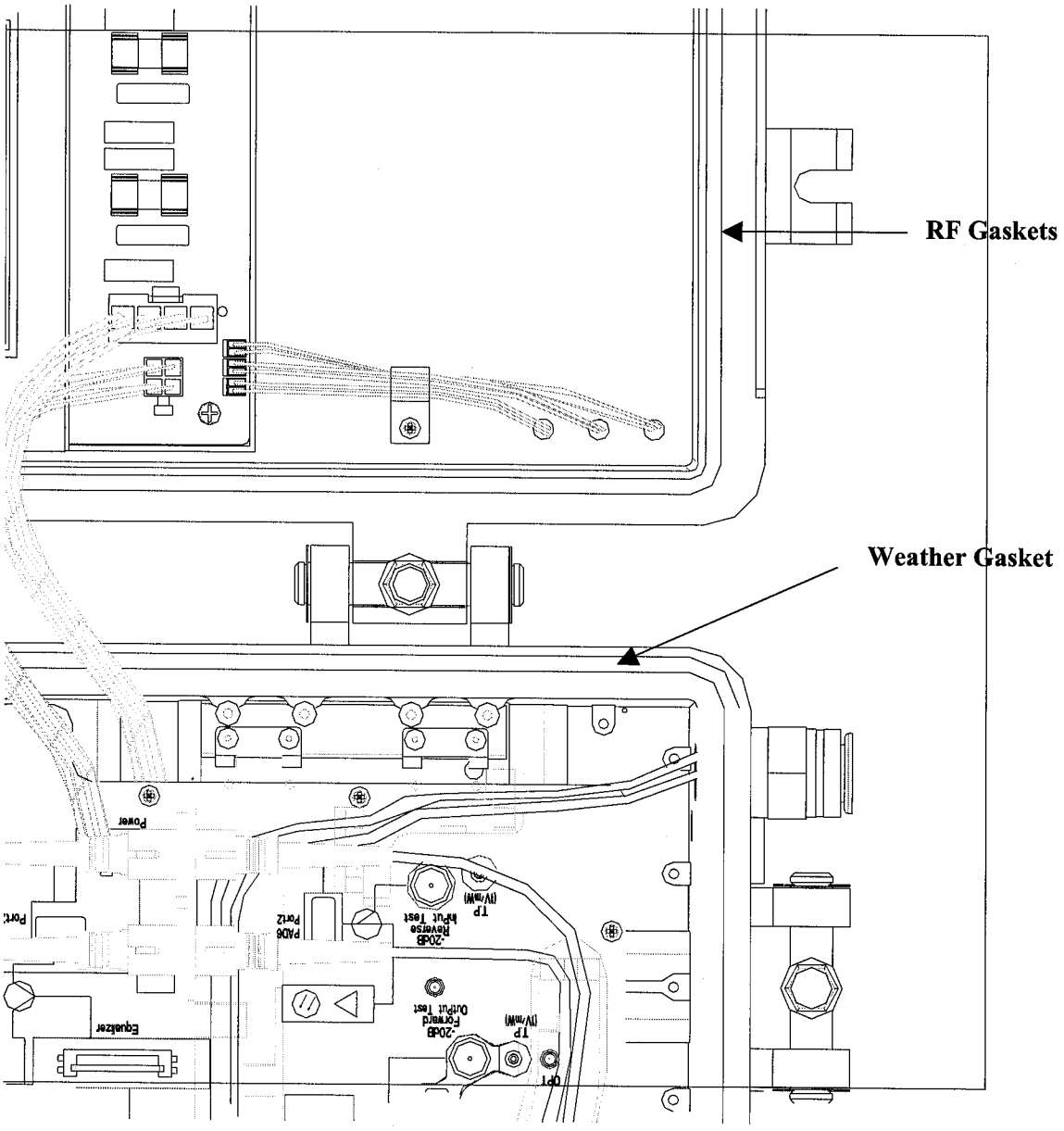


Figure 2-3 ONU8702 Weather Gasket / RF Gaskets

2.3 Power Supply

ONU 8702 power supply is located in the housing lid to optimize heat transfer and to balance the thermal load between the base and the lid. An umbilical cord connects the ONU8702 to the housing base.

A flexible power-distribution design enables you to power the node from any of the two RF ports. Using fuses, you can configure the node to distribute power to the remaining active ports.

The power supply includes surge protector that triggers at approximately 230V and presents a short circuit to the line during periods of overvoltage. After the ac input voltage returns to normal, the surge protector returns to its open circuit state. This provides the node with a level of protection against surge currents on the ac line.

Figure 2-4 illustrates the ONU8702 power supply:

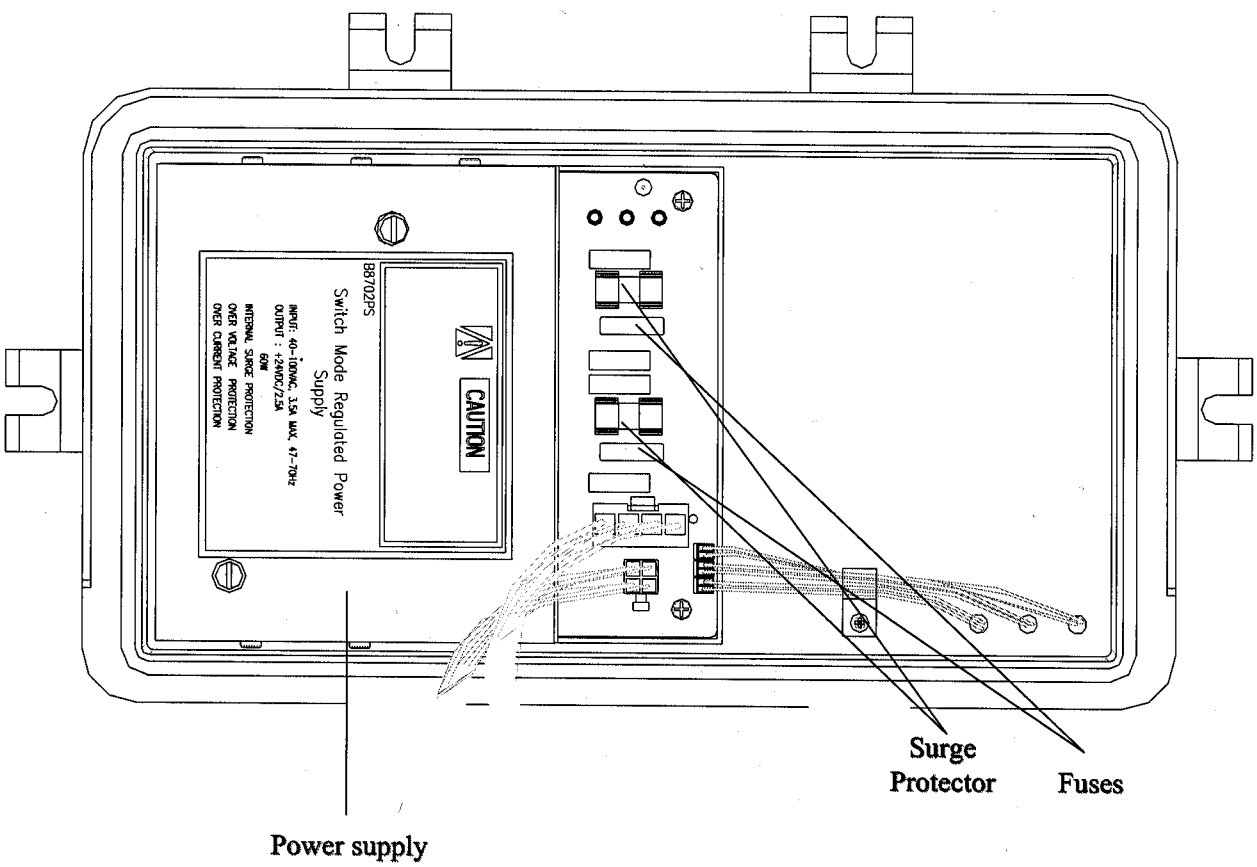


Figure 2-4 ONU8702 Power supply

2.4 Forward RF path

The receiver module is integrated within the E-pack. The receiver's integrated optical hybrid photo-detector improves RF performance over the entire 54 through 870 MHz passband.

A positive intrinsic-negative (PIN) attenuator, driven by an integrated thermal control circuit, provides temperature compensation for the forward RF path.

An ONU 8702 distribution response correction (1DR) plug-in board follows the PIN attenuator and is selected during configuration according to the slope option required (low, medium, or high). It provides a portion of the required slope characteristic. Plug-in forward equalizers located before each output hybrid provide the remainder of the slope characteristic.

Each output stage uses a silicon or GaAs power-doubled output hybrid. The diplex filters are selected during configuration according to the preferred frequency split. You can change the filter to accommodate different splits.

ONU8702 can be factory configured for one or two outputs. If you require only one output, the second RF output is not populated on the E-pack and a jumper is installed on place of the forward splitter. To field upgrade a single-output node to a dual-output node, a two output E-pack is needed.

Figure 2-5 illustrates block diagram of ONU8702 configuration:

(Next page)

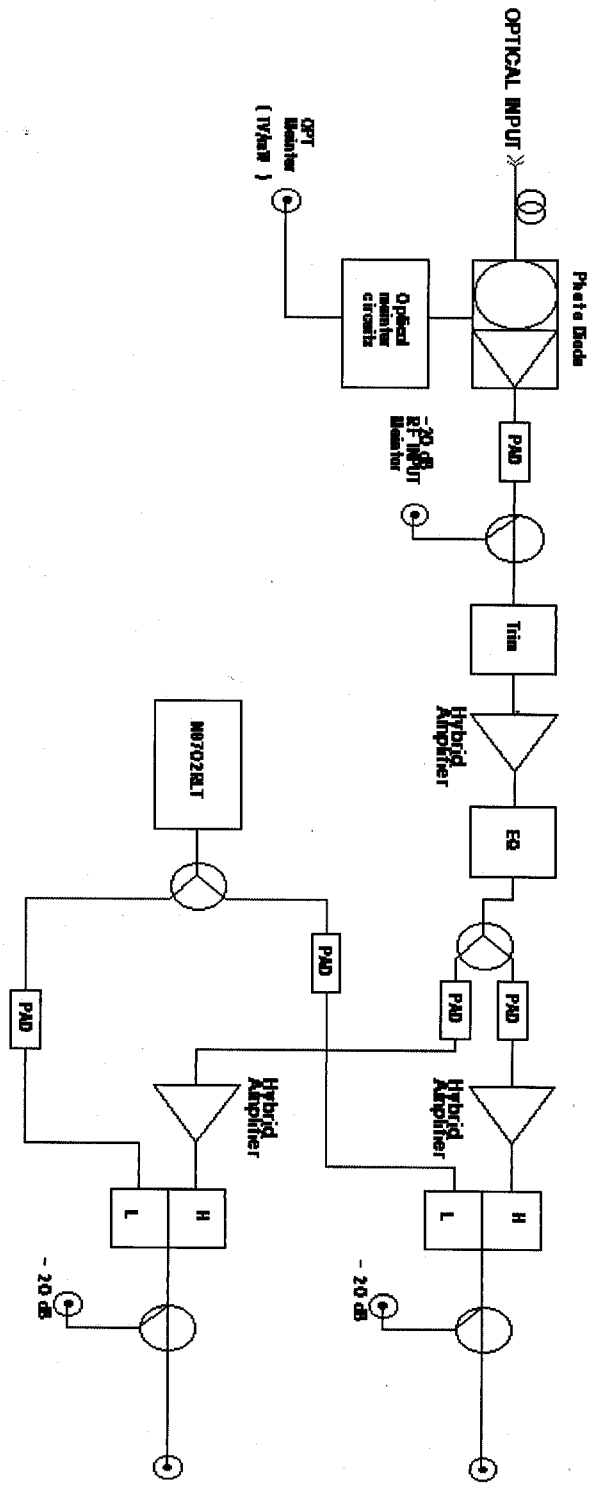


Figure 2-5 ONU8702 Block diagram

2.5 Return Path

To meet present and future return-path requirements, You can configure the ONU 8702 with one of two optical transmitters to accommodate data and video signal transmission.

Optical Return Transmitters

The two optical return transmitters and their features include:

N8702RLT-FP : Uses an uncooled, non-isolated FP laser operating at 1mW for improved link performance. Carries a full 35 MHz of digital data or up to two video channels.

N8702RLT-DFB: Uses an uncooled, non-isolated DFB laser operating at 2mW for improved link performance. Carries a full 35 MHz of digital data or up to two video channels.

Figure 2-6 illustrates ONU8702 Optical Transmitter block diagram

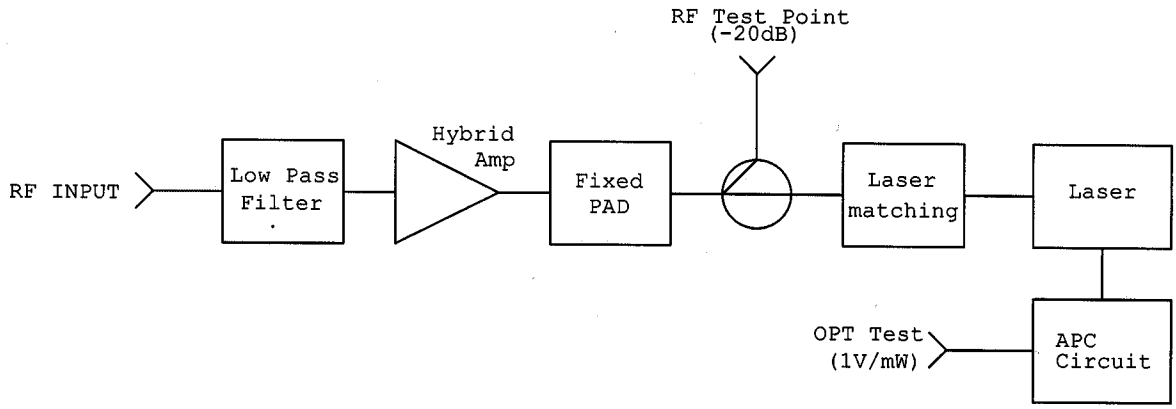


Figure 2-6 ONU 8702 Optical Transmitter block diagram

All transmitters include thermal compensation to minimize the change in received optical and RF signal level at the headend as the node temperature varies.

Section 3. Setup and Operation

This section provides information governing the use of various options and applications required by your system.

Before you install the ONU 8702, it must be setup to meet the power and configuration requirements for the node location. Bench setup is recommended to ensure proper functioning of all components and to simplify field installation.

Powering the Node

You can conveniently power the node by applying 60Vac or 90Vac to any of the two RF ports. You can configure the node to distribute power from any port to either or both of the remaining ports.

For optimal operation, the ac input from the trunk line to the power supply must be between 44 V and 90 V root mean square (rms) with a line frequency of 50 Hz of 60 Hz. The waveshape of the input voltage must be quasi-squarewave. A precision output regulator protects against overcurrent and short circuits thus providing a precise output voltage.

You can power the ONU 8702 from 60 Vac or 90 Vac system supplies. Remove the cover if your system uses 90 Vac powering, reposition the suitcase jumper on the dc power supply to the 90 V (HI) position to optimize the supply turn-on voltage for the higher input range.

No damage results if you do not change the jumper. In a 90 V system, changing the jumper ensures that the dc supply does not turn on until the proper input voltage level is reached. This prevents excessive loading of the system power supply during turn on after a power-off situation.

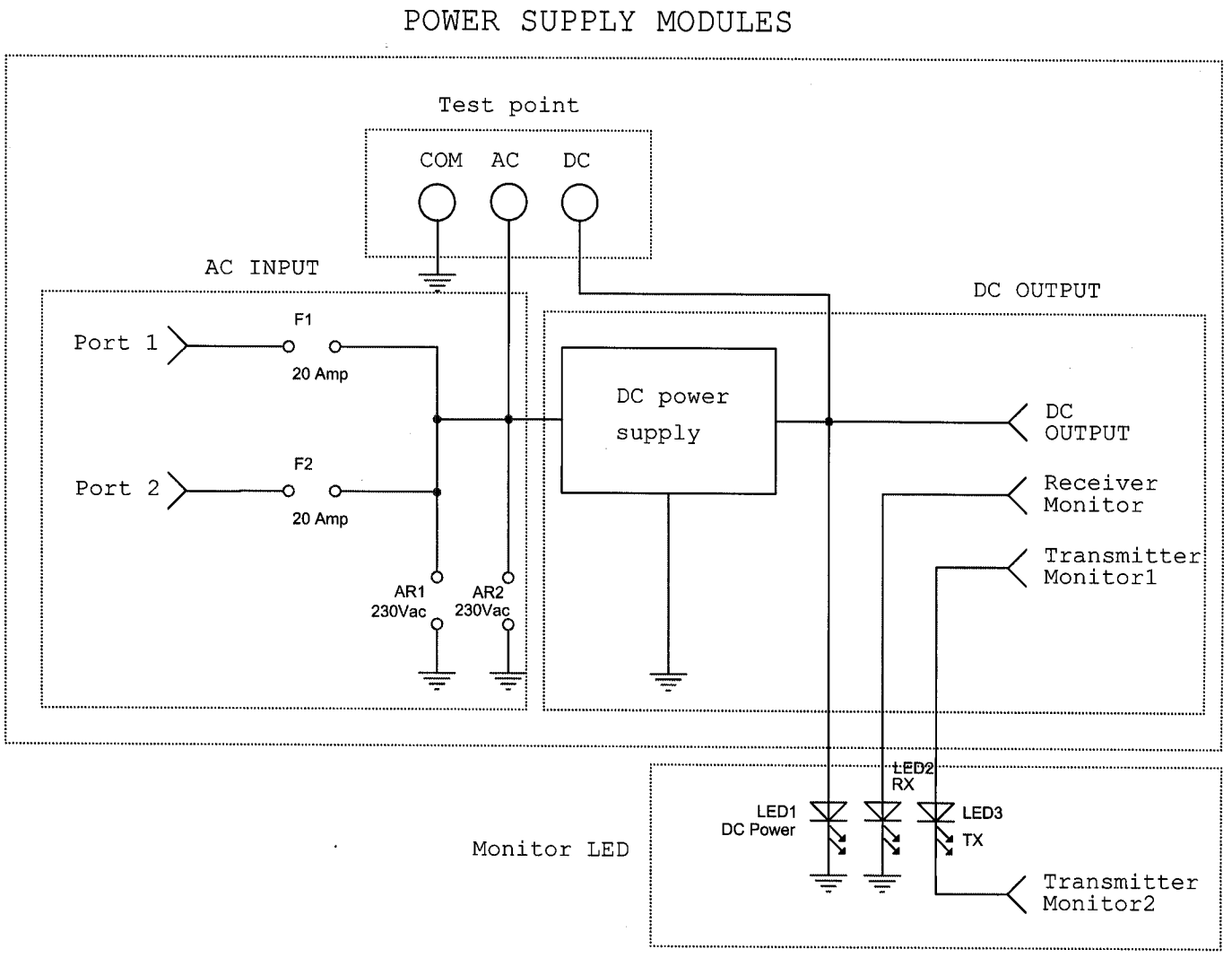


Figure 3-1 Power supply modules

Setting-Up the Forward-Path Receiver

The following subsections provide information for specific forward-path receiver functions. Figure 3-2 illustrate the ONU 8702 RF chassis in the housing base. The chassis cover provides a functional diagram and indicates the location of all major components.

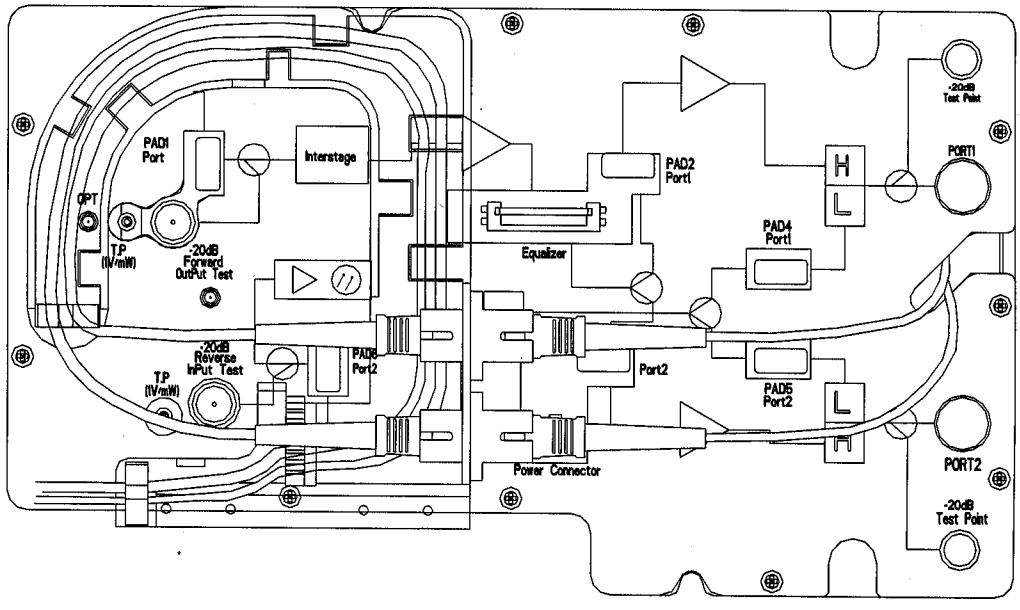


Figure 3-2 RF chassis with cover

Forward Path Padding

The pad values, presented in Tables 3-1 through 3-3, serve as a starting-point reference for typical installations. These charts are prepared specifically for 77 channel systems with an upper-band edge of 870 MHz. For a 110 channel system, reduce the value of the input by 1.5 dB.

The pad values shown are the minimum values expected. If you need more padding, increase the input pads to a maximum of 15 dB and place the remainder of the required padding at the output facility.

Table 3-1 N8702 Pad chart

Input dBm		RF Output level (dBmV)								
		38	39	40	41	42	43	44	45	46
2	Input Pad	14	14	14	14	14	14	14	14	14
	Output Pad	8	7	6	5	4	3	2	1	0
1.5	Input Pad	13	13	13	13	13	13	13	13	13
	Output Pad	8	7	6	5	4	3	2	1	0
1	Input Pad	12	12	12	12	12	12	12	12	12
	Output Pad	8	7	6	5	4	3	2	1	0
0.5	Input Pad	11	11	11	11	11	11	11	11	11
	Output Pad	8	7	6	5	4	3	2	1	0
0	Input Pad	10	10	10	10	10	10	10	10	10
	Output Pad	8	7	6	5	4	3	2	1	0
-0.5	Input Pad	9	9	9	9	9	9	9	9	9
	Output Pad	8	7	6	5	4	3	2	1	0
-1	Input Pad	8	8	8	8	8	8	8	8	8
	Output Pad	8	7	6	5	4	3	2	1	0
-1.5	Input Pad	7	7	7	7	7	7	7	7	7
	Output Pad	8	7	6	5	4	3	2	1	0
-2	Input Pad	6	6	6	6	6	6	6	6	6
	Output Pad	8	7	6	5	4	3	2	1	0

Table 3-2 provides minimum output levels for the ONU 8702 receiver.

The receiver levels measured:

* Are on the input side of the forward input pad.

* Assume the signal source is a GI advanced laser module (ALM) series transmitter at 1310nm.

Optical Input Level (dBm)	77 Channels (dBmV)	110 Channels (dBmV)
2.0	28.31	26.76
1.5	27.31	25.76
1.0	26.31	24.76
0.5	25.31	23.76
0.0	24.31	22.76
-0.5	23.31	21.76
-1.0	22.31	20.76
-1.5	21.31	19.76
-2.0	20.31	18.76

Table 3-2 ONU8702 minimum output levels

Selecting the Wavelength

You can use the ONU 8702 with 1310 or 1550nm transmitters. An internal wavelength-selection jumper optimizes the optical-power test point calibration for the system wavelength. This jumper has no effect on the optical-to-RF performance (gain, flatness, slope) of the node.

The wavelength jumper is factory-set and provides optimum calibration in a 1310nm system.

To reset the jumper:

1. Loose the chassis cover screws and remove the cover.

2. Position the jumper on the appropriate pins for the preferred gain control mode.

3. Replace the chassis cover and torque the screws to 15 to 17 in-lbs. Be careful that you do not pinch the fibers between the chassis cover and chassis.

Figure 3-3 illustrates the wavelength selection jumper and its location:

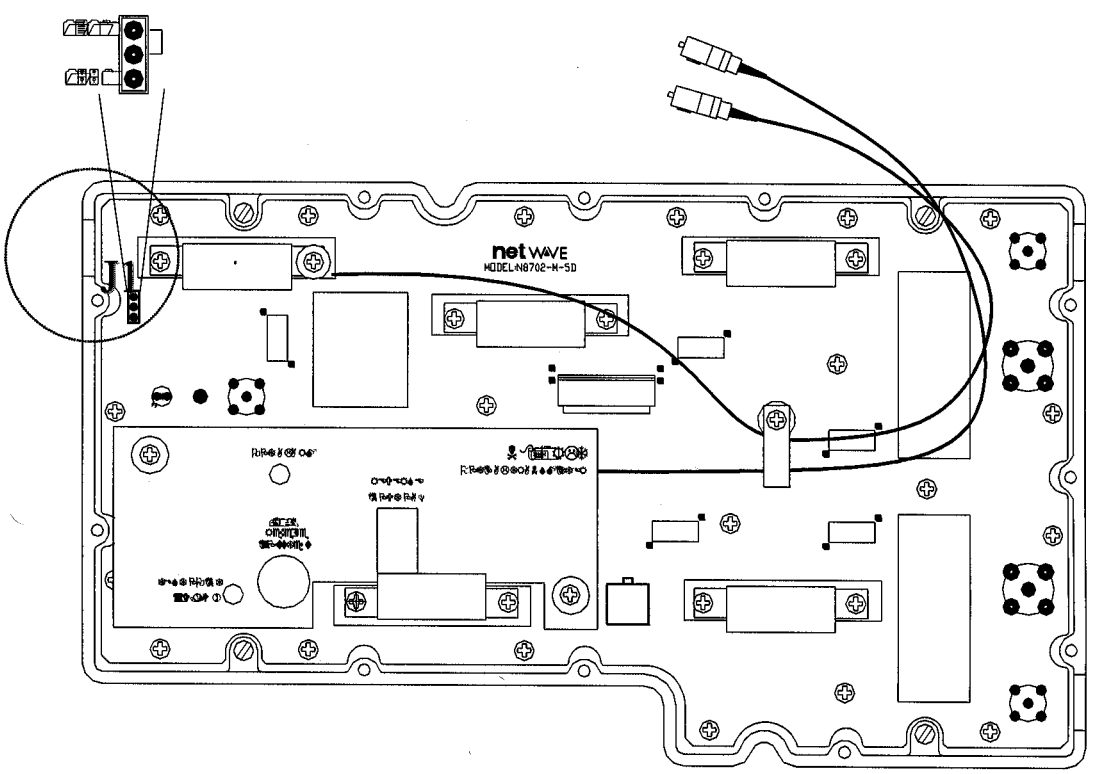


Figure 3-3 Wavelength selection jumper

Configuring the Return-Path

Designed specifically for use in the ONU 8702, the optical modules combine high performance with easy maintenance.

The optical return-path modules available with the ONU8702 include:

N8702 RLT-FP : Uses an uncooled, non-isolated FP laser operating at 1mW for improved link performance. Carries a full 35 MHz of digital data or up to two video channels.

N8702 RLT-DFB: Uses an uncooled, non-isolated DFB laser operating at 2mW for improved link performance. Carries a full 35 MHz of digital data or up to two video channels.

Figure 3-4 illustrates an N8702 RLT-FP optical transmitter. The structure of the N8702 RLT-DFB transmitters is identical.

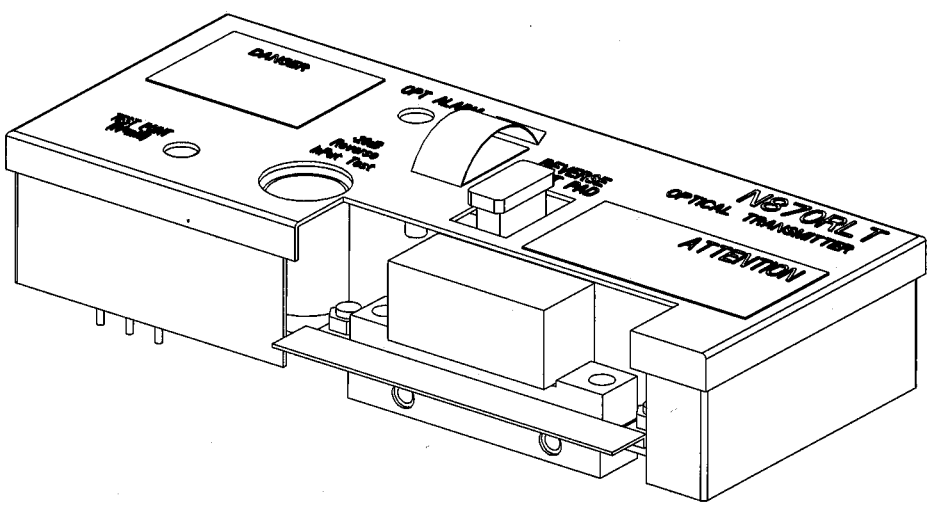


Figure 3-4 N8702 RLT –FP optical transmitter

Installing ONU 8702 Optical Modules

The ONU 8702 optical module's design enables you to install them with the node in service.

DANGER! Voltages up to 90 VAC are accessible. Use caution when performing any procedure on an open node.

To install the ONU 8702 optical module:

1. Remove the module cover if one is present.
2. Install the proper LPF for the preferred split.
3. Install a 5dB pad in the input pad location if the module is used in a dual-output ONU8702. Install a 8dB pad in the input pad location for single output ONU 8702.
4. Loosen the screws that secure the chassis cover to the chassis and remove the cover. Insert the optical module into the return path module location.
5. Install the cover on the optical module.
6. Loosen the screw holding the fiber strain relief just enough to rotate the strain relief cover away from the strain relief block. Support the strain relief block so that it does not rotate and damage the fibers.
7. Swing the strain relief cover away from the strain relief block and place the optical module fiber into the empty slot in the block. Replace the strain relief cover.
8. Tighten the screw that holds the fiber strain relief. Support the strain relief block so that it does not rotate.
10. Route the fiver pigtails through the slot in the chassis cover.
11. Install the chassis cover and torque the screws. Be careful that you do not pinch the fibers between the chassis cover and chassis.
12. If present, remove the dust covers from the service cable connector and the module's optical connector.

13. Carefully clean the optical connectors.
14. Connect the module's optical connector to the appropriate bulkhead connector on the fiber tray.
15. Pull up on the fiber tray carriage and open the fiber tray to expose the fiber connections.
16. Connect the service cable optical connector to the bulkhead adaptor.
17. Lift and insert the fiber tray into the fiber tray carriage. Push the fiber tray carriage into the housing base until it snaps in place.
18. If necessary, check the optical power levels with an optical power meter and verity the voltage reading at the optical-power test point. Check and align the RF power levels in accordance with system requirements and procedures.

Section 4. Installation

This section provides pre-installation instructions that enable you to prepare the node for mounting. It also provides detailed instructions for installing the node.

Pre-installation Procedures

To decrease weight and the possibility of damage during installation, the housing is normally mounted with the lid and E-pack removed. Node components that have been previously configured and bench-tested may need only minimal alignment following field installation.

Pre- installation instructions include:

* Removing the lid
* Removing the E-pack

Removing the Lid

1. Loosen the eight bolts that secure the lid to the housing base.
2. Open the lid and remove any umbilical cables that connect the lid to the housing base.
3. Remove the lid by pressing down on the release tab illustrated in Figure 2-1 and sliding the lid to the left.

Removing the E-pack

To remove the E-pack:

1. Remove any pin-type connectors installed in the RF ports by loosening the seizure screw and removing the connector.
2. Disconnect the fiber pigtails and cover the ends with protective caps. If two fiber pigtails come out of the E-pack, the unit is equipped with an optical return-path transmitter. Mark the pigtails to avoid confusion during re-assembly.
3. Disconnect all umbilical cables that connect the E-pack to the lid.
4. Use a 5/16 inch socket and loosen the four hex-head screws that hold the E-pack in the housing. The screws are captive and remain with the E-pack after disengagement from the housing.
5. Place the 5/16 inch socket over the prying nubs located in the ends of the E-pack. Pry up evenly on both nubs to remove the E-pack.

Installing the Node

Installing procedures include:

* Installing the housing on the strand
* Installing the RF main chassis
* Splicing the four-fiber service cable to the transportation fiber
* Installing the pin-type connectors
* Installing the coaxial cables and the fiber cables
* Close the housing

Strand Wire Mounting

Two strand clamps and bolt assemblies are located on top of the housing for normal horizontal mounting below the strand.

Figure 4-1 illustrates the rear view of the housing, strand clamps, and pedestal mounting holes:

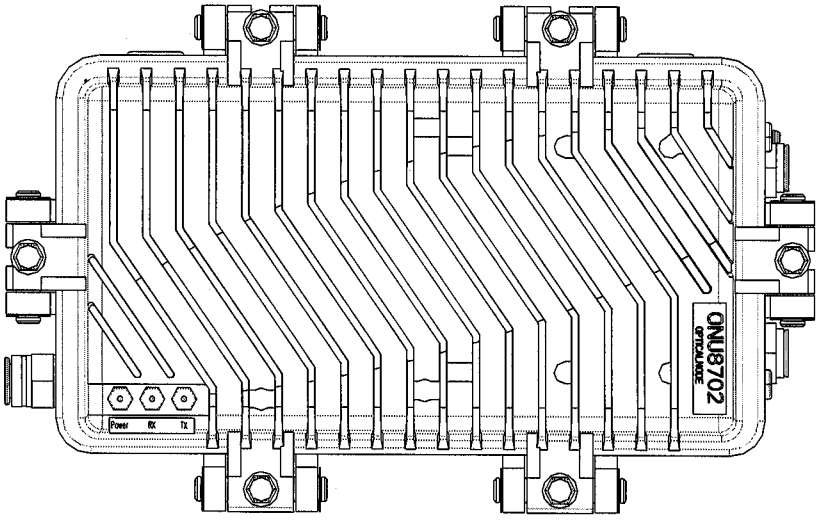


Figure 4-1 Rear view of housing, strand clamps, and pedestal mounting holes

To mount the housing to the strand wire:

1. Loosen the two 5/16-18 strand clamp bolts located on top of the housing.

2. Engage the strand in the housing strand clamps. Do not fully tighten the hex-head bolts at this time. This enables the clamps to slide along the strand wire until the housing is finally positioned with respect to the cables.

3. Re-install all modules and electronic components previously removed.

Installing the E-pack

To re-install the E-pack:

1. Remove any dirt or debris from the underside of the E-pack and the machined heat-sink rails on the housing base to ensure good electrical and thermal connection.

2. Carefully insert the E-pack in the housing base and use a 5/16 inch socket to torque the screws to 18 to 22 in-lbs.

3. Reconnect any umbilical cables to the housing lid.

4. Reconnect the fiber pigtails.

5. Re-install the pin-type connectors and torque the seizure screws to 11 to 12 in-lbs.

Splicing the Service Cable

The four-fiber service cable can be spliced to the transportation cable at any time during the node installation. Splicing does not need to coincide with the installation of the housing.

Fusion splicing is recommended because it has low insertion loss and is the most reliable method Splicing should be performed by an experienced technician.

To splice the fiber:

1. Obtain a 50-foot, four-fiber service cable complete with compression fitting.

2. Splice each fiber according to procedures recommended by the manufacturer of the splicing equipment. A blue-coded fiber is suggested for the forward-signal distribution and a brown-coded fiber is recommended for the return path. Cleanliness in the work area is essential.

3. Assemble the splice enclosure following the instructions furnished with the enclosure.

4. Suspend the extra cable from the strand using locally accepted methods. Commonly used methods include suspending it from the strand along its entire length, and/or fashioning a figure-eight coil and suspending it from the strand.

If you install the housing at a later time, protect the compression-fitting end of the service cable and the fiber connectors from dirt and moisture.

Installing Pin-Type Connectors

Connections to the housing are made using standard KS-type housing port entry connectors. Pin-type connectors with a normal center conductor diameter of 0.067 inches are required. It is extremely important that you trim the center conductor to match the dimensions.
Figure 4-2 illustrates the connector fitting:

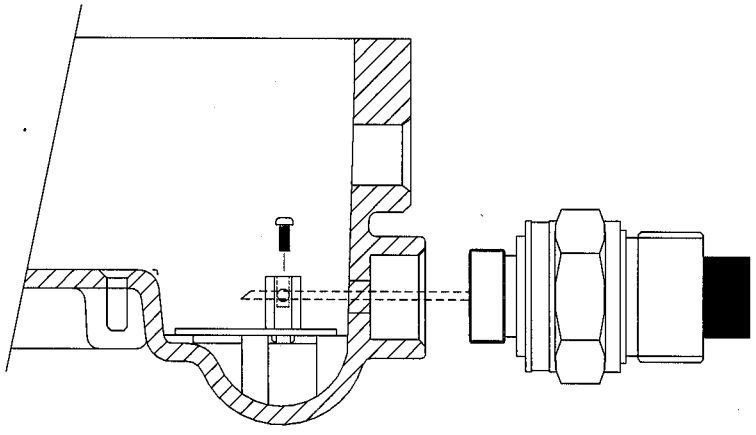


Figure 4-2 Connector fitting

Installing the Coaxial Cables

To install the coaxial cables:

1. Loosen the eight bolts that secure the housing lid to the base.
2. Lower the housing lid away from the housing base.
3. For each port, verify that the seizure screw is loosened to accept the center pin of the cable connector.
4. Screw the connector body into the port and tighten.
5. Secure the cable end into the cable connector as described in the instruction sheet for the connector.
6. Insert the center conductor fully until it enters the seizure mechanism. Tighten the center conductor seizure screw and torque to 12 in-lbs (1ft-lb). Do not overtighten.
7. Repeat steps 3 through 6 for all other cable connections required.
8. Protect all cable connections with heat-shrink tape or tubing.
9. Lash the cables to the strand where they approach it and secure the cable lashing wire to the strand with commercial clamps.
10. Torque the port plug on any unused ports to 25 to 40 in-lbs.

Installing the Fiber Cables

The ONU8702 provides two fiber-optic cable ports located on opposite sides of the housing. To install the fiber-optic cables:

1. Determine which port to use based on the fiber-optic cable routing of your system and remove the protective plug.

2. Carefully pass the connector ends of the fiber-optic service cable through this port. Do not remove the rubber caps from the connectors at this time. Insert one connector at a time being careful not to bend the fiber any more than is necessary.

3. Thread the compression fitting into the port. The compression nut and rubber grommet must be sufficiently loose to enable the fitting to be turned without turning the fiber cable at the same time. Torque the main body of the fitting to 60 to 70 in-lbs (5 to 6 ft-lbs).

4. Note which fiber is used for the forward path and which is used for the return path. The fiber cable contains up to four fibers each jacketed in a different color. You will use two fibers and two will remain as spares.

5. Pull up on the fiber tray carriage and open the fiber tray as illustrated in Figure 4-3:

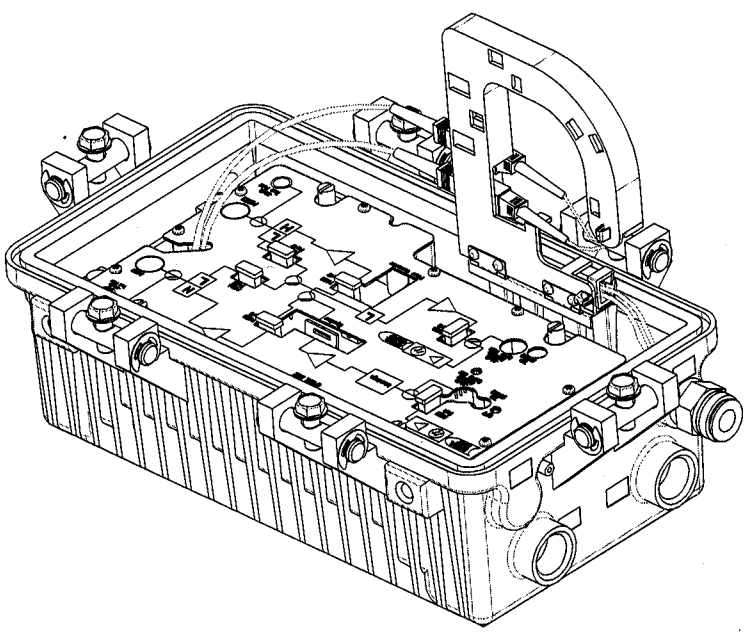


Figure 4-3 Fiber tray and carriage