OTPN-800H

OLSON TECHNOLOGY PREMISE NODE

INDOOR OPTICAL NODE

INSTRUCTION MANUAL

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SAFETY WARNINGS

LASER RADIATION

The OTPN-800H can be equipped with a laser transmitter which emits invisible radiation that can cause permanent eye damage. ***AVOID DIRECT EXPOSURE TO BEAM***. Operate the transmitter only with the proper optical fiber installed in the transmitter optical connector. Power to the OTPN-800H should be turned-off or preferably, disconnected whenever the optical connector cover is opened and there is no installed fiber (as when the fiber connector is being installed or removed from the transmitter connector).

NEVER **USE ANY OPTICAL INSTRUMENT TO VIEW THE OUTPUT OF THE LASER TRANSMITTER. "OPTICAL INSTRUMENT" INCLUDES MAGNIFYING GLASSES, ETC.**

NEVER **LOOK INTO THE OUTPUT OF THE LASER TRANSMITTER**

NEVER **LOOK INTO THE OUTPUT OF A FIBER CONNECTED TO A LASER TRANSMITTER.**

NEVER **LOOK INTO OR USE ANY OPTICAL INSTRUMENT TO VIEW THE DISTANT END OF A FIBER THAT MAY BE CONNECTED DIRECTLY OR VIA AN OPTICAL SPLIT, TO A TRANSMITTER THAT MAY BE OPERATING. THIS SPECIFICALLY APPLIES TO FIBERS THAT ARE TO BE CONNECTED TO RECEIVERS (SUCH AS THE OTPN-1000) OR OTHER DEVICES AT ANY DISTANCE FROM THE LASER TRANSMITTER.**

HIGH VOLTAGE

The power supply section (bottom section) of the OTPN-800H contains no user serviceable parts. There is exposed high voltage inside this section. Only factory service technicians should open the power supply section.

SHOCK HAZARD

The OTPN-800H is designed for indoor use only. Direct exposure to moisture must be avoided. Connect the AC Adapter into the OTPN-800H BEFORE plugging the adapter into the wall.

SPECIFICATIONS *(Forward Optical Receivers)*

RF OUTPUT & PERFORMANCE PARAMETERS:

Frequency Range (±1.0dB)	54-870MHz (NTSC) -or- 85-870MHz (PAL)
Output Level (@ -1dBm optical input) *	+38dBmV (@ 550MHz)
Return Loss	14dB min., 16dB typical
Impedance	75 Ohm
CNR (@ -1dBm optical input) *	> 54dB
CSO (@ -1dBm optical input) *	> 65dBc
CTB (@ -1dBm optical input) *	> 68dBc
RF Gain Adjustment	0-20dB *(via internal variable attenuator)*
Slope (Standard: H = 6)	0-10dB *(via Model# 95180x plug-in equalizer)*
RF Test Point (forward)	-20dB *(external)*; Type F

OPTICAL PARAMETERS:

Wavelength	1280 - 1610 nm
Optical Input Power Range	+2dBm to -8dBm
Return Loss	> 50dB with APC connector
Optical Input Power Test Point	1V/mW ± 0.1V *(external)*
Optical Connector	SC/APC standard; FC/APC optional); 8° APC

** NOTE: Typical. H @ 6dB slope to 870MHz with 8dBm optical transmitter with OMI @ 3.2%, with 77 NTSC channel loading to 550MHz & digital loading to 870MHz (-6dB below analog).*

ELECTRICAL, ENVIRONMENTAL & MECHANICAL PARAMETERS:

Dimensions/Weight	3" H x 7" D x 2.1" H / 12 oz.
Operating Temperature Range	-10 to +55ºC (temperature at the mounting plate)
Enclosure IP Rating	IP20
Powering	+12V_{DC} (via Model# OTPS-12A-PIC)
DC Ripple	< 50mV
Power Dissipation (with return Tx)	< 7W

SPECIFICATIONS *(Return Optical Transmitters: FP, DFB & CWDM versions)*

RF INPUT & PERFORMANCE PARAMETERS:

Frequency Range (±1.0dB)	5-42MHz (NTSC) -or- 5-65MHz (PAL)
RF Test Point (return)	-20dB (external); Type F
Return Loss (with Return TX installed)	>16dB within the return band
Return Path NPR: 15dB min. of NPR Range	FP: 37dB NPR Threshold; DFB/CWDM: 41dB NPR Threshold

*** NOTE: As measured with 6dB (FP) or 10dB (DFB) of fiber and OTOR-300 High Sensitivity Return Band Receiver*

OPTICAL PARAMETERS:

Optical Output	FP = 2mW @1310nm, DFB = 3mW @1310nm, CWDM = 2mW @1470-1610nm
Return Loss	> 50dB with APC connector
Optical Connector	SC/APC standard; FC/APC optional); 8° APC

INTRODUCTION

The Olson Technology Inc. OTPN-800H is a high quality, cost effective, bidirectional CATV node designed around the latest optical receiver technology. It is designed to operate and meet full specifications with optical input levels ranging from -8dBm to +2dBm. The receive RF path includes provisions for plug-in equalizers to provide for sloped output response as well as user adjustable padding to set the forward and reverse RF gains. The OTPN-800H is available with two different band splits.

Model	Return Band	Forward Band
OTPN-80x-H4x-xx	5-42 MHz	54-870 MHz
OTPN-80x-H6x-xx	5-65 MHz	85-870 MHz

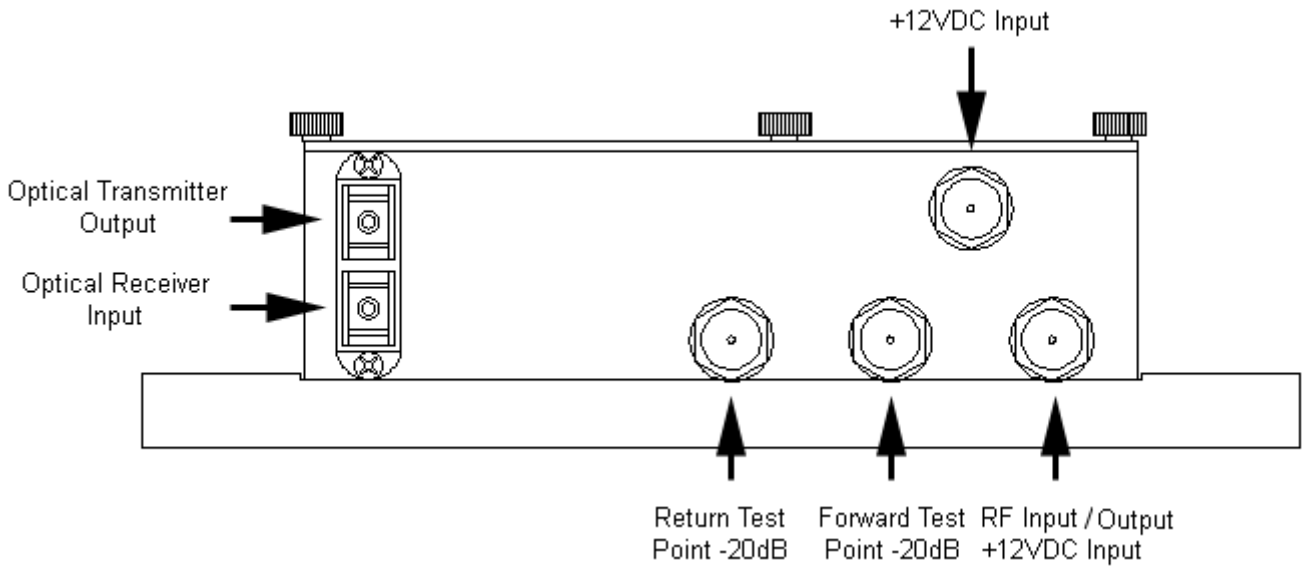
The OTPN-800H can be equipped with an optional return laser transmitter.

An optional AC adapter is available with an input range of 100-240V_{AC}, 50/60Hz.

INSTALLATION / ENVIRONMENTAL CONSIDERATIONS

The OTPN-800H is specified to operate from -10°C to +55°C. It should be mounted in an adequately ventilated area. Like any other electronic equipment, it will probably have a longer life span if it is not operated at the upper limit of the temperature range. Installation in wet areas or areas of extremely high humidity should be avoided. The OTPN-800H should not be installed in areas that are accessible to children.

The OTPN-800H may be installed and operated in any position on a flat surface. The unit has two slots in the bottom plate to accommodate mounting hardware. The unit should be mounted by sliding over one screw and then tightening the other screw. If mounting requires a wood screw, use #6 or #8 (maximum) pan-head sheet metal screws. These are commonly available at hardware stores. If mounting with a machine screw (to tapped holes), use 6-32 pan-head screws.



OPTICAL CONNECTORS AND CLEANING

The standard optical connector is available in SC/APC or FC/APC type terminations. The port closest to the lid is for use with a return band transmitter. The port below this one is for the forward band receiver.

The fiber ends can be damaged by the insertion of contaminated connectors. Some types of customer damage to connectors are not covered under warranty. Fiber connectors should never be left uncovered. Prepackaged alcohol wipes are the most convenient means of cleaning optical connectors. Clean alcohol and lint free wipes or swabs may also be used.

POWERING

Apply only +12 V_{DC} to either the "F" connector closest to the top cover of the unit, or through a power inserter in series with the Main RF output connector, the "F" connector closest to the outside edge of the housing. NOTE: the center conductor of the "F" connector is "+" and the shield is ground.

OPERATIONAL SETUP - RECEIVER (FORWARD PATH)

The OTPN-800H optical receiver as the last component in a specific optical link will provide carrier-to-noise performance and an RF output level that is dependent on several parameters. The RF input level to the source optical transmitter and the optical input level to the OTPN-800H basically determine the link performance.

Both the laser modulation and the receiver output level are basically limited by total power. The RF input level to any optical transmitter is dependent on the number of channels being transmitted. As the number of carried channels is lowered, the RF input level to the transmitter can be raised. This results in increased RF levels at the OTPN-800H receiver. This improves the carrier-to-noise ratio over the link. Links should be designed and transmitters should be set up using values that represent the maximum number of channels likely to be carried.

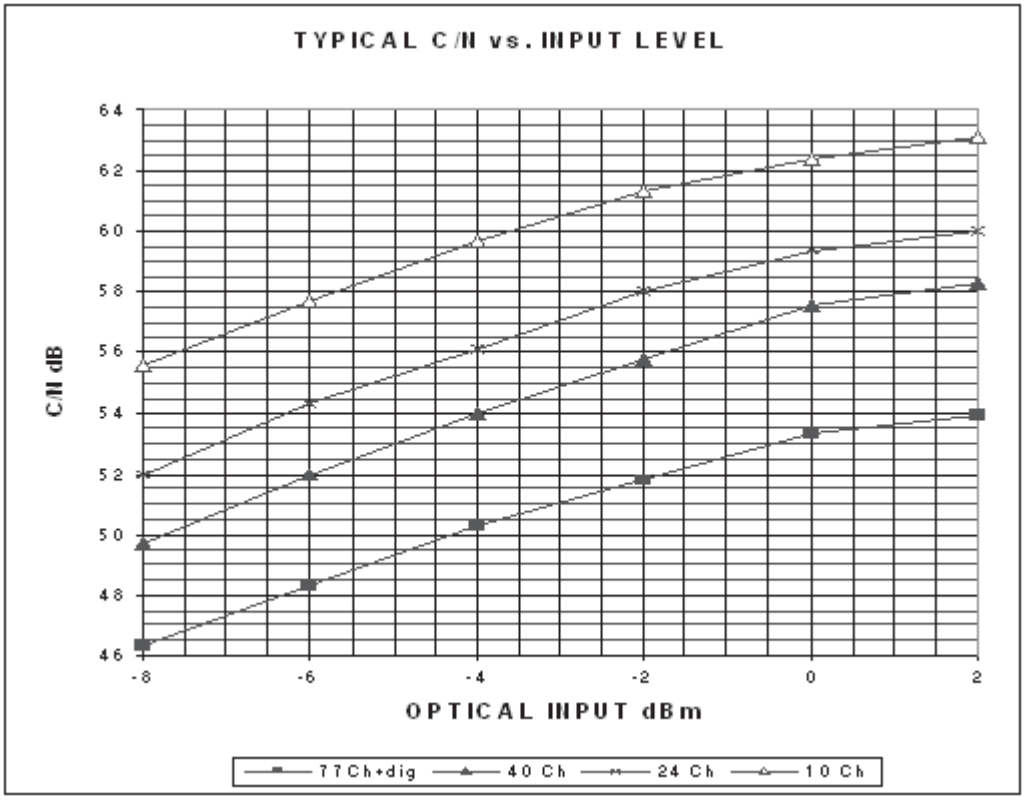
The receiver output power is also affected by the amount of equalization used. The use of a lower value equalizer will require reducing the output level as measured at the highest channel. This is because the attenuation of the lower channels is reduced.

The following chart assumes approximately 77 channels from 55MHz to 550MHz and digital loading from 550MHz to 870MHz at -6 dB below the carrier. The RF levels indicated are for an equivalent slope of 6 dB from 54-870MHz with the actual levels measured at 547.25MHz.

OPTICAL INPUT LEVEL	RECEIVED POWER @ T.P.	FORWARD EQUALIZER	APPROX. FWD T.P. LEVEL	APPROX. RF OUTPUT LEVEL
-8 dBm	.16 V	10 dB	18 dBmV	38 dBmV
-6 dBm	.25 V	10 dB	18 dBmV	38 dBmV
-4 dBm	.40 V	10 dB	18 dBmV	38 dBmV
-2 dBm	.63 V	10 dB	18 dBmV	38 dBmV
0 dBm	1.0 V	10 dB	18 dBmV	38 dBmV
+2 dBm	1.58 V	10 dB	18 dBmV	38 dBmV

Although the node will operate at optical input levels as high as +2dBm, there is little improvement in the C/N performance of the node at optical input levels above 0 dBm. For optimum distortion performance it is recommended that the optical input to the node be kept at or below 0 dBm. The Olson Technology model OTOA-xxx optical attenuators are ideal for this application. To lower the output level the adjustable pad should be increased but a reduction below +38dBmV output at 547.25 MHz by this method is not recommended. If lower output is desired, the unit should be set for +35dBmV and an in-line pad added to the RF output to reduce the output level. This will maintain optimum C/N performance. This will also reduce the OMI of the return transmitter if so equipped.

Unlike many optical nodes, the OTPN-800H is designed to give full output performance at an input of -8 dBm. The following chart shows the approximate C/N performance at various input levels and channel loading. This performance can vary considerably depending upon fiber and laser performance so it is presented as a design aid only.

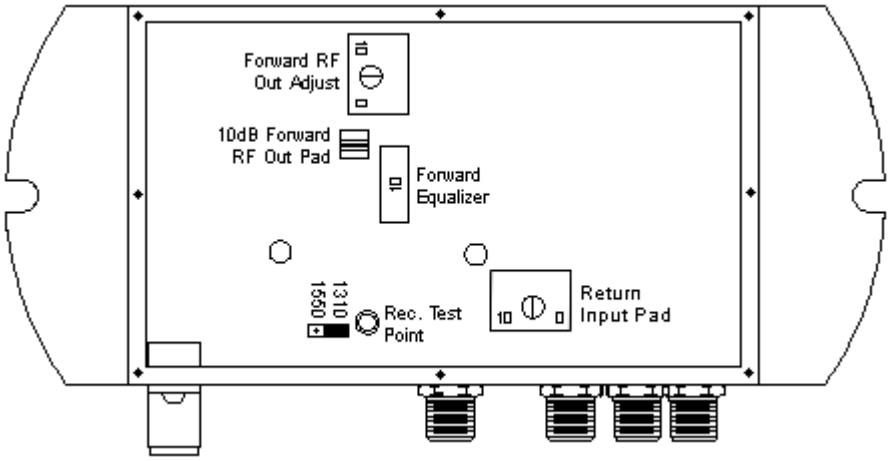


The OTPN-800H ships with an MLEQ-10 forward equalizer which gives 6dB of slope from 54-870 MHz. This can be changed by the user to vary the amount of slope that the unit has. A higher value MLEQ will give more slope, while a lower value MLEQ will give less slope. This is so that the unit can be properly setup for the amount of coax that the output will be going through. Longer distances require more slope then shorter distances.

INTERNAL TEST POINTS and ADJUSTMENTS

The OTPN-800H receiver has an internal adjustable pad to allow the RF output level of the node to be adjusted. There is also a plug-in equalizer to compensate for cable slope. These adjustments are accessed by removing the 8 thumbscrews that hold the top cover on. The unit should not be operated for extended periods with the top cover removed. This is because of RF ingress and contamination from dirt or other objects. When replacing the top cover, be sure to firmly tighten all thumbscrews. RF ingress or oscillation can be caused by loose screws.

The locations of the internal adjustments are shown in the following diagram.



There are two forward RF out adjustments, a variable attenuator, and a 10 dB switchable pad. This gives the unit 20 dB of RF output range. If the optical input level is between -3dB and +2dB, then the 10dB switchable pad should be as shown above with the flat part being parallel to the front of the unit by rotating the jumper if needed. The variable attenuator can then be used to get the RF output to the correct level. If the optical input level is in between -8 dB and -3dB, then position the 10dB switchable pad should be rotated so that it is perpendicular to the front of the unit. And then adjust the variable attenuator for proper RF output.

Return Transmitter Setup

The specification for the return band transmitter RF input level is -57dBmV/Hz (measured at OTPN-800 RF Out Port). This value operated the system at NPR threshold. The OTPN-800 has an adjustable attenuator in the return path. Also included is a -20dB test point in the return path. The single carrier equivalent of -57dBmV/Hz is +9dBmV per carrier. The return pad must be adjusted to set the carrier to +9 dBmV actual after the attenuator. With a test carrier present at the port (+19dBmV max), measure its level at the return -20dB test point. Adjust the pad for a -20dB test point reading of -11dBmV return input.

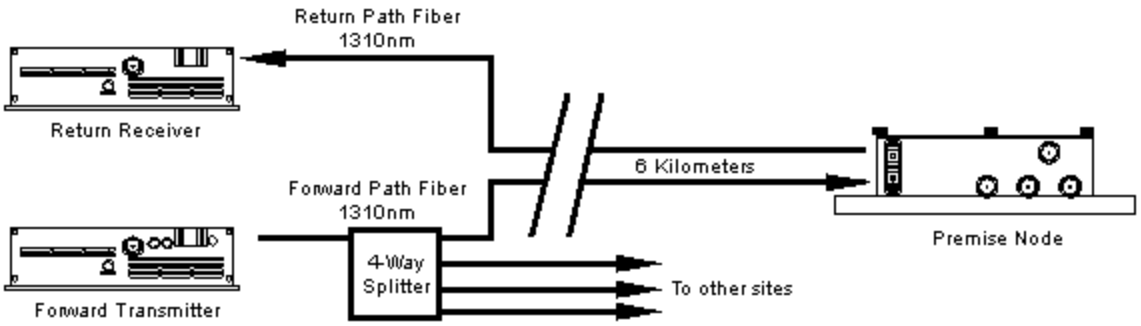
EXTERNAL TEST POINTS

The OTPN-800H has three external test points. The received "Optical Power" test point is calibrated at 1V per mW @ 1310 nm, it should be measured with a high impedance voltmeter. This test point is for long term monitoring purposes as well as initial setup. The optical power should be measured with a power meter at the time of installation. The input test point is calibrated at the factory at 1310 nm. The value at 1550 nm may be off by 15% due to diode variations. The input test point reading will be considerably off if the input wavelength is 1550 nm and the internal jumper has not been changed. The jumper is located inside the unit next to the receive level test point as shown above. The position closest to the test point is for 1310nm, and the position farther from the test point is for 1550nm.

The Forward Test Point is -20 dB from the RF output of the receiver. If the RF out is +38 dBmV, then the test point should be approximately +18dBmV.

The Return Test Point is -20 dB from the RF input going to the return transmitter. Optimal input should be +9 dBmV (57 dBmV/Hz), so the test point should read -11 dBmV.

System Setup & Troubleshooting



Fiber Loss at 1310nm is 0.330dB per kilometer, and 1550 is 0.188dB per kilometer. Going off this formula, if the fiber run is 6 kilometers (3.73 miles), then a 2dBm transmitter is required for the distance. If the forward band is being split, then the additional loss must be accounted for. A fiber splitter generally splits the signal equally between each output. If the forward path is to be split 4 ways, then a transmitter with an output power of 8 dBm will be required to travel the 6 kilometers. If the links coming out of the splitter are different lengths, then be sure to have enough transmitting power to reach the receiver with the longest link. Those with shorter links can be attenuated to lower the signal to a level the receiver can use. To be sure the receiver is in the correct range, use the Receive Test Point using a high impedance multimeter. The best operating range for most Olson Technology receivers is $0.5V_{DC}$ to $0.9V_{DC}$ (approx. -3dBm to -0.5dBm). Some have operating ranges down to -8 dBm, please consult the specifications for the receiver you are using.

If the Fiber run is less than a few kilometers, then the optical signal must be lowered before the system can operate correctly. Failure to lower the signal into the operating range of the receiver may cause an overloaded or distorted picture. The easiest way to lower the signal is to use an optical attenuator. Olson Technology makes an easy to use attenuator called the OTOA-1000. This provides for an easy way of lowering the optical signal by wrapping the fiber tightly into the slot inside of it. Every fiber is different, some may require more wraps then others. Generally one wrap around largest of the three post will lower the optical signal by approximated 1.75 dB. The two smaller post attenuate the signal more.

If the signal getting to the receiver is to low, but the correct power transmitter is being used, please consult the following:

1: Be sure all fiber connectors are clean. To clean them, please use either an approved fiber cleaner, or a lint free cloth (Kim-Wipe or coffee filter will work).

2: Be sure the fiber connectors are all of the same type. All Olson Technology units ship with either SC/APC or FC/APC style connectors. These will be green in color. You can NOT mix green and blue connectors, as the end terminations are different. This can also result in low signal or snowy picture. ST connectors are generally orange, these are for use with Multimode, and are not appropriate for broadband use.

3: Broadband RF transmitters such as those made by Olson Technology require the use of Single-mode fiber. Multimode fiber will not work. Attempting to use Multimode fiber will result in low signal or snowy picture.