OTPN-800CL

OLSON TECHNOLOGY PREMISE NODE

INDOOR OPTICAL NODE

INSTRUCTION MANUAL

Phone: (209) 586-1022
(800) 545-1022
Fax: (209) 586-1026
E-Mail: salessupport@olsontech.com
www.olsontech.com

025-000493 Rev X5

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SAFETY WARNINGS

LASER RADIATION

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

INTRODUCTION

The OTPN-800CL 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 OTPN-800CL is available with three different band splits; 1) 5-42/54-1,000MHz, 2) 5-30/45-1,000MHz, 3) 5-65/85-1,000MHz

The OTPN-800CL 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-800CL 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-800CL should not be installed in areas that are accessible to children.

The OTPN-800CL 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. If mounting with a machine screw (to tapped holes), use 6-32 pan-head screws.

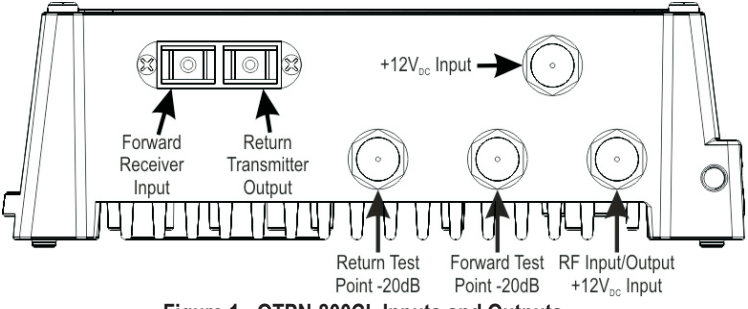


Figure 1 - OTPN-800CL Inputs and Outputs

OPTICAL CONNECTORS AND CLEANING

The standard optical connector is available in SC/APC or FC/APC type terminations. The left port is for the forward band receiver. The right port closest is for use with the return band transmitter.

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-800CL 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-800CL basically determine the link performance.

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-800CL 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.

Table 1 assumes approximately 77 channels from 54MHz to 550MHz and digital loading from 550MHz to 1,000MHz at -6 dB below the carrier.

Optical Input Level	Received Power @ TP	Forward Equalizer	Approx. Fwd T.P. Level	Approx. RF Output Level
-8dBm	0.16V	None	-6dBmV	+14dBmV
-6dBm	0.25V	None	-2dBmV	+18dBmV
-4dBm	0.40V	None	+2dBmV	+22dBmV
-2dBm	0.63V	None	+6dBmV	+26dBmV
0dBm	1.00V	None	+10dBmV	+30dBmV
+2dBm	1.58V	None	+14dBmV	+34dBmV

Table 1 - Setup Reference

Although the node will operate at optical input levels as high as +2dBm, there is little improvement in the CNR 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-1000 optical attenuator are ideal for this application. The OTPN-800L does not have an internal gain adjustment, so the RF output is directly proportionate of the optical input level. If lower output is desired, the unit should be lower by adding an in-line pad to the RF output to reduce the output level. This will maintain optimum CNR performance. This will also reduce the OMI of the return transmitter if so equipped.

Unlike many optical nodes, the OTPN-800CL is designed to give full output performance at an input of -8 dBm. Figure 1 shows the approximate CNR 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-800L does not have the provision for a forward equalizer, and therefore has 0dB of slope (flat). This unit is designed to go through a relatively short amount of coax. Extended lengths of coax will cause down sloping (lower RF level) of higher frequencies.

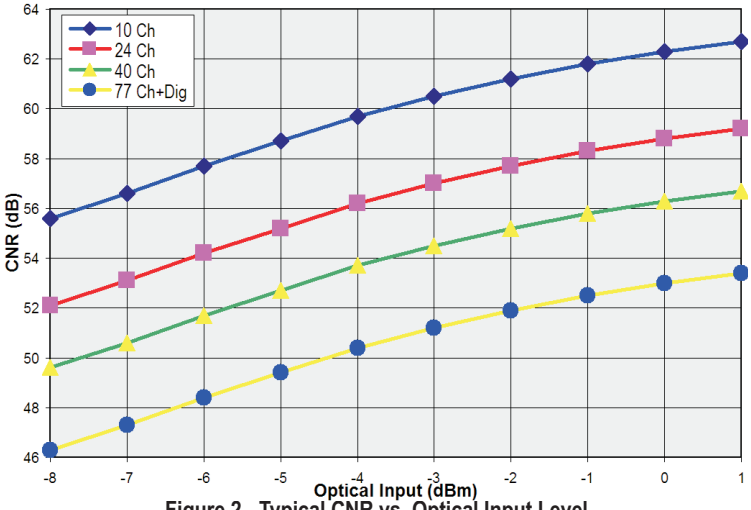


Figure 2 - Typical CNR vs. Optical Input Level

INTERNAL TEST POINTS and ADJUSTMENTS

The OTPN-800CL receiver has two user adjustments inside the unit. One is used to change the Forward Receive level test point calibration between 1310nm and 1550nm optical input ranges. The other is to set the OMI of the return band transmitter, (if equipped) this will be discussed later 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.

Figure 3 shows the locations of the internal adjustments. The specification for the return band transmitter RF input level is -57dBmV/Hz (measured at OTPN-800CL RF Output Port). This value operated the system at NPR threshold. The OTPN-800CL has an adjustable attenuator in the return path. There is a -20dB test point in the return path. The single carrier equivalent of -57dBmV/Hz is +9dBmV. The return pad must be adjusted to set the carrier to +9dBmV 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.

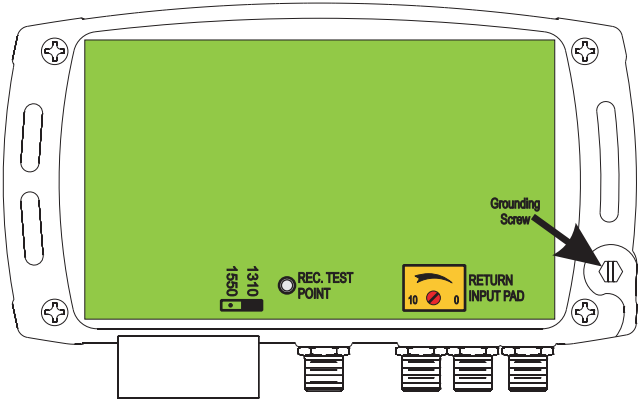


Figure 3 - OTPN-800CL Location of Internal Adjustments

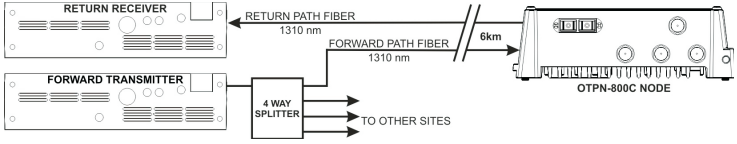
Return Transmitter Setup

The specification for the return band transmitter RF input level is -57dBmV/Hz (measured at RF Out Port). This value operated the system at the NPR threshold. The has an adjustable attenuator in the return path. A -20dB test point is included 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-800CL has three external test points. The received “Optical Power” T.P. is calibrated at 1V per mW @ 1310 nm. Measure with a high impedance voltmeter. This test point is for monitoring purposes as well as initial setup. Measure the optical power with a at the time of installation. The reading at 1550nm may be off by 15% even assuming that the internal jumper has been changed. The jumper is located inside the unit near the receive level T.P. 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 T.P. is -20 dB from the receiver RF output. If the RF out is +28 dBmV, then the T.P. will be about +8dBmV. The Return T.P. is -20dB from the Return transmitter RF input. Optimal input is +9dBmV (57dBmV/Hz), so the T.P. should read -11 dBmV.



Fiber Loss at 1310nm is 0.330dB/km, and 1550 is 0.188dB/km. Using these values, if the fiber run is 6km (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 +8dBm transmitter is required to cover the 6km. 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, measure the Receive T.P. using a DVM. The best operating range for most OT forward receivers is $0.5V_{DC}$ to $0.9V_{DC}$ (approximately -3dBm to -0.5dBm). Some have operating ranges down to -8dBm.

If the fiber run is less than a few km, then the optical signal must be lowered before the system can operate correctly. Failure to do so may cause an overloaded or distorted picture. The easiest way to lower the signal is to use an optical attenuator. OT 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 the 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 received power is too low, but the correct power transmitter is being used, please consult the following:

1: Be sure all fiber connectors are clean using an approved fiber cleaner.

2: Be sure the fiber connectors are all of the same type. All OT 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.

3: Broadband RF transmitters such as those made by OT require the use of SM fiber. MM will not work. Attempting to use MM fiber will result in low signal or snowy picture.