DISCONTINUED

I-HUB

I-HUB Chassis

HARDWARE INTERFACE MANUAL

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PRODUCT INTRODUCTION

1. Product Introduction

ATX has revolutionized node splitting and fiber reclamation solutions with its Chromadigm optical transmitter. Its latest offering, the I-HUB optical hub, brings a new generation of forward and return path DWDM solutions for broadband service providers.

As broadband access architectures evolve towards fiber deep networks and fiber-to-the-premise, they require new solutions that utilize the existing fiber networks more efficiently, while reducing the operational complexity of older architectures in favor of a full band solution. With the introduction of the I-HUB, full band solutions can now extend to 80 km or more, while retaining the ability to discretely bring back a large number of return path signals on the same fiber with the forward path signals.

I-HUB Features:

- EDFA modules for forward and return.
- Optical switch modules for redundancy.
- Opto-stacking modules for return recovery and ITU retransmission.
- Multiport EDFAs for RFoG & PON RF overlay with return expansion ports.
- Field-hardened optical Mux and DMux modules.
- Fiber management tray for fiber routing and bulkhead connector termination.
- Fiber and power entry ports on both ends of housing.
- Redundant load-sharing power supplies.
- Status monitor/control options

I-HUB Benefits:

- Full-band, multi-wavelength transport efficiently utilizes existing fibers in the network.
- Field optical amplification for extended reach and fiber deeper networks.
- Eliminates hub facilities and remote OTN cabinet locations.
- Optical passives co-located or installed deeper in network splice enclosures.
- I-HUB forward and return path redundancy can be incorporated.

The I-HUB includes redundant power supplies, fiber management, and 10 non-exclusive module slots to support a multitude of applications and network architectures such as hub elimination, node splitting and segmentation, RFoG extension, and long haul super-trunking.

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PRODUCT SPECIFICATIONS

2. Product Specifications

For detailed information on product specifications, go to the ATX website (atxnetworks.com) in the Resources & Support section, User Documents sub-section to download the I-HUB Chassis Specs and Ordering Info pdf.

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PRODUCT INSPECTION

3. Product Inspection

3.1 Unpacking & Inspecting a New Unit

Before shipment, ATX inspects and packs all the essential items carefully. Nevertheless, damage may occur during shipment. The carrier assumes full responsibility for a safe delivery of the equipment.

1. Inspect the package for any physical damage.
2. Open the package.
3. Remove any packing material.
4. Inspect the unit for any physical damage.
5. Shake the unit with care, paying attention to any rattling loose parts that may suggest concealed damage (some noise due to moving cables is normal).
6. Check for any missing accessories.

When any damage is noticed to the merchandise, please notify customer service (see Service & Support section) and file a claim with the carrier as noted below.

3.2 What To Do About Physical Damage

Record any evidence of physical damage or loss on the freight bill or receipt and have the carrier's agent sign it. If you fail to do so, the carrier may refuse to honor the damage claim. The carrier will supply you with any forms required to file such a claim.

3.3 What To Do About Concealed Damage

Damage which is not apparent until the unit has been unpacked is considered concealed damage. The contents may have been damaged due to rough handling even if there is no external evidence. If you should notice damage upon unpacking the unit you should make a written request for inspection by the carrier's agent within 10 days of the delivery date. Afterwards file a claim with the carrier.

3.4 How To Return Equipment

Call customer service (see Service & Support section) for a Return Materials Authorization (RMA) number. You will need the unit's serial number, description of the problem, and some shipping information. We must receive the unit within thirty (30) days from the date a RMA number is issued. If for any reason, you want to ship the unit 30 days after the RMA number has been issued, you must obtain a new RMA number by calling customer service. Units received without an RMA number or one with an expired RMA number will not be accepted by our receiving department.

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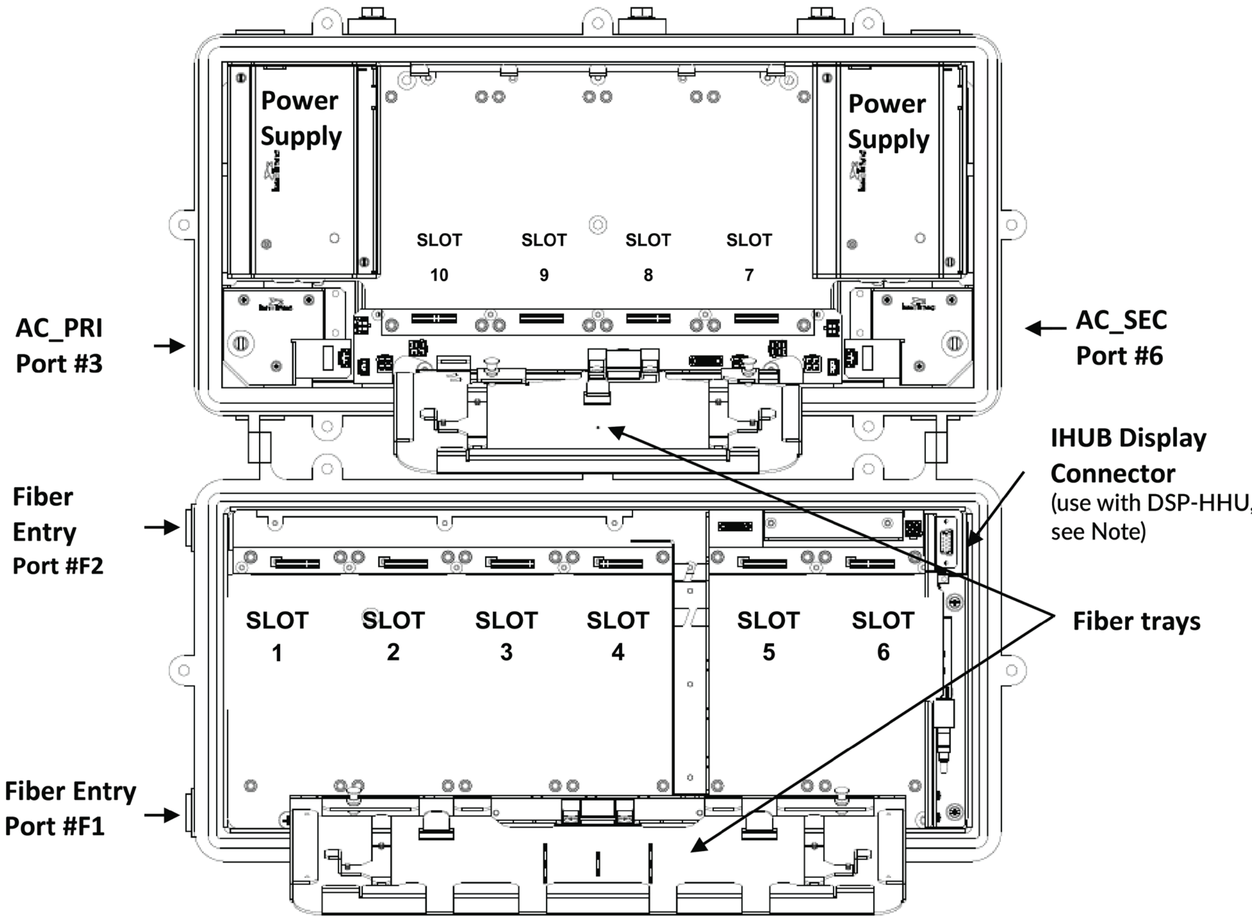
GENERAL I-HUB CHASSIS

4. General I-HUB Chassis

This section provides general information about the I-HUB chassis housing.

4.1 I-HUB Chassis Component Identification

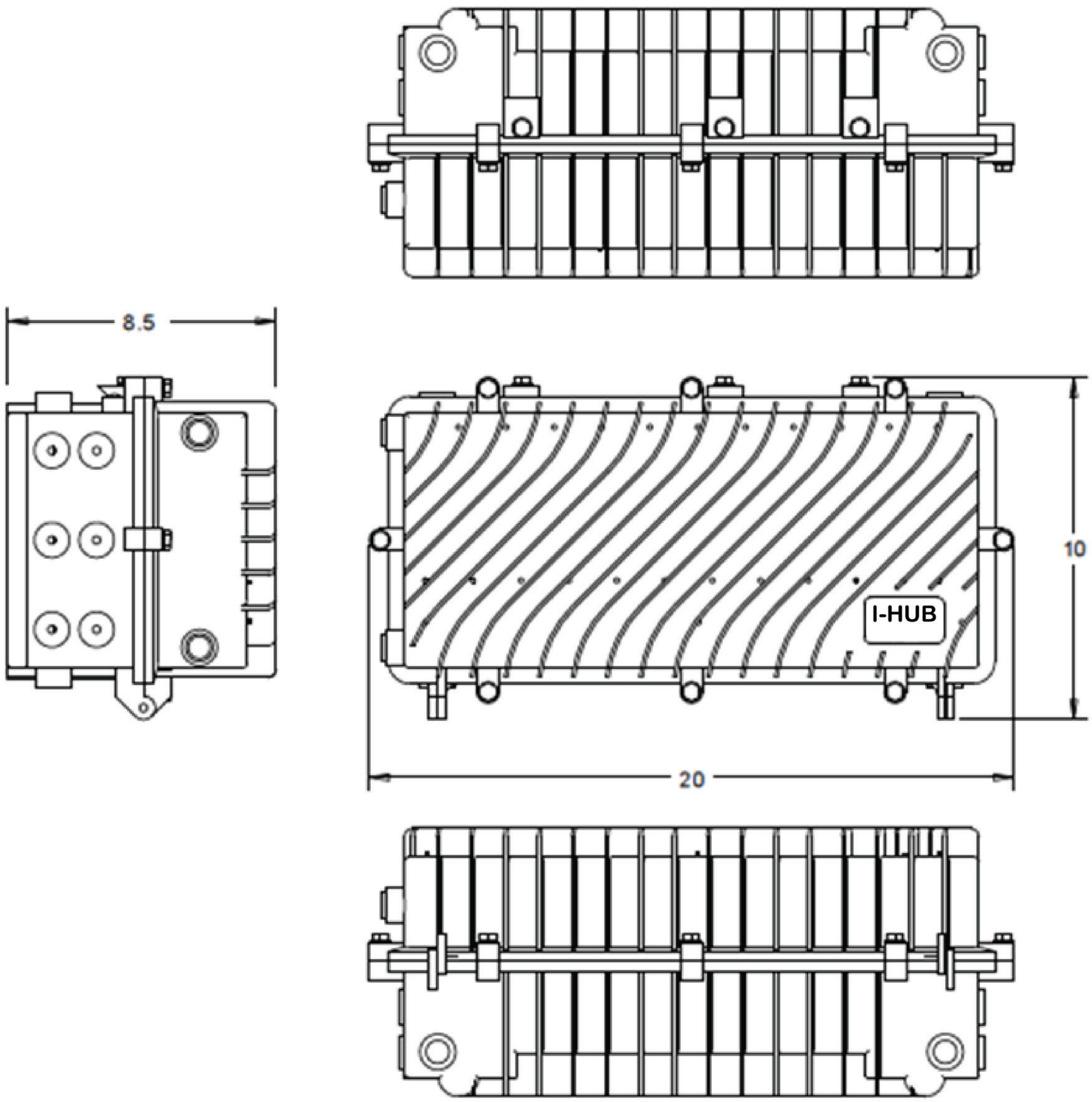
The diagram below identifies the key components and interfaces for the I-HUB chassis housing which includes the fiber and power entry ports, power distribution, fiber trays, management interface, and module slot locations. Each of the cable entry ports is a standard 5/8”-24 threaded sleeve.



The I-HUB suppports dual redundant load sharing power supplies, 10 non-exclusive module slots and two fiber trays to manage storage of buffer cable, passive modules and connectors. Note the gap between slots 4 & 5. You cannot install a dual or triple module that crosses this gap because the screws will not line up. Dual mode is ok in slot 5/6.

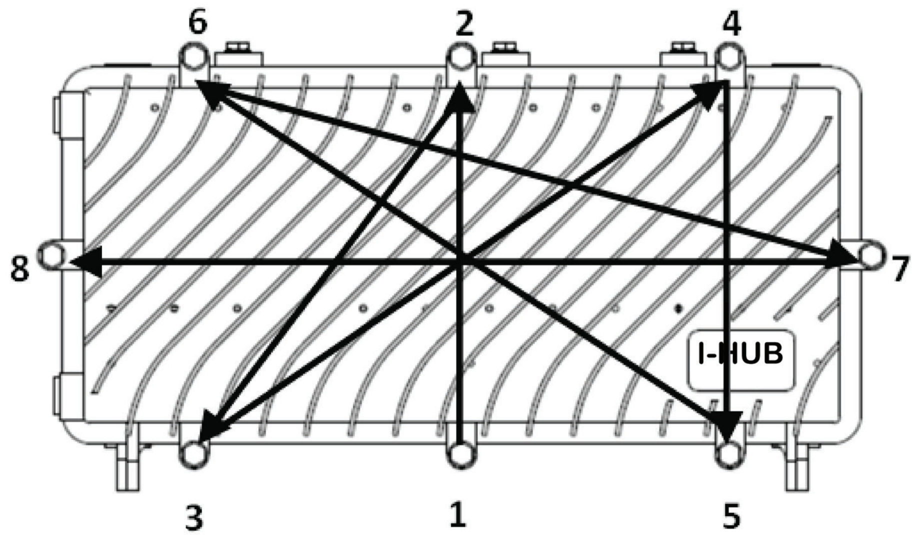
NOTE: *I-HUB is shown with IHUB-CTLR-2 installed (not included with part number IHUB-HSG2). Connect a DSP-HHU handheld interface to CTLR-2 DB-15 serial port for setup. This is the only way to SET modules with IHUB-CTLR2, though an opto-stacker link does allow remote monitor (1-way) once the IHUB is configured. If the advanced IHUB-CTLR-3 is installed, you can connect DSP-HHU, RJ45, SFP for remote or local management.*

4.2 I-HUB Node, Housing Mechanical Dimensions



4.3 Housing Closing & Tightening

Examine the rubber gasket and mesh seal to be sure they are clean. Make sure all cables are properly positioned and clear of the lid and base while closing the lid. Use a 1/2-inch wrench to snug the eight housing bolts in the order shown below. Next, use a torque wrench to tighten the bolts to 17 foot-pounds (14.0 newton-meters) following the same sequence.



Tightening Sequence

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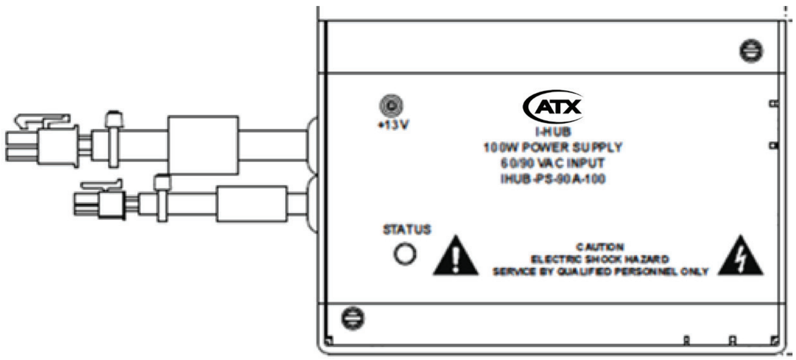
I-HUB MODULE CONFIGURATION

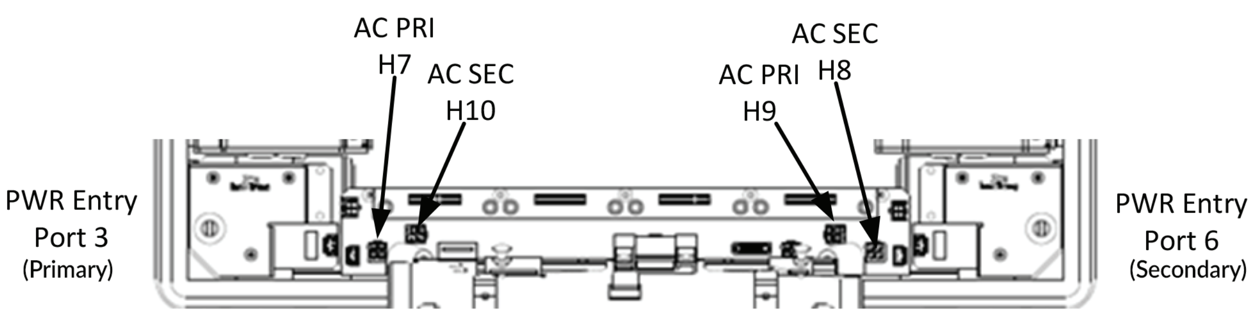
5. I-HUB Module Configuration

5.1 I-HUB-PS Power Supply Module

The DC power supply modules reside in dedicated slots and may be configured in a hot standby load-share configuration with either a single or dual AC source for both module and supply side redundancy.



The AC supply power may be connected via housing port 3 or 6 or both for supply redundancy. The following diagram and chart depict the power connections and primary and secondary plug positions.



Power Entry & Module Connection Points

AC Supply Configuration	AC Input Port	Backplane +13V Connection
Dual, Primary & Secondary	#3 & #6	H7 & H8
Single, Primary	#3	H7 & H9
Single, Secondary	#6	H8 & H10

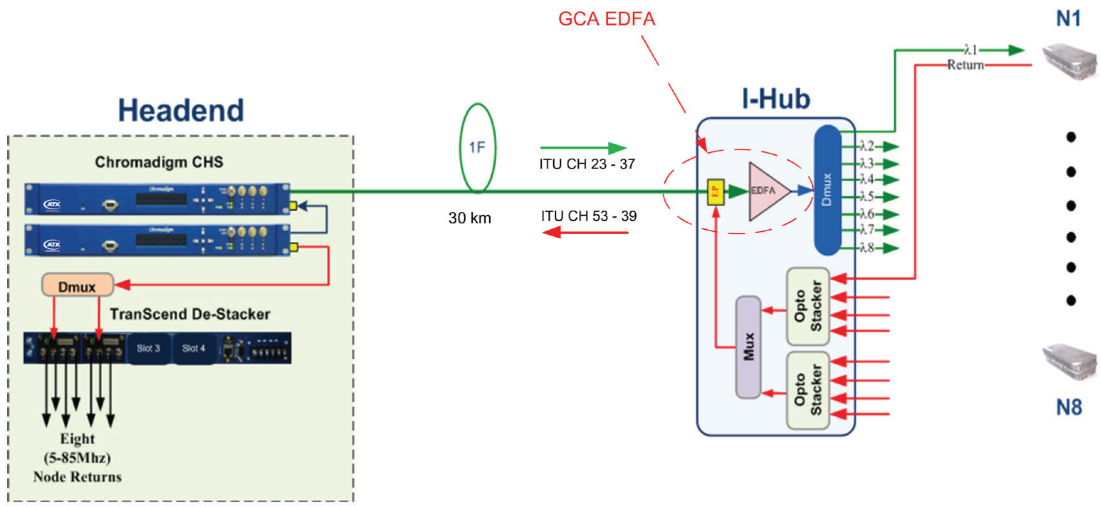
Module Power Connection Configuration Chart

5.2 I-HUB-GCA, Gain Controlled EDFA Module

5.2.1 Overview

The gain controlled EDFA is a single-slot plug-in module for the I-HUB chassis. It operates in constant gain mode and is ideally suited for multi-wavelength applications. Adding or removing wavelengths will not result in a constant power output that changes per wavelength levels. It is up to the system designer to not violate the maximum composite power specifications of the GCA, lest gain does become saturated and per wavelength power does change as more wavelengths are added. Since the I-HUB is typically deployed to extend the network reach beyond 30 km of fiber, the optical channel loading is designed for 4 λ or 8 λ per fiber with analog RF channels. Thus the GCA EDFA is optimized, or “band-flattened”, for ITU optical channels 23-37 to be used with any similar ITU transmitters. The GCA is also available with an optional integrated optical filter to provide an express port to combine upstream optical channels onto the same fiber being utilized for the downstream channels for greater fiber efficiency.

The following diagram shows an example of a typical application where eight downstream and eight upstream optical channels (16 in total) share the same fiber to a group of nodes over 30 km from the headend. Here the GCA is extending the reach capability of the multi-wavelength system. In this application the input side “express port” is utilized to combine the upstream block of optical channels onto the single fiber.



The following chart provides guidance for the optimal input levels based on the RF channel loading and the expected performance along with the correlation between power per optical channel and total composite power.

Model	GCA-0615*		GCA-0918*	
Number of λ	4	8	4	8
Input P range per λ (dBm)				
80 A + 75 QAM	0 to +3	-1 to +1	0 to +3	-1 to +1
40 A + 115 QAM	-2 to +3	-2 to +1	-2 to +3	-2 to 0
154 QAM	-7 to +3	-7 to +1	-7 to +3	-7 to 0
Composite Input P (dBm)				
80 A + 75 QAM	+6 to +9	+8 to +10	+6 to +9	+8 to +10
40 A + 115 QAM	+4 to +9	+7 to +10	+4 to +9	+7 to +9
154 QAM	-1 to +9	+2 to +10	-1 to +9	+2 to +9
Gain (dB)	6	6	9	9
Output P per λ (dBm)				
80 A + 75 QAM	+6 to +9	+5 to +6	+9 to +10	+8 to +9
40 A + 115 QAM	+4 to +9	+4 to +6	+7 to +10	+7 to +9
154 QAM	-1 to +9	-1 to +6	+2 to +10	+2 to +9
Composite Output P (dBm)				
80 A + 75 QAM	+12 to +15	+14 to +15	+15 to +16	+17 to +18
40 A + 115 QAM	+10 to +15	+13 to +15	+13 to +16	+17 to +18
154 QAM	+5 to +15	+8 to +15	+8 to +16	+11 to +18

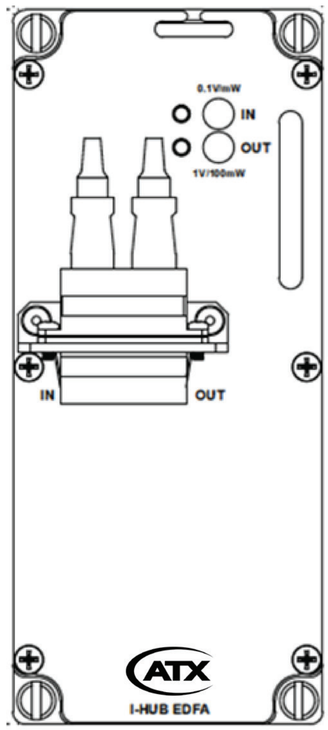
It is important to note that the rated output power is the maximum and the EDFA will maintain its rated gain as long as the input power + gain do not exceed the rated output power. For example, for the model GCA-0615:

- If the composite input power exceeds 9 dBm, the EDFA cannot produce more than 15 dBm of output power.
- If the input composite power falls below the recommended value, the EDFA will attempt to maintain its 6 dB of gain.

- If the EDFA composite input goes too low, the output power may become unstable and signal performance can be impacted.
- The optional express port adds approximately 1 dB of insertion loss to the input of the EDFA. Adjust the network design accordingly to compensate.

5.2.2 Module Status

The GCA module offers plug-n-play operation with no user-defined parameters to configure. The GCA provides visual alarm indicators along with optical input and output power test points to facilitate quick troubleshooting. Once all optical connections are properly cleaned and connected, the input and output power LEDs will display green when the optical input power is within the operational range and the module gain is operating correctly.



LED Operation

The following chart defines the LED indicators:

LED	Function	Value
IN	Optical Input Power *(Composite Total Power)*	Green = P > -3 dBm Amber = < -4 to -6 dBm Red = < -6 dBm
	Module Temperature	Red = Temp. Out of Range
OUT	Gain Status *(Deviation from Nominal Gain)*	Green = +/- 1 dB Red = > +/- 1 dB

Optical Power Test Point

The optical power test points provide a means to check optical input and output power without disrupting service. Each test point provides a DC voltage reference of the composite power of all wavelengths in milliwatts (mW) and is calibrated as follows:

- IN test point = 0.1 volt per mW of optical power. For example, a measurement of 0.4 V = 4 mW total composite power.
- OUT test point = 1 volt per 100 mW of optical power. For example, a measurement of 0.316 V = 31.6 mW total composite power.

To convert mW to dBm. P (dBm) = 10*log[P(mW)]

- For the example above 4 mW = +6 dBm and 31.6 mW = +15 dBm.

5.3 IHUB-POA-* PON EDFA Module

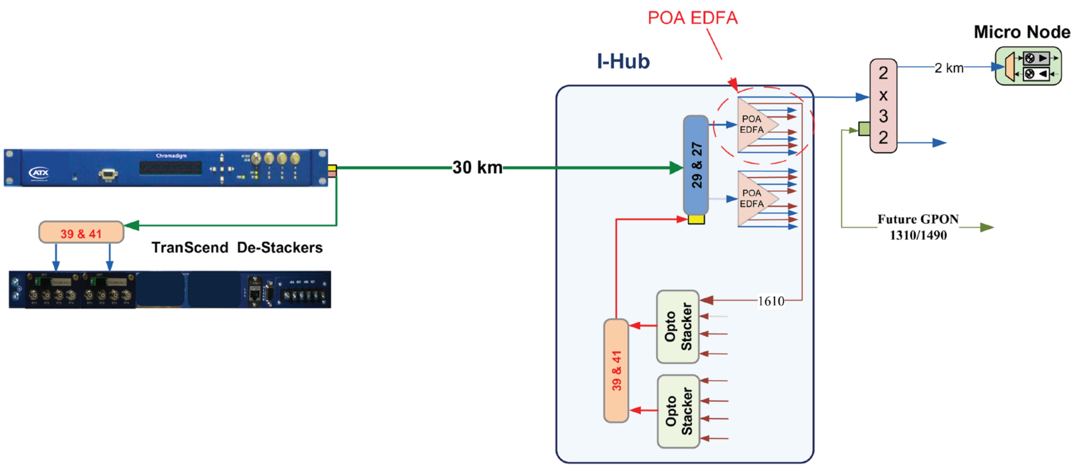
5.3.1 Overview

The I-HUB-POA EDFA is a dual-slot module for the I-HUB chassis. The POA EDFA is utilized to provide in-network amplification of optical signals for single wavelength applications where the optical signals need to be amplified to overcome network attenuation due to passive loss and extended distances. Gain is automatically adjusted to achieve constant power on the single wavelength at the output.

The POA EDFA module is ideally suited for RFoG or other extended reach PON applications where each of the four ports may feed a 1x32 or 1x64 PON splitter for a downstream segmentation of 128 or 256 homes.

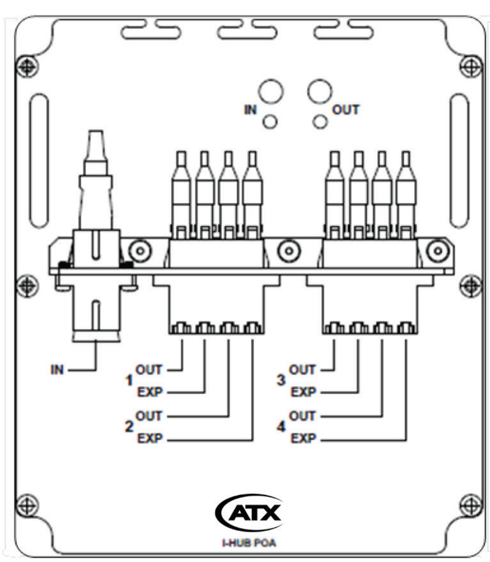
The POA module includes an optional integrated optical filter to provide an express port to demultiplex the 1310nm or 1610nm RFoG upstream wavelength from the downstream 1550nm wavelength.

The following diagram shows a typical RFoG application utilizing the POA module to extend the reach from the headend to the PON serving area. In this example two downstream wavelengths are demultiplexed to feed a one per 128 home RFoG serving area. The POA module amplifies the incoming optical signal to provide the proper optical level to the micro node. Each of the POA module's four output ports is equipped with the express port option to feed the 1610nm upstream signal from the micro node to the I-HUB Opto-stacker module for transport back to the headend.



5.3.2 Module Status

The POA module offers plug-n-play operation with no user-defined parameters to configure. The POA provides visual alarm indicators along with optical input and output power test points to facilitate quick troubleshooting. Once all optical connections are properly cleaned and connected the input and output power LEDs will display green when the optical input power is within the operational range and the module output power is operating correctly.



LED Operation

The following chart defines the LED indicators:

LED	Function	Value
IN	Optical Input Power	Green = P > -4 dBm Amber = < -4 to -6 dBm Red = < -6 dBm
	Module Temperature	Red = Temp. Out of Range
OUT	Optical Output Power *(Deviation from Nominal Pwr)*	Green = +/- 1 dB Red = > +/- 1 dB

Optical Power Test Point

An input and an output optical power test point are provided to check the optical power levels without disrupting service. Each test point provides a DC voltage reference of the optical power in dBm and is calibrated as P (dBm) = $10*[(V_{measured} - 2)]$

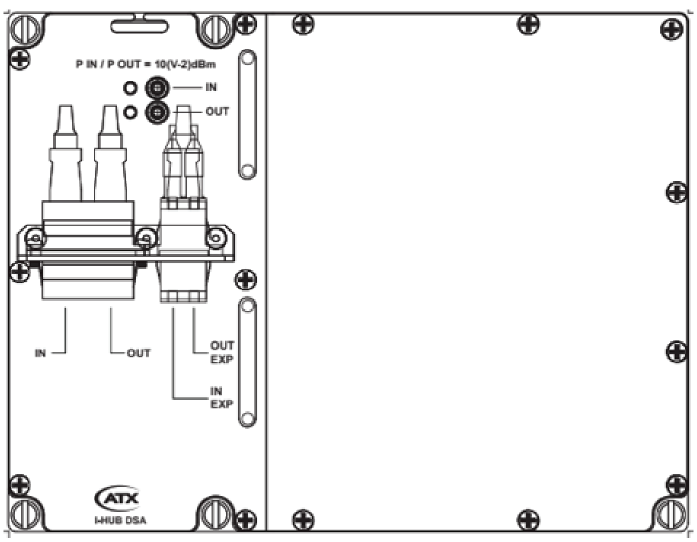
- IN - Optical input power
- OUT - Optical output power

5.4 IHUB-DSA, Dual Stage Optical Amplifier

5.4.1 Overview

This Dual-Stage Optical Amplifier occupies three slots in an IHUB chassis. It is a high performance device for long haul, multi-wavelength applications. It includes dispersion compensation (set at time of order). A typical application would be similar to the GCA above, however with longer distances and more wavelengths. ATX designers will recommend when a DSA is needed in place of a GCA.

5.4.2 DSA Module Status



The DSA module offers plug-n-play operation with no user-defined parameters to configure. It provides visual alarm indicators along with optical input and output power test points to facilitate quick troubleshooting. Once all optical connections are properly cleaned and connected, the input and output power LEDs will display green when the optical input power is within the operational range and the module gain is operating correctly.

LED Operation

The following chart defines the LED indicators:

LED	Function	Value
IN	Optical Input Power	Green = P > -4 dBm Amber = < -4 to -6 dBm Red = < -6 dBm
	Module Temperature	Red = Temp. Out of Range
OUT	Optical Output Power *(Deviation from Nominal Pwr)*	Green = +/- 1 dB Red = > +/- 1 dB

Optical Power Test Point

An input and an output optical power test point are provided to check the optical power levels without disrupting service. Each test point provides a DC voltage reference of the optical power in dBm and is calibrated as $P\ (\text{dBm}) = 10*[(V_{measured} - 2)]$

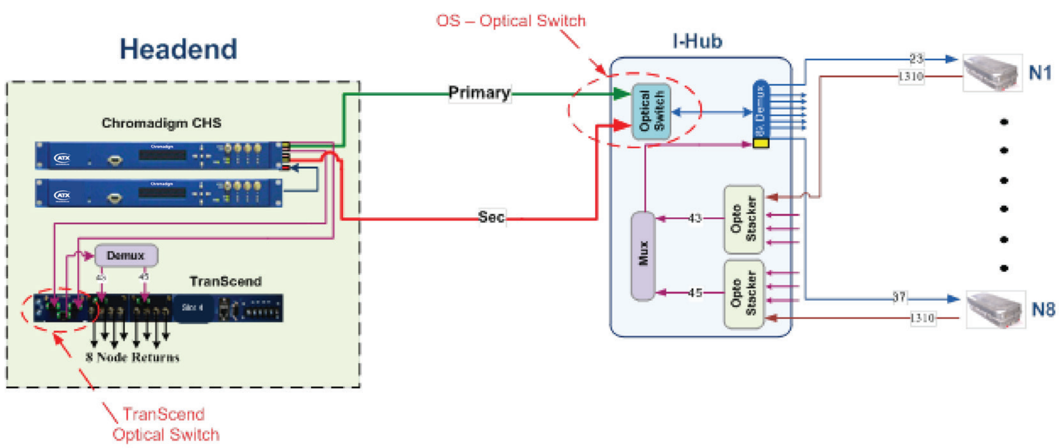
- IN - Optical input power
- OUT - Optical output power

5.5 IHUB-OS-C, Optical Switch

5.5.1 Overview

The Optical Switch is a single-slot module for protecting the network with path redundancy in C-band applications. The switch has two inputs (primary and secondary), each with a detector to monitor the optical input power level to determine which input to select according to the user-defined switch threshold settings. The detectors are directional, meaning they only detect the optical power into the PRI or SEC inputs and ignore the optical input at the OUTPUT port in bi-directional applications. The optical switch will switch from primary to secondary when the primary power drops below the user set threshold and the secondary power is above the set threshold in order to ensure an uninterrupted operation. However, if for any reason the secondary power is below the threshold, the switch will remain in the primary even when the primary fails. When the primary path is restored and the optical power in this path is above the threshold for duration longer than one second, the switch will automatically revert to this state.

The diagram below demonstrates a typical use for the IHUB-OS Optical Switch module. Alternatively the switch may be located in the headend and a simple passive coupler is used in the IHUB.



In the downstream direction a dual-output transmitter sends the optical signals in a primary and secondary fiber path for redundancy to the I-HUB. Each input is first connected to the IHUB-OS Optical Switch which monitors the optical input power and switches from the primary to the secondary path in the event the primary path falls below the set threshold level. The OS detectors do not see the upstream optical signals that are entering the OS through the common port. The upstream signals travel through the same path that is selected for downstream operation. An optical switch in the TranScend chassis at the headend detects and selects which path the return signal is present on for downstream and upstream path protection.

5.5.2 Module Configuration & Status

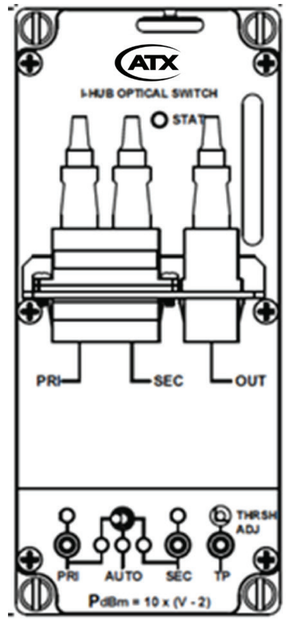
The OS module has a factory default setting for the optical switch threshold of 0 dBm. The following will describe how to manually set the threshold to a different value along with providing an understanding of the status indicators, test points and toggle switch settings.

Before starting, confirm the optical connections are properly cleaned and the primary and secondary optical paths are determined to be providing the correct input levels per the system design.

Toggle Switch

The toggle switch is a tri-position toggle switch which controls the switch position selection as follows:

- Left PRI: Manually force the switch to primary optical input.
- Right SEC: Manually force the switch to secondary optical input.
- Middle AUTO: Auto switch to primary or secondary based on threshold detection and switching criteria.



LED Operation

The following chart defines the LED indicators:

LED	Function	Value
STAT	Module Temperature Switch Alarm Position	Red = Temp. Out of Range Green = Primary Yellow = Secondary Red = Switch Fail or Both PRI & SEC Power Below Threshold
PRI	Primary Optical Input Power	Green = P_{PRI} > Threshold Red = P_{PRI}< Threshold
SEC	Secondary Optical Input Power	Green = P_{SEC} > Threshold Red = P_{SEC} < Threshold
Switch LEDs		
AUTO	Auto Switch Position	Green = Switch in Auto Position
PRI	Primary Switch Position	Green = PRI Selected in Auto or Switch in PRI Position
SEC	Secondary Switch Position	Green = SEC Selected in Auto or Switch in SEC Position

Optical Power Test Point

Three optical power test points are provided. Each test point provides a DC voltage reference of the composite power of all wavelengths in dBm and is calibrated as P (dBm) = 10*[($V_{measured}$ - 2)]

- PRI - Optical input power of the primary path
- SEC - Optical input power of the secondary path
- Threshold Adjust – Set point for the desired optical power threshold

For example:

Connect a DVM to the PRI test point and the measured value is 1.9 VDC. To determine the optical power level in dBm using the formula above, P = 10*(1.9-2), P = 10*(-0.1), P = -1.0 dBm

Adjust Optical Switch Threshold Set Point

- Place the toggle switch into the Auto position.
- Connect a digital voltmeter (DVM) to the threshold ADJ TP. Use the following formula to determine the voltage reading value for the desired power level in dBm, V = (P/10) + 2.

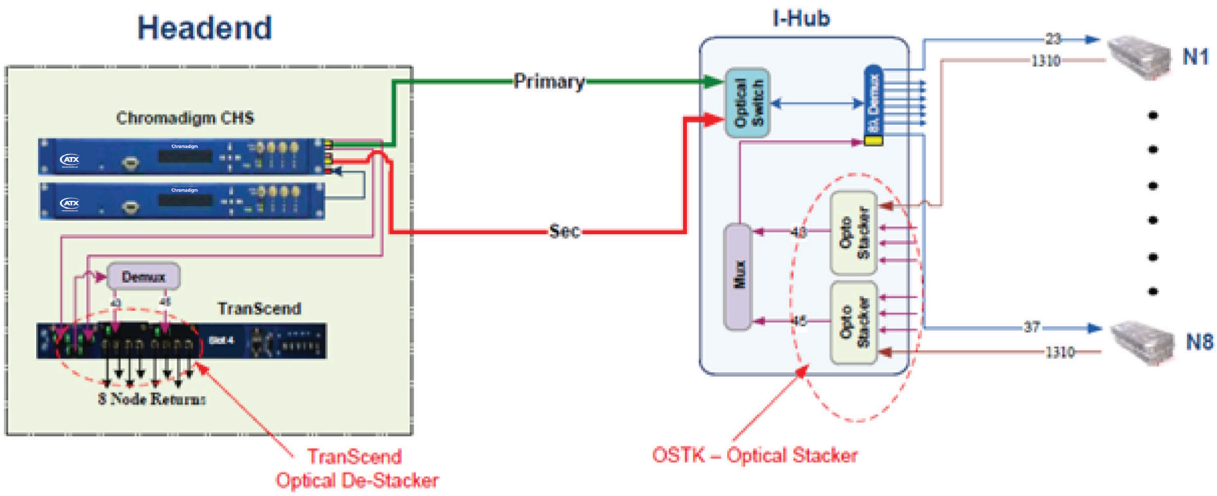
For example, if the desired threshold is -1 dBm, then V = (-1/10) + 2 or V = 1.9. Now turn the threshold adjust set control until you obtain a reading of 1.9 VDC on the DVM.

5.6 IHUB-OPSTKM, Optical Frequency Stacking Module

5.6.1 Overview

The IHUB-OPSTK-XX-C Opto-stacker is a two-slot frequency stacker module for return path applications which enables the quadrupling of the number of return path bands or streams (up to 85 MHz) from existing node return transmitters onto a single ITU wavelength. The Opto-stacker can alternatively multiplex two 5-204 MHz streams when configured in the 2-channel mode.

The following diagram depicts a typical hub elimination application where the Opto-stacker replaces hub-based, rack mount return path receivers and extends the return path of four optical nodes back to the headend with a single ITU wavelength.



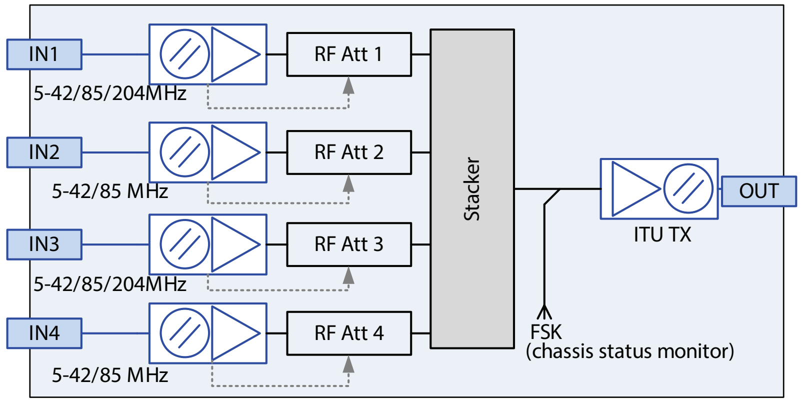
Each Opto-stacker accepts up to four optical inputs from any node manufacturers' analog return transmitters (FP or DFB) operating between 1270-1620nm. In the example, the I-HUB is equipped with two Opto-stacker modules. In this example each module is connected to the 1310nm return path fiber of four nodes. The return optical signal from each node is detected, converted to RF, RF level adjusted based on the optical input level, upconverted in frequency, and all four RF streams are multiplexed onto a single ITU wavelength. The output of the two Opto-stackers, each with four 5-42 (or 85) MHz return streams, are multiplexed with the downstream ITU wavelengths and transported back to the headend where it is destacked into the original 5-42 (or 85) MHz return path RF stream. A typical application may have up to five Opto-stacker modules per I-HUB chassis to transport 20 return path segments on five ITU channels from a collection of nodes to a headend. Up to four I-HUB chassis, each with five Opto-stacker modules and a different ITU channel, with 20 ITU channels can be multiplexed together onto a single fiber to transport up to 80 return path bands.

5.6.2 Module Operation

The following block diagram and text explains the operation of the Opto-stacker module.

The Opto-stacker module has four optical input ports. Ports one through four are utilized when the RF upstream is 85 MHz or lower and ports one and three are utilized for 5-204 MHz operation. At the input of each port is an optical receiver specified to accept optical signals between 1270-1610nm. There are three versions of stacker available, with varying sensitivity, depending on the optical input levels available in the application. Consult datasheets for current specifications. Following each receiver is an RF attenuator which is adjusted automatically if in AGC mode, or manually by user in MGC mode (use MGC mode for RFoG burst mode transmitter applications) by a microcontroller to attenuate for the difference in optical input level between ports before each return band is "stacked" using ATX technology and modulated onto a single laser in a manner that allows a complete de-stacking into the original four streams in the headend complementary de-stacker module.

The Opto-stacker also connects to the I-HUB Controller module FSK signal collecting the I-HUB configuration and sends it back to the headend Transcend or Chromaflex Destacker for one way monitor of all I-HUB modules. If IH-CTLR3 is used for FSK one way it must be enabled in the settings menu and this disables 2-way communication via Ethernet.

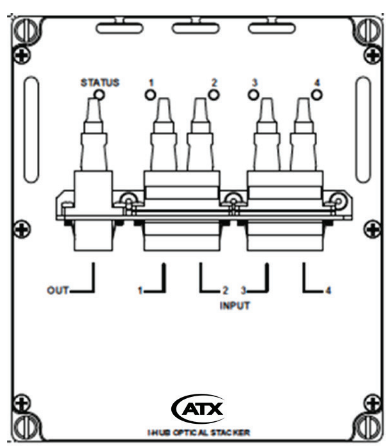


5.6.3 Module Configuration & Status

The Opto-stacker is designed for plug-n-play operation assuming that the node transmitter feeding the Opto-stacker is properly aligned with the correct RF drive level and OMI according to the manufacturers' specification. It is shipped in AGC mode and four channel operation for 5-42 or 5-85 MHz operation. It can be used without further configuration unless:

1. US input is driven by RFoG burst mode transmitter such that stacker MUST be used in MGC mode
2. 204 MHz upstream is required, so set to two channel mode

Alternatively ATX's Hand-held Display Unit (model DSP-HHU) provides additional status information, retrieval and manual adjustment of each RF attenuator setting. Please note that any manual RF level adjustment will require a two person set-up procedure to monitor the RF levels at the output of the corresponding TranScend Destacker module. If IHUB-CTLR3 module is used, the Opto-stacker parameters can be configured remotely over an IP link via web/SNMP, but ONLY if the Opto-stacker module has code rev "H" or later.



NOTE: *Caution must be exercised in manual mode to prevent overdriving the laser. Refer to ATX's I-HUB Chassis Operation Manual for configuration utilizing the hand-held Controller.*

5.6.4 Optical Input Verification

- Verify that each node's transmitters that connect to the Opto-stacker is properly aligned with the proper RF level and OMI to ensure that each return band RF signal in the Opto-stacker is neither under modulated nor over-driven for optimal return path performance.
- Ensure all optical connectors are properly cleaned following standard safety procedures.
- Measure the optical input power to be sure it is within the operating range for the Opto-stacker model. Attenuate the input level if the power is above the operating range. If the level is below the expected level then verify the network design and troubleshoot the problem to restore the power to the expected level.
- Repeat for each input.

- In AGC mode the microcontroller will automatically adjust the RF attenuator setting on each port to adjust for variation between the optical input levels of each port. There is no need to externally attenuate the optical input to the same level on each port as long as they are within the input range. If all the node return transmitters are aligned properly with the same OMI then all the RF signals will be balanced automatically for differences in optical receive level.

5.6.5 Optional Further Configuration

Set 2-channel (204 MHz) or 4-channel (< = 85 MHz) Operation

- Connect the DSP-HHU Hand-held Display Unit following the instructions in the I-HUB Chassis Operation Manual.
- After selecting the desired Opto-stacker from the chassis slot which it is populated in, select the “Setup Menu”.
- Toggle down the available options to “Frequency Ch Menu” and press select.
- “Chnl Mode” will display the current mode (default is 4-channel). Press the “right” or “left” button to display 2 or 4-channel. Press Select to commit the desired mode.
- Toggle down to “Save” and press the “right” or “left” button to choose “Yes” or “No”. Choose “Yes” and press “Select” to save your selection.

***NOTE:** Be certain to select the same 2 or 4-channel mode in the headend Destacker module to match the Opto-stacker mode of operation.*

Set RF Automatic Gain Control (AGC) or Manual Gain Control (MGC)

It is recommended to operate the Opto-stacker RF attenuator setting in the default AGC mode when connected to *continuous mode* transmitters which are the normal operation of an HFC node and operate in the MGC node when utilizing the Opto-stacker with RFoG RONU *burst mode* transmitters.

Operating in AGC with HFC node (continuous mode) transmitters allows the Opto-stacker to automatically set the proper RF level to each upconverter based on the optical receive level. In RFoG networks the optical level will turn on and off, in *burst mode*. Thus operating in MGC will prevent the attenuator from adjusting to the varied optical input levels.

- Connect the DSP-HHU Hand-held Controller Unit following the instructions in the I-HUB Chassis Operation Manual.
- After selecting the desired Opto-stacker from the chassis slot which it is populated in, select the “Setup Menu”.
- Choose “Sel Chnl” and select the desired channel 1 through 4.
- Toggle down to the “Mode Setting Menu”. Press the “right” or “left” button to select “AGC” or “MGC” and press “Select”.
- Toggle down to “Save” and press the “right” or “left” button to choose “Yes” and press “Select” to save your selection.
- Repeat for each channel.

LED Operation

The following chart defines the LED indicators:

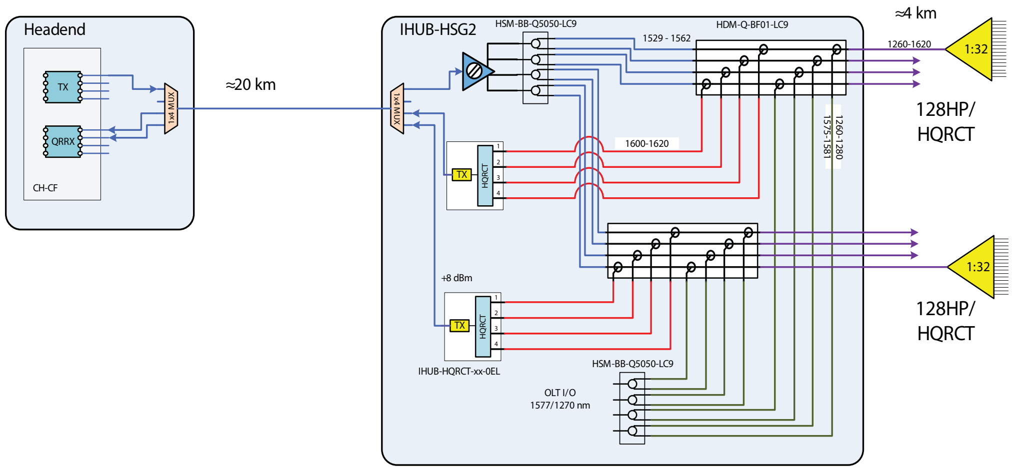
LED	Function	Value
STATUS	Module Temperature Optical Output Power	Red = Temp. Out of Range Green = $P_{OUT\ (Nominal)}$ ± 1 dB
1 through 4	Port # Optical Input Power IHUB-OPTSKM IHUB-OPTSM1	Green = +2 to -9 dBm Yellow = > +2 to 3 dBm, < -9 to -10 dBm Red = > +3 dBm, < -10 dBm Green = -1 dBm to -14 dBm Yellow = > -1 to 0 dBm, < -14 to -15 dBm Red = > +0 dBm, < -15 dBm
	IHUB-OPSTM2	Green = 15 to -21 dBm Yellow = > -15 to -14, < 21 to -22 dBm Red = 7-14 dBm, < -22 dBm

5.7 IH-HQRCT, RFoG Quad Return Combiner with ITU Transmitter

5.7.1 Overview

The HQRCT is ideal for combining and retransmitting multiple RFoG 1610nm return passive optical networks into a single service group in RFoG Repeater applications. The application below is an example where a single I-HUB contains two IH-

HQRCT, one four output EDFA , and several optical passives to achieve an RFoG system with PON overlay to serve 256 HP. Data is supported via PON network, so upstream RFoG supports legacy set-top box return with little concern for OBI. Each HQRCT module ingests up to 4 ports of 32 combined R-ONUs to support 128HP per HQRCT. The RFoG signals are RF combined and then applied to a single ITU laser for efficient retransmission back to the headend or hub.



5.7.2 Module Configuration & Status

The module ships preconfigured to be in MGC mode in support of burst mode RFoG ONUs. Apply a CW test signal to any one of the ONUs that are associated this HQRCT module, at the manufacturer's rated input level for the desired OMI% (typ. 20-25%). The HQRCT will ship pre-set with an RF atten of 9 dB which yields best performance in an application where HQRCT input is approx. -18dBm. This atten can be adjusted by 2dB for every 1dB in optical RX level that differs from this value (eg at -15dBm HQRCT input, set 15dB RF atten to maintain TP and output level).
Operation can be confirmed using the designated RF test points on the HQRCT. These are SMB ports so an appropriate cable must be used. ATX recommends a composite level at this point of 9dBmV +- 2dB. (7% OMI at HQRCT output is near the peak of the NPR curve)

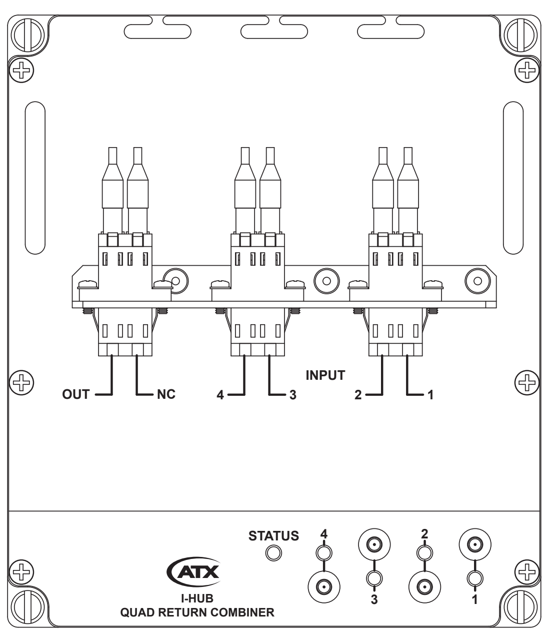
With a real QAM load in the upstream, a calculation can be made to predict the per channel test point output levels expected in regular operation.

Power per Channel = Pc - 10*log(n)

Where Pc is composite power as noted in the table below under RF Test Point Out column for the desired OMI

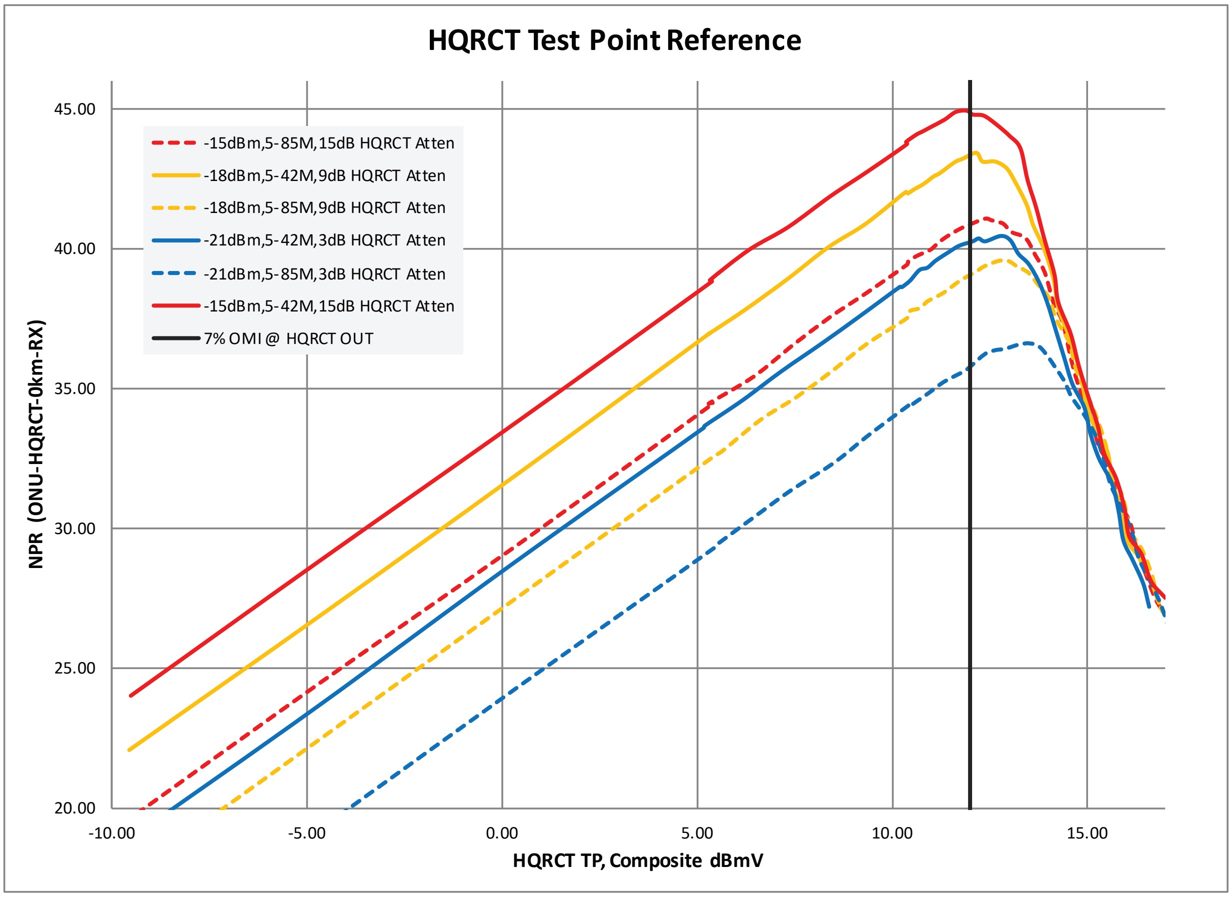
n is the number of channels

Ex: a system has 4x6MHz QAM channels and 20% OMI is desired. At the test point you should see 21.4-10log(4) = 15.4 dBmV per QAM as measured with 6MHz channel bandwidth on meter.



Optical Input, dBm	Typ RF Atten, dB	Recommended dBmV (Composite) at HQRCT TP
-12.00	21	9
-15.00	15	9
-18.00	9	9
-21.00	3	9

Initial Alignment of HQRCT



LED Operation

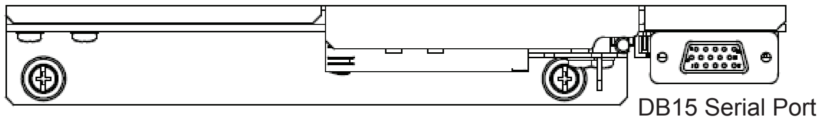
The following chart defines the LED indicators:

LED	Function	Value
STATUS	Module Temperature Optical Output Power	Red = Temp. Out of Range Green = $P_{OUT\ (Nominal)}$ ± 1 dB
1 through 4		Green = 15 to -21 dBm Yellow = > -15 to -14, < 21 to -22 dBm Red = 7-14 dBm, < -22 dBm

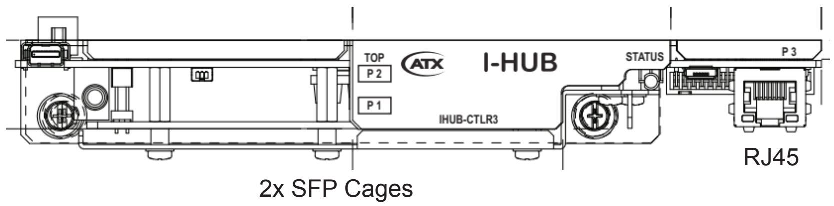
5.8 IHUB-CTLR* Controller Module

5.8.1 Overview

There are two control modules offered for the I-HUB platform: The IHUB-CTLR2 and IHUB-CTLR3. Each has a microcontroller and processors to get and set parameters from each module slot such as the type of module, module settings, current operating levels and alarm status information. The difference lie in whether remote control is supported.



IHUB-CTLR2



IHUB-CTLR3

Each controller supports a DB-15 serial connector as a local craft interface, either the DSP-HHU Hand-held Display Unit or by utilizing a standard CLI tool (many USB-serial cables are available for modern laptops without serial ports), to set each individual module's parameters or collect the module configuration, operating levels and alarms.

For remote monitoring, the IHUB-CTLR2, when used with an Opto-stacker/Destacker link, supports an FSK signal to present all I-HUB module info on a proxy screen at the headend on the rack mount (TranScend or ChromaFlex) receiver's chassis web/SNMP interface. Although SFP ports exist on IHUB-CTLR2, they do not support an Ethernet link for bidirectional control of I-HUB. This is a one way monitoring function that does not allow any writes to the I-HUB in CTLR-2.

For Remote Monitoring AND Control, the IHUB-CTLR3

This module supports the same 1-way monitor function over FSK signal as the CTLR-2, however by default it is configured for 2-way communication over ethernet to allow Read/Write via Web GUI or SNMP directly to the I-HUB IP address (no proxy needed).

Refer to ATX's I-HUB Chassis Operation Manual, for configuration utilizing the hand-held Controller and remote CLI from the TranScend chassis or a remote network.

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PROVISIONING & MONITORING

6. Provisioning & Monitoring

6.1 Overview

The I-HUB provides the ability for local provisioning along with local and remote monitoring of the I-HUB chassis configuration, individual module parameters, and any alarm status conditions.

There are currently four ways to check and monitor the I-HUB chassis and modules.

1. Utilize the DSP-HHU Hand-held Display Unit connected directly to the I-HUB Controller module DB15 port.
2. Use CLI commands (see operation manual for more details), which require local serial connection via DB15 connection a hyperterminal program on a laptop, or by Telnet access to RJ-45 port on CTLR-3 module.
3. Utilize the Web GUI or SNMP when the associated TranScend or ChromaFlex proxy chassis is networked by connecting the chassis RJ-45 Ethernet port to the management network system.
4. If IHUB-CTLR3 is installed: Directly connect to RJ45 port and access Web/SNMP locally, or connect the port to an existing network onsite, or use SFP with optical transceiver to connect over fiber back to headend network. With two SFP ports and one RJ-45 port, daisy chaining this 2-way communication to multiple I-HUBs is possible.

The default network address of all I-HUB, ChromaFlex and TranScend products is IP = 192.168.1.200, Subnet Mask = 255.255.255.0, Gateway = 192.168.1.1

This address can be changed via the CLI interface or Telnet by typing “network 192.168.1.100 255.255.255.0 192.168.1.1” or whatever new configuration is desired.

In controller modules with rev 4.6 or later, the Web GUI interface can also be used to change IP by entering same line as above without the word “network”.

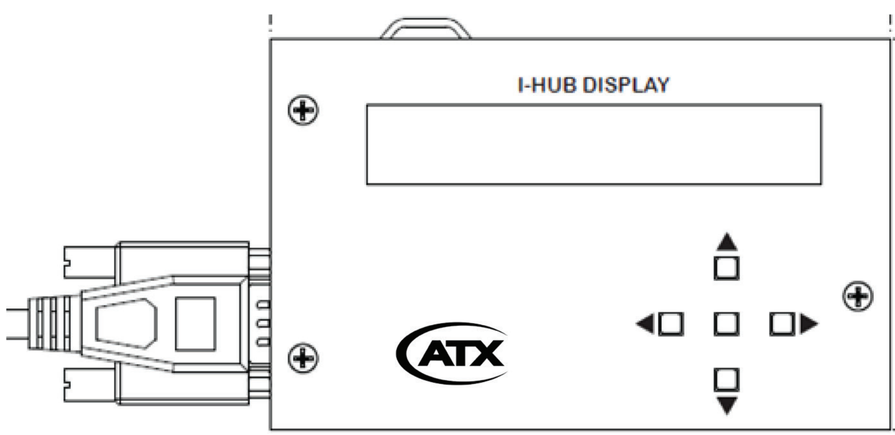
Note that if you change IP address to a different subnet (say 192.168.2.* in the example above), you will of course need to reset your host computer to the new subnet before you can access it again.

See I-HUB Operation Manual for more details on these configurations.

6.2 DSP-HHU Hand-held Display Unit

An optional DSP-HHU Hand-held Display Unit allows an operator to monitor and control the chassis locally through a special DB15 cable. All readable and writeable attributes can be monitored and set locally via the display module. When the display module is detected, the I-HUB Controller disables all remote supervisory communications. The remote supervisory communication includes monitoring of status and alarm attributes as outlined above.

The display module consists of a LCD display and 5 pushbutton menu navigation controls. Their operations are detailed in the I-HUB Chassis Operation Manual.



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MAINTENANCE & REPAIR

7. Maintenance & Repair

It is recommended to inspect the housing each time the chassis is visited for environmental integrity. Be sure that all seals are free of foreign matter, cables are routed properly to prevent pinch points and the housing is properly tightened to torque specifications.

Each module section provides information regarding the normal operating parameters, LED indicators and guidelines for troubleshooting.

The product is designed for years of trouble free and maintenance free operation. Please contact ATX (see Service & Support section) for any questions or clarification about the performance or monitoring aspects of the product. Thank you for using ATX products, your satisfaction is our primary goal.

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SERVICE & SUPPORT

8. Service & Support

8.1 Contact ATX Networks

Please contact ATX Technical Support for assistance with any ATX products.

TECHNICAL SUPPORT

Tel: 289.204.7800 – press 1

Toll-Free: 866.YOUR.ATX (866.968.7289) USA & Canada only
Email: support@atx.com

SALES ASSISTANCE

Tel: 289.204.7800 – press 2

Toll-Free: 866.YOUR.ATX (866.968.7289) USA & Canada only
Email: insidesales@atx.com

FOR HELP WITH AN EXISTING ORDER

Tel: 289.204.7800 – press 3

Toll-Free: 866.YOUR.ATX (866.968.7289) USA & Canada only
Email: orders@atx.com
Web: www.atx.com

8.2 Warranty Information

All of ATX Networks' products have a 1-year warranty that covers manufacturer's defects or failures.

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