



## RFoG - Inverted Node:

### Application:

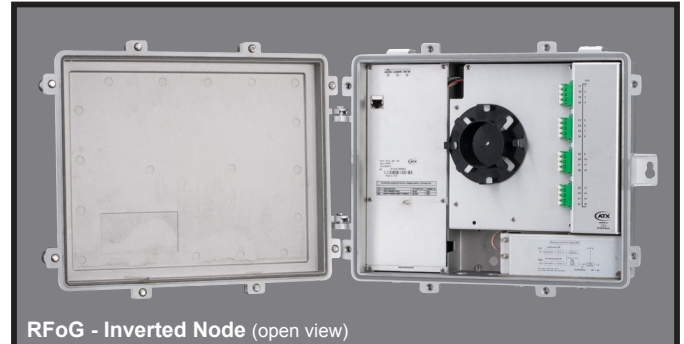
The RFoG inverted node allows MSOs to leverage their existing HFC plant & technologies in order to deploy RFoG-style FTTH services without the concern of OBI performance limitations. The RFoG inverted node acts as a central hub between the coaxial plant & fiber connected subscribers and is an ideal solution to allow MSOs the ability to enter into the FTTH marketplace in a time-efficient & cost-effective manner.

The RFoG inverted node converts downstream RF signals from the HFC plant to an analog optical transmission that is split to up to 32 ONUs. In the upstream, the RFoG inverted node receives optical transmissions from the ONUs, converts them to RF & transmits them back into the HFC plant. The RFoG inverted node is offered in 1:1 or X:1, ONU to receiver configurations & as such the following OBI mitigation techniques must be considered:

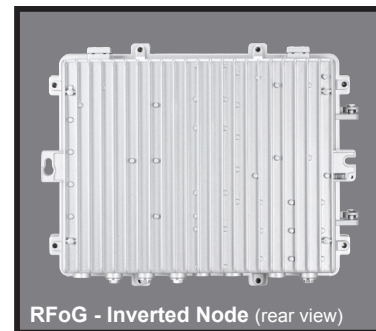
- ▶ 1:1 ONU to Receiver: in this scheme, each upstream port on the RFoG inverted node is able to receive any wavelength except for 1551nm. Therefore, an ONU of any wavelength (1310nm, 1610nm or CWDM) can be connected to any upstream port of the RFoG inverted node.
- ▶ X:1 ONUs to Receiver: in this scheme, RFoG inverted node ports are optically combined at each output in order to present multiple ONU upstreams to a single receiver. By default, this is being offered as 4:1 upstream combining, but other ratios can be explored. Contact ATX for details. ONUs that are connected within the same group should operate on different wavelengths in order to ensure OBI is mitigated & as such an X-channel ONU channel plan is recommended.

### Features:

- ▶ Allows MSOs to leverage their existing HFC plant to deliver FTTH with an OBI-free solution
- ▶ Supports up to DOCSIS® 3.1 with bandwidths up to 1218 MHz
- ▶ Environmentally hardened aluminum enclosure ensures reliable operation in rugged conditions
- ▶ Cabinet-style enclosure allows easy access to set-up the node
- ▶ Can be powered by Line (HFC plant) or Mains
- ▶ Replaceable power supply module
- ▶ Pluggable RF diplex filter to support upstream bandwidth of 42, 65, 85, 117 or 204 MHz
- ▶ Plug-in JXP attenuators & EQs allow any amount of RF level adjustment in upstream or downstream independently
- ▶ Integrated optical passives & splices simplifies installation & reduces connector loss
- ▶ LED indications of downstream RF power to laser, laser status & AC input
- ▶ Optional license-based firmware upgrade to activate Ethernet port & support an external cable modem (not provided) for remote status monitor/control



RFoG - Inverted Node (open view)



RFoG - Inverted Node (rear view)

**RFoG - Inverted Node:** \_\_\_\_\_

**RFoG - Inverted Node Specifications**

ELECTRICAL & ENVIRONMENTAL SPECIFICATIONS	
<b>VOLTAGE</b>	
LP (Line Powered)	30-65 VAC
MP (Mains Powered)	90-230 VAC
FREQUENCY	50-60 Hz
POWER	≤ 25W
POWER CABLE	MP version includes 1.5 m power cord with Euro-style 2-prong plug & an IP52 rated grommet connection for this cable LP version has this power entry port plugged
<b>ENVIRONMENTAL</b>	
IP (Ingress Protection)	IP52
OPERATING TEMPERATURE <sup>(1)</sup>	-40°C to +65°C (-40°F to +149°F)
HUMIDITY	0-95% Non-condensing
<b>CERTIFICATIONS</b>	
CONFORMITY	CE, 2kV Surge Protection, RF Immunity of 125 dBuV/m
<b>PHYSICAL</b>	
DIMENSIONS	12.3"H x 15.3"W x 4.3"D (31.1H x 38.7W x 10.8D cm)
WEIGHT	13.4 lbs (6.0 kg)
<b>NOTE:</b> (1) This is the external ambient temperature around the node. An approximate 20°C rise inside the node is expected.	

DOWNSTREAM SPECIFICATIONS	
<b>RF INPUT TO NODE</b>	
NOMINAL IMPEDANCE	75 Ω
CONNECTOR	F (Female)
RF BANDWIDTH	*-1218 MHz <sup>(1)</sup>
INPUT RETURN LOSS (Min)	15 dB
RF LEVEL ADJUST	JXP Attenuator, 0-20 dB in 0.5 dB Steps
RF SLOPE ADJUST	JXP EQ/Cable Simulator, 0-16 dB in 1 dB Steps
<b>OPTICAL OUTPUT TO ONU</b>	
OUTPUT POWER PER PORT (Min)	32-port > -4.5 dBm 16-port > -4.5 dBm 8-port > -1.0 dBm 4-port > +2.5 dBm
WAVELENGTH	1551 ± 7nm
NUMBER OF PORTS	32 or 16 (See Ordering Options)
CONNECTOR	One Female LC/APC per Port
<b>OVERALL DOWNSTREAM SPECIFICATIONS AT ONU OUTPUT<sup>(2)</sup></b>	
CNR (An, Min)	44 dB
CSO/CTB (Max)	-57 dBc
256 QAM BER (pre-FEC)	1E-9
MER	39 dB
<b>NOTES:</b> (1) Varies with duplex filter selection. For upstreams of 42, 65, 85, 117 & 204, the minimum downstream frequency is 54, 85, 102, 149 & 258 respectively. (2) Based on downstream input provided to inverted node of: minimum 70 dBuV/An flat (+/- 0.5 dB), with minimum 46 dB CNR & -60 dBc CSO & CTB. Minimum 256 QAM performance of 42 dB MER & 1E-9 BER. A suitable quality ONU must be used in order to ensure it is not limiting performance.	

**RFoG - Inverted Node:** \_\_\_\_\_

**RFoG - Inverted Node Specifications (cont'd)**

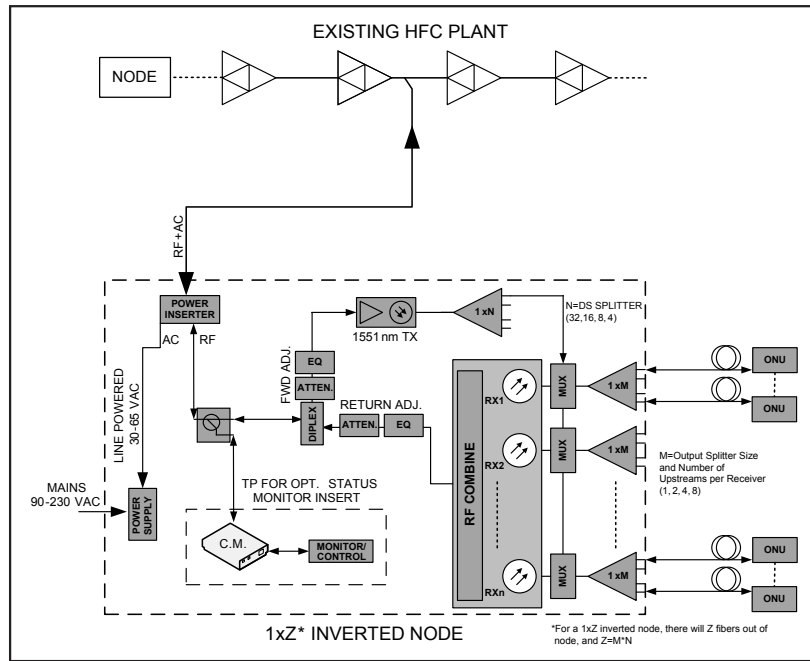
UPSTREAM SPECIFICATIONS	
<b>OVERALL UPSTREAM RF PERFORMANCE AT INVERTED NODE OUTPUT<sup>(1)</sup></b>	
CNIR (Min)	38 dB
DYNAMIC RANGE (Min)	16 dB
64 QAM BER (pre-FEC)	1E-9
MER (Min)	38 dB
<b>OPTICAL INPUT FROM ONU</b>	
ONUs PER PORT (Max)	1
NUMBER OF PORTS	32, 16, 8 or 4 (See Ordering Options)
<b>RF OUTPUT FROM INVERTED NODE</b>	
NOMINAL IMPEDANCE	75 Ω
RF BANDWIDTH	5- <sup>*</sup> MHz <sup>(2)</sup>
OUTPUT RETURN LOSS (Min)	15 dB
RF LEVEL (Min/64 QAM)	83 dBuV
RF LEVEL ADJUST	JXP Attenuator, 0-20 dB in 0.5 dB Steps
RF SLOPE ADJUST	JXP EQ, 204 MHz Bandwidth
<b>NOTES:</b>	
(1) Based on upstream 1 ONU transmitting at any given time. RF load of 8x6. 4 MHz 64 QAM @ 8% OMI per channel. Optical input power to inverted node of at least +1.5 dBm. Other performance specifications available upon request.	
(2) Varies with diplex filter selection. Maximum upstream may be 42, 65, 85, 117 or 204 MHz.	

**Upstream Performance Considerations**

PART NUMBER	DESCRIPTION	OBI MITIGATION SCHEME/ONU CHANNELIZATION	NPR/DR (Peak) 15 dB		
			5-42 MHz	5-85 MHz	5-204 MHz
IN132-PP-DX	1x32 Inverted Node, 1 ONU/RX	Unrestricted	45/15 (52)	TBD	TBD
IN116-PP-DX	1x16 Inverted Node, 1 ONU/RX				
IN108-PP-DX	1x8 Inverted Node, 1 ONU/RX				
IN104-PP-DX	1x4 Inverted Node, 1 ONU/RX				
IN432-PP-DX	1x32 Inverted Node, 4 ONU/RX	Channelized Port Groups	40/15 (49)	TBD	TBD
IN416-PP-DX	1x16 Inverted Node, 4 ONU/RX				
<b>NOTE:</b>					
This table is presented in order to provide insight as to how the specified "Single ONU On" link performance CNIR will degrade as upstream bandwidth is increased or more than one ONU is on at a given time. "Single ONU On" link performance CNIR should be degraded at 10log (BWnew/BWspec) as bandwidth is increased & at 10log (N) when there are N ONUs on at any time.					

**RFoG - Inverted Node:**

**Functional Schematic**



**Ordering Information**

**Example Part Number: IN ABB - PP - DX**

1 2 3 4

1: A = Number of ONUs Connected per Upstream Receiver (A = 1, 2, 4, 8)  
 2: BB = Total Number of ONUs Support by Node (BB = 32, 16, 08, 04)  
 3: PP = Powering Option: LP = Line Powered 30-65 VAC  
 MP = Mains Powered 90-230 VAC  
 4: DX = Diplex Filter Option in MHz: 042 = 5-42 MHz  
 065 = 5-65 MHz  
 085 = 5-85 MHz  
 117 = 5-117 MHz  
 204 = 5-204 MHz

Part Number	Description
<b>Other Optional Accessories</b>	
INDIPEX-DX	Replacement Diplex Filter (DX as defined above).
N-ACC-AP-*	JXP Plug-in Attenuators, 25 pc per pack, 5-1218 MHz, * = 0-26 dB in 0.5 dB steps.
JXPEQLH-*	JXP Plug-in Linear EQs, 1.218 GHz Rated, * = EQ value (also available as 1 GHz EQs, 204 MHz EQ, 1.218 GHz Cable Simulators, etc. Contact ATX for other options).
IN-FIBER18	18 Fiber Bundle Service Cable <sup>(1)</sup> .
IN-FIBER8	8 Fiber Bundle Service Cable <sup>(1)</sup> .
IN-COMMMOD	Remote Status Monitor Firmware Upgrade. Reports temperature, downstream RF & laser power, supply voltage, current & watts. SNMP v2c.
IN-PS-LP	Replacement Power Supply for Line Powered version.
IN-PS-MP	Replacement Power Supply for Mains Powered version.

**NOTE:**  
 (1) To connect to optical demarcation point outside of inverted node. Not included with base node. 3 m total length. 60 cm fan-out of LC/APC connectors at each end. Other dimensions available upon request.

**EXAMPLE:**  
 IN132-LP-065 is a 1x32 inverted node with one 12-65 MHz upstream (one ONU) per receiver & line powering.



Specifications subject to change without notice.