LINDSAY BROADBAND

Keeping You Connected.

Training on Lindsay Broadband Inverse Node / HFC Repeater

XTENDR™

XT series

July 2020

XTENDR™

- Extend HFC plant out to up to 20 kms max (12.5 miles) over fiber – RFoG
- Single RF Input/Output
- 2, 4, 8 or 16 output fibers available
- Optional downstream optical amplifier (EDFA)
- Downstream optical output:1550±10nm
- Upstream optical input: 1240 to 1620nm (except 1550±10nm)
- Works in combination with the Lindsay LBON series of RFoG ONU's.
- Can also be paired with Lindsay MDU optical nodes

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- DOCSIS ® 3.1 capable
- 1220 MHz Downstream bandwidth
- Field replaceable diplex filter (42/54, 85/102 or 204/258 MHz)
- Electronic ATT & EQ (tilt) adjustments
- 40-90 Vac HFC powered
- <18W max power consumption
- Strand, pole or wall mounting
- LC/APC connectors
- Multi-diode return receivers eliminate Optical Beat Interference (OBI)
- -40^{0}C to +60^{0}C (-40^{0}F to +140^{0}F)

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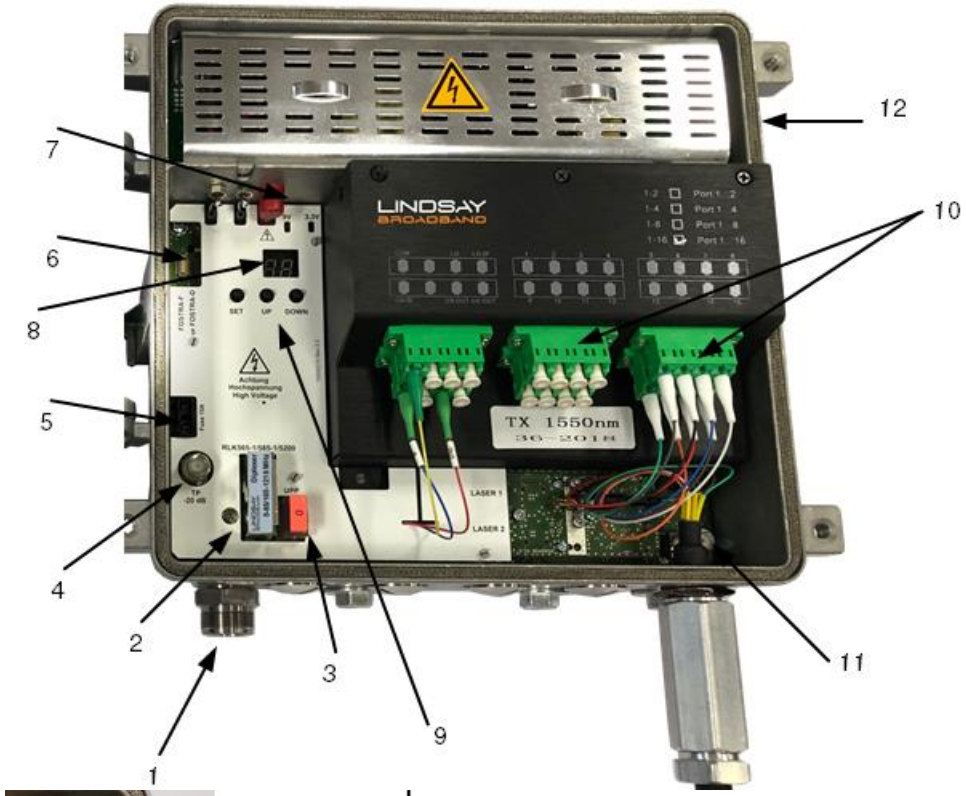
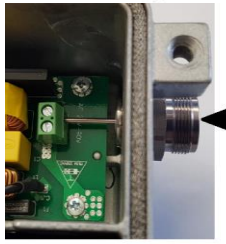
1. Downstream RF Input & Upstream RF Output. Can also combine RF and AC to power.
2. Plugin Diplex Filter
3. 1.2GHz Cable simulator
4. -20dB Bi-directional test point
5. Fuse for powering through RF port
6. Optional management module (for future release)
7. Status LEDs for 9V & 3.3V internal voltage rails
8. LED Display for setup
9. Set/Up/Down push buttons for setup
10. Downstream optical output / Upstream optical input ports to connect subscribers
11. OMI Test point (for Upstream signals only)
12. Dedicated optional powering port. Top screw terminal is positive and bottom screw terminal is ground (chassis).




AC only


AC only


Power combined with RF

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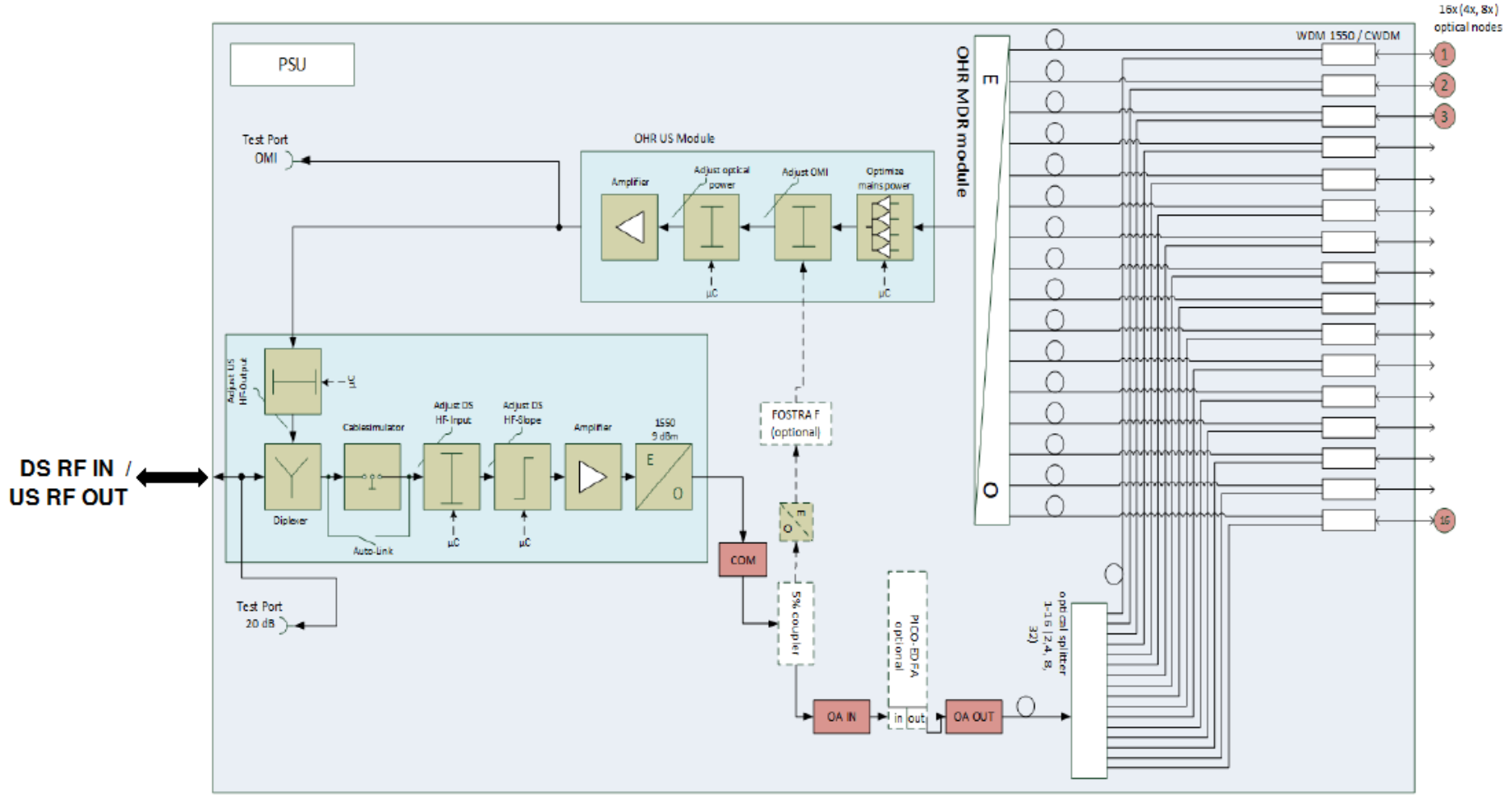

Block Diagram

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XTENDR Min Rx power: -9 dBm

XTENDR Tx power: Depends on model (see table)

ONU DS Min Rx Limit: -6dBm

ONU US Tx Power: 3dBm

XTENDR 1550nm Tx Launch Power per port (dBm)	2 ports	4 ports	8 ports	16 ports
Without EDFA	4.0	1.0	-2.00	-5.00
With EDFA	12.0	9.0	6.00	3.00

RF Input: 10 to 15dBmV / Ch
RF Output: 35dBmV / Ch for 10% OMI

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Without EDFA	2 ports	4 ports	8 ports	16 ports
XTENDR 1550nm Tx Launch Power (dBm)	4.0	1.0	-2.00	-5.00
LBON300 Min Sensitivity (dBm)	-6.0	-6.0	-6.0	-6.0
Max DS Link budget (dB)	**10.0**	**7.0**	**4.0**	**1.0**
1610nm LBON300 Tx Launch power (dBm)	3.0	3.0	3.0	3.0
XTENDR RRx min Sensitivity (dBm)	-9.0	-9.0	-9.0	-9.0
Max US Link budget (dB)	**12.0**	**12.0**	**12.0**	**12.0**

With EDFA	2 ports	4 ports	8 ports	16 ports
XTENDR 1550nm Tx Launch Power (dBm)	12.0	9.0	6.00	3.00
LBON300 Min Sensitivity (dBm)	-6.0	-6.0	-6.0	-6.0
Max DS Link budget (dB)	**18.0**	**15.0**	**12.0**	**9.0**
1610nm LBON300 Tx Launch power (dBm)	3.0	3.0	3.0	3.0
XTENDR RRx min Sensitivity (dBm)	-9.0	-9.0	-9.0	-9.0
Max US Link budget (dB)	**12.0**	**12.0**	**12.0**	**12.0**

Note: Highlighted cell is the limiting factor for subscriber reach in link budget calculation

XTENDR™

Assuming a splice every 3 kms, 1dB connector losses & 1dB miscellenous losses buffer.

	Without EDFA	Subscribers	Fiber distance in kms	Fiber distance in miles	Fiber distance in feet	Link loss (dB)	ONU DS Receive Level (dBm)	XTENDR US RRx Receive Level (dBm)
	2 Port_ No Splitters	2	20	12.43	65620	7.4	-3.4	-4.4
	2 Port_ 1x2 Splitter	4	13	8.08	42653	9.5	-5.5	-6.5
	2 Port_ 1x4 Splitter	8	0.5	0.31	1641	9.5	-5.5	-6.5
	4 Port_ No Splitters	4	17	10.57	55777	6.5	-5.5	-3.5
	4 Port_ 1x2 Splitter	8	2	1.24	6562	6.5	-5.5	-3.5
	8 Port_ No Splitters	8	5	3.11	16405	3.5	-5.5	-0.5
*	8 Port_ 1x2 Splitter	16	0.25	0.16	820	4	-6.0	-1.0
*	16 Port_ No Splitters	16	0.25	0.16	820	0.5	-5.5	2.5

*** Not Recommended. The losses are high. No buffer for misc. losses.**

Note: The link distances are calculated considering average cable, connector, splitter & splice losses.
If any of these losses are different in the network, XTENDR reach could change.

Link distances for XTENDR without EDFA

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Assuming a splice every 3 kms, 1dB connector losses & 1dB miscellenous losses buffer.

	With EDFA	Subscribers	Fiber distance in kms	Fiber distance in miles	Fiber distance in feet	Link loss (dB)	ONU DS Receive Level (dBm)	XTENDR US RRx Receive Level (dBm)
	2 Port_ No Splitters	Not realistic, too hot for downstream power; No use case						
	2 Port_ 1x2 Splitter	4	20	12.43	65620	11.4	0.6	-8.4
	2 Port_ 1x4 Splitter	8	8	4.97	26248	11.5	0.5	-8.5
*	2 Port_ 1x8 Splitter	16	0.25	0.16	820	11.5	0.5	-8.5
	4 Port_ No Splitters	4	20	12.43	65620	7.4	1.6	-4.4
	4 Port_ 1x2 Splitter	8	20	12.43	65620	11.4	-2.4	-8.4
	4 Port_ 1x4 Splitter	16	8	4.97	26248	11.5	-2.5	-8.5
*	4 Port_ 1x8 Splitter	32	0.25	0.16	820	11.5	-2.5	-8.5
	8 Port_ No Splitters	8	20	12.43	65620	7.4	-1.4	-4.4
	8 Port_ 1x2 Splitter	16	20	12.43	65620	11.4	-5.4	-8.4
	8 Port_ 1x4 Splitter	32	8	4.97	26248	11.5	-5.5	-8.5
	16 Port_ No Splitters	16	20	12.43	65620	7.4	-4.4	-4.4
	16 Port_ 1x2 Splitter	32	10	6.22	32810	8.5	-5.5	-5.5

*** Not Recommended. The losses are high. No buffer for misc. losses.**

Note: The link distances are calculated considering average cable, connector, splitter & splice losses.

If any of these losses are different in the network, XTENDR reach could change.

Link distances for XTENDR with EDFA

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Accessories for XTENDR

Optional Accessories	
Part #	**Description**
XT-DF-42-54	XTENDR plug-in diplexer, 5-42/54-1218 MHz
XT-DF-85-102	XTENDR plug-in diplexer, 5-85/105-1218 MHz
XT-DF-204-258	XTENDR plug-in diplexer, 5-204/258-1218 MHz
XT-CS-xx	XTENDR cable simulator plug, 1218 MHz (xx = dB value; available values = 3,6,9,12,15)
XT-SMB	XTENDR strand mount bracket
XT-F-7.5	XTENDR 7.5 amp fuse
See matrix below	Optical service cables

		# of Fibers		Cable Length (meters)		Connector
XT-SC	-	x	-	xx	-	LA
		2		10 = 10 m		LA = LC/APC
		4		15 = 15 m		
		8		30 = 30 m		
				50 = 50 m		

LBON300/500 RFoG ONU

- DS Optical Input: 1550±10nm
- LBON500 with 1G+10G PON pass through port
- Optical AGC: -6dBm to +2dBm
- 1610nm or 1310nm or CWDM Tx laser
- 2 mW (3dBm) or 3 mW (4.7dBm) Tx power
- Sub splits: 42/54MHz & 85/102MHz upto 1GHz. 1.2 GHz BW units available
- DS RF Output: 20dBmV @ 1GHz on SFU; 36dBmV @ 1 GHz for MDU (3.5% OMI within optical AGC range). 5dB slope.
- US RF Input: 20-40dBmV / Ch
- Bidirectional -20dB RF Test Point
- 1mW/1V DC test point for DS optical input
- 12~15Vdc powering
- Power ON; Optical Input & Optical Output LED Indicators
- -40C to +65C (-40F to +149F) rated

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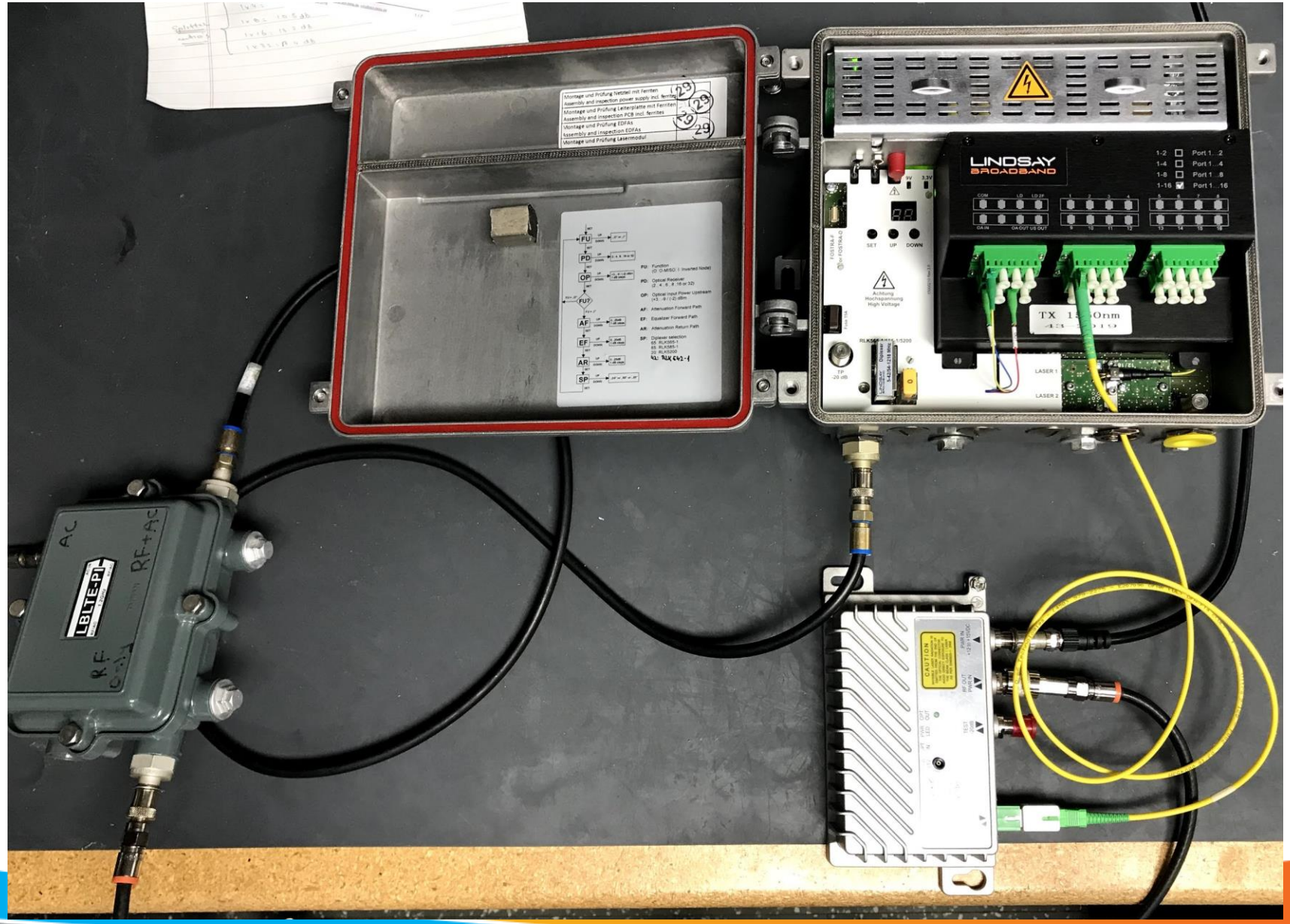
Example of very simple RFoG setup using XTENDR

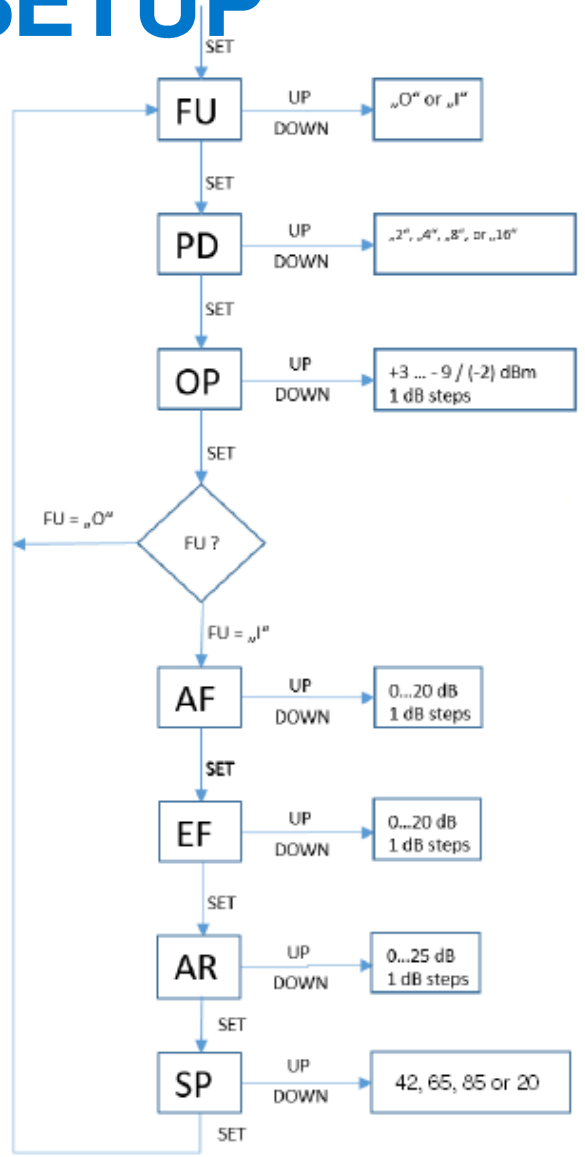


XTENDR SETUP

1. Apply 40-90Vac power: Either from RF port if you have AC & RF combined (plug in Fuse); or via dedicated powering port.
2. Downstream RF Input: 10 to 15dBmV / Ch. (refer to chart in manual)
3. Monitor levels on -20dB bi-directional test point if required.
4. “UPP” plugin is for 1.2G Cable simulator. If no CS is needed, use a 0dB JXP pad.
5. Setup Menu

   SET button: Select & advance to next parameter on the menu

   UP/DOWN buttons: To change values
6. “FU” Function Menu = “I” Inverted Node



FU: *Function*
(I: Inverted Node; O: Optical Upstream)

PD: *Optical Receiver*
(2, 4, 8 or 16 PD’s active)

OP: *Optical Input Power Upstream*
(+3… -9 / (-2) dBm)

AF: *Attenuation Forward Path*

EF: *Equalizer Forward Path*

AR: *Attenuation Return Path*

SP: *Diplexer selection*

42: *42/54 MHz*
65: *65/85 MHz*
85: *85/102 MHz*
20: *204/258 MHz*

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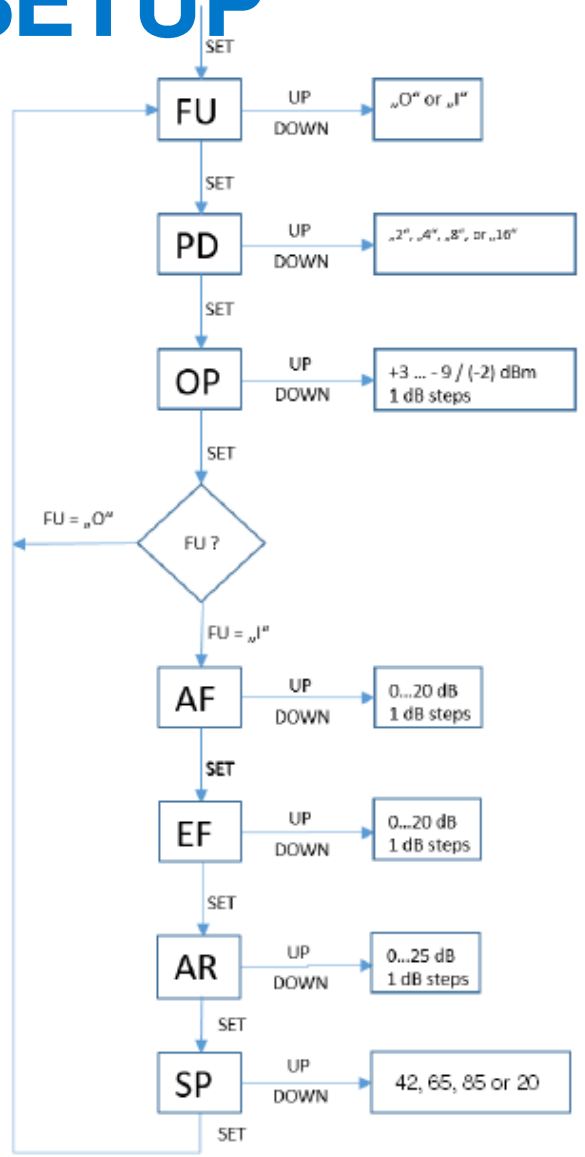
XTENDR SETUP

7. Connect Optical cables to the subscriber ports. Use Optical Power Meter to verify optical levels.
8. Set “AF” value for forward attenuation.
9. Set “EF” value for forward equalization/Slope.
10. Set “PD” Photo diode Optical receiver value as required (2, 4, 8 or 16). This will turn OFF unwanted receivers in XTENDR.
11. Check optical power level in upstream from subscriber ONUs. Set “OP” as average Optical Upstream Level.
12. Set “AR” value for reverse attenuation.
13. Set “SP” value (42, 85 or 20) for diplex filter being used.
14. Can also check bi-di or Upstream only (refer to chart in manual) TP for troubleshooting.



FU: *Function*
(I: Inverted Node; O: Optical Upstream)
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42: *42/54 MHz*
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20: *204/258 MHz*

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LBON300/500 RFoG ONU SETUP

1. Check optical fiber is clean. Make all the optical, RF & power connections.
2. The “PWR LED” should be ON when unit is powered.
3. “OPT IN” LED will also be ON if DS optical input is available.
4. To check the level of DS 1550nm optical hitting the Rx, measure the 1mW/1V DC test point using a DC volt meter. See chart.
5. Check RF output levels using the meter at RF OUT or test point. Please note TP is -20dB.

Optical RX DC Test Point:				
V (DC) on the DC Test Point of ONU	Optical Level hitting the Rx (mW)	Optical Level hitting the Rx (dBm)	OPT IN LED	
1.58	1.58	2	ON	Optical RX Spec Input Level
1.26	1.26	1		
1.00	1.00	0		
0.79	0.79	-1		
0.63	0.63	-2		
0.50	0.50	-3		
0.40	0.40	-4		
0.32	0.32	-5		
0.25	0.25	-6		
0.20	0.20	-7	ON	
0.16	0.16	-8		
0.13	0.13	-9		
0.10	0.10	-10		
		< -10	OFF	

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LBON300/500 RFoG ONU SETUP

6. Inject upstream carrier from the RF port or test port.
7. The upstream Tx laser will only turn ON if the RF input is higher than 15dBmV (from RF port) or 35dBmV (from test point). OPT OUT LED will turn ON.
8. DOCSIS traffic is bursty, “OPT OUT” LED will blink quickly and will be difficult to detect. Could also inject a CW carrier to troubleshoot.
9. Optimum RF input level is 30dBmV±5 dB from RF port.
10. For troubleshooting check:
    a. PWR LED is ON. Use only 15Vdc Lindsay PP.
    b. Check OPT IN LED is ON. 1mW/1V DC test point.
    c. Check for intermittent connections. Clean fiber, no sharp bend in fiber.
    d. Check -20dB RF TP. Can also inject CW & check OPT OUT (using OPM) or LED & RF level at headend or node.

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QUESTIONS?

Provided by: Mega Hertz | 800-883-8839 | info@go2mhz.com | www.go2mhz.com

Thank you!