

## TIN40RD31 2-Way Indoor Optical Node

Model	Bandwidth
TIN40RD31	54-1220 MHz 102-1220 MHz 258-1220 MHz



TIN40RD31 is a DOCSIS 3.1 compliant 1220 MHz high output two way indoor optical fiber node for CATV, SMATV, FTTx, MDU or private business applications.

TIN40RD31 has a wide optical input range from 1200 to 1600nm, making it ideal for either 1310nm and 1550nm systems.

Downstream section has a microprocessor controlled AGC feature which enables tracking input optical level to maintain constant RF output level.

High RF output level (35/48 dBmV with 13dB tilt) over -6 to +2 dBm input level eliminates the need for a separate RF amplifier. The nodes are powered by a plug-in wall type 24VDC power transformer via F-connector.

### FEATURES

- Supports 1220 MHz downstream for DOCSIS 3.1 migration,
- High RF output level (35/48 dBmV) through GaAs-FET Push Pull technology,
- Future proof with field replaceable diplex filters (5-85 / 102-1220 MHz and 5-204 / 258-1220 MHz),
- Extended optical input level range (-6 dBm to + 2 dBm) for maximum flexibility,
- Optical automatic gain control (AGC) via built-in microprocessor maintains constant RF output levels over a wide range of optical inputs,
- Internal digital optical TX/RX level display enables level monitoring without instrumentation,
  - JXP style pad and equalizer control,
  - 1310 nm, 1550 nm and CWDM DFB laser options for return transmitter,
    - Superior return transmitter (TX) NPR performance,
    - Separate -20dB RF test ports for forward and reverse directions,
- Powered by a plug-in wall type 24VDC power transformer via F-connector,
  - Surge protection (6kV) at RF output,
  - SCTE compliant F type connectors,
- Diecast aluminum housing for excellent heat dissipation and RFI shielding.

## SPECIFICATIONS

### Forward (Down-Stream)

#### Optical (RX)

Optical Input Wavelength	1200...1600 nm
Optical AGC Input Range	-6...+2 dBm (with AGC)
Optical Input Level Test Point	-6...+2 dBm (shown on digital display)
Optical Input Level Indicator	Green LED (> -8 dBm)

#### RF

Forward Bandwidth Options	54 - 1220 MHz / 102-1220 MHz / 258-1220 MHz (field replaceable plug-in duplex filters)
Gain Tilt	0 dB
Slope Control (input)	0...20 dB (with plug-in JXP controllers)
Stability	+/- 1.5 dB
Return Loss	Typ. -16 dB (Max. -14 dB)
Test Point	- 20 dB
<b>Link Performance (-1 dBm optical input power, NTSC77 channel, OMI=%3,5)</b>	
Output Level	35/48 dBuV (tilted)
AGC Setting	A8
CNR	-51 dBc
CTB	-64 dBc
CSO	-64 dBc
XMOD	-58 dBc (on ch2)

### Return (Up-Stream)

#### Optical (TX)

Transmitted Wavelength (TX Laser)	1310 nm, 1550 nm DFB, ITU CWDM (1270 nm...1610 nm)
Optical Output Power	2 mW (3 dBm)
Test Point	-6...+2 dBm (by digital display)
Optical Output Level Indicator	-/+ 0,25 mW (shown on digital display)

#### RF

Reverse Bandwidth Options	5-85 MHz / 5-204 MHz (field replaceable)
Flatness	+/- 1.5
Input Level Control	0...20 dB dB (with plug-in JXP controllers)
Test Point	- 20 dB
Return Loss	-16 dB

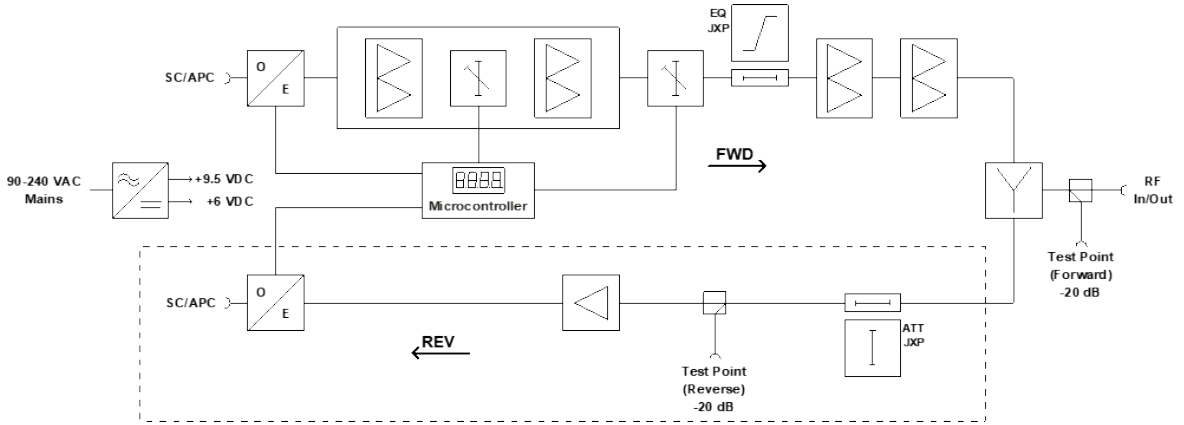
#### Link Performance (6dB link loss, 10 km fiber + optical attenuator)

Optimum Input Level	16 dBmV
NPR Peak / Input Level	51 @ 16 dBmV
TX Input Level (@ NPR=-41dB)	3-24 dBmV
TX Input Level (@ NPR=-38dB)	2-26 dBmV

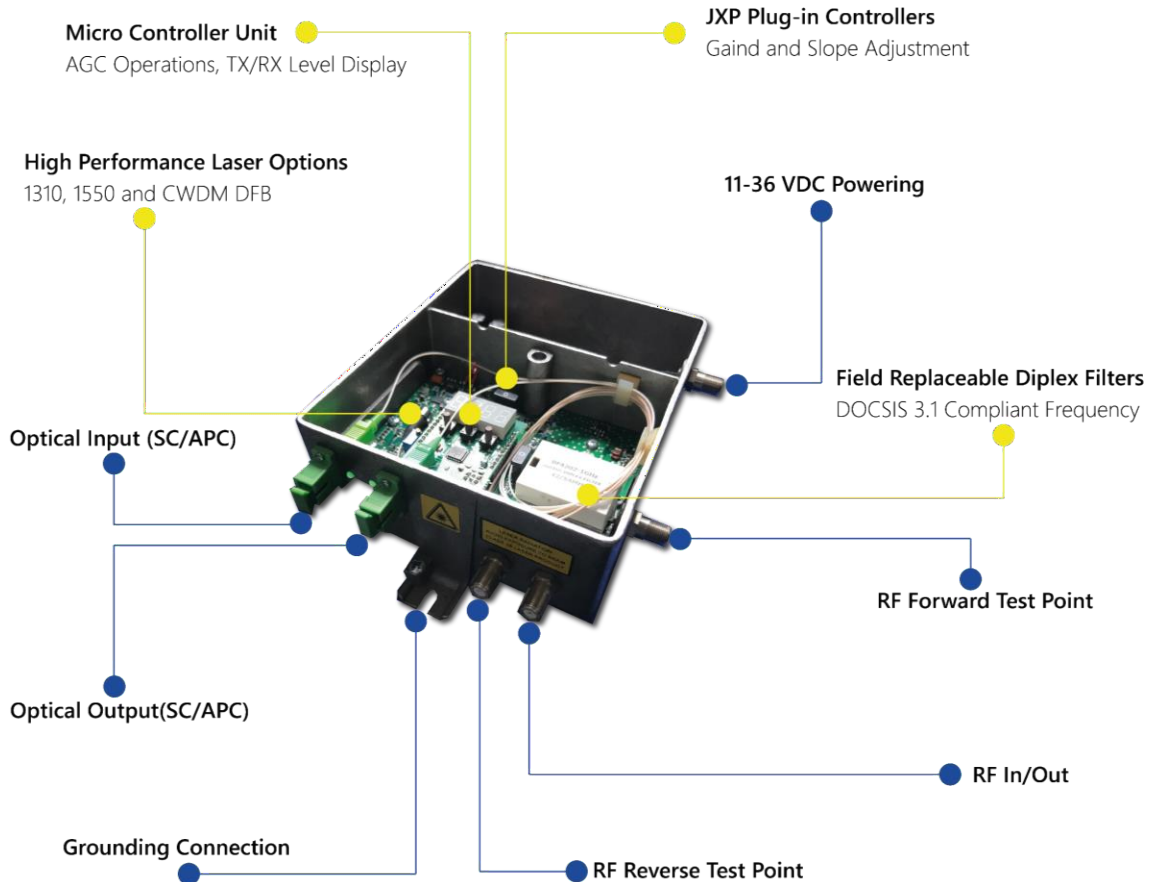
### General Features

Connectors	1 F type RF In/Out and 1 F Type Test Reverse 1 SC/APC Optical In and 1 SC/APC Optical Output
Surge Protection (in/Out)	IEEEC62.41 Cat.A3 (6kV,200A)
Powering	24 VDC with wall type external power supply
Power Consumption	8 Watt
Impedance	75 ohm
Operating Environment Temperature	-30...+55 C°
Housing	IP54 class protection, diecast housing
Weight	1,7 /3.7 (kg / lb)
Dimension	19,5 x 13,6 x 7,5 / 7-5/8 x 5-3/8 x 3 (cm / inch)

## BLOCK DIAGRAM



## INTERIOR DESIGN & CONNECTIONS



**NOTE TO SYSTEM INSTALLER**

This reminder is provided to call the System Installer's attention to Article 820-40 of the NEC that provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as practical.



**DANGER**  
**INVISIBLE LASER RADIATION! AVOID EYE INJURY!**  
**NEVER LOOK INTO THE OPTICAL CONNECTOR!**



**INSTALLATION AND GENERAL SETUP GUIDELINES**

- Mount the TIN40RD31 to mounting location to maintain a stable physical condition and operation.
- Test the optical input power on the system downstream cable with an optical power meter to verify that it is within the optical input range specification.
- Clean the optical connectors on the node and on the service cable then connect them together, matching the system downstream cable to the node receiver and the system upstream cable to the laser transmitter.
- Verify that the total upstream RF signal level is within the node's specified input range, then connect the coaxial cable to the node's RF In/Out F-port. Connect the system ground to the ground screw located directly below the output optical connector.
- Route all the cables (RF, fiber, power, ground) neatly around the node to make a tidy and safe installation.
- Lastly, apply power to the node and verify that the node's Optical LEDs illuminate.

**INSTALLATION PRECAUTIONS TABLE**

PRECAUTIONS	REQUIREMENT
Facilitate service and maintenance	Allow a minimum of 35 in. (90 cm) clearance in front of the equipment rack(s).
Avoid direct heating or air conditioning	If unavoidable, use deflector plates.
AC Power source outlets	Locate equipment near sufficient outlets to provide power for test equipment and power tools.
Moisture	Beware of dripping water onto equipment from leaky roofs, waveguide roof entries, and cold water pipe condensations.

## FORWARD PATH SET-UP

For optical levels monitoring and for forward path output level set-up refer to the “Controls and AGC Operation” section at page 5 of this manual.

1. Set the display to monitor optical input power (“O” parameter on the display). Verify that it is within your expectation and that it is within the node’s specified input range.
2. Plug an equalizer into the forward path mid stage socket. A 12dB equalizer will set the output to the specified slope, or use a value according to your system design.

While monitoring the forward output test point (-20dB) use the push button controls to set the output level in either fixed or AGC mode (“F” or “A” parameter on the display) for the proper output level. Verify that the level is correct at both ends of the bandwidth.

## REVERSE PATH SET-UP

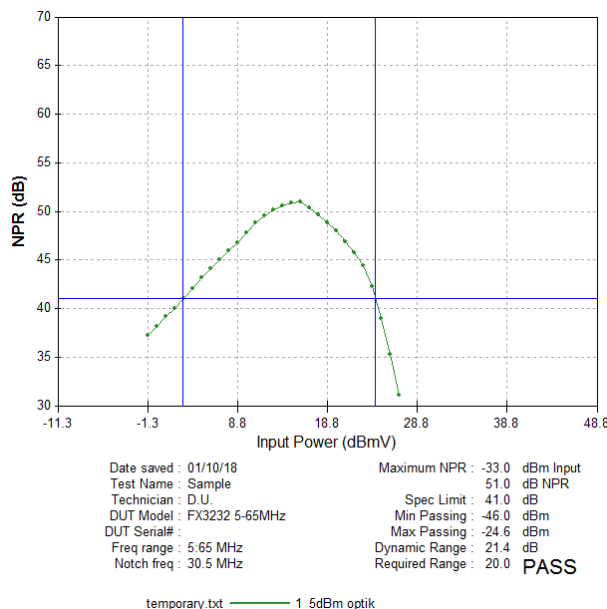
1. Set the display to “L” parameter to monitor laser output power. Check that the optical level is within node’s specified value, and that it is sufficient to operate over your link loss.
2. Figure. shows a typical NPR vs. Total RF input power curve of DFB lasers.

For an optimum operation total RF input level that is 2 to 4dB to the left of the peak on the NPR vs. Input Level curve (Fig 1 below) should be applied. This will preserve the total level from any clipping and keep it above thermal noise.

The following equation can be used for the calculation of total input power level:

Operating Point (dBmV) =  $10\text{Log}(10(S1/10) + 10(S2/10) + \dots + 10(Sn/10) )$ ; S1, Sn are the dBmV levels of each upstream service

While calculating total power level, please consider 20dB loss of the TP (test point) and adjust the level via the variable attenuator on the return path.



**Typical DFB Noise Power Ratio Curve  
(NPR)**

## CONTROLS AND AGC OPERATION

There are three push buttons that control the LED display to monitor the optical levels and to set the output level including AGC function. The middle button is the "ENTER" button.

### The display reads the following:

#### Optical Input Power "O" – Monitoring Only

The display will show optical input power in terms of dBm.

- Please see the below table (Table 1) for dBm to mW conversion.



#### Upstream Laser Output Power "L" - Monitoring Only

The display will show laser output power in terms of dBm.

- Please see the below table (Table 1) for dBm to mW conversion.



#### Fixed Forward Output Level Setting "F"

User can use fix required RF output level.

\*AGC is disabled at this at the setting.



#### AGC Forward Output Level Setting "A":

Enables AGC mode and stabilizes the fwd RF output level.

- Dot indication on the left shows that AGC is active



### Pressing "Enter" cycles through two menus:

First pressing enables to access optical monitoring menu; "F" and "A".

Second pressing enables to access output level adjustment menu; "L" and "O".

### Pressing Left and Right cycles through two menus:

On the output level adjustment menu; pressing left and right cycles between "F" and "A".

On the optical monitoring menu; pressing left and right cycles between "L" and "O".

dBm--> mW		mW--> dBm		dBm--> mW		mW--> dBm	
dBm	mW	mW	dBm	dBm	mW	mW	dBm
10	10	5	6,98	-1	0,79	2,25	3,52
9	7,94	4,75	6,76	-2	0,63	2	3,01
8	6,3	4,5	6,53	-3	0,5	1,75	2,43
7	5,01	4,25	6,28	-4	0,39	1,5	1,76
6	3,98	4	6,02	-5	0,31	1,25	0,96
5	3,16	3,75	5,74	-6	0,25	1	0
4	2,51	3,5	5,44	-7	0,19	0,75	-1,24
3	1,99	3,25	5,11	-8	0,15	0,5	-3,01
2	1,58	3	4,77	-9	0,12	0,25	-6,02
1	1,25	2,75	4,39	-10	0,1	0,2	-6,98
0	1	2,5	3,97	-11	0,07	0,15	-8,23

**dBm to mW conversion table**

## FORWARD OUTPUT LEVEL ADJUSTMENT

### Disable AGC and Adjust RF Output Level by Fix Mode – Mode "F"

To Access this menu, use the following steps;

Enter > Right Button > Enter

The AGC will be disabled. User can use + - buttons (left and right) to change the numeric value blinking on the display, which results in a change in RF output level in terms of 1 dB. In this mode, RF output level changes directly with optical input power.

After setting the RF output level, press E button to apply and save the setting.

### AGC Forward Output Mode "A"

To Access this menu, use the following steps;

Enter > Right Button x2 > Enter

AGC mode enables the AGC circuit and stabilizes the fwd RF output level over variations in input optical power. A dot is displayed to indicate that AGC is active. User can use + - buttons (left and right) to change the numeric value blinking on the display. The allowed variation in input optical power is dependent on the user AGC setting (refer to fig. below).

Valid setting range is dynamically calculated according to optical input power. Therefore, user can choose an A setting. In this mode, the device will preserve the RF output level independently from the changes in optical input power levels.

After setting the RF output level, press E button to apply and save the setting.

**Example:** A typical set up for 32/45 dBmV output level (with -1dBm optical at 3.5% OMI) will use a 12 dB equalizer and a A05 (with AGC ON) or F06 (with AGC OFF) setting. At A05 AGC setting, as it can be observed from Fig 1, this will compensate an optical input range from -6 to +4 dBm. This will lead to RF head room of 11 dB (16-5 = 11dB; '16' value is maximum A setting) and whereas this head room is 21 dB for below (5-(-16) = 21dB; -16 value is minimum A setting). If the optical power decreases to -6 dBm from -1dBm (5 dB reduction) then the RF output will also decrease by 10 dB (2x5=10 dB). Therefore, 11 dB head room is sufficient to be able to compensate 10 dB optical input variation. If the optical power increases to +4dBm (i.e. with 5dB increase) then the RF output will also increase by 10 dB (2x5 = 10dB), which stays in the 21 dB head room.

