CATV Indoor Optical Transceiver with AGC

TIN40-1000R is a high output two way indoor optical fiber node for CATV, SMATV, FTTx, MDU or private business applications.

TIN40-1000R has a wide optical input range from 1200 to 1600nm, making it ideal for either 1310nm and 1550nm systems.
Downstream section has an microprocessor controlled AGC tracking input optical level and maintains an high RF output level (37/50dBmV with 13dB tilt) over -8 to +4 dBm input level and 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

- Two way compatible and downstream bandwidth up to 1GHz,
- High RF output level (37/50dBmV) through GaAs-FET Push Pull technology,
- Extended optical input level range (-8dBm to 4dBm) for maximum flexibility,
- Built-in microprocessor controlled AGC tracks input optical level changes,
- Internal Digital optical TX/RX level display enables level monitoring without instrumentation,
- External TX/RX status monitoring LEDs,
- Tracking of optical input and output levels and displayed under lid cover, w/o any need of additional instrumentation,
- TBLE series style pad and equalizer control,
- 1310, 1550 and CWDM DFB laser options for return transmitter,
- Superior return transmitter NPR performance,
- Separate -20dB RF test ports for forward and reverse directions,
- Surge protection (6kV) at RF output,
- SCTE compliant F type connectors,
- Diecast aluminum housing for excellent heat dissipation and RFI shielding.

SPECIFICATIONS (Typical)

Typical, for T = 20ºC

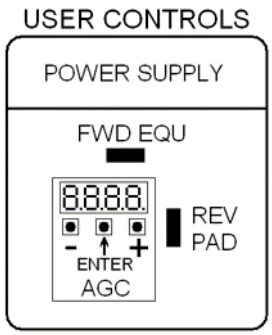
Parameter	Notes			Units
Forward				
Optical Performance				
Wavelength		1200 - 1600		nm
Input Optical Power	Max.Range	-8 to +4 (see Fig 2)		dBm
Test Point	Digital Display	-8 ... +4		dBm
Optical Indicator	Green LED	> -8		dBm
RF Performance				
Bandwidth	Plug-in Diplex Filters	54 - 1000 / 85 - 1000		MHz
Gain Tilt		0 ... 3		dB
Stability		± 1		dB
Return Loss		-16		dB
Test Point		-20		dB
Link Performance (-1 dBm optical input power, NTSC77 channel, OMI = %3,5)				
Output Level (Tilted)		35/48	37/50	dBmV
AGC Setting		A8	A10	
CNR		-51	-51	dBc
CSO		-64	-63	dBc
CTB		-64	-60	dBc
Return				
Optical Performance				
Wavelength		DFB, 1310		nm
Output Power		2mW		mW
Test Point	Digital Display	-8 ... +4		dBm
Optical Indicator	Green LED	> 0,25		mW
RF Performance				
Bandwidth	Plug-in Diplex Filters	5 - 42 / 5 - 65		MHz
Flatness		±1		dB
Input Level Control		Plug-in attenuator (TBLE)		
Return Loss		? -16		dB
Test Point		-20		dB
Link Performance (6dB link loss, 10 km fiber + optical attenuator)				
Optimum Total Input Level Range		18		dBmV tot
NPR Peak / Input Level	pls. refer to NPR	53 / 21		dB / dBmV tot
TX Input Level (@ NPR=-41dB)	chart	8 - 21		dBmV tot
TX Input Level (@ NPR=-38dB)		5 - 21		dBmV tot
Electrical & Physical Performance				
Impedance		75		ohm
Surge Withstand	In / Out	IEEEC62.41 Cat.A3(6kV,200A)		
Powering		with wall type external power supply (11-36Vdc)		
Power Consumption		8		Watt
Temperature		-30 to +55		°C
Enclosure		Aluminum diecast housing (IP54)		
Weight		1,7 /3.7		kg / lb
Dimensions		19,5 x 13,6 x 7,5 / 7-5/8 x 5-3/8 x 3		cm / inch

Block Diagram

NOTE TO CATV SYSTEM INSTALLER

This reminder is provided to call the CATV 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.

INSTALLATION AND GENERAL SETUP GUIDELINES



1. Mount the TIN40-1000R to mounting panel to maintain a stable physical condition and operation.
2. 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.
3. 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.
4. 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.
5. Route all the cables (RF, fiber, power, ground) neatly around the node to make a tidy and safe installation.
6. 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.
Rack support	Make certain rack supports are sufficiently rigid to support rack(s).
Building leakage	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. Fig.1. shows a typical NPR vs. Total RF input power curve of DFB lasers.

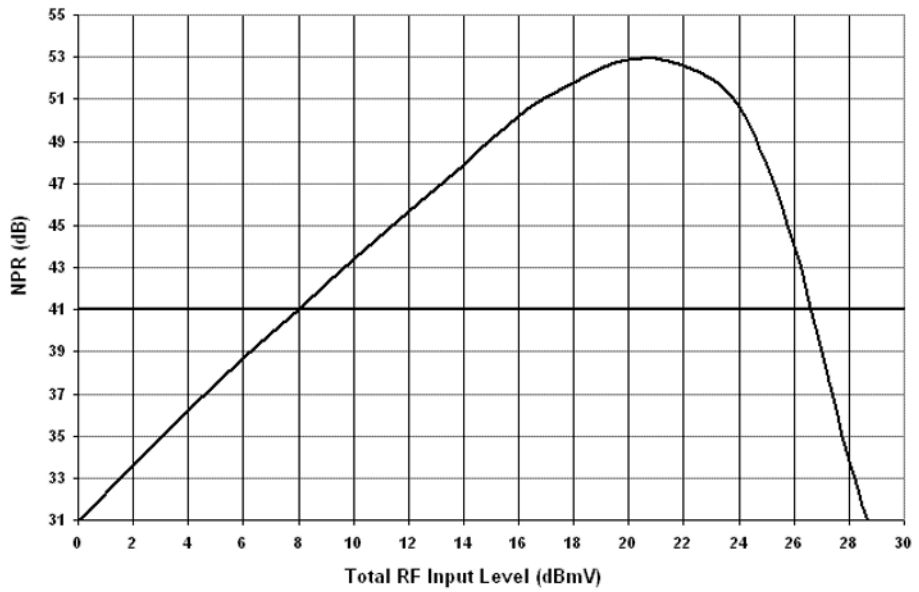
For an optimum operation total RF input level that is 2 to 4dB to the left of the peak on the NPR vs. Input Level curve (Fig 1 below) should be applied. This will preserve the total level from any clipping and keep it above thermal noise.

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

Operating Point (dBmV) = $10\text{Log}(10^{(S1/10)} + 10^{(S2/10)} + \ldots + 10^{(Sn/10)})$; 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 reverse path (upstream) JXP pads attenuation value (which is 0 dB as factory default)

Figure- 1 Typical DFB Noise Power Ratio Curve



CONTROLS AND AGC OPERATION

There are three push buttons that control the LED display to monitör 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 cyles between "F" and "A".
- On the optical monitoring menu; pressing left and right cyles 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

Table 1 – 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 2 on page 6).

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 +4.0dBm. 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.

Fig. 2 - AGC Setting and Input Optical Power