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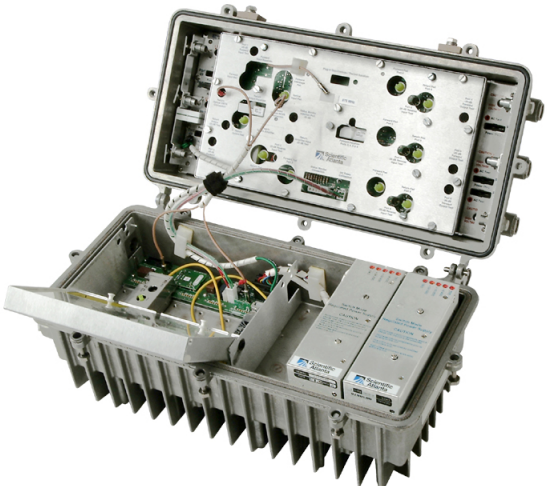
Optoelectronics

Model 6940 Four Port Optoelectronic Node 870 MHz with 42/54 MHz Split

Description

The Model 6940 Node is a high performance, four output optoelectronic node. The Model 6940 Node can be configured with a variety of forward optical receivers and reverse optical transmitters, providing flexibility for use in multiple applications.



Redundant optical receiver and transmitter capability allows optical path redundancy, enabling increased network reliability. Additionally, the Model 6940 Node is capable of reverse port segmentation using the Prisma® bdr ™ system. The bdr system utilizes Scientific-Atlanta's unique baseband digital reverse technology and allows increased performance, reach, and bandwidth efficiency for the critical reverse network.

The Model 6940 Node's housing incorporates many features that enhance ease of use and reliability, such as a separate AC powering port, optional redundant power supply, and extended ports to allow for easy heat shrink weather protection.

The Model 6940 Node can also be configured with a Scientific-Atlanta status monitoring transponder. The transponder, in conjunction with the ROSA® / TNCS or other compatible element management system, enables remote monitoring of critical node related parameters, and remote control of each optional reverse path switch for ingress troubleshooting.

Features

- 1 GHz RF platform
- 15 amperes continuous power passing
- Four high level forward RF outputs
- Screwless seizures for ease of connector installation
- 40-90 V AC high-efficiency switch mode power supply
- Optional power supply redundancy
- Local test points and LED indicators on optical receivers and transmitters simplify installation and maintenance
- Optional status monitoring and control (status monitoring transponder and TNCS or other compatible element management system required)
- Plug-in pads provide individual level control for each port for forward and reverse paths
- Optional 3-state reverse switch (on/off/-6 dB) allows each reverse input to be isolated for noise and ingress troubleshooting (status monitoring transponder and ROSA / TNCS required)
- Fiber management tray provides convenient fiber and connector storage for up to 6 connector pairs
- 1310 nm analog reverse transmitters with either Fabry-Perot or DFB lasers
- Supports Baseband Digital Reverse technology, allowing reverse path segmentation

Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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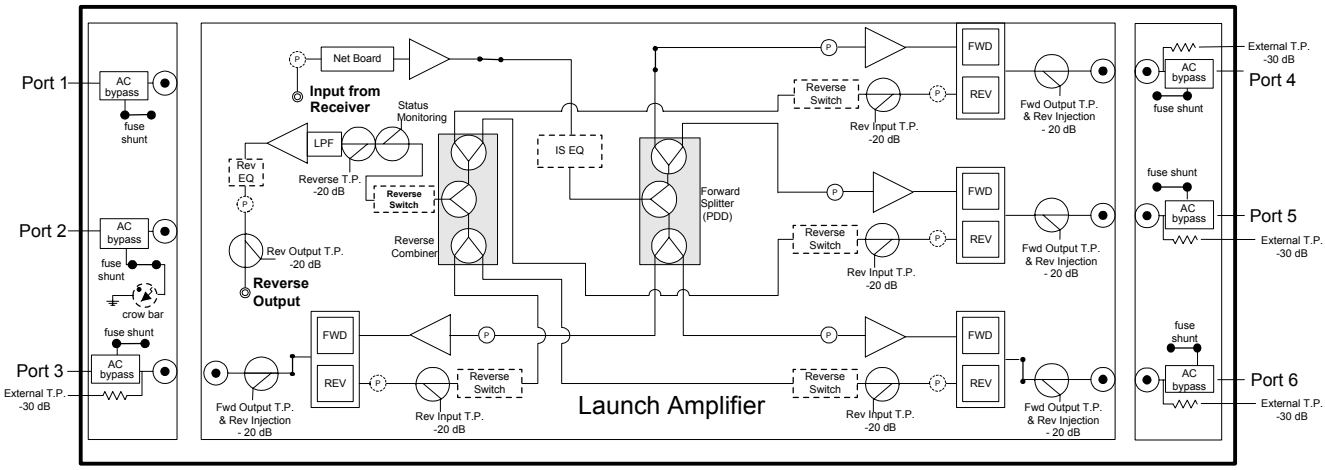
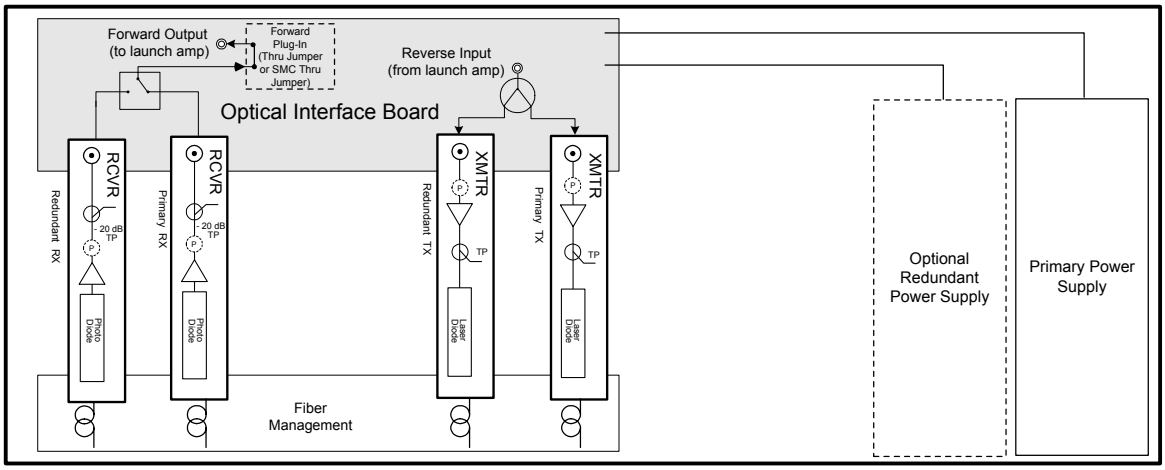
Block Diagram



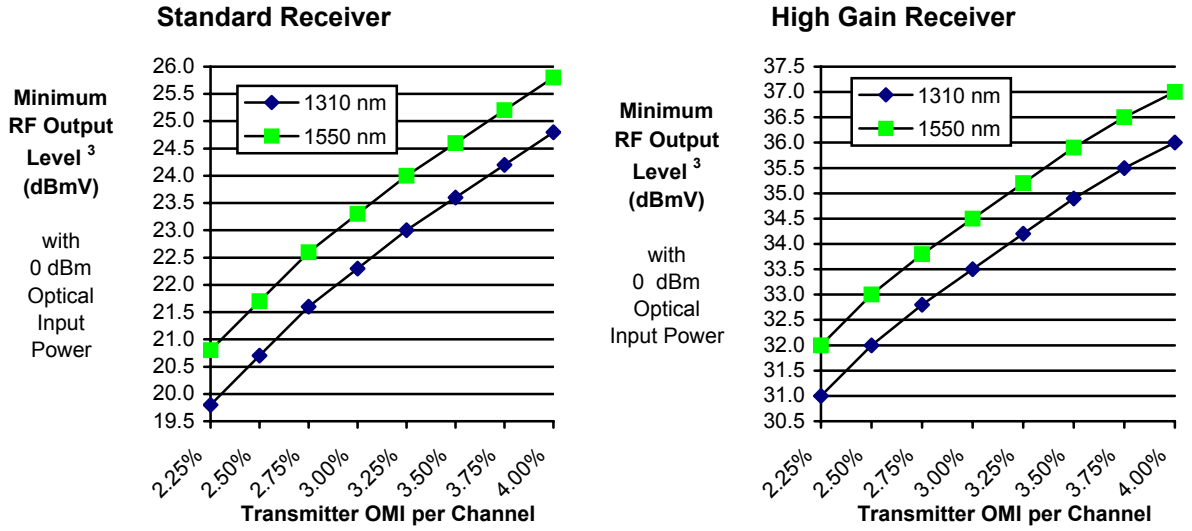


Model 6940 Optoelectronic Node - 5-42/54-870 MHz

Optical Section Specifications

Optical Section - Forward Receiver (RX) Module	Units	Standard RX	High Gain RX	Notes
Wavelength	nm	1310 and 1550	1310 and 1550	
Optical Input Range	dBm	-3 to +2.0	-3.0 to +1.0	
Pass Band	MHz	52-870	52-870	
Frequency Response	dB	± 0.75	± 0.75	1
Tilt (±1.5 dB)	dB	0	0	
Optical Input Test Point (± 20 %)	V DC	1V / mW	1V / mW	2
RF Output Test Point (± 1.0 dB)	dB	- 20	- 20	
RF Output Level	dBmv	See Chart Below	See Chart Below	3

Receiver RF Output Level Vs Transmitter OMI



Notes for Optical Section Specifications:

1. For forward receiver module only. Does not include frequency response contributions from forward optical transmitter.
2. Referenced to optical input power in milliwatts at 1310 nm.
3. Minimum receiver RF output level for the stated transmitter percent Optical Modulation Index (OMI) per channel, with receiver optical input power of 0 dBm. To determine RF output levels at other optical input power, add (or subtract) 2 dB in RF level for each 1 dB increase (or decrease) in receiver optical input power.

For reverse optical transmitter and link performance, see the "Analog Reverse Optical Transmitters for Model 6940/6944 and GainMaker® Optoelectronic Stations" data sheet or the "Model 6940/44 bdr Digital Reverse" data sheet(s).

Unless otherwise noted, the above specifications reflect typical station performance at stated reference levels in the recommended Operating configuration (s). Unless otherwise noted, specifications are based on measurements made in accordance with NCTA Recommended Practices for Measurements on Cable Television Systems using standard frequency assignments and are referenced to 68°F (20°C).

Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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RF Section Specifications

General Station Performance	Units	Forward	Reverse	Notes
Passband	MHz	54-870	5-42	
Amplifier Type	- -	PHD	Push-Pull	
Return Loss	dB	16	16	
Hum Modulation @ 12A	dB	65	65	
Hum Modulation @ 15A	dB dB	65 (54-750 MHz) 60 (751-870 MHz)	65	
Internal RF Test Points (± 1 dB)	dB	-20	-20	
External RF Test Points (± 1.5 dB)	dB	-30	-30	

Launch Amplifier Performance - Forward		Units	Forward	Notes
Operational Gain (minimum)		dB	26	4
Frequency Response		dB	± 0.5	
Internal Tilt (±1.0 dB)		dB	9.5	1,3
Noise Figure @	870 MHz 750 MHz 650 MHz 550 MHz 54 MHz	dB	11 11.5 12.5 13.5 18.5	2
Reference Output Levels @…	870 MHz 750 MHz 650 MHz 550 MHz 55 MHz	dBmV	47.5 45.7 44 42.7 35	
Reference Output Tilt (55-870 MHz)		dB	12.5	1,5
78 NTSC Channels (CW) with digital				12
Composite Triple Beat		dB	73	6
Cross Modulation		dB	72	6
Composite Second Order (high side)		dB	73	6
94 NTSC Channels (CW) with digital				13
Composite Triple Beat		dB	69	6
Cross Modulation		dB	67	6
Composite Second Order (high side)		dB	71	6
110 NTSC Channels (CW) with digital				14
Composite Triple Beat		dB	64	6
Cross Modulation		dB	63	6
Composite Second Order (high side)		dB	68	6

Forward Insertion Loss **Optical Interface Board and Plug-Ins** (Loss from optical receiver RF output to launch amplifier RF input)	Units	With Standard Thru Jumper Board Installed	With Status Monitoring (SMC) Thru Jumper Board Installed	Notes
Receiver position 1 and 2	dB	1.5	2.7	15

Unless otherwise noted, the above specifications reflect typical station performance at stated reference levels in the recommended Operating configuration (s). Unless otherwise noted, specifications are based on measurements made in accordance with NCTA Recommended Practices for Measurements on Cable Television Systems using standard frequency assignments and are referenced to 68°F (20°C).

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RF Section Specifications, continued

Launch Amplifier Performance - Reverse	Units	6940 Reverse	Notes
Operational Gain (minimum)	dB	18	8,10
Frequency Response	dB	± 0.5	10
Noise Figure	dB	14	9,10
Reference Output Levels @ 5 and 42 MHz	dBmV	35	7,10
6 NTSC Channels (CW)			
Composite Triple Beat	dB	78	10
Cross Modulation	dB	71	10
Composite Second Order	dB	73	10

Station Performance - Reverse (Station port input to optical transmitter input)	Units		Notes
Amplifier Type	- -	Push Pull	
Operational Gain (minimum)	dB	14	11

Station Delay Characteristics			
Forward (Chrominance to Luminance Delay)		**Reverse** (Group Delay in 1.5 MHz BW)	
Frequency (MHz)	**Delay (nS)**	**Frequency (MHz)**	**Delay (ns)**
55.25 - 58.83	16	5.0 - 6.5	39
61.25 - 64.83	8	6.5 - 8.0	17
67.25 - 70.83	5	8.0 - 9.5	8
		37.5 - 39.0	15
		39.0 - 40.5	19
		40.5 - 42.0	27

Notes for RF Section Specifications:

1. Reference output tilt and internal tilt are both “Linear” tilt.
2. Launch amplifier forward noise figure with 1 dB input pad and 0 dB interstage equalizer (ISEQ).
3. Forward internal tilt specified with factory installed 0 dB ISEQ.
4. Launch amplifier forward gain from RF input to station output port, with 1 dB input pad and 0 dB ISEQ. The 1 dB input pad simulates the loss of an ISEQ with value greater than 0 dB, which is typically field installed to achieve desired output tilt.
5. The forward reference output tilt specified is achieved via the field installation of appropriate ISEQ, in conjunction with the internal tilt of the launch amplifier and the tilt associated with the optical link (transmitter/receiver combination).
6. Station performance can be determined by combining optic performance and launch amplifier performance. Stated distortion performance is for launch amplifier section operated at reference output levels and tilt.
7. Reverse output reference level at reverse output of RF launch amplifier.
8. Launch amplifier reverse gain from station reverse input(s) to launch amplifier RF output, with 0 dB reverse input pad, 0 dB reverse output pad, and 0 dB reverse EQ.
9. Reverse noise figure at station input with 0 dB reverse input pad, 0 dB reverse output pad and 0 dB reverse EQ.
10. All reverse specifications are with reverse switch installed.
11. Station reverse gain from station input(s) to reverse transmitter input. With 0 dB reverse input pad, 0 dB reverse output pad, and 0 dB reverse EQ in launch amplifier. Includes optical interface board losses.
12. “Digital” refers to 550-870 MHz loading with 52 QAM carriers at –6 dB relative to analog video carrier levels.
13. “Digital” refers to 650-870 MHz loading with 35 QAM carriers at –6 dB relative to analog video carrier levels.
14. “Digital” refers to 750-870 MHz loading with 19 QAM carriers at –6 dB relative to analog video carrier levels.
15. Subtract this loss from the launch amplifier forward operational gain to determine forward station gain (gain from optical receiver output to station output).

Unless otherwise noted, the above specifications reflect typical station performance at stated reference levels in the recommended Operating configuration (s). Unless otherwise noted, specifications are based on measurements made in accordance with NCTA Recommended Practices for Measurements on Cable Television Systems using standard frequency assignments and are referenced to 68°F (20°C).

Model 6940 Optoelectronic Node - 5-42/54-870 MHz

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Specifications

Electrical	**Units**				**Notes**
Max. AC Through Current (continuous)	Amps	15			
Max. AC Through Current (surge)	Amps	25			
Component DC Power Consumption (typical)		**@ +24 V DC**	**@ +15 V DC**	**@ -6 V DC**	1
Launch Amplifier with 5 PHD hybrids	Amps	2.4	-	-	
Optical Interface Board	Amps	0.22	-	-	
6940/44 Status Monitoring Transponder	Amps	0.15	-	-	
6940/44 Standard Optical Receiver	Amps	0.25	0.01	0.035	
6940/44 High Gain Optical Receiver	Amps	0.35	0.01	0.035	
6940/44 Optical Transmitter-Standard Gain FP	Amps	0.14	-	0.07	
6940/44 Optical Transmitter-Standard Gain DFB	Amps	0.14	-	0.09	
6940/44 Reverse Switch	Amps	0.02	-	-	
Power Supply DC Current Rating	Amps	4.5	0.5	1.5	1
Power Supply Operating Efficiency	%	85			
AC Input Low Voltage Cutoff	V AC	33			
Minimum Restart Voltage	V AC	41			

Station Powering Data												
6940 Station	**I_{DC} (Amps at 24 V DC)**		**AC Voltage**									
			90	**85**	**80**	**75**	**70**	**65**	**60**	**55**	**50**	**45**	**41**
1 Std Receiver & 1 DFB or FP Transmitter	3.16	AC Current (A)	1.3	1.4	1.4	1.4	1.4	1.5	1.7	1.8	1.9	2.1	2.4
		Power (W)	91	91	90	90	90	90	90	90	91	91	92
2 Std Receivers & 2 DFB or FP Transmitters	3.55	AC Current (A)	1.4	1.5	1.5	1.5	1.6	1.7	1.9	2.0	2.2	2.4	2.7
		Power (W)	103	103	102	102	102	102	102	102	103	103	104

Data is based on stations configured for 2-way operation with status monitor transponder. AC currents specified are based on measurements made with typical CATV type ferro-resonant AC power supply (quasi-square wave), and standard version DC power supply (pn 590902).

Note:
1. The total DC power consumption of installed components should not exceed the power supply DC current rating.

Environmental	**Units**	
Operating Temperature Range	degrees	-40°F to 140°F (-40°C to 60°C)
Relative Humidity Range	percent	5% to 95%

Mechanical	
Housing Dimensions	**Weight**
20.2 in. L x 10.8 in. H x 10.8 in. D (51.3 cm L x 27.4 cm H x 27.4 cm D)	Station with 1 RX, 1 TX, 2 power supplies: 37 lbs (16.8 kg)

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Ordering Information

The ***Prisma® Node Ordering Matrix*** provides ordering information for configured nodes. This page contains ordering information for required and optional accessories that may not be included as part of a configured node. Please consult with Sales or Access Networks Applications Engineering to determine the best configuration for your particular need.

*The following **Required Accessories** must be ordered separately (not included via Prisma Node Ordering Matrix):*

Required Accessories for Model 6940 Node	Part Number
Plug-in Pads (attenuators) • 1 required per Forward Fiber Optic Receiver Output • 1 required per each Reverse RF Input used • 1 required per Reverse Fiber Optic Transmitter	See Pad (attenuator) part number table
Plug-in Forward Equalizer - Available in 1.5 dB steps from 0 to 15 dB at 870 MHz • 1 required	See EQ/Inverse EQ part number table

*The following **Optional Accessories** may be ordered separately:*

Optical Transmitters, Receivers and Related Parts Note: Transmitters and Receivers include coax cable for connection to launch amplifier	Part Number
6940/44 - Standard Optical Receiver with SC/APC connector	590922
6940/44 - Standard Optical Receiver with SC/UPC connector	590923
6940/44 - High Gain Optical Receiver with SC/APC connector *	590926
6940/44 - High Gain Optical Receiver with SC/UPC connector *	590927
6940 - 1310 nm FP Optical Transmitter -Standard Gain, with SC/APC connector	590930
6940 - 1310 nm FP Optical Transmitter -Standard Gain, with SC/UPC connector	590931
6940 - 1310 nm DFB Optical Transmitter -Standard Gain, with SC/APC connector	590934
6940 - 1310 nm DFB Optical Transmitter -Standard Gain, with SC/UPC connector	590935
6940 - 1550 nm DFB Optical Transmitter -Standard Gain, with SC/APC connector	4005116
6940 - 1550 nm DFB Optical Transmitter -Standard Gain, with SC/UPC connector	4005118
SC/APC (green) Bulkhead Mating Adaptor (mounts in fiber handling tray), (qty 10)	4006328
SC/UPC (blue) Bulkhead Mating Adaptor (mounts in fiber handling tray), (qty 10)	4006329
Plug-In Modules for 6940 870 MHz Node Optical Interface Board	
Standard Thru Jumper	717946
SMC Thru Jumper (same as above but includes coupler for status monitoring RF)	590955
Plug-In Modules for Launch Amplifier	
6940/44 – Reverse Switch (one may be ordered for each reverse input port or common path)	590956
Related Equipment	
6940/44 – Standard DC Power Supply 40 - 90 V AC	590902
6940/44 – Crowbar Surge Protector (qty. 10)	4007717
Redundant Control Module - Required for redundant optical receiver operation when Status Monitoring Transponder is *not* used	741509
Status Monitoring Transponder	See Transponder Data Sheet
75 Ohm Transmitter Terminator (used when no TX in redundant slot)	591133
75 Ohm SMB Terminator (for female SMB connector termination)	591134
SMB to F Test Cable Assembly	590961
6940/44 – RF Test Probe	562580

* Standard gain receiver is recommended.

Ordering Information, continued

Equalizers / Inverse Equalizers

870 MHz Linear Forward Equalizers	Part Number
0 dB (jumper)	717929
1.5 dB	590986
3.0 dB	590987
4.5 dB	590988
6.0 dB	590989
7.5 dB	590990
9.0 dB	590991
10.5 dB	590992
12.0 dB	590993
13.5 dB	590994
15.0 dB	590995

870 MHz Inverse Equalizers	Part Number
1.5 dB	591010
3.0 dB	591011
4.5 dB	591012
6.0 dB	591013
7.5 dB	591014
9.0 dB	591015
10.5 dB	591016

42 MHz Reverse Equalizers	Part Number
0 dB (jumper)	591056
1.5 dB	591057
3.0 dB	591058
4.5 dB	591059
6.0 dB	591060
7.5 dB	591061
9.0 dB	591062
10.5 dB	591063
12.0 dB	591064

Pads (attenuators)

Pad Value (dB)	Part Number	Pad Value (dB)	Part Number
0	279500	0.5	565231
1	279501	1.5	565232
2	279502	2.5	565233
3	279503	3.5	565234
4	279504	4.5	565235
5	279505	5.5	565236
6	279506	6.5	565237
7	279507	7.5	565238
8	279508	8.5	565239
9	279509	9.5	565240
10	279510	10.5	565241
11	279511	11.5	565242
12	279512	12.5	565243
13	279513	13.5	565244
14	504151	14.5	565245
15	504152	15.5	565246
16	504153	16.5	565247
17	504154	17.5	565248
18	504155	18.5	565249
19	504156	19.5	565250
20	504157	20.5	565251
75 ohm terminator	279524		

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