

## Product Specification

### R9100PR UltraSpan™ Counter Propagating Raman 700mW

PN: FOA-R9100PR-RBW3C-AA004

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Customer: General

### Product Features

- Fully controlled counter-propagating Raman  
– AGC, max power modes
- Accurate Raman gain measurement
- Up to 15 dB average gain for G.652 fiber
- Pump Power up to 700mW
- Optimized Gain flattening for all fiber types
- Remote software maintenance and upgrade
- SNMP v2 or v3 and Web-based GUI
- Class 1M\* laser safety classification
- 1RU rack-mountable packaging



### Applications

- Long repeaterless links or spans
- Island hopping, desert ranges and oil rigs
- Storage area networks (SANs), remote locations, disaster recovery
- 100 Gb/s and 40 Gb/s transmission and/or increasing channel count to 80+ WDM channels

The UltraSpan™ Counter Propagating Raman contains an FPGA and micro processor-controlled Raman pump for C-band or L-band distributed Raman amplification. The unit includes up to three pump laser diodes at different wavelengths and/or polarizations, and features multiple independent automatic power reduction (APR) laser safety mechanisms. This allows both the Raman amplifier itself and the network within which it is installed to be classified as class 1M\* with respect to laser safety (according to IEC 60825, and CDRH 21 CFR §1040.10), and also protects optical and electronic gear deployed along the lines. The same mechanisms are also used for alerting system management upon line deterioration and reduction in the Raman distributed gain.

In addition to the pump module the Raman includes redundant user replaceable 48V DC power supplies and cooling fans, as well as a communication module supporting SNMP and a web based GUI through a standard Ethernet RJ45 connector.

## Optical Specification

Specification		Unit	Min.	Typ.	Max.	Notes
Signal Wavelength range		nm	1529		1564	
Composite pump power		mW	680	690	710	Up to 850mW is available upon request
Expected Gain	SMF	dB		14.5		
	Leaf	dB		17.5		
	True Wave	dB		20		
	TerraLight	dB		19		
	G653	dB		22		
Effective NF for G.652		dB		-0.5		
OSC wavelength range		nm	1500	1510	1520	
OSC Bitrate		Mb/s	100		160	Other bit-rates available upon request
OSC gain, G.652		dB		10		
Number Of Channels			1		88	
Signal Input Power Range Pump Off (composite)		dBm	-44		+5	
OSC Modulated Input Power Range Pump Off (composite)		dBm	-38		-13	For 100-160Mb/s OSC.
OSC Modulation detection accuracy		dB		+/-1		
OSC band power detection range		dBm	-50		-8	
Maximum Input power Without Damage		dBm			22	
Gain Flatness versus Wavelength, G.652		dB			1.2	
Signal insertion loss		dB		1.5	1.8	
OSC insertion loss		dB		1.5	1.8	
Output monitor insertion loss		dB	20		25	
C band isolation at OSC Port		dB	12			
OSC isolation at terminal port		dB	30			
PDL		dB			0.15	
PDG		dB			0.3	
PMD		ps			0.2	
Average gain over time		dBpp			0.5	
RIN (any pump)		dB/Hz			-110	
Return loss		dB	40			

## Electrical Specification

Parameter	Unit	Min.	Typ.	Max.
Supply Voltage	V	-76		-36
Power Consumption	W			55
Supply Current @48V Supply	A			1.5

## Optical Connections

The Raman is equipped with 3 Optical ports, as described in the table below (Optical connectors: E2000 for Line port and LC/UPC for other ports):

Port	Description
Line	This port has an E2000 high power connector. Pump power is launched through this connector into the optical transmission line. The signal enters the Raman amplifier from the transmission line through this port.
Output	The signal and OSC exits the Raman amplifier through this port.
Monitor	Used to monitor the signal exiting from the output port (1% tap)

## APR Detection Mechanisms

There are three different APR detection criteria. These criteria are used either independently or collectively to detect various scenarios, which indicate a potential safety hazard and consequently result in APR activation. The criteria can also be used to detect and alert system management with regard to deterioration of the transmission line, and/or situation which could lead to reduction in the Raman gain.

The APR criteria are:

1. **Pump power back-reflection:** The pump back reflection entering the Raman from the line port is continuously monitored and compared to the output pump power. Changes in the back reflection level indicate an open connector in the system and can trigger an APR event. Shut down threshold default value is 22dB and can be configured between -22dB and -28dB.
2. **Optical Supervisory Channel (OSC):** This mechanism continuously monitors the presence of the OSC signal. Absence of the signal indicates an open connector or fiber break. If modulated OSC signal (1500-1520nm) power is < -38dBm the amplifier shuts down.
3. **Amplified Spontaneous Emission (ASE) in the short band:** This mechanism continuously monitors the ASE in the short band (1500-1520nm in case of a C-Band amplifier) entering the Raman from the line port. Changes in ASE indicate an open or degraded line (high loss points). If optical power in OSC band (1500-1520nm) is 2dB lower than value anticipated for the given fiber type, the amplifier shuts down.

## Automatic Return from Shut Down Caused by APR

Two possible scenarios can automatically restart the Raman:

1. When Raman detects CW power in OSC band > -46dBm. Once pumps are turned on, OSC is amplified via the Raman process to > -36dBm, then APR criteria depends on the OSC modulated power (< -38dBm). SD/RS hysteresis in this case is >2dB.
2. When C-band power is > -42dBm. SD/RS hysteresis in this case is 1dB.

In both cases if Raman turns “ON” and one of the reasons for APR still exists, Raman will shut down within 150msec.

## Example GUI

A typical Raman GUI snapshot can be seen in the figure below. The easy to use GUI is web-based and can be accessed using internet explorer by simply entering the IP address of the Raman unit.

The screenshot displays the Raman GUI interface with the following sections:

- Navigation:** Main, SNMP Management, Pumps Pwr Chart, OSC Band Pwr Chart, Back Reflection Pwr Chart.
- EMS Agent:** V3.13.00 (Apr 06 2010 21:01:34)
- Configuration:**
  - Operating mode: Max Power
  - W1 Manual Power Set (mW): 50.0
  - W2 Manual Power Set (mW): 50.0
  - Manual Gain Set (dB): 5.0
  - Line Fiber Type: SMF
  - Pumps Shutdown Switches:
    - Input Loss: Enabled
    - High Temp: Enabled
    - High Back Reflection: Enabled
    - OSC Loss: Enabled
    - OSC Band Drop: Enabled
  - Change Password button
  - High Back Reflection Threshold (dB): -20
  - OSC Band Threshold (dB): 2.0
  - ARP Time (sec): 10
- Status:**
  - Status: OK
  - Fans Status: OK
  - Internal Power Supply Status: OK
  - Pumps Status: Active
  - OSC Status: Exists
  - 1U Temp (°C): 25.0
  - Internal Module Temp (°C): 27.0
  - Pump #1 Temp (°C): 25.1
  - Pump #2 Temp (°C): 24.9
  - Pump #3 Temp (°C): 24.9
  - Gain (dB): N/A
  - Input Power (dBm): -0.0
  - Pumps power (dBm): 29.0
  - OSC Band Power (dBm): -20.0
  - OSC Power (dBm): 1.8
  - Back Reflection Power (dBm): -1.6
  - Back Reflection Ratio (dB): 14.0
  - Power W1 (dBm): 25.5
  - Power W2 (dBm): 23.3
  - Currents #1, #3 (mA): 654, 612
  - Current #2 (mA): 882
- Alarms:**
  - Pumps On: Green
  - OSC Band Loss: Green
  - High Back Reflection: Green
  - OSC Loss: Green
  - Input Loss: Green
  - Internal Power Supply: Green
  - Ext. Power Supply A: Red
  - Ext. Power Supply B: Green
  - ARP pause: Green
- NIR Production Parameters:**
  - SwVer: 204.51
  - Date: 08/17/2010
  - HwRev: C
  - SN: 31217
  - FwVer: 4
- 24 Hours History:**
  - Pumps Off: 0
  - OSC Band Loss: 0
  - High Back Reflection: 0
- Local Terminal Status:**
  - Restart In: OFF
  - Shutdown In: OFF
- Communication:** Connected
- Sample:** Automatic, Refresh, Interval: 2

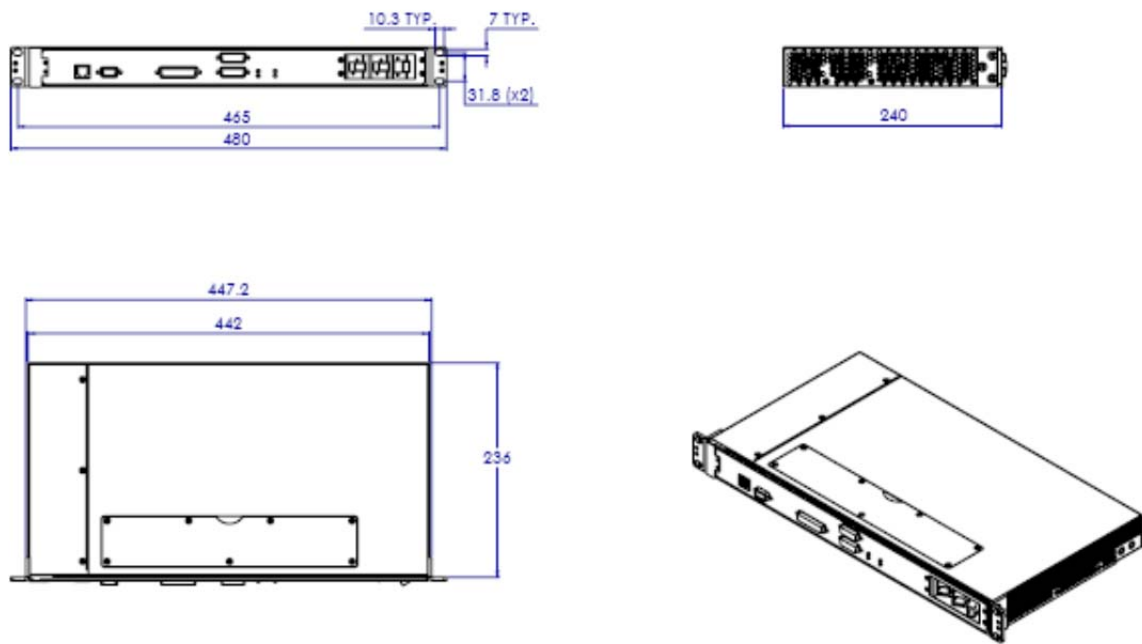
## Modes of Operation and Pump Monitoring Information

The pumps operating mode is set using the parameter “Operating mode” in the GUI. The possible values for this parameter are “Max pump power mode”, “Manual pump power set” or “Gain Setting”. When the pumps operating mode is set to “Gain setting”, the required gain is set using the parameter “Manual Gain Set” in the GUI. When the pumps operating mode is set to “Manual power set”, the pump power can be set using the parameters “W1 Power” and “W2 Power”, where the former controls the power of the higher wavelength pump and the latter controls the power of the lower wavelength pump.

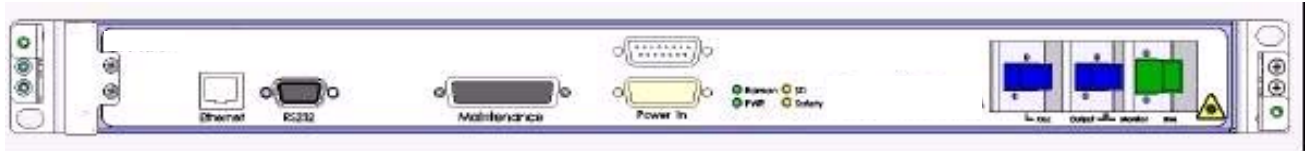
Various pump's monitoring information (status, output power, temperature and current) can be viewed in the “Status” window on the GUI.

## Mechanical Specifications (19")

The following drawing shows the Raman's width, height and length dimensions.



Front Panel Connectors are described in the drawing below:



## Environmental and Qualification

Parameter	Value/Range
Operating Temperature	-5°C to +55 °C
Operating Humidity	5 to 85%
Storage Temperature	-40°C to +85°C
Storage Humidity	5 to 95%
Qualification	ETSI, NEBS Level 3
Laser safety	Class 1M*

\* Class 1M products are not hazardous under normal circumstances, but may pose an eye hazard when the laser output is viewed with certain optical instruments (for example eye loupes, magnifiers and microscopes) within a distance of 100 mm

**Ordering Information:**



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Email orders to: [sales@xsoptix.com](mailto:sales@xsoptix.com)  
 Fax orders to: 800-878-7282