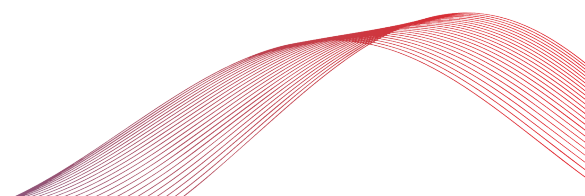




# OVA Optical Attenuator

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User Manual



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# 1

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## **COMPLIANCE**

### ***FDA-CDRH Compliance***

Under the US Food and Drug Administration (FDA) Center for Devices and Radiological Health (CDRH), the unit complies with the Code of Federal Regulations (CFR), Title 21, Subchapter J, which pertains to laser safety and labeling. See following link for more information:

- <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPartFrom=1000&CFRPartTo=1050>

### ***CSA / IEC Compliance***

The unit complies with certain standards of the Canadian Standards Association (CSA) and the International Electrotechnical Commission (IEC).

The unit falls in the Installation Category (Overvoltage Category) II under IEC 664. IEC 664 relates to impulse voltage levels and insulation coordination. The category is defined as: local level, appliances, portable equipment, etc., with smaller transient overvoltages than Installation Category (Overvoltage Category) III.

The unit falls in the Pollution Degree 2 category under IEC 1010-1 and CAN/CSA-C22.2 No. 1010.1. The IEC standard on Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use relates to insulation coordination. The CSA standard is on Safety Requirements for Electrical Equipment for Measurement Control, and Laboratory Use, Part I: General Requirements. The Pollution Degree 2 category is defined as follows: “Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.”

### ***CE Compliance***

Electronic test equipment is subject to the EMC Directive in the European Union. The EN61326 standard prescribes both emission and immunity requirements for laboratory, measurement, and control equipment. This unit has undergone extensive testing according to the European Union Directive and Standards.

# 2

## GENERAL INFORMATION

### *OVA Optical Attenuator Overview*

The OVA Optical Attenuator (Figure 1) enables precise optical power control and features high accuracy and superior repeatability. It is ideal for lab and production applications including power level adjustment in automated test systems, BER testing of transmitters and receivers, and channel equalization in WDM systems.

The OVA Optical Attenuator is available for single-mode and multimode fibers and can be configured for various wavelength ranges and input power levels.



Figure 1: OVA Optical Attenuator

### *Applications*

- Bit error rate (BER) testing
- Link loss simulation

### *Key Features*

- 100 dB dynamic range
- $\pm 0.1$  dB accuracy
- $\pm 0.01$  dB repeatability
- Customizable

- Touchscreen display
- USB/Ethernet control

***Included Accessories***

- USB A to USB B cable (1.8m)
- Ethernet cable (1.8m)
- AC power cord (2m)



# 3

## SAFETY INFORMATION




To avoid situations that could result in serious injuries or death, always observe the following precautions.

The safety instructions must be observed whenever the unit is operated, serviced, or repaired. Failure to comply with any of these instructions or with any precaution or warning contained in the user manual is in direct violation of the standards of design, manufacturing, and intended use of the unit. Santec Inc. assumes no liability for the customer’s failure to comply with any of these safety requirements.

### ***Safety Markings on the Unit***

See Table 1 for symbols and messages that can be marked on the unit. Observe all safety instructions that are associated with a symbol.

**Table 1: Safety symbols**

	<p>Laser radiation may be present. Refer to the user manual for instructions on handling and operating the unit safely. Avoid looking into any ports near which this symbol appears.</p>
	<p>Frame or chassis terminal for electrical grounding within the unit.</p>
	<p>Protective conductor terminal for electrical grounding to the earth.</p>
<p>WARNING</p>	<p>Procedure can result in serious injury or loss of life if not carried out in proper compliance with all safety instructions. Ensure that all conditions necessary for safe handling and operation are met before proceeding.</p>
<p>CAUTION</p>	<p>Procedure can result in serious damage to or destruction of the unit if not carried out in compliance with all instructions for proper use. Ensure that all conditions necessary for safe handling and operation are met before proceeding.</p>

### ***Classification***

The OVA consists of an exposed metal chassis that is connected directly to earth via a power cord and is therefore classified as a Class 1 instrument.

## Important Safety Information

### Laser Hazards

#### Warning



- Never look directly into the end of an optical cable connected to an optical output device that is operating. Laser radiation is invisible and direct exposure can severely injure the human eye.

### Electrical Hazards

#### Warning



- Some of the circuits are powered whenever the unit is connected to the AC power source (line power). To ensure that all circuits are powered off, disconnect the power cord from either the power inlet on the unit's rear panel or from the AC line-power source (receptacle). The power cord must always be accessible from one of these points. If the unit is installed in a cabinet, the operator must be able to disconnect the unit from the line power by the system's line-power switch.
- Use only the type of power cord supplied with the unit. If you need to replace a lost or damaged cord, make sure to replace with a power cord of the same type.
- Connect the power cord only to a power outlet equipped with a protective earth contact. Never connect to an extension cord or any receptacle that is not equipped with this feature.
- If using a voltage-reducing autotransformer to power the unit, ensure that the common terminal connects to the earthed pole of the power source.
- Do not interrupt the protective earth grounding. Such action can lead to a potential shock hazard that can result in serious personal injury. Do not operate the unit if an interruption to the protective grounding is suspected.
- Do not operate the unit when its cover or panels have been removed.
- To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.
- Do not use the unit outdoor.
- Operating the unit in the presence of flammable gases or fumes is extremely hazardous.

- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Only technicians authorized by Santec Inc. should carry out repairs. In addition to voiding the warranty, opening the unit (even when unplugged) can expose you to potential shock hazards.
- Some of the unit's capacitors can be charged even when the unit is not connected to the power source.
- Do not perform any operating or maintenance procedure that is not described in the user manual.

# 4

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## GETTING STARTED

### Caution



- To avoid injury or death, always observe the precautions listed in SAFETY INFORMATION on page 4.

This manual contains complete operating instructions for safe and effective operation of the OVA Optical Attenuator. It is recommended that users of the OVA familiarize themselves with contents of this manual before using the instrument.

The inspection report and a description of any customer-requested information may be found in the calibration document envelope included with the instrument.

### *Initial Inspection*

### Warning



- To avoid electrical shock, do not initialize or operate the unit if it bears any sign of damage. Ensure that the unit and any devices or cords connected to it are properly grounded.

- ✓ Inspect the package and contents for signs of damage.
- ✓ Ensure all contents are included.
- ✓ Read the user manual thoroughly and become familiar with all safety symbols and instructions to ensure that the unit is operated and maintained safely.
- ✓ If the initial inspection reveals any damage or missing components, immediately notify Santec Inc. and if necessary, the carrier.

### *Operational Requirements*

For the unit to meet the warranted specifications, the operating environment must meet the conditions outlined in Table 2.

**Table 2: Environmental requirements**

Parameter	Specification
Altitude	Up to 2000m
Temperature	0 to 40°C
Humidity	Up to 95% RH (0 to 40°C)
Voltage	Main supply voltage fluctuations must not exceed $\pm 10\%$ of the nominal voltage

## Product Overview

### OVA Front Panel

A front view of the OVA attenuator is shown in Figure 2. The standard front panel bulkhead types are FC or SC.



**Figure 2: Front view of the OVA Optical Attenuator**

### OVA Rear Panel

A rear view of the OVA attenuator is shown in Figure 3. See Table 3 for a detailed description.

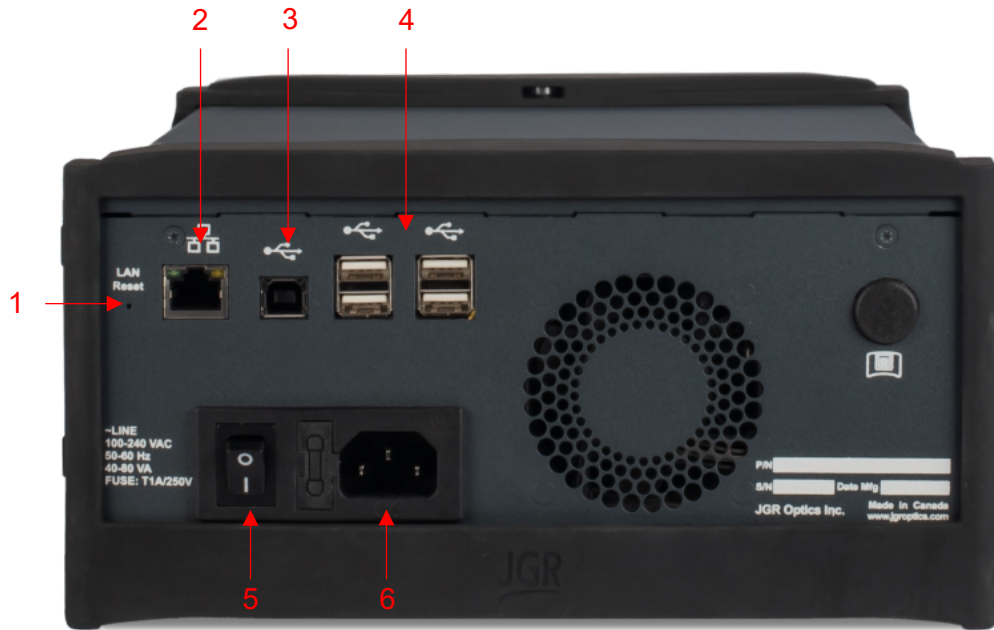


Figure 3: Rear view of an OVA

Table 3: Detailed description of the OVA rear panel components (see Figure 3)

Item #	Description
1	LAN/Reset <ul style="list-style-type: none"> <li>Press once: reset network settings</li> </ul>
2	Ethernet port <ul style="list-style-type: none"> <li>Connection to LAN</li> </ul>
3	USB B port <ul style="list-style-type: none"> <li>Connection to PC</li> </ul>
4	USB A ports <ul style="list-style-type: none"> <li>Connections to peripherals</li> <li>WARNING: do not connect USB powered devices such as cell phone chargers or inspection probes</li> </ul>
5	IO switch <ul style="list-style-type: none"> <li>On/off toggle</li> </ul>
6	Power input <ul style="list-style-type: none"> <li>Contains user-replaceable fuse</li> </ul>

# 5

## OPERATION

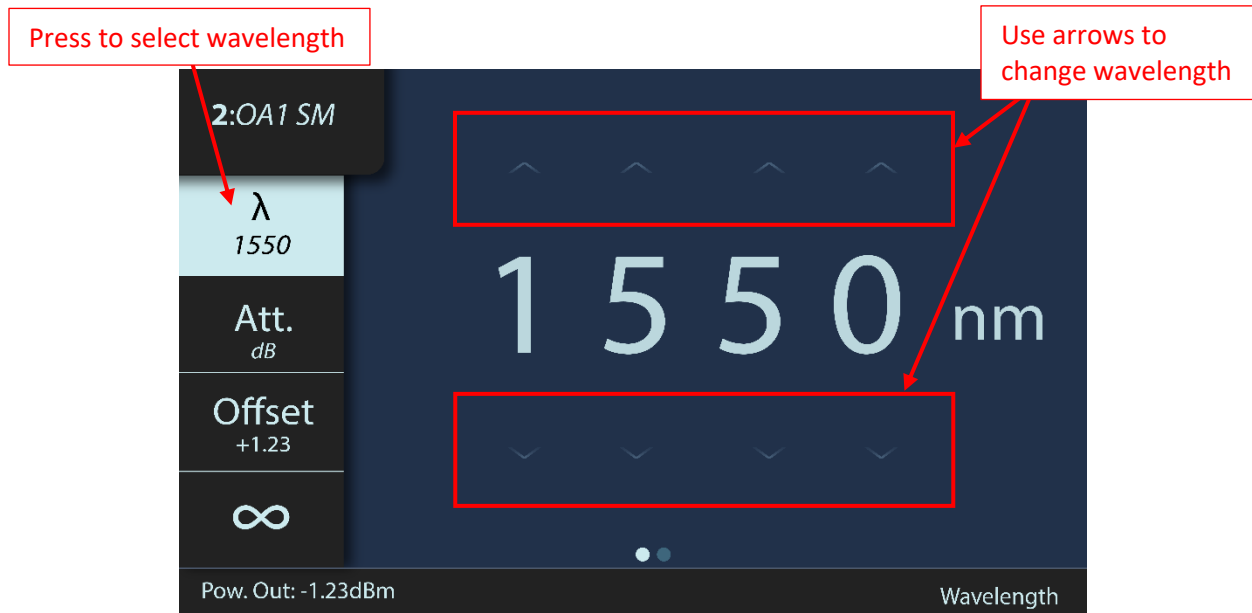
### *Powering Up the Attenuator*

To power up the attenuator:

1. Verify that the power switch is set to the “off” position (O). Connect the attenuator to an AC power supply using the power cord provided.
2. Toggle the power switch to the “on” position (I).

### *Setting the Wavelength*

Swipe right to access the main operations of the OVA. Pressing the  $\lambda$  button allows for wavelength selection (Figure 4).



**Figure 4: Front panel operation – setting the wavelength**

The OVA has 4 stored wavelength settings. Pressing the  $\lambda$  button a second time will display the flyout to select the wavelength “slot” (Figure 5).



Figure 5: Front panel operation – wavelength flyout menu

### Setting the Attenuation

Press the *Att.* button to set the attenuation (Figure 6).

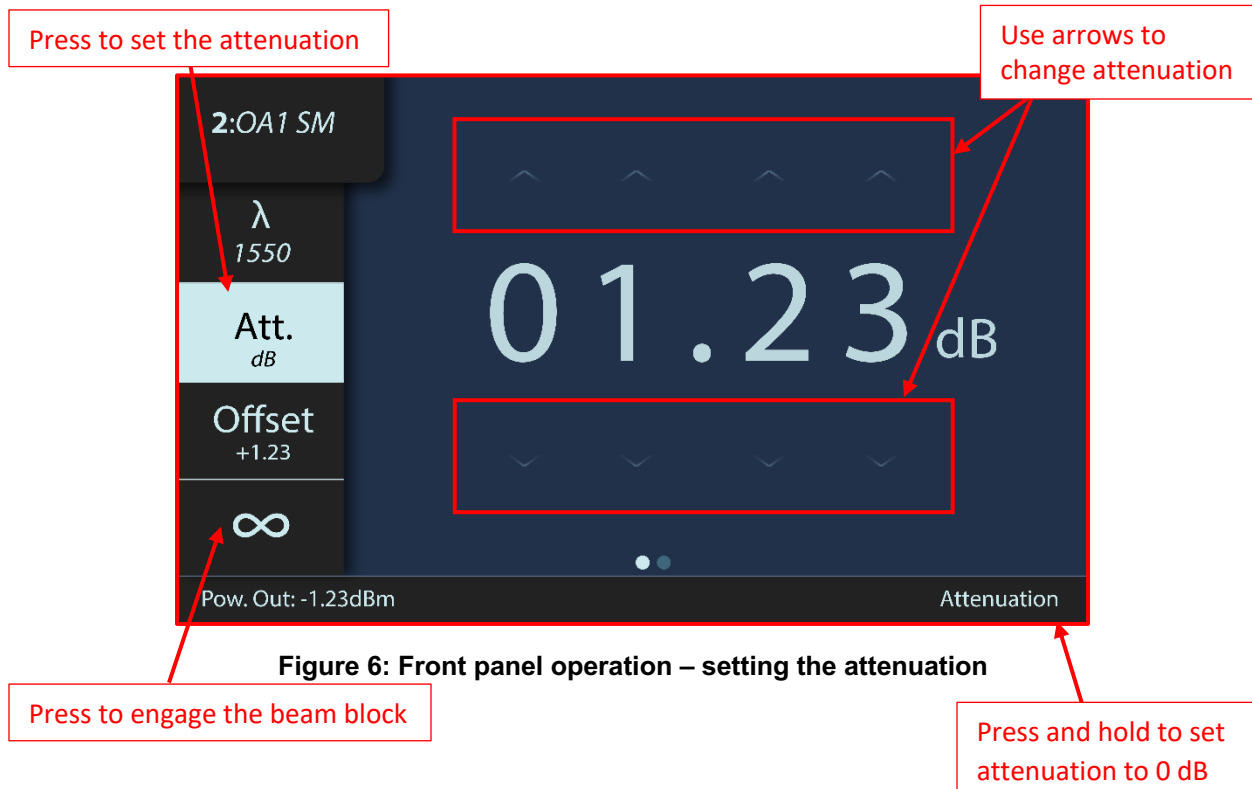


Figure 6: Front panel operation – setting the attenuation



Press and hold on the screen to set the attenuation to 0 dB. Press and hold a second time to go to the minimum IL point.

Pressing the  $\infty$  button will engage the beam block shutter (> 100 dB attenuation).

Pressing the *Att.* button a second time (Figure 7) will display the flyout to select dB or dBm mode. In dBm mode, with the power monitoring option, the output power can be set in dBm.

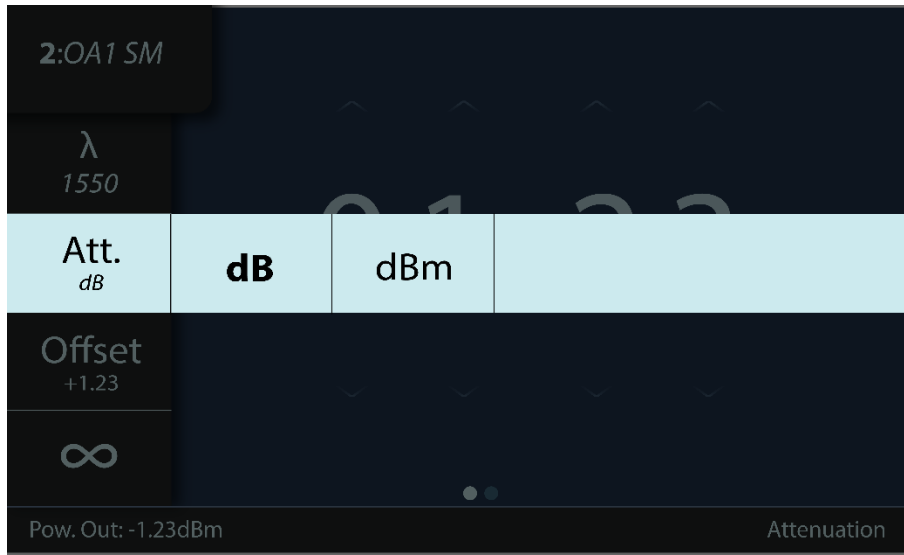


Figure 7: Front panel operation – attenuation flyout menu

### Setting an Offset

Press the *Offset* button to set an attenuation offset (Figure 8).

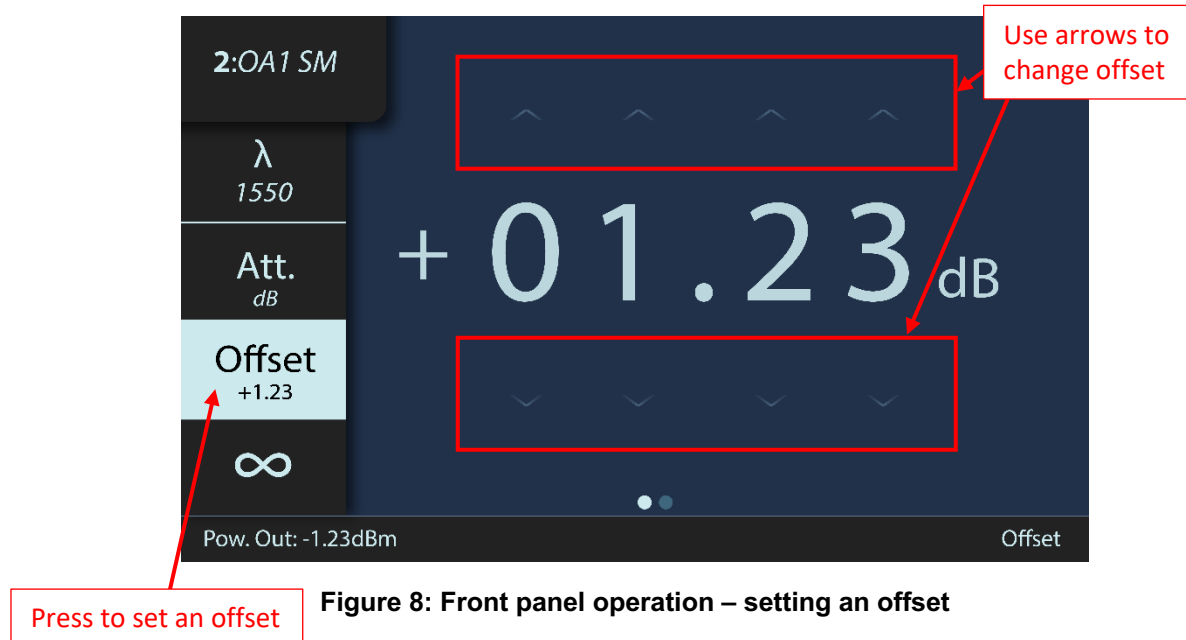


Figure 8: Front panel operation – setting an offset

## Device Information and Settings

Swipe left to access the Setup page (Figure 9). This page will display information about the unit, its connectivity status and settings.

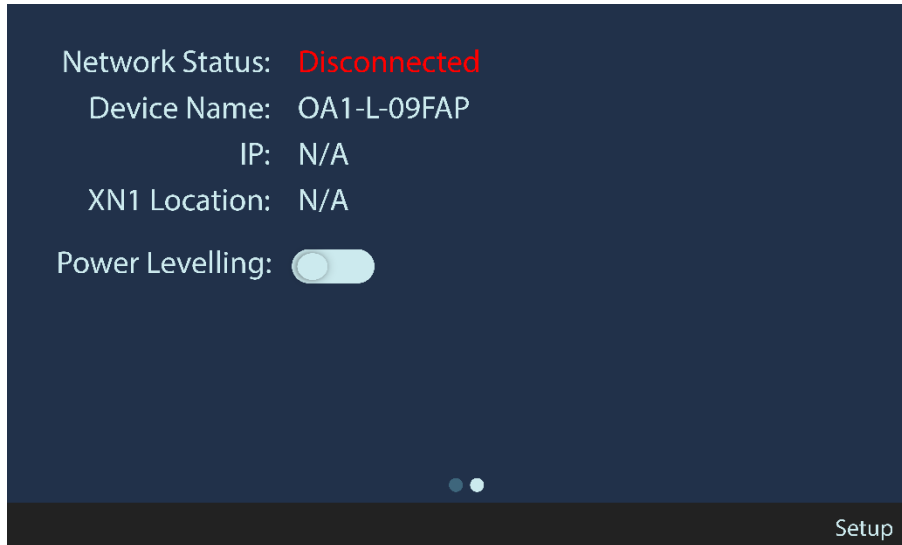


Figure 9: OVA Setup page

Table 4: Detailed description of the OVA Setup page (Figure 9)

Parameter	Description
Network Status:	<ul style="list-style-type: none"> <li>If connected to a network via Ethernet, it will show as <i>Connected</i>.</li> <li>If not connected to a network, it will show as <i>Disconnected</i>.</li> </ul>
Device Name:	<ul style="list-style-type: none"> <li>Displays the PN of the unit.</li> </ul>
IP:	<ul style="list-style-type: none"> <li>If connected to a network via Ethernet, it will show the IP address of the unit. Use this IP address to access the OVA webpage or connect to it via software.</li> <li>If not connected to a network, it will show as <i>N/A</i>.</li> </ul>
XN1 Location:	<ul style="list-style-type: none"> <li>Shows the IP address and port of the last connected XN1 server.</li> <li>If it hasn't been connected, it will show as <i>N/A</i>.</li> </ul>
Power Levelling:	<ul style="list-style-type: none"> <li>If enabled, the OVA will vary the attenuator to match and maintain the attenuation set in dBm mode.</li> </ul>

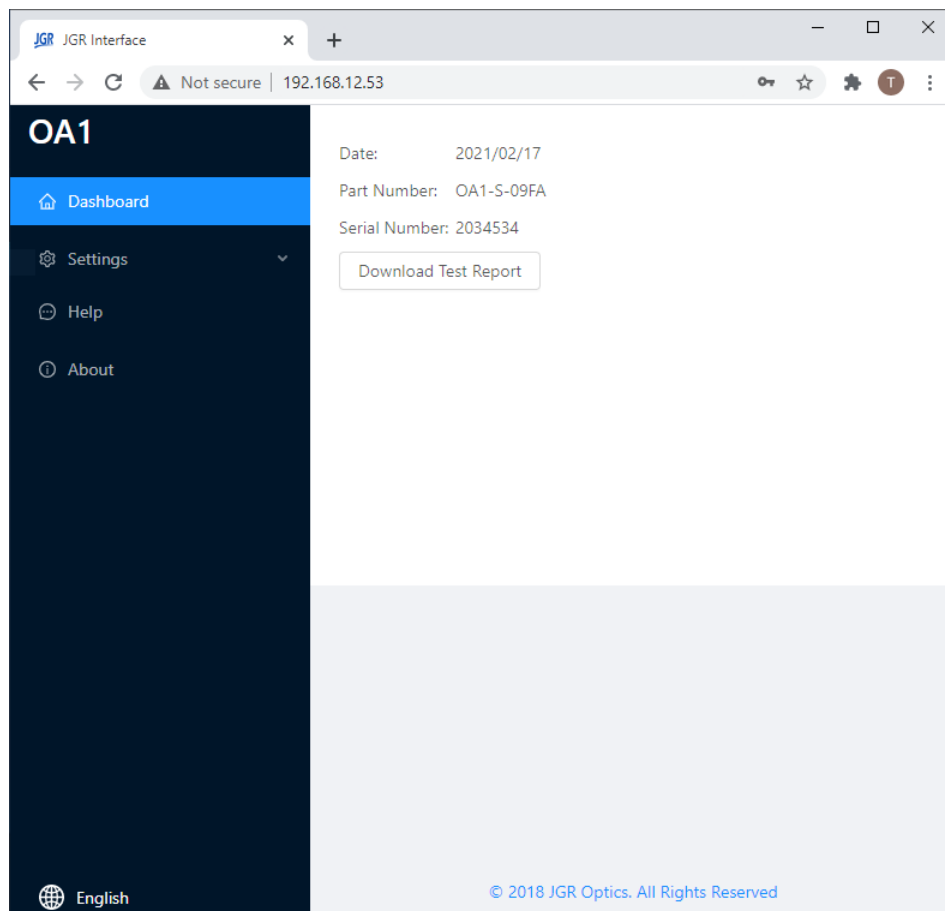
# 6

## OVA WEBPAGE

To access the OVA webpage, connect the attenuator to a network and on any computer or tablet on the same network, open a web browser (recommended: *Google Chrome*) and enter the OVA's IP address in the URL bar.

### ***Dashboard***

Access the *Dashboard* tab to view the manufactured date, part and serial numbers (Figure 10). You can also download a PDF of the attenuator test report.



**Figure 10: OVA webpage – *Dashboard* tab**

## Settings

Click on the *Settings* tab to expand.

### Network Settings

You can view, edit or reset the network settings of the OVA from the *Settings > Network Settings* tab (Figure 11).

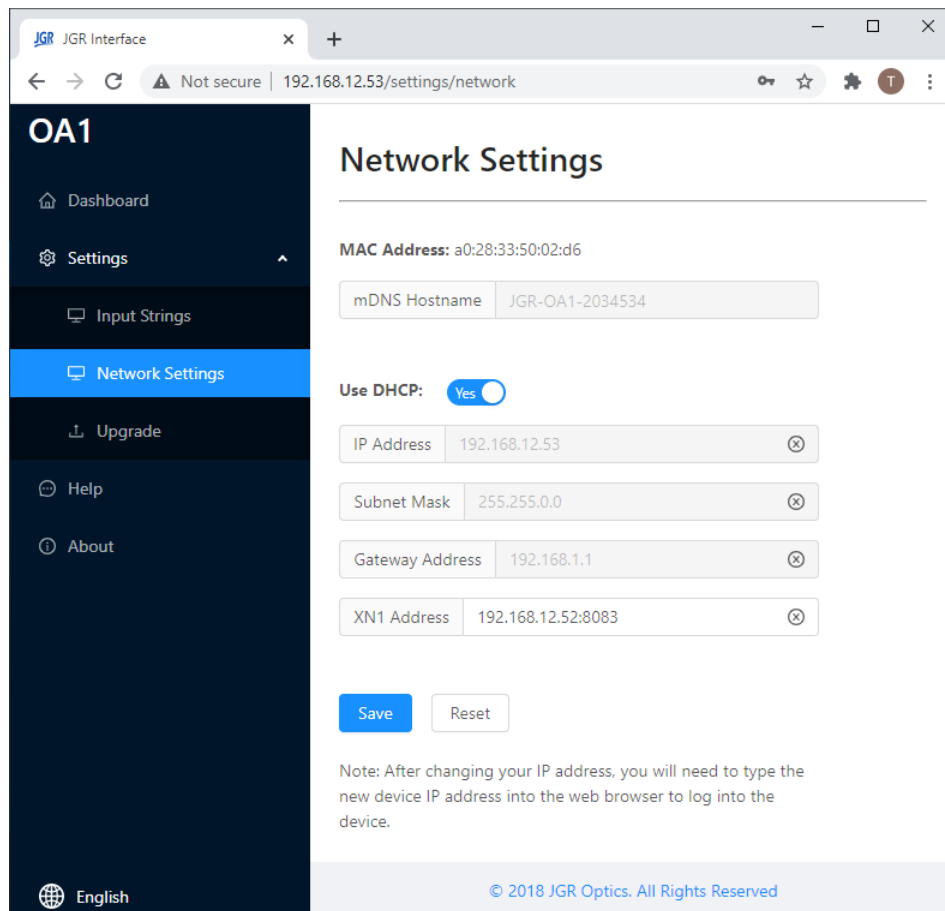


Figure 11: OVA webpage – *Network Settings* tab

## Upgrade

Go to *Settings* > *Upgrade* to view the version of, upgrade or re-install the firmware of the OVA (Figure 12). Please contact [support@jgroptics.com](mailto:support@jgroptics.com) before performing a firmware upgrade for additional instructions.

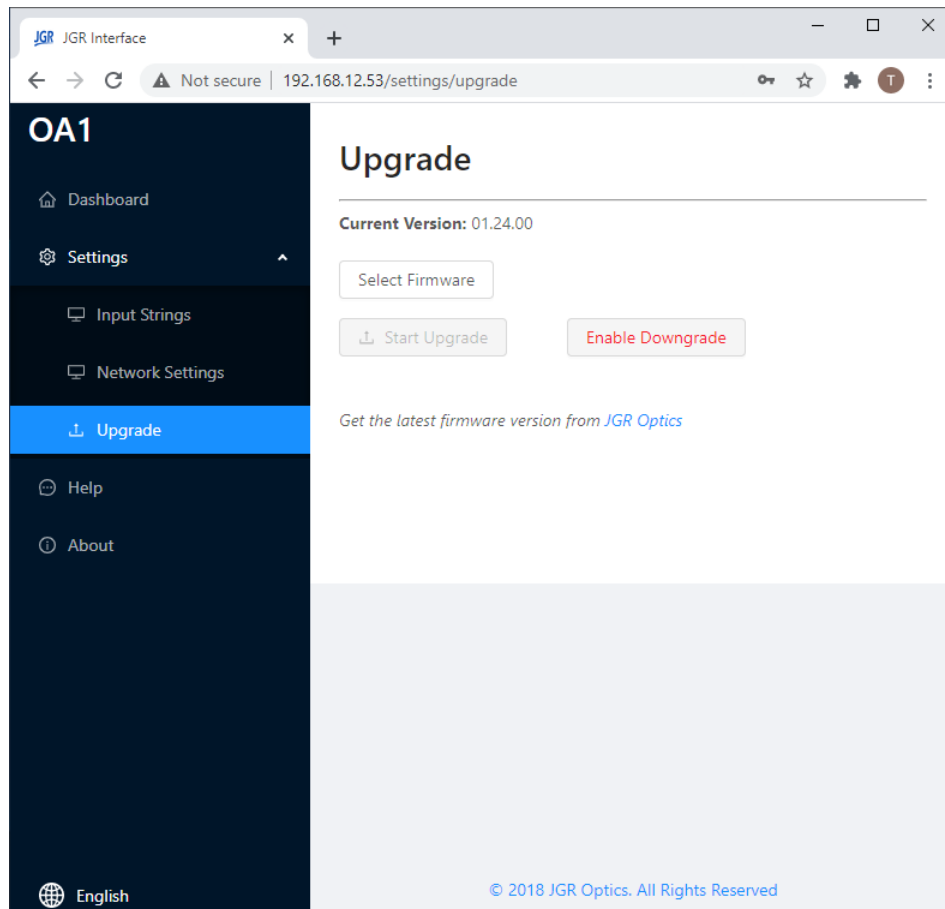


Figure 12: OVA webpage – *Upgrade* tab

## Help

Click on the *Help* tab for the website technical support and sales contact forms as well as a link to the software downloads page.

Alternatively, email [support@jgroptics.com](mailto:support@jgroptics.com) for technical support or [info@jgroptics.com](mailto:info@jgroptics.com) for sales and other inquiries.

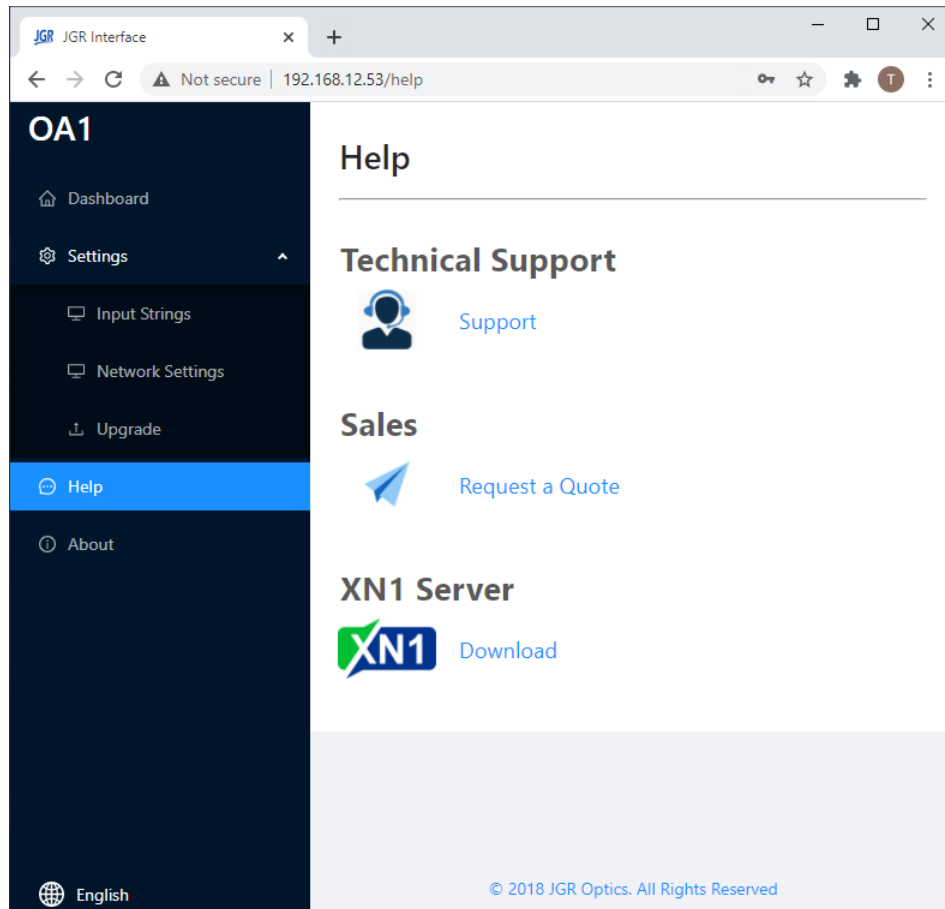


Figure 13: OVA webpage – *Help* tab

## About

The *About* tab displays the unit's firmware version, model and serial number. *Advanced* mode is reserved for SANTEC technicians and SANTEC-approved service centers.

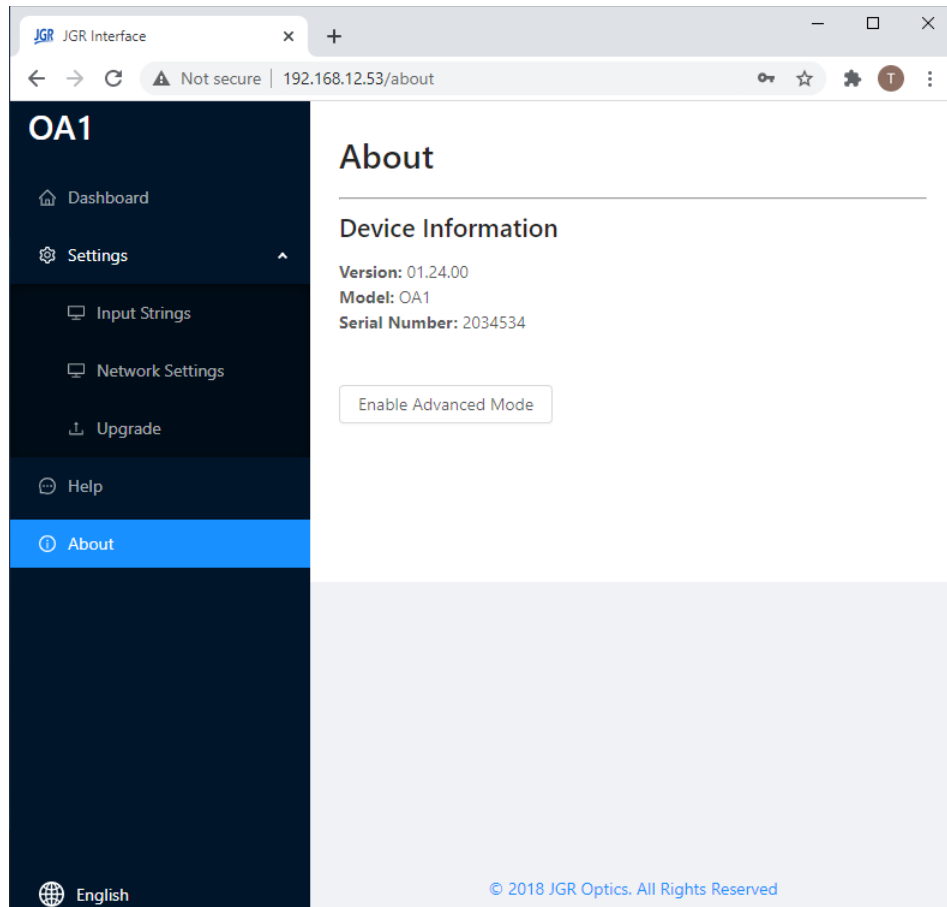


Figure 14: OVA webpage – *About* tab

# 7

## PROGRAMMING GUIDE

### General Information

The OVA follows the *SCPI* (Standard Commands for Programmable Instruments) message-based programming standard. It conforms to the *USBTMC* (USB Test and Measurement) standard.

The TCP/IP libraries provided by most operating systems are sufficient.

Note: any *VISA* implementation can control the OVA via TCP/IP on port 5025.

### Step-by-step Guide

This section will provide a step-by-step programming guide in a *.NET* programming environment such as *C#* or *VB.NET*.

1. Install *VISA* drivers on the development system
2. Connect the OVA via its USB B port to the development system
3. Add a reference to *Ivi.Visa.dll* in your project:

*C:\Program Files (x86)\IVI Foundation\VISA\Microsoft.NET\Framework32\v2.0.50727\VISA.NET Shared Components 5.11.0\Ivi.Visa.dll*

4. Use the *IVI.Visa.GlobalResourceManager* to find all USB instruments on your system:

```
Public Overrides Function GetAllAddresses() As String()  
    Try  
        Dim nameList As New List(Of String)  
        nameList = GlobalResourceManager.Find("USB?*INSTR")  
        Return nameList.ToArray()  
    Catch ex As Exception  
        Return Nothing  
    End Try  
End Function
```

5. Open an *IMessageBasedSession* to the desired device using an address from the *nameList* in the previous step:

```
Private visa As IMessageBasedSession  
  
visa = GlobalResourceManager.Open(addr)
```

6. Use the *Write* method to send SCPI commands and the *Read* method to retrieve results:



```
Public Overrides Function Read(ByVal readableOnly As Boolean) As String
    Dim response As String = String.Empty
    response = visa.RawIO.ReadString()
    If response = String.Empty Then
        Throw New Exception("Read from device failed")
    End If
    Return response
End Function

Public Overrides Sub Write(ByVal strCommand As String)
    visa.RawIO.Write(strCommand)
End Sub
```

Write commands require termination with the linefeed character `\n`.

**Note**

The OVA runs SCPI commands synchronously. An `*OPC?` Command can be sent and a `1` will be returned when all operations have been completed:

**Commands Lists**

See Table 5 and Table 6 for SCPI required and OVA commands respectively.

**Table 5: Standard SCPI required commands list**

*CLS
*ESE #
*ESE?
*ESR?
*IDN?
*OPC
*OPC?
*OPT?
*RCL "filename"
*RST
*SAV "filename"
*SRE #
*SRE?
*STB?
*TST?
*WAI
:STATus:OPERation:CONDition?
:STATus:OPERation:ENABle <byte>
:STATus:OPERation:ENABle?
:STATus:OPERation[:EVENT]?
:STATus:QUEStionable:CONDition?
:STATus:QUEStionable:ENABle <byte>

:STATus:QUEStionable:ENABle?
:STATus:QUEStionable[:EVENT]?
:STATus:PRESet
:SYSTem:ERRor[:NEXT]?
:SYSTem:VERSion?
:SYSTem:COMMunicate:LAN:ADDRes <ip/dhcp>
:SYSTem:COMMunicate:LAN:ADDRes?
:SYSTem:COMMunicate:LAN:GATEway <gateway>
:SYSTem:COMMunicate:LAN:GATEway?
:SYSTem:COMMunicate:LAN:MASK <netmask>
:SYSTem:COMMunicate:LAN:MASK?
:SYSTem:COMMunicate:LAN:HOSTname <hostname>
:SYSTem:COMMunicate:LAN:HOSTname?
:SYSTem:COMMunicate:LAN:MAC?

Note: for a single module OVA, omit [n] in the commands below.

**Table 6: OVA commands list**

<b>Command</b>	<b>Description</b>
INput:ATTenuation #	Attenuates <#> dB.
INput:ATTenuation:ALL #	Attenuates <#> db on all modules that support it. If any modules don't support this, returns an error.
INput:ATTenuation?	Returns the current attenuation.
INput:OFFSet #	Sets an attenuation offset <#> dB. The offset only affects the displayed attenuation value, not the actual attenuation. $ATT_{display} = ATT_{actual} + Offset.$
INput:WAVelength <#>	Sets the wavelength <#>.
INput:WAVelength?	Returns the current wavelength.
INput:ILMin	Goes to the min IL point.
OUTput:APMode #	Sets the absolute power mode: <1> (enabled) or <0> (disabled).
OUTput:POWer #	Sets the desired setpoint <#> in dBm mode.
OUTput:POWer?	Returns the setpoint in dBm mode.
OUTput:OFFset #	Sets the power offset <#> in dBm mode.
LCL #	Sets the interaction mode <#> (1 = local, 0 = remote).
LCL?	Returns the interaction mode.
OUTput:TRACKing #	Sets the power levelling setting <#> in dBm mode (1 = enabled, 0 = disabled).
OUTput:DRIFT #	Sets the drift tolerance <#> in dB for the power levelling. Default value is 0.1 dB, must be greater than 0.
OUTput:POW:MON?	Returns the current internal PD reading (no offsets).
OUTput:DARK	Measures and stores the dark current on the PD. The beam block will engage if necessary. The command returns 1 if successful, 0 if not.

OUTput:STATe #	Sets the state <#> of the beam block (1 = enabled, 0 = disabled). The state remains through power cycles.
----------------	---

# 8

---

## MAINTENANCE

### *Cleaning the Unit*

1. Unplug the unit from the line power.
2. Clean the enclosure with a damp cloth.
3. Do not plug the unit back in until it is completely dry.

### *Cleaning the Output*

#### **Warning**



- Connecting contaminated or damaged connectors to the OVA can damage the unit and affect its performance.
- Damaging the output fiber during maintenance can affect the performance of the unit.

1. Inspect all connectors before each mating and if needed, clean with a lint-free wipe and/or IPA. Figure 15 shows a dirty connector requiring cleaning. Figure 16 shows a clean connector ready to be mated.
2. Loosen the front panel thumbscrews.
3. Gently remove the output panel. Ensure a clear line of sight to the fiber to prevent any stress on the output fiber.
4. Remove the connectors from the mating sleeves.
5. Clean the connectors and mating sleeves in accordance with the section Cleaning Jumper Connectors on page 25.
6. Reinstall the connectors into the mating sleeves.
7. Reinstall the output panel with the thumbscrews. To avoid damaging the fibers, keep a clear line of sight to the fiber as it spools back inside the unit. It should lay flat and spool back in without resistance or twisting. Figure 17 shows an exposed view of good output fiber management. Figure 18 shows poor fiber management.

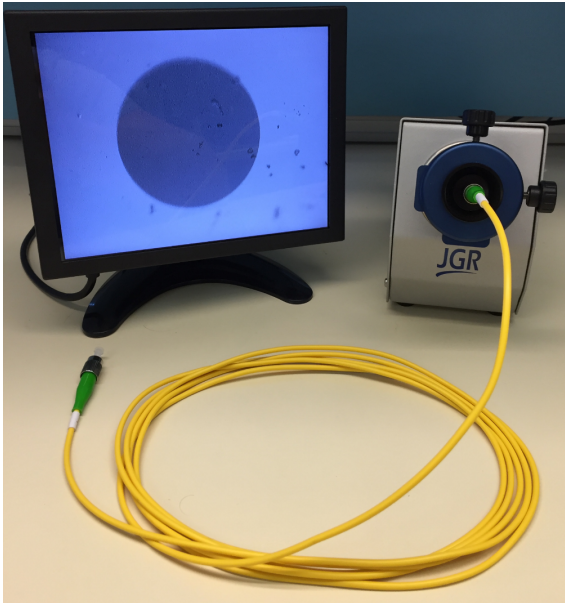


Figure 15: Dirty connector end-face inspection using SANTEC's EFI-100

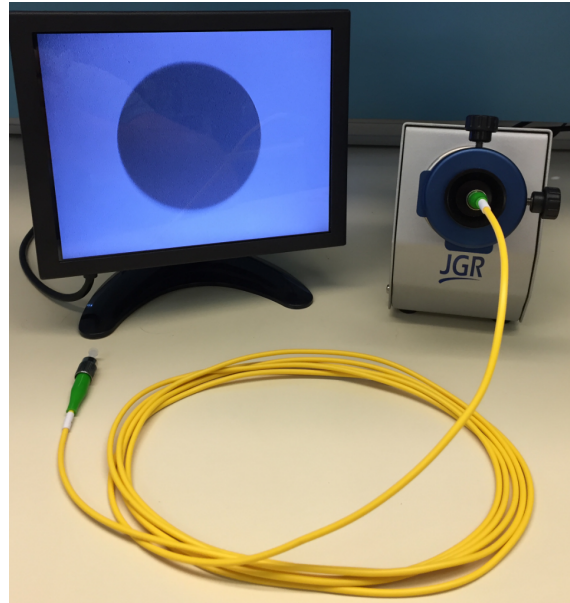


Figure 16: Clean connector end-face inspection using SANTEC's EFI-100

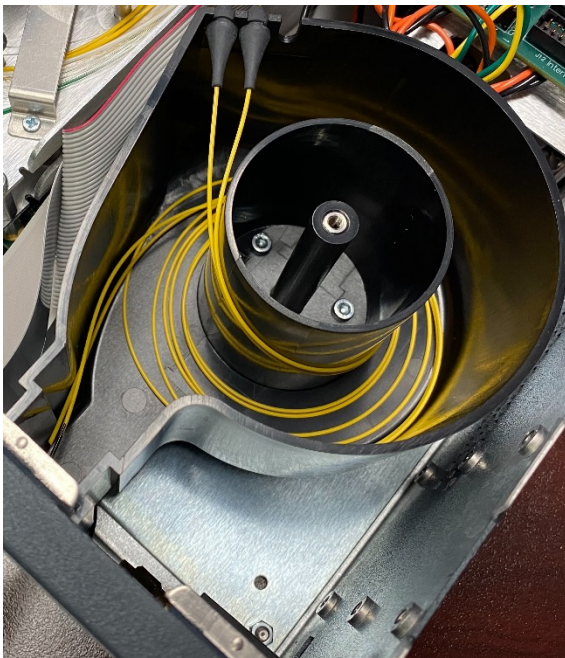


Figure 17: Exposed view of good output fiber management

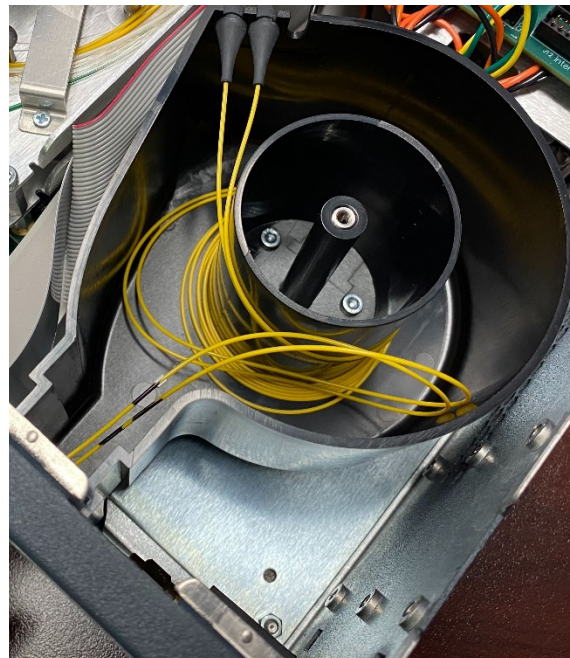


Figure 18: Exposed view of poor output fiber management

Note: the exposed views are only for instructional purposes. **The OVA chassis should not be opened during normal maintenance.**

## Cleaning Jumper Connectors

### Warning



- Using contaminated or damaged jumpers can affect the performance of the unit.
- Never force an optical connector mating. Some connectors have a ceramic ferrule that can be easily broken.

Optical cable ends need to be inspected before each mating to ensure they are free of contamination or damage. An inspection scope such as SANTEC's EFI-100 is required.

If they are contaminated, they must be cleaned. The following items are required.

- Filtered compressed air or dusting gas
- Lint-free swabs and lint-free wipes
- Optical grade isopropyl alcohol (IPA) or optical grade 200° ethanol (**do not use rubbing alcohol** which can contain up to 30% water)

To clean the connectors:

1. Blow the sleeve with compressed air.
2. Apply the alcohol to a small area of the lint-free wipe and rub the end of the ferrule over the wet area.
3. Wipe the ferrule on a dry area of the lint-free wipe.
4. Blow the end of the ferrule with compressed air.
5. Apply the alcohol to a lint-free swab to clean the remaining parts of the connector.
6. With the other end of the swab, dry the areas cleaned.
7. Blow the areas cleaned with compressed air.

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## STORAGE AND SHIPPING

Damage can occur from improper handling. Make sure to maintain the unit within the specified temperature range during storage or shipping. Please follow the recommendations below to minimize the possibility of damage:

- If possible, pack the unit in its original packing material when shipping.
- Avoid high humidity or large temperature fluctuations that could generate condensation within the unit.
- Avoid unnecessary shocks and vibrations.

### ***Returning Instruments to Santec***

As indicated above, please ship the returned material in the original shipping box and packing material. If these are not available, follow the guidelines below:

1. Contact Santec to obtain an RMA number.
2. Cover the front panel with foam to prevent damage.
3. Wrap the unit in anti-static packaging. Use anti-static connector covers.
4. Pack the unit in a strong enough shipping box considering the unit's weight.
5. Use enough shock-absorbing material (10 to 15 cm) to cushion the unit and prevent it from moving inside the box. Pink poly anti-static foam is recommended.
6. Seal the shipping box securely.
7. Clearly mark FRAGILE on at least 3 of the 4 sides of the box.
8. Always provide the model and serial number of the unit and, if applicable, the RMA number on any accompanying documentation. If possible, indicate the RMA number on the box itself to facilitate identification.

### ***Contact Information***

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## SPECIFICATIONS

**Table 7: OVA optical and electrical specifications sheet**

Parameter	Specification			
	Single-mode Long	Single-mode Short	Multimode Short	Flexcore Short
Wavelength Range (nm)	1200 to 1700		750 to 1700	960 to 1080
Attenuation Range (dB)	100	60	60	60
Insertion Loss (dB) <sup>1</sup>	SM (9 μm) <sup>2</sup>	1.5		
	MM (50 or 62.5 μm) <sup>3</sup>		1.8	
	HI1060 (5 μm)			2.5
Return Loss (dB) <sup>1</sup>	SM (9 μm)	60		
	MM (50 or 62.5 μm) <sup>4</sup>		35	
	HI1060 (5 μm)			50
PDL (dB)	< 0.1		N/A	< 0.1
Repeatability (dB)	± 0.01			
Absolute Accuracy (dB)	± 0.1			
Resolution (dB)	0.01			
Max Optical Input Power (dBm)	23			
Beam Block (dB)	> 100			
Input Voltage	110 to 240 V AC, 50-60 Hz			
Interface	USB or Ethernet			

Notes:

<sup>1</sup> excluding connectors and couplers

<sup>2</sup> at 1550 nm, 0.3 dB higher at 1310 nm

<sup>3</sup> at 850 nm, 0.3 dB lower at 1310 nm

<sup>4</sup>at 850 and 1300nm

**Table 8: OVA mechanical and environmental specifications sheet**

Parameter	Specification
Unit Dimensions W x H x D (cm)	23.5 x 12 x 32.5 (2U half rack)
Shipping Box Dimensions W x H x D (cm)	36.5 x 39 x 53
Unit Weight (kg)	8
Total Shipment Weight (kg)	9
Operating Temperature (°C)	0 to 40
Storage Temperature (°C)	-40 to 70
Humidity (Non-condensing)	Max 95% RH from 0 to 40°C





In the event of any trouble with this product, turn the unit off in accordance with the procedures to shut off the power described in this operation manual, disconnect the power source cord, make sure the product name and serial number described on the name plate of the product, and then contact our dealer at your place or directly contact us at Santec Photonics Laboratories. Our telephone number and facsimile number are shown below. However, we are not responsible for any trouble arising from your own repair or modification on this product.

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