OSX-100
Optical Switch

User Manual
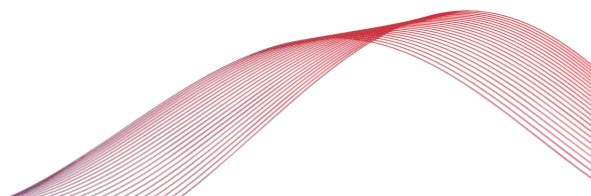
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COMPLIANCE

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.

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GENERAL INFORMATION

OSX-100 Optical Switch Overview

The OSX-100 Optical Switch (Figure 1) is a customizable benchtop/rackmount instrument, ideal for high-volume manufacturing production testing.

Figure 1: OSX-100 Optical Switch

Available in single-mode or multimode, the switch configurations range from 1x2 up to 1x360. Optional 2x1 or 4x1 built-in switches can provide additional common inputs. The switch may be controlled through remote interface (USB or Ethernet).

Applications

- High volume production testing
- Multiple device testing
- Test automation
- Paired with the RLM for multi-fiber testing

Key Features

- Ultra low IL < 0.5 dB
- ± 0.005 dB repeatability
- Up to 360 outputs

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- Chassis modular
- Customizable

Included Accessories

- Test report
- USB A to USB B cable (1.5m)
- Ethernet cable (1.5m)
- AC power cord (2m)

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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 Canada Corp. 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. Observe all safety instructions that are associated with a symbol.

Table 1: Safety symbols

⚠	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.
⏚	Frame or chassis terminal for electrical grounding within the unit.
⏚	Protective conductor terminal for electrical grounding to the earth.
WARNING	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.
CAUTION	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.

Classification

The OSX-100 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.

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- 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 Canada Corp. 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.

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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 OSX-100 Optical Switch. It is recommended that users of the OSX-100 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 Canada Corp. 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.

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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 ± 10% of the nominal voltage

Product Overview

OSX-100 Front Panel

A front view of the OSX-100 switch is shown in Figure 2. The standard front panel bulkhead types are FC, SC or LC.

Figure 2: Front view of a 24 channel OSX-100

OSX-100 Rear Panel

A rear view of the OSX-100 switch is shown in Figure 3. See Table 3 for a detailed description.
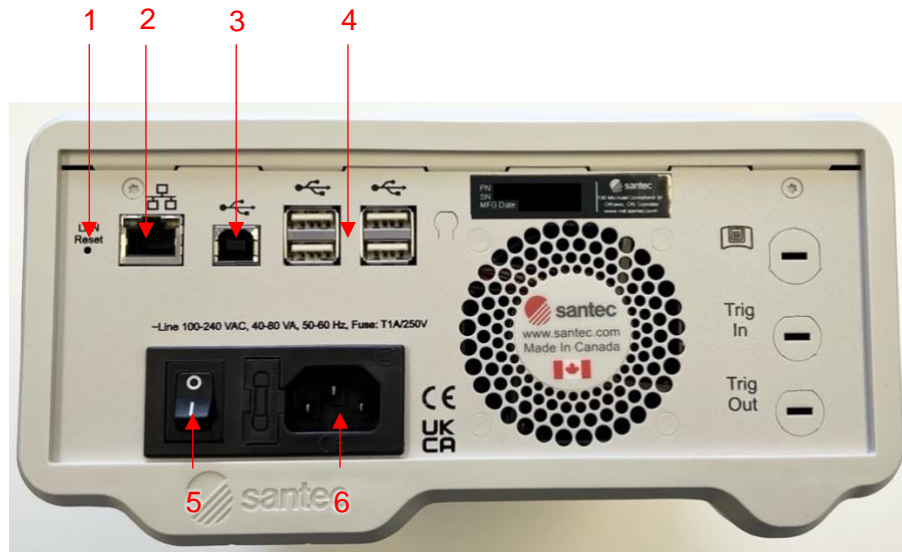
Figure 3: Rear view of an OSX-100

Table 3: Detailed description of the OSX-100 rear panel components (see Figure 3)

Item #	Description
1	LAN/Reset • Press once: reset network settings
2	Ethernet port • Connection to LAN
3	USB B port • Connection to PC or RLM
4	USB A ports • Connections to peripherals • WARNING: do not connect USB powered devices such as cell phone chargers or inspection probes
5	IO switch • On/off toggle
6	Power input • Contains user-replaceable fuse

Attaching Optional Rackmount Ears

If rackmount ears were purchased with the 2U half rack OSX-100, remove the rubber bezels and use an M2 hex driver to attach the 6 screws on each side as pictured in Figure 4 and Figure 5.
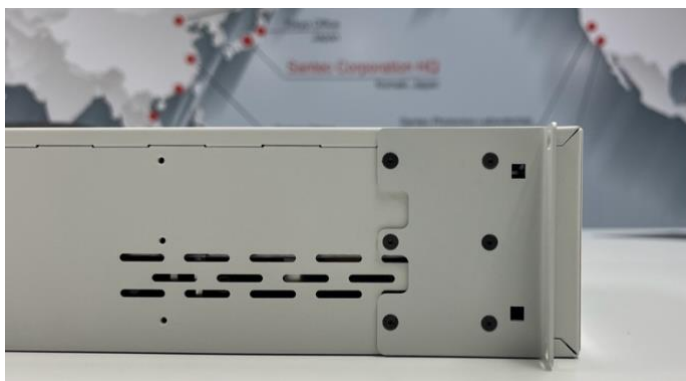
Figure 4: 2U half rack OSX-100 rackmount ear side view

Figure 5: 2U half rack OSX-100 rackmount ear front view

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OPERATION

Powering Up the Switch

To power up the switch:

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

Using with an RLM

When using the OSX-100 with an RLM, connect a USB cable from the OSX-100 USB B port to one of the RLM's USB A ports. All switch operations are then controlled via the RLM.

Establishing Communication

If not using with an RLM, the OSX-100's control is done via USB or Ethernet.

USB

Connect a USB cable from the OSX-100 USB B port to a PC or tablet. *VISA* drivers are required.

- Recommended: *NIVISA*
  - https://inst.santec.com/resources/programming
- Alternatives: *R&S*, *Keysight*, etc.

Ethernet

Each OSX-100 is factory pre-set to use DHCP. To retrieve the IP address of the OSX-100, it must initially be connected to a PC or tablet via USB and the OSX-100 queried via remote access (see Figure 6):

- Connect the OSX-100 to the network via an Ethernet cable
- Connect the OSX-100 to a PC or tablet with *VISA* drivers (see above)
- Download, install and run Terminal SCPI Command Software:
  - https://inst.santec.com/resources/software-downloads
- Click on *Detect Devices* to establish communications
- To confirm communications, send the following command:
  - *idn?
- To retrieve the IP address, send the following command:
  - syst:comm:lan:addr?

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santec
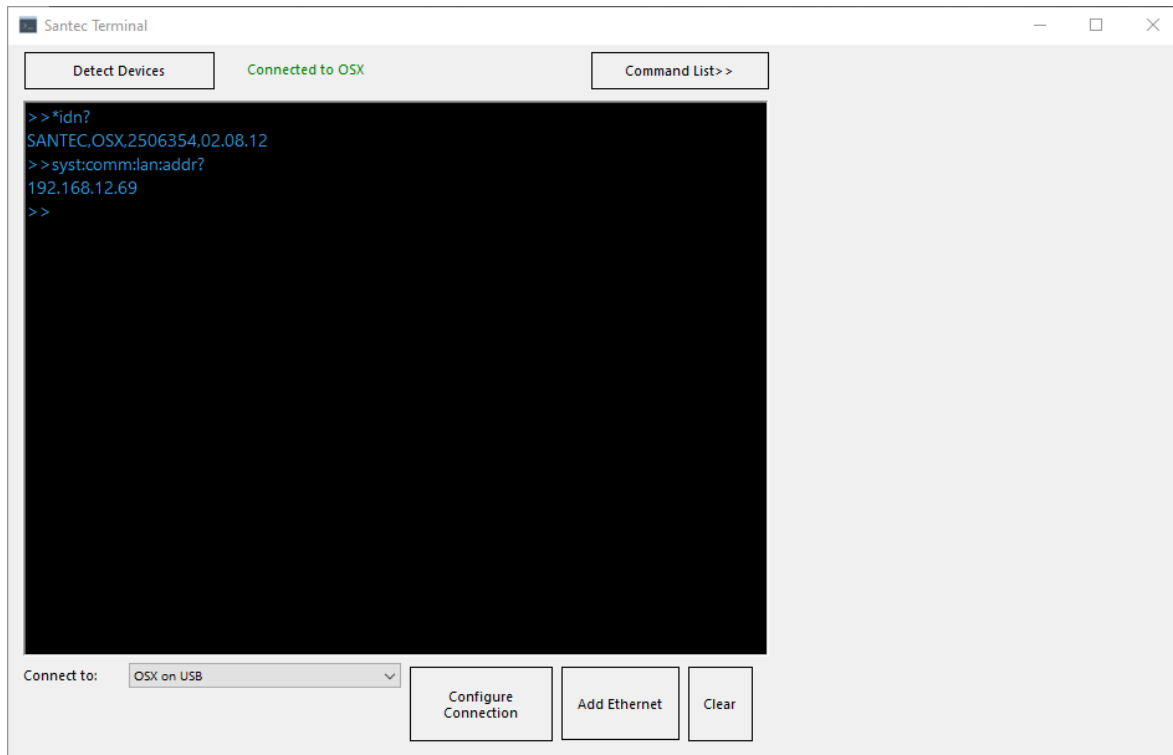
Figure 6: Retrieving the OSX-100's IP address

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OSX-100 Webpage

To access the OSX-100 webpage, connect the switch to a network and on any computer or tablet on the same network, open a web browser (recommended: *Google Chrome* or *Firefox*) and enter the OSX-100's IP address in the URL bar. For more information on retrieving the OSX-100's IP address, see page 11.

Dashboard

Access the *Dashboard* tab to view the manufactured date, part and serial numbers (Figure 7). You can also download a PDF of the switch test report.
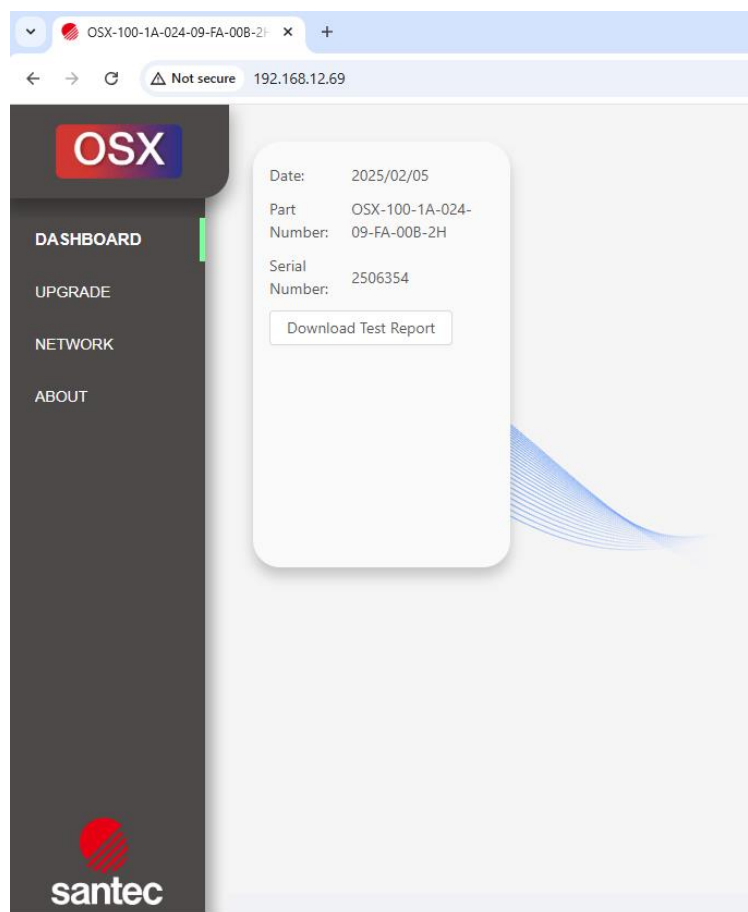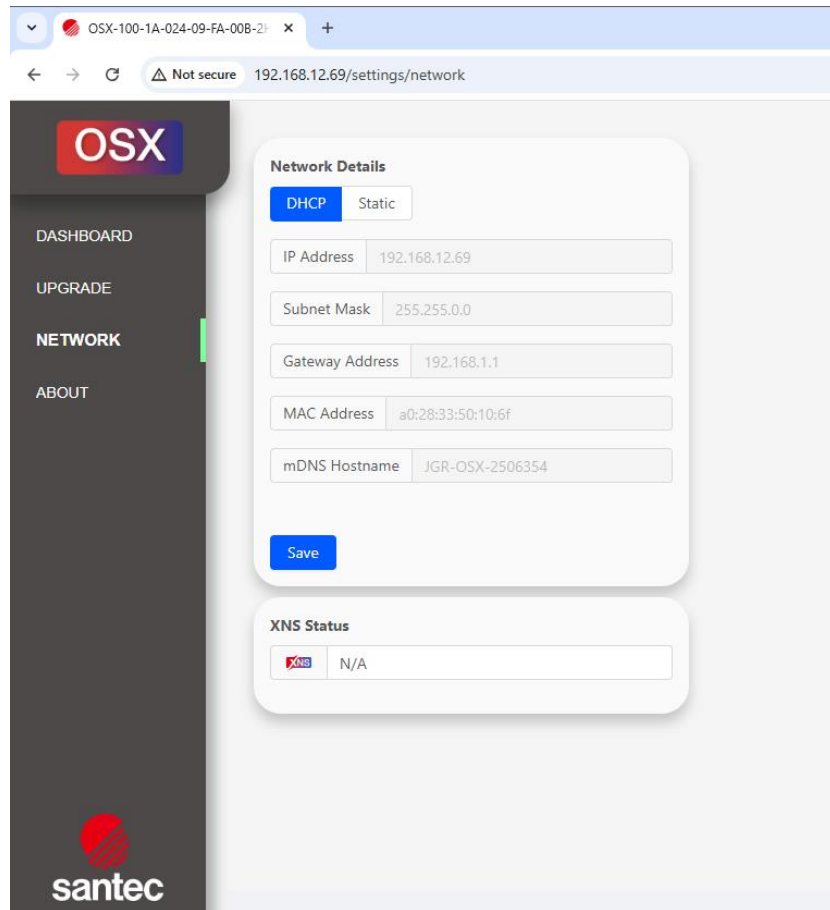
Figure 7: OSX-100 webpage – *Dashboard* **tab**

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Network Settings

You can view, edit or reset the network settings of the OSX-100 from the *Network* tab (Figure 8).

Figure 8: OSX-100 webpage – *Network* tab

Upgrade

Go to *Upgrade* to view the version of, upgrade or re-install the firmware of the OSX-100 (Figure 9). Please contact support.inst@santec.com before performing a firmware upgrade for additional instructions.

Figure 9: OSX-100 webpage – *Upgrade* tab

About

The *About* tab displays the unit's firmware version, model and serial number. Error logs can be downloaded, and additional support resources are available.

Advanced mode is reserved for Santec technicians and Santec-approved service centers.
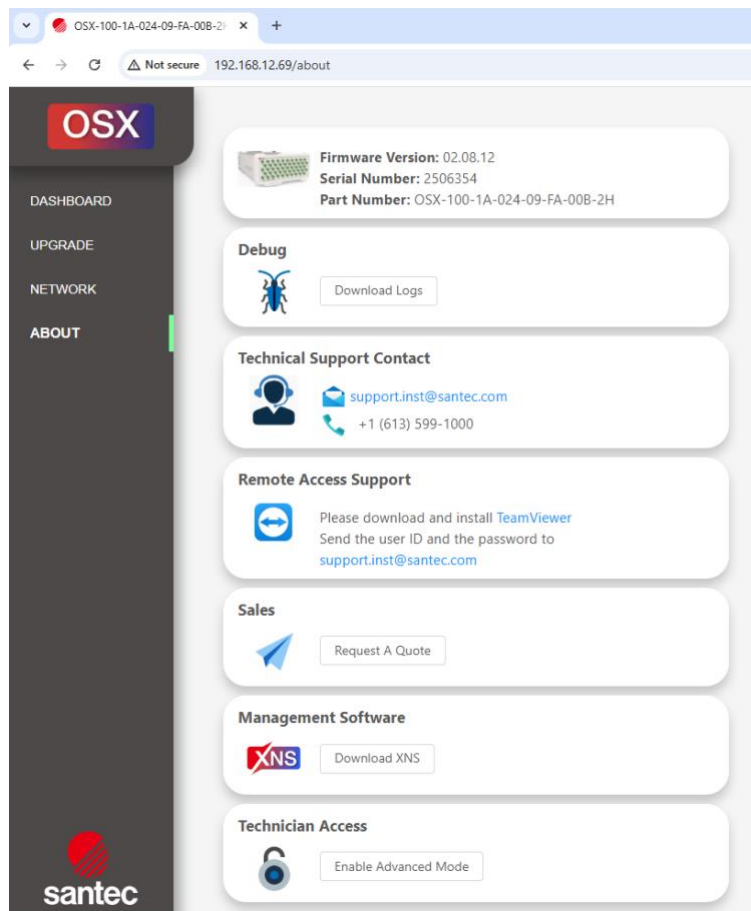
Figure 10: OSX-100 webpage – *About* tab
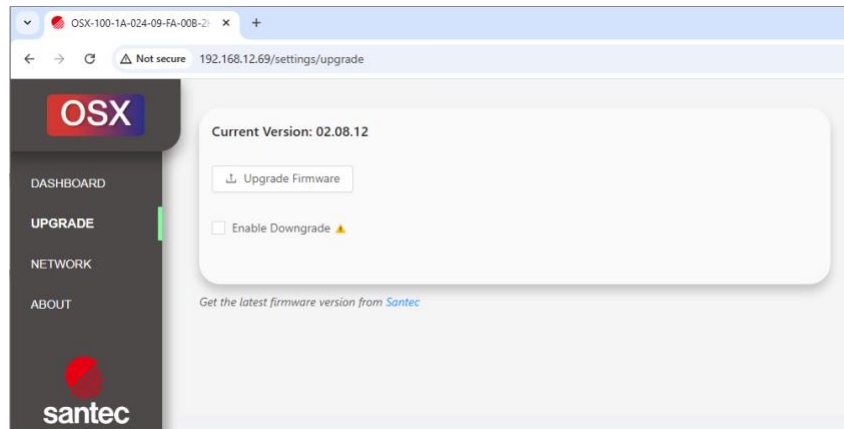
![santec logo]

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Programming Guide

General Information

The OSX-100 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 is capable of controlling the OSX-100 via TCP/IP on port 5025.

See the *Establishing Communication* section on page 11 for more information.

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 OSX-100 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:

```vbnet
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:

```vbnet
Private visa As IMessageBasedSession

visa = GlobalResourceManager.Open(addr)
```

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

```vb
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 OSX-100 runs SCPI commands asynchronously. To check if an operation is complete, it is required to poll the status bit via the query "*STAT:OPER:COND?*". If the return value is 0, the OSX-100 has completed its operation.

```vb
Try
    Write("Close" + cCommand.SChannel.ToString + vbLf)

    While (iResponse <> 0)
        strSwitchResponse = Query(":STAT:OPER:COND?" + vbLf)

        If Not Integer.TryParse(strSwitchResponse, iResponse) Then
            iResponse = -1
        End if

        System.Threading.Thread.Sleep(10)

        iCycles += 1

        If iCycles > 300 Then
            Throw New System.TimeoutException("Switch did not complete its
operation")
        End If
    End While
Catch ex As Exception
    MsgBox(ex.Message)
End Try
```

Commands Lists

See Table 4 and Table 5 for SCPI required and OSX-100 commands respectively.

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Table 4: 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:ADDRess <ip/dhcp>`
`:SYSTem:COMMunicate:LAN:ADDRess?`
`: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?`

Table 5: OSX-100 commands list

Command	Description
`CLOSe`	Move switch to the next channel.
`CLOSe #`	Move switch to channel #.

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CLOSe?	Return current switch channel.
CFG:SWT:END?	Return switch channel count.
MODule:CATalog?	Returns a comma separated list of all modules present in the unit. Ex. "SX 1Ax24","SX 2Bx12" List is always returned in order. I.e first item is module 1, last item is module n.
MODule#:INFO?	Return details about module n. This info will be more detailed, equivalent to the data shown in the module selection grid. First module is Module 0.
MODule:NUMber?	Return total number of modules present.
MODule:SELect	Select next module.
MODule:SELect #	Select module #.
MODule:SELect?	Return current selected instrument.
ROUTe:CHANnel:ALL #	Change channel to # on all modules.
ROUTe#:CHANnel #	Change channel to # on module #.
ROUTe#:CLOSe #	Change channel to # on module #.
ROUTe#:CHANnel?	Return current channel of module #.
ROUTe#:COMMon #	Change common (input) on module #.
ROUTe#:COMMon?	Return currently selected common.
ROUTe#:HOMe	Reset the switch motors by finding the "home" position again. Use if switch channels ever desynchronize.
LCL #	Local = 1 or remote=0.
LCL?	Return interaction mode.
TEST:NOTIFY# "<string>"	Push a notification to the OSX-100 LCD. # determines icon

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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 Connectors

1. Use a bulkhead inspection probe to inspect the output connectors.
2. If needed, use the appropriate in-bulkhead cleaning device.

User Replaceable Fuse

The OSX-100 has a user replaceable T1A, 250V, 1A fuse.

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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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Email: info.inst@santec.com
Website: www.santec.com

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Specifications

Parameter	Specification	
	Single-mode	Multimode
Wavelength Range (nm)	1250 to 1670	840 to 1350
Insertion Loss (dB)[1]	< 0.5	
Backreflection (dB)[1]	< -60	< -40
PDL (dB)	< 0.05	N/A
Repeatability (dB)[2]	± 0.005	
Crosstalk (dB)	< -80	
Maximum Input Power (mW)	300	
Switching Time (ms)	300	
Control	USB or Ethernet	
Input Voltage	100 to 240 V AC, 50 to 60 Hz	
Power Consumption (VA)	40 to 80	
Switch Life (cycles)	10^8	

Notes:
[1] *excluding connectors*
[2] *sequential switching, add ± 0.02 dB for random*

Table 6: OSX-100 mechanical and environmental specifications sheet

Parameter	Specification	
	2 – 48 Channels	> 48 Channels
Unit Dimensions W x H x D (cm)	23.5 x 12 x 32.5 (2U half rack)	48.5 x 13.5 x 49.5 (3U full rack)
Shipping Box Dimensions W x H x D (cm)	36.5 x 39 x 53	53 x 32 x 57
Unit Weight (kg)	3.6	10.8
Total Shipment Weight (kg)	4.6	11.8
Operating Temperature (°C)	0 to 55	
Storage Temperature (°C)	-40 to 70	
Humidity (Non-condensing)	Max 95% RH from 0 to 40°C	

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