polatis

SWITCHES FOR TEST, DEFENSE & COMMUNICATIONS

User Manual

Operations Guide

SCPI Protocol – Operation

Issue: May 2013

P-PROD-C-101-13-0

P O L A T I S

S O F T W A R E R I G H T S

POLATIS INC OWN THE RIGHTS TO THE SOFTWARE EMBEDDED WITHIN THE UNIT DESCRIBED IN THIS MANUAL*. THIS SOFTWARE IS SUPPLIED SOLELY FOR OPERATION OF THE UNIT AS DESCRIBED IN THIS MANUAL. NEITHER THE EMBEDDED SOFTWARE NOR ANY PART THEREOF MAY BE EXTRACTED, MODIFIED, REVERSE COMPILED, REPRODUCED, DISTRIBUTED OR USED FOR ANY OTHER PURPOSE THAN THAT INTENDED.

*** CERTAIN COMPONENTS OF THE SOFTWARE ARE PROVIDED TO POLATIS UNDER LICENSE. THE FULL SOFTWARE LICENSING AGREEMENTS IS AVAILABLE FROM CUSTOMER SUPPORT OR CAN BE DOWNLOADED ONLINE FROM WWW.POLATIS.COM/SUPPORT.**

THE SPECIFICATIONS AND INFORMATION REGARDING THESE PRODUCTS ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE, BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED.

Release Notes
SCPI

The below subsections refer the user the relevant section of the SCPI Operations. Manual

IP Address Configuration

Please refer to the Section 3.9.3 for configuring the IP Address(es). Use a Terminal Emulation program such as HyperTerminal or TeraTerm to connect to the unit's RS232 interface. For general details of unit control and operation using the RS232 interface, the reader should refer to the **Quick Start Guide**

.

The unit is shipped with its factory assigned IP address of **192.168.0.1** on Ethernet Port 0. To query the IP address for Ethernet Port 0, use the command:

:syst:comm:netw:addr?

Reply:	IP="192.168.0.1" Gateway="0.0.0.0" Mask="255.255.255.0" Broadcast="192.168.0.255

To set the IP address for Ethernet Port 0, use the command:

:syst:comm:netw:addr <ip>[,<gateway>[,<mask>[,<broadcast>]]]

Example	: syst:comm:netw:addr “192.168.0.1”
Reply:	<none>

If the switch is configured with a second Ethernet Port 1, its factory assigned IP address is **192.168.1.1**.

To query the IP address for Ethernet Port 1, use the command:

:syst:comm:netw2:addr?

Reply:	IP="192.168.1.1" Gateway="0.0.0.0" Mask="255.255.255.0" Broadcast="192.168.1.255

To set the IP address for Ethernet Port 1, use the command:

:syst:comm:netw2:addr <ip>[,<gateway>[,<mask>[,<broadcast>]]]

Example	: syst:comm:netw2:addr “192.168.1.1”
Reply:	<none>

CONTENTS

1 INTRODUCTION

This manual details control of the different Polatis Optical Switch product families using the Polatis SCPI command line interface.

Depending on the product variant, control messages are sent via TCP/IP sockets over Ethernet, via RS232 or via GPIB.

For details of preparing a switch for control the reader should refer to the relevant **Installation and Commissioning** manual for the unit.

This manual details the Polatis SCPI Control Interface. If not explicitly stated otherwise the operation of the Polatis SCPI Control Interface is common to all variants of Optical Switches where this command interface is a feature and enabled.

The Polatis SCPI Control Interface release extends to the Polatis Switch Module product family. It has also had four new subsystems of SCPI Device Specific commands added for enhanced operation as well as status reporting: OXC Switch Subsystem, OXC Boot Operations, OXC Unsolicited Event Notification and OXC Unsolicited Report Subsystem and OXC Protection Switching Subsystem.

For editorial convenience the remainder of this manual shall generally use examples of a 16x16 switch (such as the OSM-16x16 Switch Module; or OST-16x16 Tray in the Polatis Optical Switch product family).

1.1 Overview of SCPI Protocol

The Polatis SCPI Control Interface commands are based on the Common Commands and reporting structures of IEEE488.2 with the addition of some Device Specific Commands to control the capabilities particular to the switch.

Multiple commands may be sent per line. These should be separated by ; (semicolon).

The following example of a SCPI synchronisation command instructs a Polatis optical switch (such as those in the OSM-NxM Module or OST-NxM Tray) to a new state and returns a 1 when switching is complete:

Sample Command: `:oxc:swit:conn:only (@1,2,3),(@17,18,19);*opc?`

Reply: `1`

It is not necessary to repeat header paths when entering multiple commands in a single line. For example:

Sample Command: `:oxc:swit:conn:only (@1,2,3),(@17,18,19); stat?`

Reply: `(@1,2,3),(@17,18,19)`

Ports can be specified as lists and as ranges. For example the following commands are effectively the same as above.

Sample Command: `:oxc:swit:conn:only (@1:3),(@17:19); stat?`

Reply: `(@1,2,3),(@17,18,19)`

Similar means of synchronisation may be achieved through the use of the SCPI Common Commands status reporting structures and the use of *OPC and status byte polling *STB?.

SCPI commands are not case–sensitive.

1.2 Switch Management Overview

An NxM switch can logically be represented as shown in the Figure below. Ports are generally numbered sequentially. In other words for a 16x16 switch, port 9 is an input port; whereas for an 8x8 switch, port 9 is an output port.

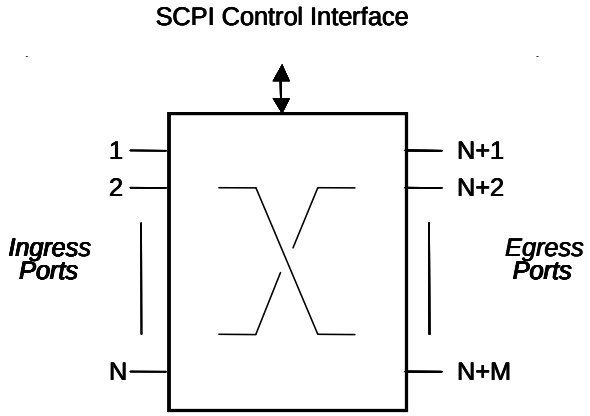


Figure 1. Logical representation of NxM optical switch

For a Polatis 16x16 optical switch (with 16 ingress ports and 16 egress ports) a full set of 16 pairs describing the mapping of ingress ports to egress ports is required. The example SCPI command below shows how the switch state is set:

```
:oxc:swit:conn:only   (@1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16),
(@17,18,19,20,21,22,23,24,25,26,27,28,29,30,31)
```

Note — Not all Polatis Optical Switches use this port numbering scheme. The operator should use the port numbers shown on the unit operated.

1.3 Using SCPI with Reconfigurable Switches

This section describes the Polatis SCPI Control Interface command set when used with Reconfigurable Switches.

For Reconfigurable Switches the ports are numbered sequentially from 1 to N, where N is the total number of optical fibres connected to the switch. Unlike a conventional switch where individual ports are always either input or output ports, all of the N ports can be dynamically specified either as input ports or output ports.

For a 32 port Reconfigurable Optical Switch each port could be connected to the next port in the sequence using the **:oxc:swit:conn:only** command:

```
:oxc:swit:conn:only   (@1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31),
(@2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32)
```

The logical representation of this is:

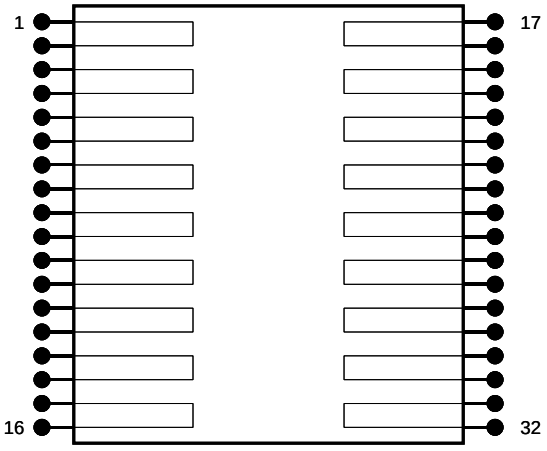


Figure 2. Logical representation of 32 port Reconfigurable Optical Switch with each port connected to its adjacent port

The above SCPI command would not be valid for a conventional 16x16 switch.

A 32 port Reconfigurable Switch could naturally also be connected, similar to a conventional 16x16 switch, with a straight through connection pattern using the SCPI command below:

```
:oxc:swit:conn:only   (@1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16),
(@17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32)
```

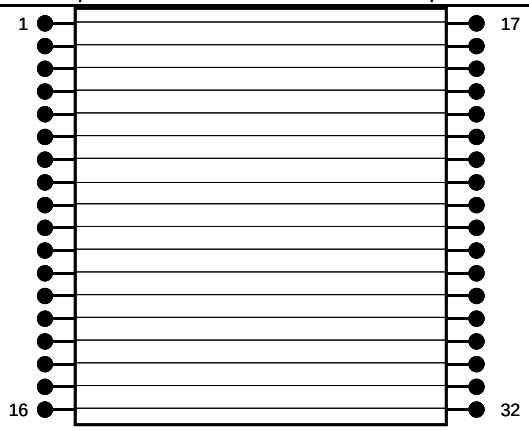


Figure 3. Logical representation of 32 port Reconfigurable or 16x16 conventional Optical Switch with straight through connection pattern

1.4 References

[1] IEEE Standard Codes, Formats, Protocols, and Common Commands, IEEE-488.2-1987, ISBN 471-61871-3.

[2] Standard Commands For Programmable Instruments, Version 1999.0, May 1999 (see http://www.ivifoundation.org/scpi/default.aspx).

[3] GR-199-CORE, OTGR Section 12.2: Operations Application Messages - Memory Administration Messages, Issue 5, August 2002 (Telcordia Technologies).

[4] GR-833-CORE, OTGR: Network Maintenance: Network Element and Transport Surveillance Messages, Issue 5 August 2004 (Telcordia Technologies).

[5] "Recovery (Protection and Restoration) Terminology for Generalized Multi-Protocol Label Switching (GMPLS)", RFC 4427, March 2006 (see http://www.ietf.org/).

[6] "Generalized Multi-Protocol Label Switching (GMPLS) Recovery Functional Specification", RFC 4426, March 2006 (see http://www.ietf.org/).

[7] "Transmission Systems And Media, Digital Systems and Networks", ITU Recommendation G.808.1, 03/2006.

1.5 Definitions, acronyms and abbreviations

Abbreviation	Meaning
APS	Automatic Protection Switching
NIC	Network Interface Card (see **Error! Reference source not found.**)
SSL	Secure Socket Layer. A protocol for secure communication over a network.
Switch Controller	A unit that allows multiple Polatis switches to be controlled as a single unit
VOA	Variable Optical Attenuation

2 SCPI COMMON COMMANDS

This section lists the SCPI Common Commands mandated by the standards documents [1] and [2].

2.1.1.1 *CLS

SCPI Clear Status command. Clears all Event registers summarized in the status byte and Error Queue.

Sample Command: `*cls`
Reply: `<none>`

2.1.1.2 *ESE <value>

Parameter	Form	Description
value	numeric_value	Value for ESE register

SCPI Standard Event Status Enable Register (ESE) command. Sets the value of the Standard Event Status Register.

Sample Command: `*ese 0`
Reply: `<none>`

2.1.1.3 *ESE?

SCPI Standard Event Status Enable Register query. Returns the current value of the Standard Event Status Register.

Sample Command: `*ese?`
Reply: `191`

Note The above reply is an example. The exact reply will vary depending on the content of the Standard Event Status Enable Register.

2.1.1.4 *ESR?

SCPI Standard Event Status Register query. Returns the current value of the Standard Event Status Register and clears the register after the read.

Sample Command: `*esr?`

Reply: `1`

2.1.1.5 *IDN?

SCPI Identification query. Returns identification information about the unit including vendor, model number, serial number and software version.

Sample Command: `*idn?`

Reply: `Polatis,VST-24x24-LU1-MNANS-500,00000178, 5.3.9 [Rel]`

Note The above reply is an example. The exact reply will vary depending on the actual switch model, serial number and software release.

2.1.1.6 *OPC

SCPI Operation Complete command. The unit will set the OPC bit of the Standard Event Status Register (ESR) on completion of any outstanding operations.

In conjunction with the appropriate Standard Event Status Enable (ESE) and Standard Service Request Enable (SRE) register settings, this permits the controller to poll the switch's status byte for completion of any outstanding operations.

Sample Command: `*opc`

Reply: `<none>`

2.1.1.7 *OPC?

SCPI Operation Complete query. The unit will complete any outstanding operations and then return a 1 to signal when it has done so.

Sample Command: `*opc?`

Reply: `1`

2.1.1.8 *RST

SCPI Reset command. The switch will perform a reset to default settings without changing any SCPI Event Register settings (ESR, ESE).

Sample Command: `*rst`

Reply: `<none>`

2.1.1.9 *SRE <value>

Parameter	Form	Description
value	numeric_value	Value for SRE register

SCPI Service Request Enable command. Sets the value of the Standard Service Enable Request Register (SRE).

Sample Command: `*sre #hff`

Reply: `<none>`

2.1.1.10 *SRE?

SCPI Service Request Enable query. Returns the value of the Standard Service Enable Request Register (SRE).

Sample Command: `*sre?`

Reply: `0`

Note The above reply assumes the Standard Service Enable Request Register is empty.

2.1.1.11 *STB?

SCPI Read Status Byte query. Returns the value of the status byte.

Sample Command: `*stb?`

Reply: `0`

Note The above reply assumes the Status Byte has not been set.

2.1.1.12 *WAI

SCPI Wait to Continue command. The OXC will complete any outstanding operations before processing any following commands.

Sample Command: `*wai`

Reply: `<none>`

3 SCPI COMMAND TREE

This section defines all the commands in the SCPI command tree. These include both standard and device-specific SCPI commands.

The following top-level branches are present in the Polatis SCPI implementation. Some branches are only relevant to specific products.

Branch	Description	Notes
APS	Contains commands for Automatic Protection Switching.	Available as an option in switches fitted with optical power monitors.
ATTenuate	Contains commands for Variable Optical Attenuation.	Available as an option in switches fitted with optical power monitors.
MMemory	Commands for storing and loading switch configurations	Available in all NIC products.
OXC	Commands for provisioning optical cross connects	Available in all products.
PMONitor	Commands for configuring optical power monitors	Available as an option in NIC products
SCT	Commands for configuring Switch Controllers	Available only in Switch Controller units.
SECurity	Commands for configuring security features	Used in switches running SSL-enabled web-browser.
STATus	Commands for querying switch status	Available in all NIC products.
SYSTem	System configuration commands	Available in all products.

3.1 :APS Command Subtree

3.1.1 Automated Protection Switching Overview

3.1.1.1 Terminology

The terminology used in this document is taken from reference [5] where possible, which defines a common terminology for GMPLS-based recovery mechanisms. Terminology is also chosen to be consistent with TL1 commands relating to protection switching, defined in references [3] and [4].

Figure 4 shows a simple example to illustrate the basic terms. User data (*Normal Traffic*) enters at the ingress interface and exits at the egress interface. The working span carries this traffic unless it fails in which case the traffic is switched to the recovery span instead. The nodes are cross-connects such as Polatis switches. When the working span is functioning correctly the spare protection capacity may be used to carry low-priority data (*Extra Traffic*).

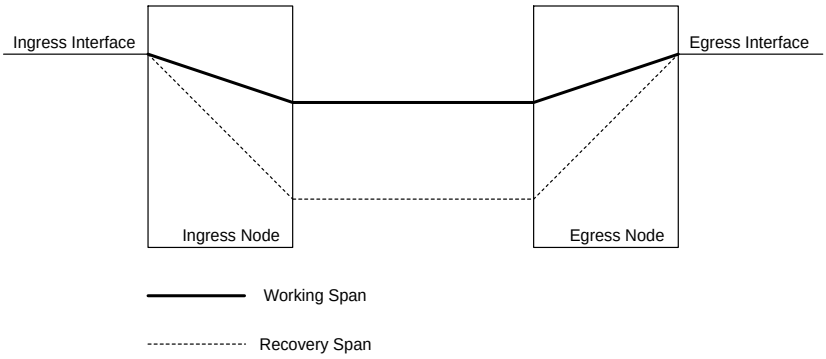


Figure 4. Basic Protection Switching Terminology.

On a single node the ports are defined as shown in Figure 5. The port carrying the working span is the Working Port or the Protected Port. The ports carrying recovery spans are called the Protection or Protecting ports.

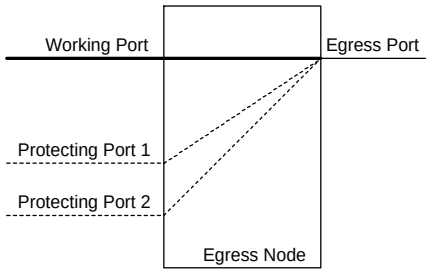


Figure 5. Definition of Ports on a Single Egress Node.

3.1.1.2 Polatis Protection Switching Model

Polatis switches support *M:N* Protection Switching in which *M* recovery spans are used to backup *N* working spans,. Normally $M \leq N$. *M:N* protection switching is a superset of the 1:1 and 1:*N* protection switching models. The model is based on the IETF Common Control and Measurement Plane (CCAMP) working group's $(M:N)^n$ recovery scheme, in which there are n Protection Groups each consisting of N working spans and M recovery spans [6]. Some of the recovery spans in each Protection Group may be shared between the other Protection Groups. This is shown in Figure 6 for two Protection Groups.

When a working span fails in one of the Protection Groups the protection switching algorithm first uses its dedicated recovery spans so as to minimise the use of shared resources. When the dedicated recovery spans are exhausted the shared spans are brought into use.

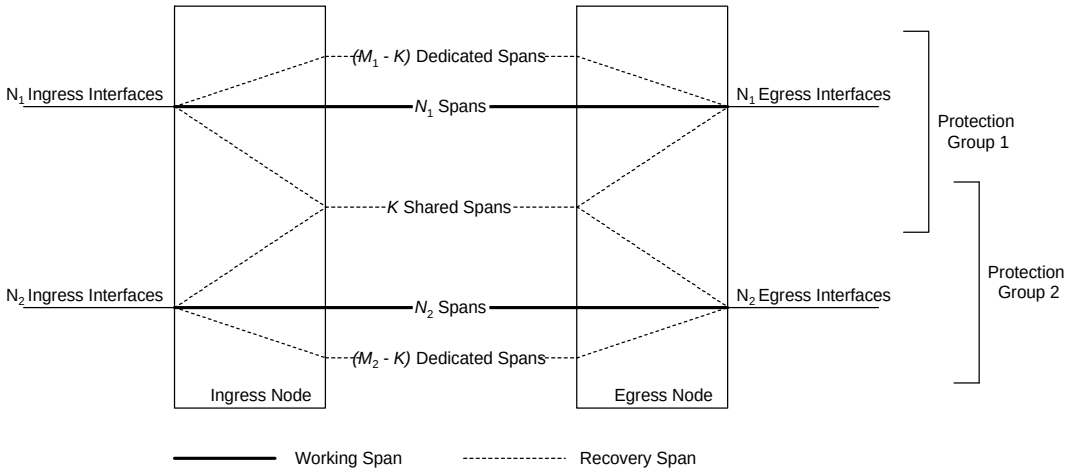


Figure 6. Schematic of Two Protection Groups Sharing Recovery Spans.

Protecting ports must be chosen to be accessible to the ingress or egress interface connected to the working port. For example, an output port on a 16x16 switch can only be protected by other output ports. Similarly, an input port can only be protected by other input ports. In a reconfigurable switches any port may be used as a protecting port.

The priority of protecting ports is determined by the order they are specified by the user in the command provisioning them. When protection switching is triggered the highest priority available protecting port is chosen for the recovery span.

Protection switching for a port can be enabled or inhibited using the **`:APS:SWIT:TOPR:ENAB`** command and the **`:APS:SWIT:TOPR:DIS`** command respectively. If a protecting port is inhibited then it will not be used for protection switching. The detailed behaviours of these commands are described below.

Protection Switching is non-revertive. The switch will not automatically switch back to the working port. Additionally, *extra* traffic that is dropped in favour of protected *normal* traffic is not reinstated automatically when the working span is brought back into use.

Protection switching can in general be unidirectional or bi-directional. The differences are summarised below. Example of a further reference is [7].

- Unidirectional: Protection switching occurs only at the node detecting the fault. No communication is required with the node at the other end of the recovery span.
- Bi-directional: Protection switching occurs at both ends of the recovery span. This requires a communications protocol between nodes to coordinate switching.

Polatis protection switching is restricted to unidirectional protection switching, as due to complete optical transparency is no support for communication between nodes[1]. A consequence of this is that if the node detecting failure switches to a recovery span that is carrying extra traffic, this traffic might be for a period of time be connected to an Egress Interface until the node at the other end of the recovery span switches to the recovery span.

3.1.1.3 Triggering Protection Switching

Protection switching is triggered by a power monitor alarm event on either the working port or the ingress/egress port, to that the working port is connected to in the working configuration. For details on configuring Power monitor alarms see the section *Using SCPI with OPM Switches*.

To enable protection switching for a port a *Facility Protection Group* (FFP) for the port must also be created.

When an alarm is triggered the working span will be switched to the highest priority recovery span available in the FFP.

If a further is triggered by on the recovery span a further protection switch event will take place, moving the traffic onto the next highest priority recovery span available.

When an alarm is triggered on a protecting port, e.g. if the switch attempts to switch traffic to a failed span, the traffic will be switched to another recovery span in the FFP.

The failed protecting port in the Protection Group is flagged as inhibited, as though the user had used the **`:APS:SWIT:TOPR:DIS`** command to inhibit the port. This protecting port will not be used again by any Protection Group until the user re-enables the protecting port using the **`:APS:SWIT:TOPR:ENAB`** command.

Creating a Facility Protection Group is described in the section Facility Protection Group Configuration

[1] Conventionally bi-directional switching is required for *M*:*N* protection switching.

3.1.1.4 APS Interactions with Cross-Connect Provisioning

This section defines how the APS subsystem interacts with normal provisioning of cross connects. It is important to define how the switch behaves when, for example, the user attempts to use a port that is already in use as a recovery span.

The APS subsystem is essentially superimposed on the normal provisioning of cross-connects. Therefore the provisioning commands act on the actual cross-connects in the switch without considering whether they are working or protecting ports. A query of the cross-connects will always return the current connectivity, so if a protection switch has taken place it will show the protecting port connected to the ingress or egress.

3.1.1.4.1 Facility Protection Group Configuration

The following sections define the switch's behaviour under different circumstances when a Facility Protection Group is created.

Note: In the sections below the states **`PRIN`** and **`WKIN`** are used to refer to ports that have switch-to-protection inhibited and switch-to-working inhibited respectively. These states are defined as part of the **`:APS:SWITCH:STATE?`** command.

3.1.1.4.2 Configuration Without Existing Cross-Connects

In this scenario a Protection Group is created containing a working port that is not cross-connected to anything. This is likely to be a common scenario, in which a Protection Group is configured prior to provisioning a cross connect so that the working port is protected immediately.

However, this raises the issue of protection switching being triggered on the working port before a cross-connect is made. This is resolved by inhibiting protection switching on the working port (i.e. the **`PRIN`** condition is raised). However, when a cross-connect is made to the working port this inhibition is automatically released.

3.1.1.4.3 Configuration With Existing Cross-Connects

In this scenario a Protection Group is created for ports which are already provisioned with cross-connects. In this case traffic carried by the working port is protected immediately (i.e. the **`PRIN`** condition is not raised on the working port). Any traffic carried by protecting ports is treated as Extra Traffic.

3.1.1.4.4 Deleting Cross-Connects

The following sections define the switch's behaviour when a cross-connect is deleted.

3.1.1.4.4.1 Delete Working Port, With Working Span Active

In this scenario a Protection Group has been configured and the working port has a cross connect in place that is carrying working traffic. An attempt to delete the cross-connect to the working port will be rejected unless the command is forced by specifying **`FORCed`** as the command's mode parameter.

If the disconnect is forced by the user the situation becomes the same as that described in the **Configuration Without Existing Cross-Connects** section, in which a Protection Group exists without a cross-connect. Therefore protection switching is inhibited on the working port just before making the disconnect, and is flagged so that the inhibition is released automatically when a new cross-connect is made. This is shown schematically in the diagram below.

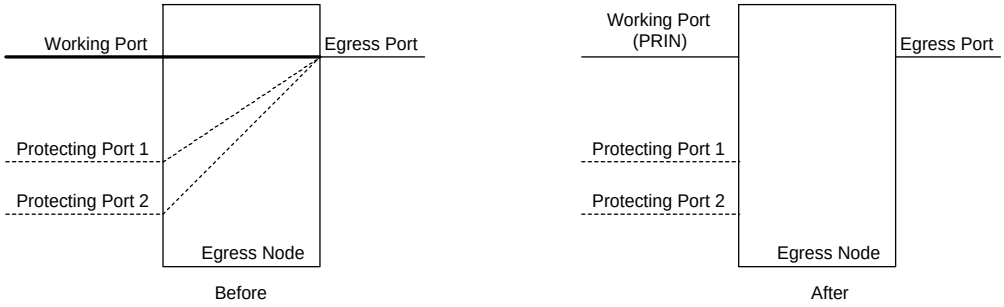


Figure 7. Delete Cross-Connect to Working Port

3.1.1.4.4.2 Delete Working Port, With Recovery Span Active

In this scenario a Protection Group has been configured, APS has been triggered and now a protecting port is carrying the traffic rather than the working port. An attempt to delete the cross-connect to the working port will have no effect because the actual cross-connect in place is to the protecting port and not to the working port – the cross-connect provisioning commands act on the current state of the switch.

3.1.1.4.4.3 Delete Protecting Port, With Working Span Active

In this scenario a Protection Group has been configured, the working port has a cross connect in place and is carrying the working traffic. If the user attempts to delete the cross-connect to a protecting port then the command will succeed because it is only Extra Traffic that is affected by the command, which can safely be dropped at any time.

3.1.1.4.4.4 Delete Protecting Port, With Recovery Span Active

In this scenario a Protection Group has been configured, APS has been triggered and now a protecting port is carrying the traffic rather than the working port.

Attempting to delete the cross-connect to the protecting port will fail unless the command is forced by specifying **`FORCed`** as the command's mode parameter. If the delete command is forced then **`PRIN`** is raised for the working port to prevent protection switches on the disconnected port. This is a temporary inhibition and is cleared when a new cross-connect is made to the working port. In effect this situation becomes the same as that described in the **Configuration Without Existing Cross-Connects** section and is shown schematically in the figure below.

In the case where **`WKIN`** has been raised by the user for the working port, the condition will be cleared automatically when **`PRIN`** is raised. This means that if the user has set **`WKIN`** on the working port,

the **WKIN** condition is automatically cleared when the connection is deleted, and a **PRIN** condition is raised for the working port instead.

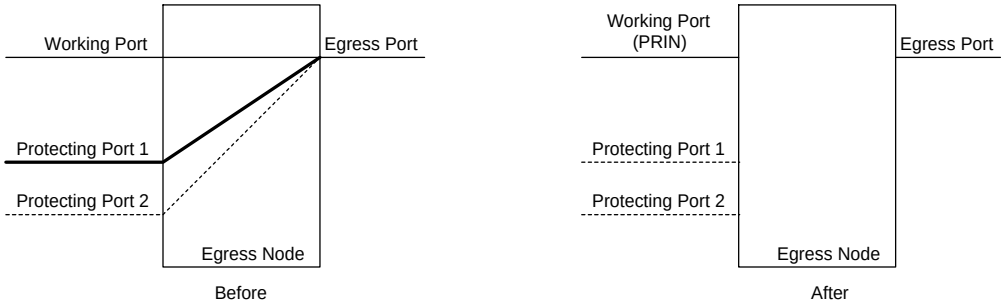


Figure 8. Delete Cross-Connect to Protecting Port.

3.1.1.4.5 Modify a Cross-Connect

The following sections describe the switch's behaviour when cross-connects are modified.

3.1.1.4.5.1 Modify Working Port With Working Span Active

In this scenario a Protection Group has been configured, the working port has a cross connect in place and it is carrying traffic. Attempting to connect a different ingress or egress to the working port is rejected unless it is forced by specifying **`FORCed`** as the command's mode parameter.

If the command is forced then the update is made, and in order to prevent a protection switch while updating the routing **`PRIN`** is raised for the working port during the change. This condition is released as soon as the switch is complete. This is shown in the diagram below.

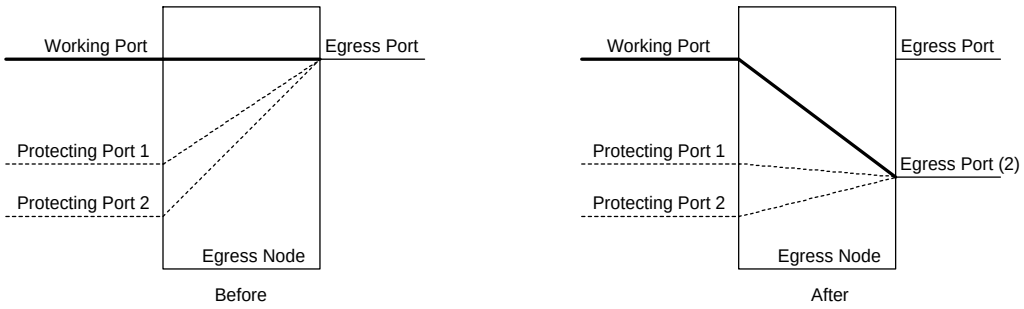


Figure 9. Modify Working Port With Working Span Active.

3.1.1.4.5.2 Modify Protecting Port With Working Span Active

In this scenario a Protection Group has been configured, the working port has a cross connect in place and it is carrying the working traffic. Updating the cross-connect to a protecting port will succeed because it is only Extra Traffic that is affected by the command.

3.1.1.4.5.3 Modify Ingress/Egress Port With Working Span Active

In this scenario a Protection Group has been configured, the working port has a cross connect in place and is carrying traffic. Attempting to modify the routing of the ingress or egress port (i.e. so as to leave the working port disconnected) is rejected unless it is forced by specifying **`FORCed`** as the command's mode parameter. This is shown schematically in the figure below.

This is handled in the same way as deleting a cross-connect to a working port (refer to **Configuration Without Existing Cross-Connects** section). **`PRIN`** is raised for the working port.

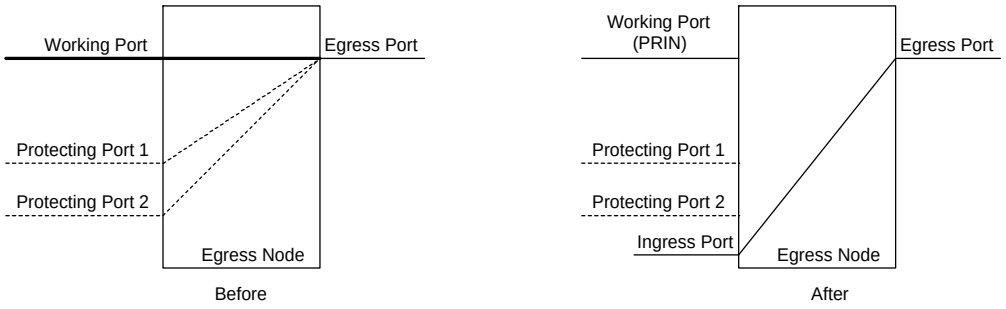


Figure 10. Modify Ingress Port with Working Span Active.

3.1.1.4.5.4 Modify Working Port With Recovery Span Active

In this scenario a Protection Group has been configured, APS has been triggered and now a protecting port is carrying the traffic rather than the working port.

Attempting to update the cross-connect to the working port will be rejected unless the command is forced by specifying **`FORCed`** as the command's mode parameter. If the command is forced then not only will the working port be connected to the new ingress or egress port, but the protecting port will be disconnected as well. This is because it is inconsistent for the protecting port to be 'protecting' traffic for a connection, which has been forcibly broken by the user.

Also, **`PRIN`** is raised for the working port to prevent protection switches on it. This is not flagged as a temporary inhibition. This is deliberately in contrast to the function described in the **Configuration Without Existing Cross-Connects** section. The user must manually clear this inhibition to allow protection switching again on this new cross-connect.

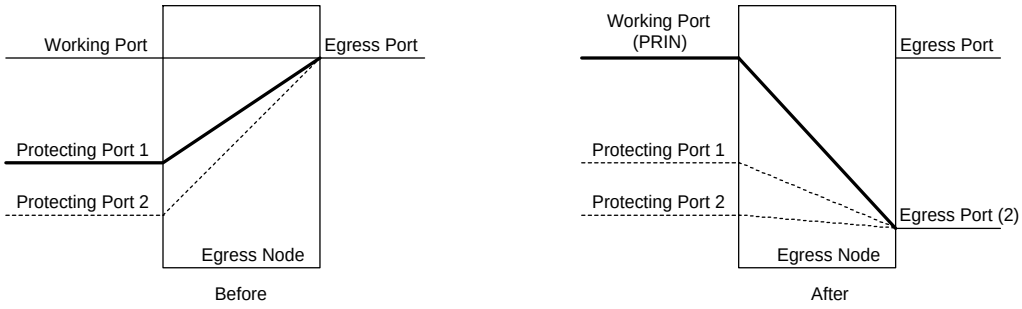


Figure 11. Modify Working Port With Recovery Span Active.

3.1.1.4.5.5 Modify Protecting Port With Recovery Span Active

In this case a Protection Group has been configured, APS has been triggered and now a protecting port is carrying the traffic rather than the working port.

Attempting to update the cross-connect to the protecting port will be rejected unless the command is forced by specifying **FORCed** as the command's mode parameter. If the command is forced then the update is made in three stages.

1. Traffic is switched back to the working port and **PRIN** is raised for the working port. If the working port has raised the condition **WKIN** then this condition is cleared automatically. This is not a temporary inhibition – it has to be cleared manually.

2. **PRIN** is raised for the protecting port that is about to be used for the new cross-connect.

3. The new cross-connect is made for the protecting port, and this is considered to be Extra Traffic on that port. This is illustrated in the figure below.

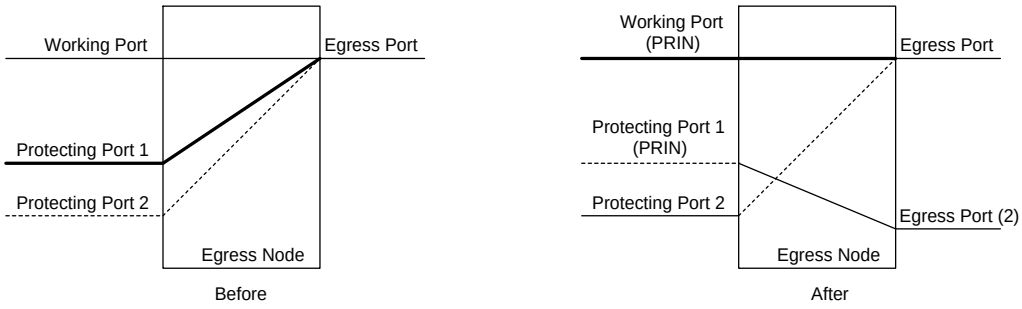


Figure 12. Modify Protecting Port With Recovery Span Active.

3.1.1.4.5.6 Modify Ingress/Egress Port With Recovery Span Active

In this scenario a Protection Group has been configured, APS has been triggered and now a protecting port is carrying the traffic rather than the working port.

Attempting to modify the routing of the ingress or egress port (i.e. so as to leave the protecting port disconnected) is rejected unless it is forced by specifying **`FORCed`** as the command's mode parameter. This is handled in the same way as deleting a cross-connect to a protecting port (refer the **Configuration Without Existing Cross-Connects** section). **`PRIN`** is raised for the disconnected working port.

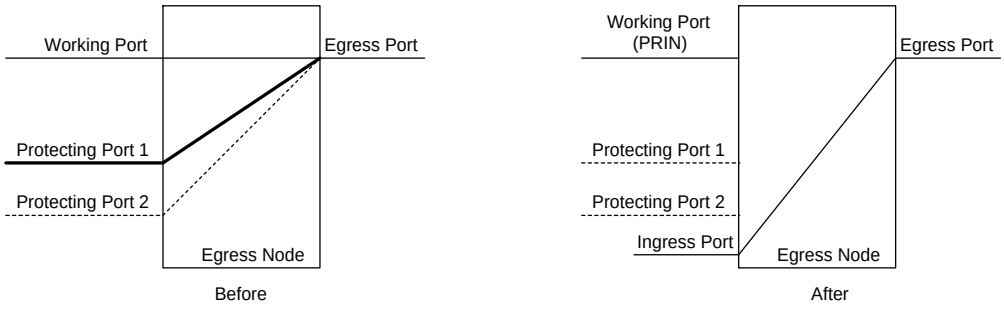


Figure 13. Modify Ingress/Egress Port With Recovery Span Active.

3.1.2 APS Commands

Two command subsystems are relevant to Automated Protection Switching (APS). The APS commands are summarised in the subsection below. In addition commands in the **:OXC:SWITch:CONNect** Subsystem are affected by APS.

Command	Parameter Form
APS	
:FFP	
:ADD	<channel_list>,<channel_list>
:STATE?	<channel_list>
:SUB	<channel_list>,<channel_list>
:SWITCH	
:STATE?	<ports>,[ISNR|OS|OSAu|OSMa|PRIN|WKIN]
:TOPROTECTION[:MANUAL]	<numeric_value>,[<numeric_value>]
:TOPROTECTION:DISABLE	<channel_list>
:TOPROTECTION:ENABLE	<channel_list>
:TOWORKING[:MANUAL]	<numeric_value>
:TOWORKING:DISABLE	<channel_list>
:TOWORKING:ENABLE	<channel_list>

3.1.2.1 :APS:FFP:ADD <working ports>, <protecting ports>

Parameter	Form	Description
working ports	channel_list	A list of ports to be configured as Working Ports.
protecting ports	channel_list	A list of ports to be used as Protecting Ports.

This command configures Facility Protection Groups for ports. The Protecting Ports listed here are added to the FFP for the Working Ports specified. The priority of the Protecting Ports within each FFP is determined by the order in which they are specified (highest priority first).

Sample Command: **:aps:ffp:add (@1,2,3),(@4,5,6)**

Reply: **<none>**

3.1.2.2 :APS:FFP:STATE? <working ports>

Parameter	Form	Description

working ports	channel_list	A list of Working Ports to be queried

This command queries Facility Protection Group configuration for the working ports specified.

Sample Command: `:aps:ffp:stat? (@1,2,3)`

Reply: `(@4,5,6),(@4,5,6),(@4,5,6)`

3.1.2.3 :APS:FFP:SUB <working ports>, <protecting ports>

Parameter	Form	Description
working ports	channel_list	A list of Working Ports.
protecting ports	channel_list	A list of ports to be removed as Protecting Ports.

This command configures Facility Protection Groups for ports. The Protecting Ports listed here are removed from the FFP for the Working Ports specified.

Sample Command: `:aps:ffp:sub (@1,2,3),(@5,6)`

Reply: `<none>`

3.1.2.4 :APS:SWITCH:STATE? <ports>, [<condition>]

Parameter	Form	Description
ports	channel_list	A list of ports to be queried (both working ports and protecting ports).
condition	`ISNR|OS|OSAu|OSMa|PRIN|WKIN`	An optional filter parameter to query ports with specific states

The <condition> parameter can take the following values. These are also the values reported in the reply.

- **`ISNR`** Filter on ports that are in service
- **`OS`** Filter on ports that are out of service
- **`OSAu`** Filter on ports that are out of service due to an automatic protection switch
- **`OSMa`** Filter on ports that are out of service due to a manual protection switch
- **`PRIN`** Filter on ports that have Switch-to-Protection inhibited
- **`WKIN`** Filter on ports that have Switch-to-Working inhibited

Sample Command: **`:aps:swit:stat? (@1:16)`**

Reply:
```
(1 OSM,2 PRIN,3 PRIN,4 ISNR,5 ISNR,6 ISNR,7 ISNR,8 ISNR,9
ISNR,10 ISNR,11 ISNR,12 ISNR,13 ISNR,14 ISNR,15 ISNR,16
ISNR)
```

3.1.2.5 :APS:SWITCH:TOPROTECTION[:MANUAL] <working port> [<protecting port>]

Parameter	Form	Description
working port	numeric_value	The working port for which a protection switch is requested
protecting port	numeric_value	An optional protecting port for which a protection switch is requested

This command performs a manual protection switch from the working port specified in the AID. The command fails if **`:APS:SWITCH:TOPROTECTION:DISABLE`** has been used to inhibit protection switching for this port.

<protecting port> identifies the protecting port to use, and it must be within the FFP of the working port. If this is not specified then the highest priority recovery span available in the FFP is used.

If the traffic on the working port has already been switched to a recovery span then this command will trigger another protection switch to the next highest priority recovery span available.

Sample Command: **`:aps:ffp:topr 1`**

Reply: **`<none>`**

3.1.2.6 :APS:SWITCH:TOPROTECTION:DISABLE <ports>

Parameter	Form	Description
ports	channel_list	A list of ports to be configured (both Working Ports and Protecting Ports).

This command inhibits protection switching to a recovery span for the ports specified (it sets the **PRIN** condition for the these ports). This command applies both to manual and automatic protection switching.

For a working port, this command inhibits a switch from the working span to a recovery span. If a protection switch has already taken place for the working port then traffic will be switched back to the working span from the recovery span.

For a protecting port, this command inhibits the use of that port as a recovery span. If the recovery span is in use then a protection switch takes place from the inhibited span to the next highest priority recovery span available in the FFP. If there are no other recovery spans available in the FFP then the traffic is switched back to the working span.

If this command is sent to a working port for which a protection switch has taken place, and the protecting port has the condition **WKIN** (i.e. switch-to-working is inhibited) then the command will fail. Similarly, if the command is sent to a protecting port and the corresponding working port has raised the condition **WKIN** then the command will fail.

Sample Command: `:aps:swit:topr:dis (@1,5,6)`

Reply: `<none>`

3.1.2.7 :APS:SWITCH:TOPROTECTION:ENABLE <ports>

Parameter	Form	Description
ports	channel_list	A list of ports to be configured (both Working Ports and Protecting Ports).

This command enables switch-to-protection on the ports specified (it clears the **PRIN** condition for the these ports).

Sample Command: `:aps:swit:topr:enab (@1,5,6)`

Reply: `<none>`

3.1.2.8 :APS:SWITCH:TOWORKING[:MANUAL] <port>

Parameter	Form	Description
port	numeric_value	A working port for which protection switching is to be released.

This command causes a switch back to the working span for the Working Port specified..

Sample Command: `:aps:swit:tow 1`

Reply: `<none>`

3.1.2.9 :APS:SWITCH:TOWORKING:DISABLE <ports>

Parameter	Form	Description
ports	channel_list	A list of ports to be configured (both Working Ports and Protecting Ports).

This command inhibits switching from a recovery span for the ports specified (it sets the **WKIN** condition for the these ports). The switch only supports non-revertive protection switching, so this command only applies to manual switching back to a working span.

For working ports, this command inhibits a switch from a recovery span to the working span. If the working span is carrying traffic, this command also triggers a protection switch from the working span to the highest priority recovery span available in the FFP. If no recovery span is available, either because they are in use or have raised the condition **PRIN**, an error is returned and this command fails.

For protecting ports that are in use in recovery spans, this command inhibits a switch from the recovery span back to the working span. If the protecting port is not in use in a recovery span then it still raises the condition **WKIN**, and it will apply to any working traffic that is subsequently switched to the port.

Sample Command: `:aps:swit:tow:enab (@1,5,6)`

Reply: `<none>`

3.1.2.10 :APS:SWITCH:TOWORKING:ENABLE <ports>

Parameter	Form	Description
ports	channel_list	A list of ports to be configured (both Working Ports and Protecting Ports).

This command enables a switch from the recovery span to the working span on the ports specified (it clears the **WKIN** condition for the these ports). This command does not cause a switch to occur.

Sample Command: `:aps:swit:tow:enab (@1,5,6)`

Reply: `<none>`

3.2 :ATTenuate Command Subtree

3.2.1 Introduction

VOA functionality is configured using the commands defined in this section, although not all Polatis products are fitted with this feature. In addition, each VOA product variant may support only a subset of the attenuation modes specified below. The table below lists the VOA modes which are applicable to each product variant.

Where configured, Series 6000 switches support a new Variable Optical Attenuation (VOA) mode called CONVERGED. This is similar in behaviour to ABSOLUTE mode, but once the attenuation converges to the desired level the switch freezes the VOA control loop. This reduces noise caused by the control loop continually striving to improve the attenuation.

To support this mode, a new command has been added to the SCPI interface, namely `:ATTenuate:CONVerged`, with the same parameters as the `:ATTenuate:ABSolute` command.

Table 1. VST Product Variants And Their Supported VOA Modes.

VST Model Numbering and Power Monitor Configurations				Supported VOA Modes				
VST Model	**Input Power Monitors**	**Output Power Monitors**	**NONE**	**FIX**	**ABS**	**CONV**	**REL**	**MAX**
Fixed VST 100	No	Yes	Yes	Yes	Yes	Yes*	No	Yes
Fixed VST 200	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes
Fixed VST 300	No	Yes		VOA feature not supported on this model				
Fixed VST 400	Yes	No		VOA feature not supported on this model				
Fixed VST 500	Yes	Yes		VOA feature not supported on this model				
Reconfigurable VST 100	No	Yes	Yes	Yes	Yes	Yes*	No	Yes
Reconfigurable VST 300	No	Yes		VOA feature not supported on this model				
Reconfigurable VST 400	Yes	No		VOA feature not supported on this model				

* Only supported on Series 6000 switches

3.2.2 VOA Commands

Command	Parameter Form
ATTenuate	
:ABSolute	<channel_list>,<numeric_value>
:CONVerged*	<channel_list>,<numeric_value>
:FIXed	<channel_list>
:MAXimum	<channel_list>
:NONE	<channel_list>
:RELative	<channel_list>,<numeric_value> [,<channel_list>]
:STATe?	<channel_list>

* Only supported on Series 6000 switches

3.2.2.1 :ATTenuate:ABSolute <egr-list>,<power>

Parameter	Form	Description
egr-list	channel_list	A list of egress ports
power	numeric_value	An absolute power level in dBm

Configures the attenuation feature of the specified egress ports to maintain a desired absolute power level. In this state, the switch will adjust as necessary the attenuation levels of the ports specified in **`egr-list`** to effect clamping of their output powers to the value given by <power>. If the specified output power level of an egress port is higher than that which can be achieved given the available input power, minimum insertion loss will be provided.

Sample Command: **`:att:abs (@17,18,19),-10`**

Reply: **`<none>`**

Note Only basic error checking is performed on the port list. Only egress ports may be specified in the list. Valid <power> values are –40.00 to +24.00 dBm or as detailed in product specifications.

3.2.2.2 :ATTenuate:CONVerged <egr-list>,<power>

Parameter	Form	Description
egr-list	channel_list	A list of egress ports
power	numeric_value	An absolute power level in dBm

This command, only available on Series 6000 switches, configures the attenuation feature of the specified egress ports to maintain a desired absolute power level, and once the attenuation converges to the desired level the switch freezes the VOA control loop. This reduces noise caused by the control loop continually striving to improve the attenuation.

In this state, the switch will adjust as necessary the attenuation levels of the ports specified in **`egr-list`** to effect clamping of their output powers to the value given by <power>. If the specified output power level of an egress port is higher than that which can be achieved given the available input power, minimum insertion loss will be provided. This is similar in behaviour to ABSOLUTE mode, but once the attenuation converges to the desired level the switch freezes the VOA control loop.

Sample Command: `:att:conv (@17,18,19),-10`

Reply: `<none>`

Note Only basic error checking is performed on the port list. Only egress ports may be specified in the list. Valid <power> values are –40.00 to +24.00 dBm or as detailed in product specifications.

3.2.2.3 :ATTenuate:FIXed <egr-list>

Parameter	Form	Description
egr-list	channel_list	A list of egress ports

Disables closed-loop updating of the attenuation feature for the specified egress ports. Following issuance of this command, the ports specified in <egr-list> will continue to hold their current attenuation levels without any optical feedback. Thus, any changes in their respective input or reference power levels will no longer be tracked.

This feature may be useful in cases where the feedback control system has the potential to interfere with experimental measurements. To re-enable closed-loop feedback, reissue an appropriate :att:abs or :rel command.

Sample Command: `:att:fix (@17,18,19)`

Reply: `<none>`

Note Only basic error checking is performed on the port list. Only egress ports may be specified in the list.

3.2.2.4 :ATTenuate:MAXimum <egr-list>

Parameter	Form	Description
egr-list	channel_list	A list of egress ports

This command configures the attenuation feature of the specified egress ports to provide maximum attenuation. In this state, the ports specified in <egr-list> will provide a maximum level of attenuation on their outputs regardless of their connection state or the level of optical input power.

This feature may be useful when first connecting high-power sources to sensitive equipment.

Sample Command: `:att:max (@17,18,19)`

Reply: `<none>`

Note Only basic error checking is performed on the port list. Only egress ports may be specified in the list.

3.2.2.5 :ATTenuate:NONE <egr-list>

Parameter	Form	Description

egr-list	channel_list	A list of egress ports

Disables the attenuation feature on the specified egress ports. In this state, the switch will provide minimum insertion loss between connected ports.

Sample Command: **`:att:none (@17,18,19)`**

Reply: **`<none>`**

Note Only basic error checking is performed on the port list. Only egress ports may be specified in the list.

3.2.2.6 :ATTenuate:RELative <egr-list>, <delta-power>,[<ref-list>]

Parameter	Form	Description
egr-list	channel_list	A list of egress ports
delta_power	numeric_value	A relative power difference in dBm
ref-list	channel_list	A list of reference ports

Configures the attenuation feature of specified egress ports to impose a constant difference in optical power in relation to the specified reference ports. In this state, the switch will adjust as necessary the attenuation levels of the ports specified in **`egr-list`** such that their output power levels track relative to the input or output power levels of the ports specified in **`ref-list`**, respectively, by the difference in power specified by **`delta-power`**. If the effective desired output power level of an egress port is higher than that which can be achieved given the available input power, minimum insertion loss will be provided.

The **`ref-list`** parameter is optional and may be omitted. When omitted, the system will automatically assign a reference port to each specified egress port according to the connections that are provisioned at the time of execution of the **`:att:rel`** command. If any port in **`egr-list`** is not in a connection, the command will generate an error.

If **`ref-list`** is specified, it must be the same length as the list of egress ports to be attenuated but may be comprised of any combination of ports that are equipped with power monitors, whether ingress or egress. The reference port list may also contain repeated ports. When reference ports are repeated, the system essentially works to equalize the output powers of the egress ports that have been specified to attenuate relative to the same reference port.

Sample Command: **`:att:rel (@17,18,19),-10,(@1,2,2)`**

Reply: **`<none>`**

Note Only basic error checking is performed on the port list. Only egress ports may be specified in <egr-list>. Valid <delta-power> values are –45.00 to +60.00 dB.

Note Creating a deep dependency chain should be avoided since it may cause unstable behavior. For example, the following command would be ill-advised:

```
:att:rel (@17,18,19),-10,(@1,17,18)
```

3.2.2.7 :ATTenuate:STATe? <egr-list>

Parameter	Form	Description
egr-list	channel_list	A list of egress ports

Returns the attenuation state of the specified egress ports as a list of comma-separated data blocks. Each data block consists of three fields: **`mode level ref-port`**

If either of the **`level`** or **`ref-port`** fields are not applicable to a given mode, their values are replaced by an asterisk symbol (*).

Mode	Description	Example
N	None	`N * *`
A	Absolute	`A -10.50 *`
R	Relative	`R -5.00 1`
F	Fixed	`F * *`
M	Maximum	`M * *`

Sample Command: **`:att:stat? (@17,18,19)`**

Reply: **`(N * *,A -10.50 *,R -5.00 1)`**

Note

Only basic error checking is performed on the port list. Only egress ports may be specified in the list

3.3 MEMory Command SubTree

The commands in this section are used to manage switch configurations stored locally on the switch.

Note that these commands are only supported in NIC products.

3.3.1 Commands

Command	Parameter Form
MMEMory	
:CATalog?	
:DELete	<character_data>
:LOAD:OXC	<character_data>
:MOVE	<character_data>,<character_data>
STORe:OXC	<channel_list>,<character_data>,[ADD|ONLY]

3.3.1.1 :MMEMory:CATalog?

Lists all the stored files containing switch states (i.e. that can be loaded using the **:MMEM:LOAD:OXC** command).

Sample Command: **:mmem:cat?**

Reply: **652,0,"pattern1,MACR,370","pattern2,MACR,282"**

Note The first number is the space in bytes occupied by the files. The second number is the free space on the file system. Currently this always displays as zero in Polatis switches, but in fact the free space is approximately 1Mbyte. Then there is an entry for each file, giving its name, its type (**MACR** – see SCPI specification for file types) and its size.

3.3.1.2 :MMEMory:DELete <file>

Parameter	Form	Description
file	character_data	A file to be deleted from the system

Deletes a file from the file system.

Sample Command: `:mmem:del "pattern1"`

Reply: `<none>`

3.3.1.3 :MMEMory:LOAD:OXC <file>

Parameter	Form	Description
file	character_data	A file to be loaded from non-volatile memory

Loads an OXC switch state that was previously stored in memory. The mode of operation depends on how the file was saved (see the **`:MMEMory:STORe:OXC`** command). Two modes are available in that command, **`ADD`** and **`ONLY`**, which have the following behaviour:

`ADD` When the file is loaded the connections are added to any existing connections (i.e. the equivalent of the **`:OXC:SWIT:CONN:ADD`** command.

`ONLY` When the file is loaded the connections replace any existing connections (i.e. the equivalent of the **`:OXC:SWIT:CONN:ONLY`** command.

Sample Command: `:mmem:load:oxc "pattern1"`

Reply: `<none>`

3.3.1.4 :MMEMory:MOVE <src_file>, <dest_file>

Parameter	Form	Description
src_file	character_data	The current name of the file
dest_file	character_data	The new name of the file

Moves (renames) a file in the file system.

Sample Command: `:mmem:move "pattern1","pattern2"`

Reply: `<none>`

3.3.1.5 :MMEMory:STORe:OXC <ports>, <file>, [mode]

Parameter	Form	Description
Ports	channel_list	A list of ports to be included in the file
file	character_data	The name of the file to be created
mode	ADD|ONLY	The mode for the data.

Stores the connections for the ports specified in the first parameter into the file name given by the second parameter. The data are saved in non-volatile memory.

If the last parameter is specified as **ADD** then when this file is loaded using the **:MMEMory:LOAD:OXC** command the connections will be added to any existing ones as if the **:OXC:SWIT:CONN:ADD** command had been used. If the last parameter is specified as ONLY then when this file is loaded using the **:MMEMory:LOAD:OXC** command the connections will be created as if the **:OXC:SWIT:CONN:ONLY** command had been used. If this parameter is omitted it defaults to **ADD**.

Sample Command: `:mmem:stor:oxc (@17:32),"pattern1"`

Reply: `<none>`

3.4 :OXC Command SubTree

3.4.1 Introduction

The :OXC subtree is the largest in the Polatis SCPI implementation. It contains the following branches, defined in the following sections:

Branch	Description
:BOOT	Commands controlling the switch's start-up mode
:CUSTOM	Commands to manage switch identification
:GANGed	Commands to control grouped port functions
:REPort	Commands to control unsolicited event notifications
:SUSPend	Commands to control the OXC control loop compensation
:SWITch	Commands to control cross-connects

3.4.2 Configuring The Switch Start-up Mode

Command	Parameter Form
OXC	
:BOOT	
:DLY:SECS	<numeric_value>
:DLY:SECS?	
:MODE	<DARK|REST|AUT>
:MODE?	

3.4.2.1 :OXC:BOOT:DLY:SECS <secs>

Parameter	Form	Description
secs	numeric_value	The boot delay to be set, measured in seconds.

Sets the time interval for the OXC to pause after booting.

Sample Command: **:oxc:boot:dly:secs 30**

Reply: **<none>**

Note This option permits the OXC to be configured to "pause" after initially booting. In conjunction with unsolicited report notifications, this can effectively permit the OXC to be configured to "pause" after notifying the external management entity that it has rebooted. The "pause" period can give time for the external management entity to receive the unsolicited report notification and respond appropriately to an OXC power cycle or reboot.

Valid time values are 0 to 254 seconds. A time value of 0 specifies no delay.

3.4.2.2 :OXC:BOOT:DLY:SECS?

Returns the time interval for the OXC to pause after booting. The time value is specified in seconds.

Sample Command: `:oxc:boot:dly:secs?`

Reply: `30`

Note The above reply is an example. The exact reply will vary depending on period set for reporting unsolicited events. Default is 30 seconds.

3.4.2.3 :OXC:BOOT:MODE <mode>

Parameter	Form	Description
mode	DARK|REST |AUT	The boot mode.

Sets the boot mode, where the mode is one of:

- **`DARK`** the switch boots up dark (the default)
- **`RESTore`** the switch restores a defined pattern, explicitly set by the user
- **`AUTosave`** the switch restores the last-known pattern, automatically updated whenever a switch is made

Sample Command: `:oxc:boot:mode AUT`

Reply: `<none>`

Note This command is only supported in NIC products.

3.4.2.4 :OXC:BOOT:MODE?

Returns the current boot mode.

Sample Command: `:oxc:boot:mode?`

Reply: `AUT`

Note The above reply is an example. The exact reply will vary depending on the switch configuration.

Note This command is only supported in NIC products.

3.4.3 Switch Identification

Command	Parameter Form
OXC	
:CUSTom	<character_data>
:CUSTom?	

3.4.3.1 :OXC:CUSTom <string>

Parameter	Form	Description
string	character_data	Customer-specific string (max 32 characters).

Command to program an arbitrary string into non-volatile memory of a switch. The use of this string is customer specific. Examples include identification strings or information associated with a unit.

Sample Command: **:oxc:cust "My Private Identification String"**

Reply: **<none>**

Note In the Polatis SCPI Control Interface Release 2 this command supports 32-character strings.

3.4.3.2 :OXC:CUSTom?

Query to return the current value of the non-volatile customer specific string.

Sample Command: **:oxc:cust?**

Reply: **"My Private Identification String"**

Note The reply shown is an example.

3.4.4 Provisioning Cross-Connects – Grouped Ports

The Grouped Ports function allows ports to be switched in groups, as a single unit. This functionality sits alongside the normal port switching functionality. Some of the ports can be configured as members of groups, the remainder can be used as individual ports as normal. Not all Polatis switches support this function.

Individual ports are switched using the **`:oxc:swit`**: branch of tree of SCPI commands. Grouped ports are switched using the **`:oxc:gang:`** branch.

The switch prevents conflicts between these two groups of commands. For example, **`:oxc:swit:disc:all`** does not affect any ports configured as part of ganged groups. The **`:oxc:swit:`** commands can only be used on ports that are not members of a Group, and the **`:oxc:gang:`** commands can only be applied to groups.

The only exception to this is that the **`:oxc:swit:conn:stat?`** command lists all port connections by default, including ports that are members of ganged groups. If this command is run with its optional parameter set to **`PORT`**, then connections that are part of the ganged-ports subsystem are filtered out and not shown in the returned ports.

The command **`:oxc:ganged:group:create`** is used to create new groups of ganged ports. The ports specified as members of this group must not be in use in a connection-pair when this command is sent, otherwise an error will be generated because of the conflict between ganged and non-ganged switch subsystems.

The order in which ports are specified in ganged groups is important. When two groups are connected, their respective ports are connected in the order in which they were specified in the **`:oxc:ganged:group:create`** command.

Each port can be a member of any number of groups. For example, two groups could be created containing the same ports, but specified in a different order.

Only groups with the same number of ports in them can be connected to each other.

Command	Parameter Form
OXC	
:GANGed	
:CONNect	
:ADD	<character_data>,<character_data>
:ONLY	<character_data>,<character_data>
:STATe?	
:SUB	<character_data>,<character_data>
:DISConnect:ALL	
:GROup	
[:LIST]?	[<character_data>]
:CREate	<character_data>,<channel_list>
DELete	<character_data>

3.4.4.1 :OXC:GANGed:CONNect:ADD <grp1>, <grp2>

Parameter	Form	Description
grp1	character_data	The name of one group in the connection.
grp2	character_data	The name of the other group in the connection.

This command is the ganged-port equivalent of the **`:oxc:swit:conn:add`** command. It connects the ports in <grp1> to the ports in <grp2>. The command does not disconnect other ganged ports in the switch.

The groups <grp1> and <grp2> must contain equal numbers of ports to connect to each other.

If the groups <grp1> and <grp2> do not contain the same number of ports an error will be generated and -220, "Parameter error; Incompatible sizes in groups" is added to the SCPI error queue. None of the ports specified in the groups <grp1> and <grp2> will be switched.

Sample Command: **`:oxc:gang:conn:add "group1","group2"`**

Reply: **`<none>`**

3.4.4.2 :OXC:GANGed:CONNect:ONLY <grp1>, <grp2>

Parameter	Form	Description
grp1	character_data	The name of one group in the connection.
grp2	character_data	The name of the other group in the connection.

This command is the ganged-port equivalent of the **`:oxc:swit:conn:only`** command. It connects the ports in <grp1> to the ports in <grp2>, and disconnects any other ganged ports in the switch that may be connected.

The groups <grp1> and <grp2> must contain equal numbers of ports to connect to each other.

If the groups <grp1> and <grp2> do not contain the same number of ports an error will be generated and -220, "Parameter error; Incompatible sizes in groups" is added to the SCPI error queue. None of the ports specified in the groups <grp1> and <grp2> will be switched.

This command does not affect any connections made using ports that are outside the ganged-port subsystem (i.e. those made using the **`:oxc:swit:conn`** commands).

Sample Command: `:oxc:gang:conn:only "group1","group2"`

Reply: `<none>`

3.4.4.3 :OXC:GANGed:CONNect:STATe?

This command is the ganged-port equivalent of the **`:oxc:swit:conn:stat?`** command. It lists all the ganged-port groups that are connected.

The reply contains two lists of ganged-port groups, where each group in the first list is connected to the corresponding group in the second list.

Sample Command: `:oxc:gang:conn:stat?`

Reply: `(input1,input2),(output1,output2)`

3.4.4.4 :OXC:GANGed:CONNect:SUB <grp1>, <grp2>

Parameter	Form	Description
grp1	character_data	The name of one group in the connection.
grp2	character_data	The name of the other group in the connection.

This command is the ganged-port equivalent of the **`:oxc:swit:conn:sub`** command. It disconnects the ports in the connection between <grp1> and <grp2>.

This command does not affect any connections made using ports that are outside the ganged-port subsystem (i.e. those made using the **`:oxc:swit:conn`** commands).

Sample Command: **`:oxc:gang:conn:sub "group1","group2"`**

Reply: **`<none>`**

3.4.4.5 :OXC:GANGed:DISConnect:ALL

This command is the ganged-port equivalent of the :oxc:swit:disc:all command. It disconnects all ports that are defined within the ganged-ports subsystem.

Sample Command: **`:oxc:gang:disc:all`**

Reply: **`<none>`**

3.4.4.6 :OXC:GANGed:GROup[:LIST]? [<name>]

Parameter	Form	Description
name	character_data	An optional parameter specifying the group to query

If no parameter is given this command queries all the groups of ports defined in the switch. If a parameter is specified then only the group specified is listed.

The reply is a list of comma-separated entries, one for each group in the output. Each entry is a quoted string containing the name of the group followed by a channel list with the ports that are members of that group.

Sample Command: `:oxc:gang:gro:del "group1"`

Reply: `("group1,(@1,2,3,4)","group2,(@17,18,19,20)")`

3.4.4.7 :OXC:GANGed:GROup:CREate <name>, <ports>

Parameter	Form	Description
name	character_data	The name of the new group
ports	channel_list	A list of ports making up the group.

This command defines a named group of ports that can be switched as a ganged unit.

Sample Command: `:oxc:gang:gro:cre "group1", (@1:4)`

Reply: `<none>`

3.4.4.8 :OXC:GANGed:GROup:DELete <name>

Parameter	Form	Description
name	character_data	The name of the Group to be deleted

This command deletes the port grouping specified. This command can only be run if the group being deleted is not in use.

Sample Command: `:oxc: :oxc:gang:gro?gang:gro:del "group1"`

Reply: `<none>`

3.4.5 Unsolicited Event Notification

This release of the Polatis SCPI Control Interface includes a simple asynchronous unsolicited event reporting subsystem. It is enabled or disabled as a runtime option controlled by the command :oxc:report:unsolicited. (Refer page 36.)

The scheme is designed as an enhancement of the standard SCPI error queue system. It provides unsolicited messaging to an external management entity of any notifiable changes in the OXC status. This can dramatically reduce the required frequency of polls to the OXC, while still ensuring a timely response to unexpected changes in the OXC status.

To ensure compatibility with the existing poll-based standard SCPI error queuing and reporting subsystem, only a single unsolicited event report is currently generated.

```
$$$EVT,-900,"Notifiable Event Occurred"$$$
```

This notifies the external management entity that the OXC status has changed due to one of the following:

- Power on or reset
- Error message placed in SCPI event/error queue
- Event message placed in SCPI event/error queue

This notification message will be repeated at intervals set by the **`:oxc:report:period`**, until the external management entity explicitly cancels notification retransmissions by using the **`:oxc:report:ack`** command.

On receipt of an unsolicited event notification, the external management entity should acknowledge receiving the event notification using the **`:oxc:report:ack`** command and then poll the OXC to determine the cause of the status change using normal SCPI status monitoring to check the SCPI status registers and read the SCPI error queue. Alternatively, the external management entity may wish to first check the OXC status and empty the SCPI error queue before acknowledging the unsolicited event notification. The adopted scheme will depend on the time required to check on the OXC status over the communications link (RS232, Ethernet or GPIB), and the programmed time interval for unsolicited event report retransmissions.

The figure below shows the state diagram for unsolicited event reporting.

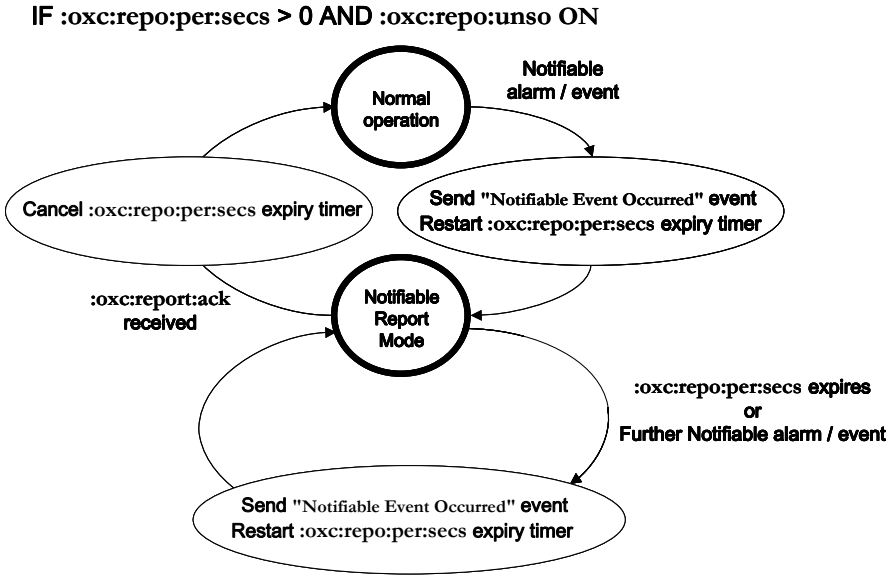


Figure 14. Unsolicited event reporting state diagram

Note — If unsolicited reports are not required then this option may be turned off using the **`:oxc:report:unsolicited`** command. Conventional standard SCPI poll-based operation will be configured by default (**`:oxc:rep:unso OFF`**) when units are shipped from the factory.

Command	Parameter Form
OXC	
:REPort	
:ACK	
:MODE	RS232|UDP|TCP|SOCKet|BROADcast
:MODE?	[NUMBer|STRing]
:PERiod	
:SECS	<numeric_value>
:SECS?	
:UDP	
:ADDRress	<character_data>
:ADDRress?	
:UNSolicited	ON|OFF
:UNSolicited?	

3.4.5.1 :OXC:REPort:ACK

Command to acknowledge the receipt of unsolicited report messages.

Sample Command: **:oxc:rep:ack**

Reply: **<none>**

Note This command halts transmissions of unsolicited event notifications, when a notifiable report condition exists in the OXC.

3.4.5.2 :OXC:REPort:MODE <mode>

Parameter	Form	Description
mode	RS232|UDP|TCP |SOCKet |BROADcast	The mode of unsolicited reporting

Sets the unsolicited report control to enable reports on the selected channel.. The availability of a reporting channel is dependent on the specific Polatis product variant, as shown in the table below.

Channel	***OSM***	***OST XPort***	***xST Multi-session***	*Comments*
RS232	√	√	√	*This option sends unsolicited reports to the front-panel RS232 interface.*
UDP		√	√	*This option sends unsolicited reports to a UDP port on a remote host.* *In products with a NIC interface this option is deprecated in favour of* ***SOCKet***
TCP			√	*This option sends unsolicited reports to SCPI sessions open on the Ethernet interface.*
SOCKet			√	*This option sends unsolicited reports over Ethernet to a socket on a remote host. Use the :**SYST:COMM:SOCK** commands to configure this mode of operation.*
BROADcast			√	*This option sends unsolicited reports to all available interfaces.*

Sample Command: `:oxc:rep:MODE UDP`

Reply: `<none>`

3.4.5.3 :OXC:REPort:MODE? [<NUMBer|STRing>]

Parameter	Form	Description
format	NUMBer|STRing	The format to use for the reply

Returns the value of the unsolicited report control channel.

The value can be returned either as a number or as a string representation, determined by the optional parameter. If the parameter is omitted it defaults to **`NUMBer`**. The following table shows the mapping between numbers and text values.

Channel	Value	Comments
RS232	1	
UDP	2	
TCP	3	
SOCKet	2	This is the same value as **`UDP`** because in products with a NIC interface the **`UDP`** option is simply treated as a type of **`SOCKet`**.
BROADcast	4	

Sample Command: **`:oxc:repo:MODE?`**

Reply: **`2`**

3.4.5.4 :OXC:REPort:PERiod:SECS <secs>

Parameter	Form	Description
secs	numeric_value	The report period in seconds.

Sets the time interval between repeat notifications of unsolicited events; until reporting is acknowledged (using the **`:oxc:rep:ack`** command).

Sample Command: **`:oxc:rep:per:secs 30`**

Reply: **`<none>`**

Note The time value should be set to a duration sufficient for the management entity to receive and respond to unsolicited reports and clear notifiable alarm/event conditions. In practice this will depend on the physical control path (RS232 or Ethernet).

- The maximum period is 180 seconds.
- A time value of 0 specifies that no retries will be emitted.

Note For products not supplied with a NIC, e.g. Series 1000 modules, the abbreviation for PERIOD is PERI and not PER as shown above.

3.4.5.5 :OXC:REPort:PERiod:SECS?

Returns the time interval set for the period between repeating unsolicited event notifications (until the notification is acknowledged using the :oxc:repo:ack command). The time value is returned in units of seconds.

Sample Command: **`:oxc:rep:per:secs?`**

Reply: **`30`**

Note The above reply is an example. The exact reply will vary depending on the actual period set for repeating unsolicited event notifications.

3.4.5.6 :OXC:REPort:UDP:ADDRess <addr>

Parameter	Form	Description
addr	character_data	The target IP address and port, in the form **`IP:PORT`**, e.g. **`"192.168.0.1:10000"`**.

Sets the IP address and port for unsolicited reports under UDP. The format of <ip-address:port> is a conventional string, as shown in the example below:

Sample Command: `:oxc:rep:udp:addr "192.168.3.113:10002"`

Reply: `<none>`

Note In NIC products this command is deprecated in favour of **`:SYST:COMM:SOCK`** commands.

3.4.5.7 :OXC:REPort:UDP:ADDRess?

Returns the value of the IP address and port configuration for unsolicited reports under UDP. The format of <ip-address:port> is a conventional string, as shown in the example reply below:

Sample Command: `:oxc:rep:udp:addr?`

Reply: `"192.168.20.100:1033"`

Note The above reply is an example. The exact reply will depend on the IP address and port configured.

Note In NIC products this command is deprecated in favour of **`:SYST:COMM:SOCK`** commands.

3.4.5.8 :OXC:REPort:UNSolicited <mode>

Parameter	Form	Description
mode	ON|OFF	Enables or disables unsolicited reports

Sets the unsolicited report control flag to enable or disable unsolicited reports (events and alarms). If unsolicited reports are enabled then reports of notifiable events will be sent to the appropriate report channel (configured using the :OXC:REPO:MODE command described below).

Sample Command: `:oxc:rep:uns OFF`
Reply: `<none>`

3.4.5.9 :OXC:REPort:UNSolicited?

Returns the value of the unsolicited report control flag.

Sample Command: `:oxc:rep:uns?`
Reply: `0`

Note A returned value of 0 means that unsolicited reports are disabled. A returned value of 1 means that unsolicited reports are enabled.

3.4.6 OXC Suspend Commands

Command	Parameter Form
OXC	
:SUSPend	
:CONTrol	OFF|TIMed|INDefinite
:STATe?	
:TIME	<numeric_value>
:TIME?	

3.4.6.1 :OXC:SUSPend:CONTrol <mode>

Parameter	Form	Description
mode	OFF|TIMed |INDefinite	Sets the mode for OXC compensation suspension.

Set mode of operation for unit's built-in long-term maintenance control loops. By default these long-term loops are enabled. . Turning off or suspending the long-term control loops allows very accurate measurements to be made for optical switching instrumentation applications. However, leaving them disabled for long periods (longer than a few minutes) may seriously degrade the performance of the unit.

Sample Command: **:oxc:susp:cont TIMED**

Reply: **<none>**

Note For the **TIMED** mode of operation the default time the long-term maintenance control loops will be suspended is 60 seconds.

3.4.6.2 :OXC:SUSPend:STATe?

Queries the suspension state.

Sample Command: **:oxc:susp:stat?**

Reply: **ACTIVE,INDEFINITE**

3.4.6.3 :OXC:SUSPend:TIME <secs>

Parameter	Form	Description
secs	numeric_value	The duration in seconds for suspension of compensation.

Sets the time that the built-in long-term maintenance control loops will be suspended.

Sample Command: **`:oxc:susp:time 60`**

Reply: **`<none>`**

3.4.6.4 :OXC:SUSPend:TIME?

Returns the time set for suspension of the long-term maintenance control loops of the unit.

Sample Command: **`:oxc:susp:time?`**

Reply: **`60`**

Note Time specified in seconds.

3.4.7 Provisioning Cross-Connects

Command	Parameter Form
OXC	
:SWITch	
:CONNect	
:ADD	<channel_list>,<channel_list>[,NORMal|FORCed]
:ONLY	<channel_list>,<channel_list>[,NORMal|FORCed]
:PORT?	<numeric_value>
:STATe?	[ALL|PORT]
:SUB	<channel_list>,<channel_list>[,NORMal|FORCed]
:DISConnect	
:ALL	[NORMal|FORCed]
:PORT	
DISable	<channel_list>
ENABle	<channel_list>
STATe?	[<channel_list>]
SIZE?	

3.4.7.1 :OXC:SWITch:CONNect:ADD <ing-list>,<egr-list> [<mode>]

Parameter	Form	Description
ing-list	channel_list	A list of ingress ports
ing-list	channel_list	A list of egress ports
mode	NORMal |FORCed	An optional parameter specifying the command mode, only relevant when Automatic Protection Switching is used.

Reconfigures the OXC to add port-pairs to the existing connection state. Successive ports in the <ing-list> are paired with corresponding ports in the <egr-list> to describe connections to be made. For a 16x16 switch up to 16 port pairs may be listed. For an 8x8 switch up to 8 port pairs may be listed. Since connections are defined as pairs of ports, the number of ports listed in the <ing-list> and <egr-list> must be equal.

Any previous connections utilising ports listed in either the ingress or egress lists are automatically disconnected prior to establishing the new connections. Consequently, any ports part of previously existing connection pairs, which are orphaned, will automatically be 'parked' (i.e. disconnected).

In effect, this command permits the complete switch state (including disconnected ports) to be added to or amended incrementally. Connections may be added without disturbing existing connections (unless the new connections rob existing connections of ports).

If Automatic Protection Switching is in use, the optional **mode** parameter controls the interaction of this command with protection switching. If this parameter is omitted or specified as **NORMal** then the command will fail if its completion would affect protection switching. With **mode** specified as **FORCed** the command will complete despite its effect on protection switching. The switch's behaviour in these cases is defined in the Automated Protection Switching Subsystem section.

Sample Command: `:oxc:swit:conn:add (@1,2,3),(@17,18,19)`

Reply: `<none>`

Note Only basic error checking is performed on the connection list. Ports must be used only once in the connection list.

3.4.7.2 :OXC:SWITch:CONNect:ONLY <ing-list>,<egr-list> [<mode>]

Parameter	Form	Description
ing-list	channel_list	A list of ingress ports
ing-list	channel_list	A list of egress ports
mode	NORMal |FORCed	An optional parameter specifying the command mode, only relevant when Automatic Protection Switching is used.

Reconfigures the OXC to the exactly described connection state. Successive ports in the <ing-list> are paired with corresponding ports in the <egr-list> to describe a connection state that is to be established. For a 16x16 switch up to 16 port pairs may be listed. For an 8x8 switch up to 8 port pairs may be listed. Since connections are defined as pairs of ports, the number of ports listed in the <ing-list> and <egr-list> must be equal.

Any ports not explicitly included in either the ingress or egress lists are automatically disconnected – hence the command "ONLY". In effect, this command permits the complete switch state (including disconnected ports) to be configured.

If Automatic Protection Switching is in use, the optional **mode** parameter controls the interaction of this command with protection switching. If this parameter is omitted or specified as **NORMal** then the command will fail if its completion would affect protection switching. With **mode** specified as **FORCed** the command will complete despite its effect on protection switching. The switch's behaviour in these cases is defined in the Automated Protection Switching Subsystem section.

Sample Command: `:oxc:swit:conn:only (@1,2,3),(@17,18,19)`

Reply: `<none>`

Note Only basic error checking is performed on the connection list. Ports must be used only once in the connection list.

3.4.7.3 :OXC:SWITch:CONNect:PORT? <port>

Parameter	Form	Description
port	numeric_value	The port to query.

Returns the port connected to **`port`**.

Sample Command: **`:oxc:swit:conn:port? 2`**

Reply: **`"18"`**

Note The above reply is an example. If port 2 is connected to port 18. If port is unconnected an empty string ("") is returned.

3.4.7.4 :OXC:SWITch:CONNect:STATe? [<mode>]

Parameter	Form	Description
mode	ALL|PORT	Optional parameter to specify the mode of the query, only relevant when Grouped Ports are in use..

Returns the existing complete switch state in the form of port pair lists **`ing-list,egr-list`**, where **`ing-list`** and **`egr-list`** are channel lists of ingress and egress ports. For a 16x16 switch up to 16 port pairs may be listed. For an 8x8 switch up to 8 port pairs may be listed. Since connections are pairs of ports, the number of ports in each list will be equal.

Any ports not listed in either the ingress or egress channel lists may be assumed to be disconnected. In effect, this command permits the complete switch state (including disconnected ports) to be retrieved.

If **`mode`** is omitted or specified as **`ALL`** then all connected port pairs are returned, including those of Grouped Ports. If mode is specified as **`PORT`** then the results are filtered to remove any connections that are part of the grouped-ports subsystem.

Sample Command: **`:oxc:swit:conn:stat?`**

Reply: **`(@1,2,3),(@19,18,22)`**

Note This command query replaces **`:OXC:STATe?`** in Polatis SCPI R1.

3.4.7.5 :OXC:SWITch:CONNect:SUB <ing-list> <egr-list> [<mode>]

Parameter	Form	Description
ing-list	channel_list	A list of ingress ports
ing-list	channel_list	A list of egress ports
mode	NORMal |FORCed	An optional parameter specifying the command mode, only relevant when Automatic Protection Switching is used.

Reconfigures the OXC to remove ports from the existing connection state. This command permits individual connections to be disconnected without disturbing the state of other connections.

All ports listed in either the ingress or egress lists are automatically disconnected, regardless of whether or not the port pair defines a single connection. For example in the first sample command below, if ports 1 and 17 were not connected to each other, the connections associated with ports 1 and 17 would both be disconnected.

A channel list is required for *both* ingress and egress ports. A blank list of the form **(@)** must be entered in the case where no ports are listed (see second sample command below).

If Automatic Protection Switching is in use, the optional **mode** parameter controls the interaction of this command with protection switching. If this parameter is omitted or specified as **NORMal** then the command will fail if its completion would affect protection switching. With **mode** specified as **FORCed** the command will complete despite its effect on protection switching. The switch's behaviour in these cases is defined in the Automated Protection Switching Subsystem section.

Sample Command: **:oxc:swit:conn:sub (@1),(@17)**
Reply: **<none>**

Sample Command: **:oxc:swit:conn:sub (@1,2,3),(@)**
Reply: **<none>**

Note The above description refers to the behaviour of switches controlled via the multisession Network Interface Card (NIC). In products where the NIC is not present, the number of ports listed in the <ing-list> and <egr-list> must be equal.

Note Only basic error checking is performed on the connection list. Ports must be used only once in the connection list.

3.4.7.6 :OXC:SWITch:DISConnect:ALL [<mode>]

Parameter	Form	Description
mode	NORMal |FORCed	An optional parameter specifying the command mode, only relevant when Automatic Protection Switching is used.

Disconnects all connections.

If Automatic Protection Switching is in use, the optional **`mode`** parameter controls the interaction of this command with protection switching. If this parameter is omitted or specified as **`NORMal`** then the command will fail if its completion would affect protection switching. With **`mode`** specified as **`FORCed`** the command will complete despite its effect on protection switching. The switch's behaviour in these cases is defined in the Automated Protection Switching Subsystem section.

Sample Command: `:oxc:swit:disc:all`

Reply: `<none>`

Note This is a utility command to save explicit connections having to be listed.

3.4.7.7 :OXC:SWITch:PORT:DISable <ports >

Parameter	Form	Description
ports	channel_list	A list of ports to be disabled

Disables the ports specified by **`ports`**.

Sample Command: `:oxc:swit:port:dis (@2,4,6)`

Reply: `<none>`

Note The above command acts like a virtual shutter. Disabled ports may still appear in switch commands but no light will be passed over a connection involving the port until it is re-enabled.

3.4.7.8 :OXC:SWITch:PORT:ENABle <ports>

Parameter	Form	Description
ports	channel_list	A list of ports to be disabled

Enables the ports specified by **`ports`**.

Sample Command: **`:oxc:swit:port:enab (@2,4,6)`**

Reply: **`<none>`**

3.4.7.9 :OXC:SWITch:PORT:STATe? [<ports>]

Parameter	Form	Description
ports	channel_list	A list of ports to be queried

Returns state of the ports listed in the channel list <port-list>, or of all ports if <port-list> is not specified. Response is a parenthesis-enclosed list of comma-separated letters, one for each channel:

- D Disabled Channel
- E Enabled Channel
- F Failed Channel

Sample Command: **`:oxc:swit:port:stat? (@2,4,6)`**

Reply: **`(D,E,F)`**

Note Channels are sorted in ascending order before the list is returned.

3.4.7.10 :OXC:SWITch:SIZE?

Returns the size of the switch as the number of ingress ports and the number of egress ports.

Sample Command: `:oxc:swit:size?`

Reply: `16,16`

Note The above sample command is an example for a 16x16 switch.

3.5 :PMONitor Command Subtree

Polatis switches offer the options of Input and/or Output Optical Power Monitors. In addition, our Series 6000 switches offer the option of bi-directional optical power monitors (OPMs), i.e. both forward-facing and reverse facing OPMs on the same port.

Polatis switches offer two OPM Sensitivity Grades classified as Network and Sensitive. These are specified when the switch is ordered, and can be queried with the command specified below.

All existing SCPI commands for power monitoring have been modified to support bi-directional OPMs, by appending an extra optional parameter which can take the values `FORWard` or `REVerse` (default=`FORW`).

Thus, for example, the specification for the
`:PMONitor:POWer?` query is now
`:PMONitor:POWer? <ports>[,<direction>]`

and the specification for the
`:PMONitor:ALARm:LEVel:HIGH` command is now
`:PMONitor:ALARm:LEVel:HIGH <ports>,<level>[,<direction>]`

3.5.1 Configuring Power Monitor Alarms

Command	Parameter Form
PMONitor	
:ALARm	
EDGE	<channel_list>,<HIGH|LOW|BOTH> [,<direction>]
LEVel	
HIGH	<channel_list>,<numeric_value> [,<direction>]
LOW	<channel_list>,<numeric_value> [,<direction>]
MODE	<channel_list>,<OFF|SINGLE|CONTinuous> [,<direction>]
STATE?	<channel_list> [,<direction>]

3.5.1.1 :PMONitor:ALARm:EDGE <ports>, <edge> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
edge	HIGH|LOW |BOTH	The edge to use to trigger the alarm..
direction	FORW|REV	Optional OPM Direction (default=FORW)

Sets the threshold at which the alarm triggers:

- **HIGH** The alarm triggers when the power crosses a high-power threshold
- **LOW** The alarm triggers when the power crosses a low-power threshold
- **BOTH** The alarm triggers when the power crosses either a high or low power threshold.

Sample Command: `:pmon:alarm:edge (@17,18,19),HIGH, FORW`
Reply: `<none>`

Note Only basic error checking is performed on the port list.

3.5.1.2 :PMONitor:ALARm:LEVel:HIGH <ports>, <level> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
level	numeric_value	The alarm threshold in dBm.
direction	FORW|REV	Optional OPM Direction (default=FORW)

Sets the alarm high-power threshold for the channels specified:

Sample Command: `:pmon:alarm:lev:high (@17,18,19),14.7, FORW`
Reply: `<none>`

Note Only basic error checking is performed on the port list.

3.5.1.3 :PMONitor:ALARm:LEVel:LOW <ports>, <level> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
level	numeric_value	The alarm threshold in dBm.
direction	FORW|REV	Optional OPM Direction (default=FORW)

Sets the alarm low-power threshold for the channels specified:

Sample Command: **`:pmon:alarm:lev:low (@17,18,19),-34.5, FORW`**

Reply: **`<none>`**

Note Only basic error checking is performed on the port list.

3.5.1.4 :PMONitor:ALARm:MODE <ports>, <mode> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
mode	OFF|SINGLE |CONTinuous	The alarm mode.
direction	FORW|REV	Optional OPM Direction (default=FORW)

Sets the alarm mode:

- **OFF** The alarm is switched off for the channels listed
- **SINGLE** The alarm switches off after it has triggered once
- **CONT** The alarm remains armed even after it has triggered.

Sample Command: **:pmon:alarm:mode (@17,18,19),SINGLE, FORW**

Reply: **<none>**

Note Only basic error checking is performed on the port list.

3.5.1.5 :PMONitor:ALARm:STATe? <port-list> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
direction	FORW|REV	Optional OPM Direction (default=FORW)

Queries the alarm state for the channels specified. The reply is a list of comma-separated entries, where each entry details the alarm state for the corresponding port in the parameter list. Each entry has four elements. The first is the alarm mode (O for Off, S for Single, and C for Continuous modes). The second is the alarm edge (L for Low, H for high, and B for Both). The third item is the low-power threshold and the fourth is the high-power threshold.

Sample Command: **:pmon:alarm:stat? (@17,18,19), FORW**

Reply: **(S H -60.00 13.50,S H -60.00 13.50,S H -60.00 13.50)**

Note The above values are only an example. Only basic error checking is performed on the port list.

3.5.2 Configuring Power Monitors

Command	Parameter Form
PMONitor	
:ATIMe	<channel_list>,<numeric_value> [,<direction>]
:ATIMe?	<channel_list> [,<direction>]
:OFFSet	<channel_list>,<numeric_value> [,<direction>]
:OFFSet?	<channel_list> [,<direction>]
:POWer?	<channel_list> [,<direction>]
:WAVelength	<channel_list>,<numeric_value> [,<direction>]
WAVelength?	<channel_list> [,<direction>]
GRADe?	None

3.5.2.1 :PMONitor:ATIMe <ports>, <select> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
select	numeric_value	The power monitor averaging time.
direction	FORW|REV	Optional OPM Direction (default=FORW)

Sets the averaging-time selection of the power monitors associated with the ports specified in <port-list>. The integer value of **select** corresponds to averaging time as follows:

select	Averaging Time
1	10 ms
2	20 ms
3	50 ms
4	100 ms
5	200 ms
6	500 ms
7	1 sec
8	2 sec

Sample Command: **:pmon:atim (@17,18,19),4, FORW**

Reply: **<none>**

Note Only basic error checking is performed on the port list. Valid **`select`** values are 1 to 8. Default is 4.

3.5.2.2 :PMONitor:ATIMe? <ports> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
`direction`	FORW|REV	Optional OPM Direction (default=`FORW`)

Returns the averaging time selections of the power monitors associated with the specified ports as a list of comma-separated selection values.

Sample Command: **`:pmon:atim? (@17,18,19), FORW`**

Reply: **`(4,4,4)`**

Note Only basic error checking is performed on the port list.

3.5.2.3 :PMONitor:OFFSet <ports>,<offset> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
offset	numeric_value	The power monitor offset in dBm.
`direction`	FORW|REV	Optional OPM Direction (default=`FORW`)

Sets the offset of the power monitors associated with the ports specified in <port-list>. The value of <offset> is added to power monitor measurements when responding to **`:pmon:pow?`** queries. Thus, specifying an offset can be used as a means of referencing the power monitors against external meters.

It should be noted that the offset feature does NOT impact the behaviour of the attenuation feature: attenuation settings always operate relative to the actual power monitor readings, i.e. without any user-specified offsets.

Sample Command: **`:pmon:offset (@17,18,19),-10, FORW`**

Reply: **`<none>`**

Note Only basic error checking is performed on the port list. Valid <offset> values are –100.00 to +100.00 dB. Default is 0 dB.

3.5.2.4 :PMONitor:OFFSet? <ports> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
`direction`	FORW|REV	Optional OPM Direction (default=`FORW`)

Returns the offset settings of the power monitors associated with the specified ports as a list of comma-separated offsets in dB.

Sample Command: **`:pmon:offset? (@17,18,19), FORW`**

Reply: **`(-10.0,-10.0,-10.0)`**

Note Only basic error checking is performed on the port list.

3.5.2.5 :PMONitor:POWer? <ports> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
`direction`	FORW|REV	Optional OPM Direction (default=`FORW`)

Returns the optical powers measured on the specified ports as a list of comma-separated power measurements in dBm. To ensure accurate power monitor readings, it is important to specify the correct wavelength for each port via **`:pmon:wav`**. Reported powers also reflect optional, user-specified offsets as specified by the **`:pmon:offset`** command.

Sample Command: **`:pmon:pow? (@17,18,19), FORW`**

Reply: **`(3.12,-5.10,-28.51)`**

Note Only basic error checking is performed on the port list.

3.5.2.6 :PMONitor:WAVelength <port-list>, <wavelength> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
wavelength	numeric_value	The wavelength in nm.
direction	FORW|REV	Optional OPM Direction (default=FORW)

Sets the wavelength for the ports specified in <port-list>. The value of <wavelength> is used to compensate for wavelength dependence of power monitor responsivity. Therefore, it is important to specify the correct wavelength for each port to ensure accurate power monitor readings.

Sample Command: `:pmon:wav (@17,18,19),1547.5, FORW`

Reply: `<none>`

Note Only basic error checking is performed on the port list. Valid <wavelength> values are 1290.0 to 1625.0 nm. Default is 1550 nm.

3.5.2.7 :PMONitor:WAVelength? <ports> [,<direction>]

Parameter	Form	Description
ports	channel_list	A list of ports
direction	FORW|REV	Optional OPM Direction (default=FORW)

Returns the wavelength settings of the specified ports as a list of comma-separated wavelengths in nm.

Sample Command: `:pmon:wav? (@17,18,19), FORW`

Reply: `(1547.5,1547.5,1547.5)`

Note Only basic error checking is performed on the port list.

3.5.2.8 :PMONitor:GRADe?

Returns the Sensitivity Grade of the OPMs as either "NETWORK" or "SENSITIVE." These are a customer selected option specified when the switch is ordered.

Sample Command: `:pmon:grad?`

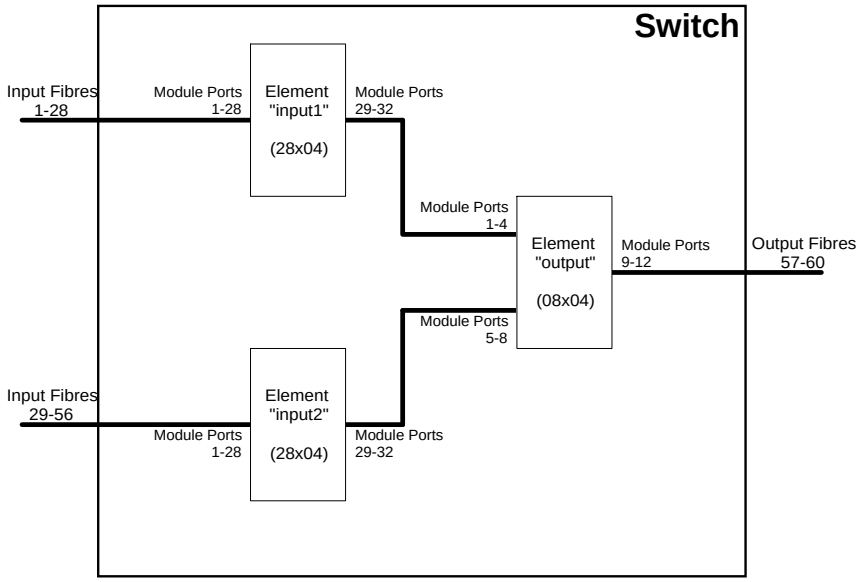
Reply: `NETWORK`

3.6 :SCT Command Subtree

Note: - Only Multi-Switch Controller products support the functionality described in this section.

3.6.1 Multi-Switch Controller Overview

The Switch Controller allows a number of Polatis switches to be configured to behave as a single larger switch. The following diagram shows how the Switch Controller could be configured to manage three separate switches to create a single 56x04 switch.



In the context of the Switch Controller, the term *Element* is used to describe the individual units in the system – individual optical switch trays. The term *Switch* is reserved for the complete system.

In the diagram above two 28x04 *elements* are used on the input side, to provide 56 inputs in total. The 4 outputs from each of the 28x04 *elements* are connected to a 08x04 *element*, with its 4 outputs providing the 4 outputs from the combined switch.

The term *Fibre* is used to describe the external connections to the *Switch*. The connections to individual elements are termed *Ports*. Part of the configuration of the Switch Controller is the mapping between fibre numbers and port numbers on individual elements. For example, in the figure above input ports 1-28 on element “input1” are mapped to fibres. 1-28. On element “input2” input ports 1-28 are mapped to fibres 29-56. Therefore the switch has 56 input fibres in total, spread across two elements.

Once the Switch Controller has been configured, it is used by referring only to the input and output fibres that have been set up. The user does not need to be aware of the elements within the switch and their internal connections. The switch is treated as a black box.

3.6.2 Switch Configuration

This section shows how to set up the Switch Controller configuration shown in the diagram above.

3.6.2.1 Prerequisites

This section assumes the following items are available:

- A Switch Controller, with its Private IP Address configured as 192.168.0.1. See the Installation Notes for details on this.
- Two 28x04 Polatis switches, with serial numbers 123 and 456, configured with IP addresses 192.168.1.10 and 192.168.1.20.
- An 08x04 Polatis switch with serial number 789, configured with IP address 192.168.1.30.
- All three switches connected to the Switch Controller's Private Ethernet interface using an Ethernet hub or switch.

The Switch Controller is assumed to start with a blank configuration. Any existing configuration can be deleted from the Switch Controller's memory using the command **`:SCT:ELEM:DEL:ALL`**. Note that this command does not delete configuration stored in non-volatile memory. Only the configuration in RAM is deleted.

3.6.2.2 Defining The Elements in the Switch

The first step is to tell the Switch Controller which elements are available to it. The following commands are used to do this:

Command: **`:SCT:ELEM:INS "input1", 123, "28x4", "192.168.1.10"`**
Command: **`:SCT:ELEM:INS "input2", 456, "28x4", "192.168.1.20"`**
Command: **`:SCT:ELEM:INS "output", 789, "08x04", "192.168.1.30"`**

At this point check the error queue to make sure that no errors were generated. Also, check the elements in the system. In the above example configuration there should be three elements defined:

Command: **`:SYST:ERR?`**
Reply: 0, "No error"

Command: **`:SCT:ELEM:CAT?`**
Reply: **`"input1","input2","output"`**

3.6.2.3 Configuring the Input Fibre Mapping

Next, define the mapping of input fibres to the element and its ports.

Input fibres 1-28 will be mapped to the input ports on element input1. The following command achieves this:

Command: **`:SCT:CONN:DEF:PORT "input1", input, (@1:28),(@1:28)`**

Next map input fibres 29-56 to the input ports on element input2

Command: **`:SCT:CONN:DEF:PORT "input2", input, (@1:28), (@29:56)`**

3.6.2.4 Configuring the Internal Connections

Next set up the internal connections between the elements.

Use the following commands to connect the output ports of elements input1 and input2 to the input ports of the final element .

Command: **`:SCT:CONN:DEF:INT "input1", (@29:32), "output", (@1:4)`**

Command: **`:SCT:CONN:DEF:INT "input2", (@29:32), "output", (@5:8)`**

3.6.2.5 Configuring the Output Fibre Mapping

Finally, define the mapping between the output ports of element output and the output fibres of the switch. There are 56 input fibres, so the output fibres must begin at number 57.

Command: **`:SCT:CONN:DEF:PORT "output", output, (@9:12), (@57:60)`**

3.6.2.6 Storing the Configuration

The Switch Controller is now fully configured, but the configuration is only stored in RAM. To store the configuration in non-volatile memory use the following command. The configuration will then be reloaded automatically when the Switch Controller is power-cycled.

Command: **`:SCT:CONN:STOR "56x04"`**

3.6.2.7 Using the Switch Controller

The Switch Controller can now be used as a normal 56x04 switch. The switch can be treated as a black box. There is no need to think about the internal elements and their connections.

3.6.3 Switch Controller Commands

Command	Parameter Form
SCT	
:CONFig	
[:NAME]	
:CATalog?	
:DELete	<character_data>
:LOAD	<character_data>
:STORe	<character_data>
:CONNection	
CATalog?	<character_data>
DEFine	
INTerconnect	<character_data>,<channel_list>, <character_data>,< channel_list >
PORT	<character_data>,<INPut|OUTput> <character_data>,<channel_list>
DELete	
[:NAME]	<character_data>
ALL	
ROUTe	
BLOCked?	
[:LIST]?	<channel_list>
:ELEMent	
CATalog?	
DEFine	<character_data>,<numeric_value>
DEFine?	<character_data>
DELete	
[:NAME]	<character_data>
:ALL	
:INSert	<character_data>,<numeric_value>, <character_data>,<character_data>
STATe?	<character_data>

3.6.3.1 :SCT:CONFig[:NAME]?

This command queries the name of the Switch Controller configuration automatically loaded up at boot time.

Sample Command: **:sct:conf?**

Reply: **"56x04"**

3.6.3.2 :SCT:CONFig:CATalog?

This command lists all stored Switch Controller configurations.

Sample Command: `:sct:conf:cat?`

Reply: `3845,0,"56x04,MACR,3845"`

Note The first number is the space in bytes occupied by the files. The second number is the free space on the file system.

Currently this always displays as zero in Polatis switches, but in fact the free space is approximately 1Mbyte.

Then follows an entry for each file, specifying its name, its type (e.g. MACR, see SCPI specification for file types) and its size.

3.6.3.3 :SCT:CONFig:DELete <name>

Parameter	Form	Description
name	character_data	Name of the configuration to be deleted

This command deletes the named configuration from non-volatile memory.

If this is the default configuration loaded at boot time then the result will be that the Switch Controller starts up with an empty configuration the next time it is power-cycled.

Sample Command: `:sct:conf:del "56x04"`

Reply: `<none>`

3.6.3.4 :SCT:CONFig:LOAD <name>

Parameter	Form	Description
name	character_data	Name of the configuration to be loaded

This command loads the named configuration into the Switch Controller's memory. This configuration will also be loaded into memory automatically when the switch is power-cycled.

Sample Command: `:sct:conf:load "56x04"`

Reply: `<none>`

3.6.3.5 :SCT:CONFig:STORe <name>

Parameter	Form	Description
name	character_data	Name of the configuration to be stored

This command stores the current Switch Controller configuration into non-volatile memory. This configuration will also be loaded into memory automatically when the switch is power-cycled.

Sample Command: `:sct:conf:stor "56x04"`

Reply: `<none>`

3.6.3.6 :SCT:CONNection:CATalog? <name>

Parameter	Form	Description
name	character_data	Name of the element to be queried

This command queries the connectivity of the named element. The output contains a comma-separated list of entries, one for each port on the element that has been configured. Ports that have not been configured are omitted from the output. The output format for each configured port is shown below:

Port Configuration	Format
Input fibre	<element port > I F <fibre number>
Output fibre	<element port > O F <fibre number>
Input interconnect	<element port> I <element> <remote element port>
Output interconnect	<element port> O <element> <remote element port>

Sample Command: `:sct:conn:cat? "output"`

Reply:
```
1 I "input1" 29,2 I "input1" 30,
3 I "input1" 31,4 I "input1" 32,
5 I "input2" 29,6 I "input2" 30,
7 I "input2" 31,8 I "input2" 32,
9 O F 57,10 O F 58,11 O F 59,12 O F 60
```

3.6.3.7 :SCT:CONNection:DEFine:INTerconnect <name>, <portlist>, <remote-name>,<remote-portlist>

Parameter	Form	Description
name	character_data	Name of the element to be configured
portlist	channel_list	A list of ports to be configured as internal interconnects
remote-name	character_data	The name of the remote element to which these ports are connected
remote-portlist	channel_list	A list of the ports on the remote element on the other end of these interconnects.

This command configures ports on the specified element to be internal interconnects between two elements within the switch.

Sample Command: `:sct:conn:def:int "input1", (@28:32), "output", (@1:4)`

Reply: `<none>`

3.6.3.8 :SCT:CONNection:DEFine:PORT <name>, <type>, <portlist>, <fibrelist>

Parameter	Form	Description
name	character_data	Name of the element to be configured
type	INPut|OUTput	The type of connection
portlist	channel_list	A list of ports on the element to be configured
fibrelist	channel_list	A list of fibre numbers to be associated with the ports specified

This command configures ports on the specified element to be input or output fibres on the combined switch. **`portlist`** specifies the ports on the element to be configured, and **`fibrelist`** indicates which fibre number to be associated with each of these ports.

Sample Command: `:sct:conn:def:port "output", output, (@9:12), (@57:60)`

Reply: `<none>`

3.6.3.9 :SCT:CONNection:DELete[:NAME] <name>

Parameter	Form	Description
name	character_data	Name of the element to be configured

This command deletes all fibre and interconnect definitions from the named element. The element itself is not deleted.

Sample Command: `:sct:conn:del "output"`

Reply: `<none>`

3.6.3.10 :SCT:CONNection:DELete:ALL

This command deletes all fibre and interconnect definitions from all elements defined in the Switch Controller. The elements themselves are not deleted.

Sample Command: `:sct:conn:del:all`

Reply: `<none>`

3.6.3.11 :SCT:CONNection:ROUTe:BLOCked?

This command lists any connections that are blocked (i.e. that cannot be made) using the current switch configuration. The output is a list of ingress ports and egress ports specifying the connections that cannot be made.

Sample Command: `:sct:conn:rout:bloc?`

Reply: `(@1,2),(@35,36)`

3.6.3.12 :SCT:CONNection:ROUTe:[LIST]? <fibres>

Parameter	Form	Description
fibres	channel_list	A list of fibres to be queried

This command shows the routes configured for the fibres listed in the parameter. The output contains a comma-separated list of strings with routing information, with one string for each fibre in the parameter. The output from this command takes the following form, for the connection between fibre numbers n and m

```
Fibre n <-> (<input> <name> <output>) <-> Fibre m
```

The statement in parentheses identifies the element in the switch used in the connection, and the ports used on that element. There may be more than one such statement, if more than one element is required to complete the connection.

The following command assumes that the switch is configured according to the diagram shown in the description above (i.e. three elements making up a 56x04 switch). Suppose that a connection has been made between input fibre 10 and output fibre 58.

Sample Command:
```
:sct:conn:rout? (@10)
```

Reply:
```
Fibre 10 <-> (10 input1 30) <-> (2 output 10) <-> Fibre
58
```

This example shows that fibre 10 is mapped to input port 10 on element input1. Input port 10 is connected to output port 30 on this element, which in turn is connected to input port 2 on element output. The connection between port 30 on input1 and port 2 on output is made by the user and is specified as part of the configuration of the switch controller. Port 2 is connected to port 10 on element output, and port 10 is mapped to fibre 58 in the switch.

3.6.3.13 :SCT:ELEMent:CATalog?

Queries the elements defined in the Switch Controller.

Sample Command: `:sct:elem:cat?`

Reply: `"input1","input2","output"`

3.6.3.14 :SCT:ELEMent:DEFine <name>, <ser-num>

Parameter	Form	Description
name	character_data	Name of the element to be configured
ser-num	numeric_value	Serial number of the element

Changes the name associated with the element which has the serial number specified. This command affects a element that has been previously added to the Switch Controller using the :SCT:ELEMent:INSert command.

Sample Command: `:sct:elem:def "sample", 345`

Reply: `<none>`

3.6.3.15 :SCT:ELEMent:DEFine? <name>

Parameter	Form	Description
name	character_data	Name of the element to query

Queries the serial number of the element that has been associated with the name specified as the parameter.

Sample Command: `:sct:elem:def? "sample"`

Reply: `345`

3.6.3.16 :SCT:ELEMent:DELete[:NAME] <name>

Parameter	Form	Description
name	character_data	Name of the element to be deleted

This command deletes the named element from the Switch Controller.

Sample Command: `:sct:elem:del "input"`
Reply: `<none>`

3.6.3.17 :SCT:ELEMent:DELete:ALL

This command deletes all elements from the Switch Controller.

Sample Command: `:sct:elem:del:all`
Reply: `<none>`

3.6.3.18 :SCT:ELEMent:INSert <name>, <ser-num>, <type>, <ip-address>

Parameter	Form	Description
name	character_data	Name of the element to be configured
ser-num	numeric_value	The serial number of the element
type	character_data	The type of the element (see below for details)
ip-address	character_data	The IP address of the element

This command inserts a new element into the Switch Controller. The element is identified internally in the Switch Controller by its serial number, and so the serial number of each element must be unique. The name provides a user-friendly tag for the element, and can be changed at any time using the **`:SCT:ELEMent:DEFine`** command.

The type parameter specifies the type of the element as a string parameter. The value to use here is the size of the switch. For NxM elements this will be a string such as "16x16" or "32x32". For reconfigurable elements this will be a string of the form "32xCC".

The IP address is also required, so the Switch Controller knows how to communicate with the element.

Sample Command: **`:sct:elem:ins? "input1", 345, "16x16", "192.168.1.16"`**

Reply: **`<none>`**

3.6.3.19 :SCT:ELEMent:STATe? <name>

Parameter	Form	Description
name	character_data	Name of the element to be queried

This command queries the status of the named element.

Sample Command: **`:sct:elem:stat "input"`**

Reply: **`"OK"`**

3.7 :SECurity Command Subtree

NIC products encompass Polatis Optical Switches with a 'Network Interface Card' including releases of Optical Switch Trays with Ethernet, GPIB or USB interface options. Some models have a secure interface enabled.

Command	Parameter Form
SECurity	
:SSL	
:FILE	
:CATalog?	
:DELete	<character_data>
:END	
:LINE	<character_data>
:LIST?	<character_data>
:STARt	<character_data>
:PASSphrase	
:STORe	<character_data>

3.7.1 Storing SSL Configuration Files in The Switch

3.7.1.1 :SECurity:SSL:FILE:CATalog?

Lists SSL files on the system. The format of the output data is compatible with the standard SCPI :MMEM:CAT? query.

Sample Command: **:sec:ssl:file:cat?**

Reply: **7301,0,"cert.pem,MACR,6022","dh1024.pem,MACR,801", "dh512.pem,MACR,478"**

3.7.1.2 :SECurity:SSL:FILE:DELete <filename>

Parameter	Form	Description
filename	character_data	Name of the SSL file to be deleted

Deletes an SSL file from the switch.

Sample Command: `:sec:ssl:file:delete "cert.pem"`
Reply: `<none>`

3.7.1.3 :SECurity:SSL:FILE:END

Closes an SSL file previously opened using :sec:ssl:file:star.

Sample Command: `:sec:ssl:file:end`
Reply: `<none>`

3.7.1.4 :SECurity:SSL:FILE:LINE <line>

Parameter	Form	Description
line	character_data	Line of data to be written to the file

Writes a line of data to an SSL file previously opened using :sec:ssl:file:star.

Sample Command: `:sec:ssl:file:line "Certificate:"`
Reply: `<none>`

3.7.1.5 :SECurity:SSL:FILE:LIST? <filename>

Parameter	Form	Description
filename	character_data	Name of file to list

Lists the contents of an SSL file. The files is returned as a single-line string with end-of-line characters converted into "\n".

Sample Command: `:sec:ssl:file:list? "dh512.pem"`

Reply:

```
"Diffie-Hellman-Parameters: (512 bit)\n
    prime:\n
        00:80:61:0c:2d:8a:32:df:60:4f:46:ed:8f:ad:07:\n
        e5:e1:46:78:67:33:ca:26:fa:db:6a:83:64:e6:08:\n
        3e:80:b8:a1:01:cb:0c:ec:da:b0:c0:a1:5a:57:3c:\n
        8a:b3:f4:90:c8:d5:1b:2e:3c:84:e0:ca:be:ca:12:\n
        cd:a0:10:d8:0b\n
    generator: 5 (0x5)\n
-----BEGIN DH PARAMETERS-----\n
MEYCQQCAYQwtijLfYE9G7Y+tB+XhRnhnM8om+ttqg2TmCD6AuKEBywzs2rD
AoVpX\n
PIqz9JDI1RsuPITgyr7KEs2gENgLAgEF\n
-----END DH PARAMETERS-----\n"
```

3.7.1.6 :SECurity:SSL:FILE:STARt <filename>

Parameter	Form	Description
filename	character_data	Name of file to create

Start writing a new SSL file to the flash memory, using the filename given. If the file already exists an error is put onto the error queue and the existing file is not deleted.

When all lines of data have been written to the file (using the **`:sec:ssl:file:line`** command) the file must be closed using **`:sec:ssl:file:end`**.

Sample Command: `:sec:ssl:file:star "cert.pem"`

Reply: `<none>`

3.7.2 Entering the SSL Private Pass Phrase

3.7.2.1 :SECurity:SSL:PASSphrase:STORe <passphrase>

Parameter	Form	Description
passphrase	character_data	Private pass phrase for the SSL certificate

Stores the private pass phrase for the SSL certificate.

Sample Command: `:sec:ssl:pass:stor “a894jfnw48vw3hy3”`

Reply: `<none>`

3.8 :STATus Command Subtree

Command	Parameter Form
STATus	
:OPERation	
[:EVENt]?	
:CONDition?	
:ENABle	<numeric_value>
:ENABle?	
:NTRansition	<numeric_value>
:NTRansition?	
:PTRansition	<numeric_value>
:PTRansition?	
:SWITch	
[:EVENt]?	
:CONDition?	
:ENABle	<numeric_value>
ENABle?	
:NTRansition	<numeric_value>
:NTRansition?	
:PTRansition	<numeric_value>
:PTRansition?	
:QUEStionable	
[:EVENt]?	
:CONDition?	
:ENABle	<numeric_value>
:ENABle?	
:NTRansition	<numeric_value>
:NTRansition?	
:PTRansition	<numeric_value>
:PTRansition?	
:ALARm	
[:EVENt]?	
:CONDition?	
:ENABle	<numeric_value>
:ENABle?	
:NTRansition	<numeric_value>
:NTRansition?	
:PTRansition	<numeric_value>
:PTRansition?	
:CLEar	<numeric_value>
:PREset	

3.8.1 Standard SCPI OPERation Register Set

3.8.1.1 STATus:OPERation[:EVENt]?

Returns the current value of the Standard SCPI OPERation Status Register.

Sample Command: **`stat:oper?`**

Reply: **`0`**

Note The above reply is an example. The exact reply will vary depending on the content of the Status register.

3.8.1.2 STATus:OPERation:CONDition?

Returns the current value of the Standard SCPI OPERation Condition Register.

In Polatis switches only bit 8 of this register is used. Bit 8 represents the summary status of the **`STATus:OPERation:SWITch`** status register (described below).

Sample Command: **`stat:oper:cond?`**

Reply: **`0`**

Note The above reply is an example. The exact reply will vary depending on the content of the Condition register.

3.8.1.3 STATus:OPERation:ENABle <value>

Sets the current value of the Standard SCPI OPERation Enable Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: **`stat:oper:enab 512`**

Reply: **`<none>`**

3.8.1.4 STATus:OPERation:ENABle?

Returns the current value of the Standard SCPI OPERation Enable Register.

Sample Command: `stat:oper:enab?`

Reply: `256`

Note The above reply is an example. The exact reply will vary depending on the content of the Enable register.

3.8.1.5 STATus:OPERation:NTRansition <value>

Sets the current value of the Standard SCPI OPERation NTRansition Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: `stat:oper:ntr 256`

Reply: `<none>`

3.8.1.6 STATus:OPERation:NTRansition?

Returns the current value of the Standard SCPI OPERation NTRansition Register.

Sample Command: `stat:oper:ntr?`

Reply: `256`

Note The above reply is an example. The exact reply will vary depending on the content of the transition register.

3.8.1.7 STATus:OPERation:PTRansition <value>

Sets the current value of the Standard SCPI OPERation PTRansition Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: `stat:oper:ptr 256`

Reply: `<none>`

3.8.1.8 STATus:OPERation:PTRansition?

Returns the current value of the Standard SCPI OPERation PTRansition Register.

Sample Command: `stat:oper:ptr?`

Reply: `256`

Note The above reply is an example. The exact reply will vary depending on the content of the transition register.

3.8.2 Device-Specific STATus:OPERation:SWITch Register Set

3.8.2.1 STATus:OPERation:SWITch[:EVENt]?

Returns the current value of the device-specific Switch Status Register.

Sample Command: `stat:oper:swit?`

Reply: `0`

Note The above reply is an example. The exact reply will vary depending on the content of the Status register.

3.8.2.2 STATus:OPERation:SWITch:CONDition?

Returns the current value of the device-specific Switch Condition Register.

The following bits are defined in this register:

Bit	Name	Description
0	PSU1	Status of the primary Power Supply Unit. The bit is set when the PSU is powered up. In switches that are fitted with only one PSU, this bit is always set.
1	PSU2	Status of the secondary Power Supply Unit. The bit is set when the PSU is powered up.
2	OXCC	This bit is set when OXC compensation is enabled (see section 3.4.6).
3	DIAG	This bit is set when a diagnostic measurement is running.

Sample Command: `stat:oper:cond?`

Reply: `5`

Note The above reply is an example. The exact reply will vary depending on the content of the Condition register.

3.8.2.3 STATus:OPERation:SWITch:ENABle <value>

Sets the current value of the device-specific Switch Enable Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: `stat:oper:swit:enab 3`

Reply: `<none>`

3.8.2.4 STATus:OPERation:SWITch:ENABle?

Returns the current value of the device-specific Switch Enable Register.

Sample Command: `stat:oper:swit:enab?`

Reply: `3`

Note The above reply is an example. The exact reply will vary depending on the content of the Enable register.

3.8.2.5 STATus:OPERation:SWITch:NTRansition <value>

Sets the current value of the device-specific Switch NTRansition Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: `stat:oper:swit:ntr 4`

Reply: `<none>`

3.8.2.6 STATus:OPERation:SWITch:NTRansition?

Returns the current value of the device-specific Switch NTRansition Register.

Sample Command: `stat:oper:swit:ntr?`

Reply: `4`

Note The above reply is an example. The exact reply will vary depending on the content of the transition register.

3.8.2.7 STATus:OPERation:SWITch:PTRansition <value>

Sets the current value of the device-specific Switch PTRansition Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: `stat:oper:swit:ptr 4`

Reply: `<none>`

3.8.2.8 STATus:OPERation:SWITch:PTRansition?

Returns the current value of the device-specific Switch PTRansition Register.

Sample Command: `stat:oper:swit:ptr?`

Reply: `4`

Note The above reply is an example. The exact reply will vary depending on the content of the transition register.

3.8.3 Device-Specific STATus:ALARm Register Set

These registers operate as defined in section 11.4.2 of reference [1]. The Summary Bit output appears on bit 0 of the Status Byte (read by ***STB?**).

3.8.3.1 STATus:ALARm[:EVENt]?

Returns the current value of the Alarm Status Register.

Sample Command: `stat:alar?`

Reply: `0`

Note The above reply is an example. The exact reply will vary depending on the content of the Status register.

3.8.3.2 STATus:ALARm:CONDition?

Returns the current value of the Alarm Condition Register. This register contains flags that indicate status and error conditions. These alarm flags can be cleared using the **`:STAT:ALARM:CLE`** command.

The following bits are defined in this register:

Bit	Name	Description
0	SWIT	Set on completion of a user command to switch ports.
1	PORT	Set on completion of a user command to enable or disable ports
2	ATT	Set on completion of an optical attenuation command.
3	MISS	Set when an expected event within the switch is missing
4	FANW	Set when a cooling fan is failing
5	FANF	Set when a cooling fan has failed
6	FPGA	Set when there has been an FPGA programming error
7	CONF	Set when there has been a switch configuration error
8	TEMP	Set when the witch temperature has gone out of range
9	OPML	Set when an OPM Loss-of-Service alarm has triggered
10	APS	Set when an Automatic Protection Switch has occurred
11	OPMD	Set when an OPM Degraded Service alarm has triggered
12	OXC	Set when a OXC error has occurred
13	OXCP	Set when a OXC Port error has occurred
14	SYS	Set when a general system error has occurred

Sample Command: **stat:oper:cond?**

Reply: **3**

Note The above reply is an example. The exact reply will vary depending on the content of the Condition register.

3.8.3.3 STATus:ALARm:ENABle <value>

Sets the current value of the Alarm Enable Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: **stat:alar:enab 48**

Reply: **<none>**

3.8.3.4 STATus:ALARm:ENABle?

Returns the current value of the Alarm Enable Register.

Sample Command: **stat:oper:swit:enab?**

Reply: **48**

Note The above reply is an example. The exact reply will vary depending on the content of the Enable register.

3.8.3.5 STATus:ALARm:NTRansition <value>

Sets the current value of the Alarm NTRansition Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: `stat:alar:ntr 48`

Reply: `<none>`

3.8.3.6 STATus:ALARm:NTRansition?

Returns the current value of the device-specific Switch NTRansition Register.

Sample Command: `stat:alar:ntr?`

Reply: `48`

Note The above reply is an example. The exact reply will vary depending on the content of the transition register.

3.8.3.7 STATus:ALARm:PTRansition <value>

Sets the current value of the Alarm PTRansition Register.

Parameter	Form	Description
value	numeric_value	New value for the register

Sample Command: `stat:alar:ptr 48`

Reply: `<none>`

3.8.3.8 STATus:ALARm:PTRansition?

Returns the current value of the device-specific Switch PTRansition Register.

Sample Command: `stat:alar:ptr?`

Reply: `48`

Note The above reply is an example. The exact reply will vary depending on the content of the transition register.

3.8.3.9 STATus:ALARm:CLEar <value>

Clears bits in the Alarm Condition register.

Parameter	Form	Description
value	numeric_value	Bits to be cleared in the Condition register

Bits that are set in **`value`** are cleared in the alarm Condition register.

3.8.3.10 STATus:PRESet

This standard SCPI commands configures the **STAT:OPER**, **STAT:OPER:SWIT**, **STAT::QUES** and **STAT:ALAR** register sets so that events are indicated in the Status Byte (read using ***STB?**).

The values set by the Polatis switch are as follows:

Register	Value
STAT:OPER:ENAB	#H7FFF
STAT:OPER:PTR	#H0100
STAT:OPER:NTR	0
STAT:QUES:ENAB	#H7FFF
STAT:QUES:PTR	0
STAT:QUES:NTR	0
STAT:OPER:SWIT:ENAB	#H7FFF
STAT:OPER:SWIT:PTR	#H000F
STAT:OPER:SWIT:NTR	0
STAT:ALAR:ENAB	#H7FFF
STAT:ALAR:PTR	#H7FFF
STAT:ALAR:NTR	0

3.9 :SYSTem Command Subtree

Command	Parameter Form
SYSTem	
:COMMunicate	
:GPIB	
[:SELF]	
:ADDRess	<numeric_value>
:ADDRess?	
:SERial	<character_data>
:BAUD	<numeric_value>
:BAUD?	
:NETWork#	
:ADDRess	<character_data>[,<character_data>[, <character_data>[,<character_data>]]]
:ADDRess?	
:SOCKet	
:ADDRess	<character_data>
:ADDRess?	
:CONNect	
:DISConnect	
:LISTen	
:PORT	<numeric_value>
:PORT?	
:TYPE	UDP|TCP
:TYPE?	
:ERRor	
[:NEXT]?	
:ENABle	
:ADD	<numeric_list>
:DELete	<numeric_list>
:LIST	<numeric_list>
:LIST?	
:KLOCk	ON|OFF
:KLOCk?	
:VERSion?	

3.9.1 Configuring The GPIB Bus

3.9.1.1 :SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <addr>

Parameter	Form	Description
addr	numeric_value	GPIB Primary address

Sets the GPIB address of the switch.

Sample Command: `:syst:comm:gpib:addr 7`

Reply: `<none>`

Note This command is only supported in GPIB management interface.

3.9.1.2 :SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?

Queries the GPIB address of the switch.

Sample Command: `:syst:comm:gpib:addr?`

Reply: `7`

Note This command is only supported in GPIB management interface.

3.9.2 Configuring The Serial Port

3.9.2.1 :SYSTem:COMMunicate:SERial:BAUD <baud>

Parameter	Form	Description
baud	numeric_value	Serial port baud rate, may be 4800, 9600,. 19200, 38400, 57600, 115200 baud.

Sets the baud rate for the serial port.

Sample Command: `:syst:comm:ser:baud 38400`

Reply: `<none>`

Note The baud rate of the serial port will reset to 38400 upon power-cycle of the unit.

3.9.2.2 :SYSTem:COMMunicate:SERial:BAUD?

Returns the baud rate for the serial port.

Sample Command: `:syst:comm:ser:baud?`

Reply: `38400`

3.9.3 Configuring The IP Address

3.9.3.1 :SYSTem:COMMunicate:NETWork#:ADDRess <ip>[,<gateway>[,<mask>[,<broadcast>]]]

Parameter	Form	Description
ip	character_data	IP address of the switch
gateway	character_data	Network gateway
mask	character_data	Network mask
broadcast	character_data	Broadcast address

Sets the network configuration of the switch. The IP address must be specified, the other parameters are optional. The broadcast and mask addresses should never need to be specified because the switch can calculate the correct values for these parameters itself.

For switches with a single network interface, the following command could be used (the actual addresses will vary according to your requirements).

Sample Command: `:syst:comm:netw:addr "192.168.0.5","192.168.0.157"`

Reply: `<none>`

For switches with a dual network interface, each interface is configured separately by specifying a number after the **`NETWork`** in the command. The number 1 indicates to the first Ethernet interface and the number 2 indicates the second interface. following command could be used to configure the second network interface (the actual addresses will vary according to your requirements).

Sample Command: `:syst:comm:netw2:addr "192.168.0.5","192.168.0.157"`

Reply: `<none>`

Note This command is only supported in Multi-Session Ethernet Optical Switch Trays, VOA Switch Trays and Series 2000 modules.

3.9.3.2 :SYSTem:COMMunicate:NETWork#:ADDRess?

Queries the network configuration of the switch.

For switches with a single network interface, the following command could be used (the reply will vary according to the network configuration).

Sample Command: `:syst:comm:netw:addr?`

Reply:
```
IP="192.168.0.5" Gateway="192.168.0.157"
Mask="255.255.255.0" Broadcast="192.168.0.255
```

For switches with a dual network interface, each interface is queried separately by specifying a number after the "NETWork" in the command. The number 1 indicates to the first Ethernet interface and the number 2 indicates the second interface. following command could be used to query the second network interface.

Sample Command: `:syst:comm:netw2:addr?`

Reply:
```
IP="192.168.0.5" Gateway="192.168.0.157"
Mask="255.255.255.0" Broadcast="192.168.0.255
```

Note This command is only supported in Multi-Session Ethernet Optical Switch Trays, VOA Switch Trays and Series 2000 modules.

3.9.4 Configuring Addresses For Unsolicited Event Reporting

The commands in this section are only supported in NIC products. These commands are used to configure unsolicited event reporting.

3.9.4.1 :SYSTem:COMMunicate:SOCKet:ADDRess <address>

Parameter	Form	Description
address	character_data	IP address of the remote server socket

Sets the IP address of a remote server socket to use for sending unsolicited events.

Sample Command: `:syst:comm:sock:addr "10.45.78.134"`

Reply: `<none>`

3.9.4.2 :SYSTem:COMMunicate:SOCKet:ADDRess?

Queries the IP address of a remote server socket to use for sending unsolicited events.

Sample Command: `:syst:comm:sock:addr?`

Reply: `"10.45.78.134"`

3.9.4.3 :SYSTem:COMMunicate:SOCKet:CONNect

Opens the previously-configured socket to a remote device. The switch attempts to contact a server socket on the remote device.

Sample Command: `:syst:comm:sock:conn`

Reply: `<none>`

3.9.4.4 :SYSTem:COMMunicate:SOCKet:DISConnect

Closes the socket (either server or client socket).

Sample Command: `:syst:comm:sock:disc`

Reply: `<none>`

3.9.4.5 :SYSTem:COMMunicate:SOCKet:LISTen

Opens the previously-configured socket as a server socket. The socket waits for connections from a remote client.

Sample Command: `:syst:comm:sock:list`

Reply: `<none>`

3.9.4.6 :SYSTem:COMMunicate:SOCKet:PORT <port>

Parameter	Form	Description
port	numeric_value	The TCP or UDP port number to use

Configures the TCP or UDP port number to use with the socket.

Sample Command: `:syst:comm:sock:port 54321`

Reply: `<none>`

3.9.4.7 :SYSTem:COMMunicate:SOCKet:PORT?

Queries the TCP or UDP port number to use with the socket.

Sample Command: `:syst:comm:sock:port?`

Reply: `54321`

3.9.4.8 :SYSTem:COMMunicate:SOCKet:TYPE <type>

Parameter	Form	Description
type	UDP|TCP	The type of socket to be opened

Sets the type of socket to be opened – TCP or UDP.

Sample Command: `:syst:comm:sock:type tcp`
Reply: `<none>`

3.9.4.9 :SYSTem:COMMunicate:SOCKet:TYPE?

Queries the type of socket to be opened – TCP or UDP.

Sample Command: `:syst:comm:sock:type?`
Reply: `TCP`

3.9.5 Error Reporting Subsystem

3.9.5.1 :SYSTem:ERRor[:NEXT]?

SCPI Error Queue query. Returns the next item off the Error Queue and removes it from the queue.

Sample Command: `:syst:err?`

Reply: `0, "No Error"`

Note The above reply assumes the Error Queue does not contain any items.

Note The format of the above reply will vary depending on the switch model. The example above is for NIC products. Series 1000 module responses have no space between the code and the associated message string.

3.9.5.2 :SYSTem:ERRor:ENABle:ADD <events>

Parameter	Form	Description
events	numeric_list	A list of err/event numbers to be enabled

Adds the error/event numbers in the parameter to the list of those that are enabled in the error reporting subsystem. Errors or events with these numbers will be put onto the system error/event queue.

Sample Command: `:syst:err:enab:add (100)`

Reply: `<none>`

Note The factory default is that all errors and events are enabled. Changes to error reporting made using the **`:SYST:ERR:ENAB`** commands are stored in non-volatile memory and are preserved when the switch is power-cycled.

Note This command is only supported in NIC products.

3.9.5.3 :SYSTem:ERRor:ENABle:DELete <events>

Parameter	Form	Description
events	numeric_list	A list of err/event numbers to be disabled

Deletes the error/event numbers in the parameter from the list of those that are enabled in the error reporting subsystem. Errors or events with these numbers will not be put onto the system error/event queue.

Sample Command: `:syst:err:enab:del (100)`

Reply: `<none>`

Note The factory default is that all errors and events are enabled. Changes to error reporting made using the :SYST:ERR:ENAB commands are stored in non-volatile memory and are preserved when the switch is power-cycled.

Note This command is only supported in NIC products.

3.9.5.4 :SYSTem:ERRor:ENABle:LIST <events>

Parameter	Form	Description
events	numeric_list	A list of err/event numbers to be enabled

Sets the list of errors and events that are enabled in the error reporting subsystem to that specified in the parameter. Only errors or events with these numbers will be put onto the system error/event queue.

Sample Command: `:syst:err:enab:list (100:300,400)`

Reply: `<none>`

Note The factory default is that all errors and events are enabled. Changes to error reporting made using **the `:SYST:ERR:ENAB`** commands are stored in non-volatile memory and are preserved when the switch is power-cycled.

Note This command is only supported in NIC products.

3.9.5.5 :SYSTem:ERRor:ENABle:LIST?

Returns the list of errors and events that are enabled in the error reporting subsystem to that specified in the parameter.

Sample Command: `:syst:err:enab:list?`

Reply: `(-300,-315:-310)`

Note The above reply is an example. In this example only event –300 and events in the range –315 to –310 are enabled to be reported. The exact reply will vary depending on the list of errors and events that are enabled in the error reporting subsystem.

Note This command is only supported in NIC products.

3.9.6 Locking Local Controls

3.9.6.1 :SYSTem:KLOCk <value>

Parameter	Form	Description
value	boolean	Flag to control the lock state of local controls

When set to ON the local controls of the instrument are disabled. This is only relevant to Polatis switches fitted with a touch-screen GUI.

Sample Command: `:syst:kloc 1`

Reply: `<none>`

3.9.6.2 :SYSTem:KLOCk?

Returns the value of the Local Control lock.

Sample Command: `:syst:kloc?`

Reply: `0`

3.9.7 SCPI Version Query

3.9.7.1 :SYSTem:VERSion?

Returns the SCPI version to which the instrument conforms. Polatis switches currently conform to the 1999.0 standard.

Sample Command: `:syst:vers?`

Reply: `1999.0`

APPENDIX A FAULT CODES TABLE

The below table lists the SCPI error codes and messages for the different Polatis Switch Tray and Module variants

A.1 Standard SCPI Error Codes

OST XPort and OSM	NIC products[2]	Error code and Error Msg	Description
√	√	**-100, "Command error"**	Syntax error or unrecognised command.
√	√	**-103, "Invalid separator"**	Particularly for custom string and udp address string, incorrect delimiting ("") marks.
√		**-109, "Missing parameters"**	
√		**-114, "Header suffix out of range"**	
√	√	**-115, "Unexpected number of parameters"**	
√	√	**-120, "Numeric data error"**	
√	√	**-200, "Execution error"**	Problem while executing command (including switching).
√	√	**-220, "Parameter error"**	
√		**-224, "Illegal parameter value"**	
√	√	**-225, "Out of memory"**	
√	√	**-300, "Device-specific error"**	Device specific problem
√	√	**-310, "System error"**	Generic system error occurred.

[2]NIC ~ Network Interface Card-management communications interface.

OST XPort and OSM	NIC products[2]	Error code and Error Msg	Description
√	√	**-311, "Memory error"**	Failed to write to Flash or Non-Volatile RAM
√	√	**-315, "Config Memory lost"**	Failed to read from Flash
√		**-381, "Port error (@4)(@23,24)"**	Problem with port. Supplied (example) list has list of ingress and list of egress ports with detected problem. Note, null list will be **(@)**.

A.2 Device-Specific Error Codes

OST XPort and OSM	NIC products[3]	Error code and Error Msg	Description
	√	**907**	Fan failure event (only applicable to switches fitted with cooling fans). This warns that a fan has failed.
	√	**908**	FPGA programming failure in the switch. This is a hardware failure.
	√	**909**	Configuration file error event. This indicated corruption of the switch's file system.
	√	**910**	Temperature range error event. This indicates an out-of-range temperature in the switch.
	√	**911**	Power monitor Loss-of-Service alarm event, sent when a power monitor Loss-of-Service alarm triggers.
	√	**912**	Protection switch event, sent when an automatic protection switch occurs.
	√	**913**	Protection availability event, sent when there are no more protecting ports available to a protected port.
	√	**914**	PSU event. In switches with dual-redundant PSUs, this event is sent when a PSU is switched on or off.
	√	**915**	Power monitor Degraded-Service alarm event, sent when a power monitor Degraded-Service alarm triggers.

[3]NIC ~ Network Interface Card-management communications interface.

OST XPort and OSM	NIC products[3]	Error code and Error Msg	Description
	√	**916**	Reserved
	√	**917**	General error – can be triggered by a range of errors within the unit
	√	**918**	Port error – sent when an errored port is flagged by the unit
√	√	**919**	OXC compensation suspension has terminated