

# ACX6160 Universal Metro Router Feature Guide

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# About the Documentation

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Use this guide to understand and configure the features of the ACX6160.

## Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at <https://www.juniper.net/documentation/>.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

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## Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

## Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

```
system {
  scripts {
    commit {
      file ex-script.xsl;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

```
[edit]
user@host# load merge /var/tmp/ex-script.conf
load complete
```

## Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.



```
commit {  
    file ex-script-snippet.xml; }
```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]  
user@host# edit system scripts  
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]  
user@host# load merge relative /var/tmp/ex-script-snippet.conf  
load complete
```

For more information about the **load** command, see [CLI Explorer](#).

## Documentation Conventions

[Table 1 on page x](#) defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page x defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
<b>Bold text like this</b>	Represents text that you type.	To enter configuration mode, type the <b>configure</b> command:  user@host> <b>configure</b>
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> <b>show chassis alarms</b>  No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> <li>Introduces or emphasizes important new terms.</li> <li>Identifies guide names.</li> <li>Identifies RFC and Internet draft titles.</li> </ul>	<ul style="list-style-type: none"> <li>A policy <i>term</i> is a named structure that defines match conditions and actions.</li> <li><i>Junos OS CLI User Guide</i></li> <li>RFC 1997, <i>BGP Communities Attribute</i></li> </ul>

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name:  [edit] root@# <b>set system domain-name</b> <i>domain-name</i>
<b>Text like this</b>	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> <li>To configure a stub area, include the <b>stub</b> statement at the [edit <b>protocols ospf area area-id</b>] hierarchy level.</li> <li>The console port is labeled <b>CONSOLE</b>.</li> </ul>
< > (angle brackets)	Encloses optional keywords or variables.	<b>stub</b> <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	<b>broadcast   multicast</b>  ( <i>string1</i>   <i>string2</i>   <i>string3</i> )
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	<b>rsvp { # Required for dynamic MPLS only</b>
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	<b>community name members [ <i>community-ids</i> ]</b>
Indentation and braces ( { } )	Identifies a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

## GUI Conventions

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
<b>Bold text like this</b>	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> <li>In the Logical Interfaces box, select <b>All Interfaces</b>.</li> <li>To cancel the configuration, click <b>Cancel</b>.</li> </ul>
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select <b>Protocols&gt;Ospf</b> .

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- Click the thumbs-up icon if the information on the page was helpful to you.
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- Product warranties—For product warranty information, visit <https://www.juniper.net/support/warranty/>.
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- Search for known bugs: <https://prsearch.juniper.net/>
- Find product documentation: <https://www.juniper.net/documentation/>
- Find solutions and answer questions using our Knowledge Base: <https://kb.juniper.net/>
- Download the latest versions of software and review release notes: <https://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://kb.juniper.net/InfoCenter/>
- Join and participate in the Juniper Networks Community Forum: <https://www.juniper.net/company/communities/>
- Create a service request online: <https://myjuniper.juniper.net>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://entitlementsearch.juniper.net/entitlementsearch/>

## Creating a Service Request with JTAC

You can create a service request with JTAC on the Web or by telephone.

- Visit <https://myjuniper.juniper.net>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see <https://support.juniper.net/support/requesting-support/>.

# 1

CHAPTER

## Introduction

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# ACX6160 Overview

IN THIS SECTION

- [ACX6160 Overview | 17](#)
- [Features | 18](#)
- [Managing the ACX6160 | 20](#)

This topic provides an overview of the ACX6160 transponder and its features.

## ACX6160 Overview

The ACX6160 is an [Open ROADM](#) compliant disaggregated, multiport transponder solution that supports the Client and Line ports described in [Table 3 on page 17](#):

Table 3: ACX6160 Client and Line Ports

Client Ports	Line Ports
<ul style="list-style-type: none"><li>● 8 Client ports</li></ul> <p>NOTE: This release supports only 4 Client ports.</p>	<ul style="list-style-type: none"><li>● 4 Line ports</li></ul>

### Interface Types Supported on Client and Line Ports

**TIP:** It's important to understand, in Open ROADM, Ports and Interfaces are two distinct entities.

- Ports are the physical ports on the device, in this case, the Client and Line ports on the ACX6160 front panel.
- Interfaces are configured on a supporting physical port (Client and Line). or another supporting interface.



**ACX6160 Ports**

The ACX6160 has eight Client ports (labeled **0/0** through **0/7** on the front panel) that support QSFP28 transceivers. These transceivers provide a speed of up to 100 Gbps, through four 25 Gbps channels. By default, Client ports are configured as 100 Gigabit Ethernet ports.

The ACX6160 has four Line CFP2 ports (labeled **1/0** through **1/3** on the front panel) that support C form-factor pluggable type 2 transceivers.

**ACX6160 Interfaces**

The Client and Line ports on the ACX6160 use pluggable optics, enabling you to run various interface types on the ports. All Client ports use pluggable QSFP28 transceivers that are 100 Gbps. All Line ports use pluggable CFP2-DCO transceivers that are 100 Gbps and support HGFECC.

Table 4 on page 18 describes the various interfaces available for the ACX6160 Client and Line ports and the Management port, which is (1000BASE-T).

**Table 4: ACX6160 Supported Interface Types**

Interfaces Available On Transponder Client Ports	Interfaces Available On Transporter Line Ports	On Management Port
100 Gigabit Ethernet interface	Optical Channel interface (OCH)	Ethernet interface
OTN OTU4 (100 Gbps) interface	OTN OTU4 (100 Gbps) interface	
OTU4 (100 Gbps) interface	OTN ODU4 (100 Gbps) interface	

**Features**

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- Pluggable Optical Transceivers | 19
- Performance Monitoring | 19
- One-Touch Provisioning | 19
- Forward Error Correction (FEC) | 20

This section describes the features of the ACX6160.

## Open ROADM Compliance

The ACX6160 is an Open ROADM Multi-Source Agreement (MSA) compliant device. This means it complies with the specifications described in the agreement for transponder devices. It is compatible with other devices that comply to this agreement and with Open ROADM controllers.

The Open ROADM MSA device model is a management model defined by the Open ROADM organization. Its goal is to provide a common management model to simplify the management of multi-vendor optical network architectures. It defines optical interoperability requirements for the device hardware (Reconfigurable Optical Add/Drop Multiplexers (ROADM), transponders and pluggable optics) and a NETCONF API that uses Yet Another Next Generation (YANG)-based data models that abstract the management, control and provisioning of multi-vendor optical devices.

## Pluggable Optical Transceivers

The ACX6160 uses pluggable optics for both the Client and Line ports. The eight Client ports use QSFP28 (100 Gbps) pluggable transceivers and the Line ports use CFP2-DCO (100 Gbps) Coherent DWDM pluggable transceivers with HGFECC support.

**NOTE:** Only Juniper Networks branded transceivers are supported on the ports of the ACX6160. The Juniper Part Number (JPN-SKU).

## Performance Monitoring

The ACX6160 includes a rich set of performance monitors that monitor the health of the device and notify you of any problems. It includes both current and historical performance monitoring and supports the Open ROADM YANG models for both currentPmlist and historyPmlist.

The ACX6160 supports the performance monitoring capability per the Open ROADM MSA specification version 2.00, release 2 Device white paper v0.3.

## One-Touch Provisioning

The ACX6160 supports one-touch provisioning. All that's needed to deploy it, is to bring it to the site, cable the device Ethernet (1000BASE-T) management port to the LAN on which your Open ROADM controller resides, cable the device power and power it up. The ACX6160 automatically receives a temporary IP address from your DHCP server, which must also be on same LAN. After the controller recognizes the ACX6160 as an Open ROADM device, you can assign a permanent IP address and configure the device using your Open ROADM controller and the Open ROADM YANG data models described in this guide.

## Forward Error Correction (FEC)

The ACX6160 supports HGFE (QPSK-100G) FEC.

**NOTE:** Configuring the FEC mode is mandatory. You must configure the ACX6160 interface for the HGFE (QPSK-100G) FEC mode in order to activate the interface. If you do not configure it, the corresponding CFP2-DCO module is not activated

## Managing the ACX6160

You can manage the ACX6160 through its NETCONF API using an Open ROADM compliant controller and the Open ROADM YANG data models described in this guide.

As an Open ROADM-compliant device, the configuration and management of the ACX6160 is controlled through the Open ROADM controller and stored in the controller server infrastructure and not on the ACX6160 itself.

### Management Ports

You manage the ACX6160 through the Ethernet **MGMT** port on the front panel. Connect this port to the same LAN that your Open ROADM controller is on.

### RELATED DOCUMENTATION

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[System Commissioning](#) | 31

# ACX6160 NETCONF Capabilities

## NETCONF API

Per the Open ROADM requirement, the ACX6160 supports a NETCONF API that allows you to control and manage the ACX6160 using the NETCONF protocol [RFC 6241] on TCP port 830 through your Open ROADM controller. To control and manage the ACX6160, your Open ROADM controller uses the NETCONF API and the Open ROADM YANG data models described in this guide.

### ACX6160 Default Username and Password

Per the Open ROADM requirement, the ACX6160 default username and password are: openroadm/openroadm.

#### RELATED DOCUMENTATION

<a href="#">ACX6160 Overview   17</a>
<a href="#">Open ROADM Compliance Overview   24</a>
<a href="#">System Commissioning   31</a>

# Open ROADM YANG Model Support Summary

The ACX6160 supports YANG model v1 defined in RFC 6020.

[Table 5 on page 21](#) lists the Open ROADM YANG data model support on the ACX6160.

Table 5: Summary of Open ROADM YANG Model Support on ACX6160

Module	Description
org-openroadm-alarm  See, <a href="#">“Alarm Monitoring” on page 67</a>	Active alarm list and notification
org-openroadm-common-types	Common type definitions

Table 5: Summary of Open ROADM YANG Model Support on ACX6160 (continued)

Module	Description
org-openroadm-database  See, <a href="#">“Database Save and Restore Operations” on page 102.</a>	Database save and restore actions
org-openroadm-de-operations  See, <a href="#">“Device Operations” on page 108</a>	Device restart actions  Root and main structure of the device tree, defines major lists and containers for entities such as shelves, circuit-packs, slots, ports, interfaces, users, xponder, and so forth.
org-openroadm-equipment-states-types  <a href="#">“Equipment Provisioning” on page 32</a> and <a href="#">“System Commissioning” on page 31.</a>	Equipment states that describe planning, commissioning, and deployment status of equipment.
org-openroadm-ethernet-interfaces  <a href="#">“Interfaces” on page 48</a>	Ethernet attributes augmented onto interface list
org-openroadm-file-transfer  See, <a href="#">“File System Operations” on page 91</a>	Asynchronous SFTP transfer actions
<a href="#">“Interfaces” on page 48</a>	Interface type identities
org-openroadm-maintenance-loopback  See, <a href="#">“Maintenance Testing” on page 64</a>	Maintenance loopback definitions
org-openroadm-maintenance-testsignal  See, <a href="#">“Maintenance Testing” on page 64</a>	Maintenance test signal groups and attributes.
org-openroadm-maintenance  See, <a href="#">“Maintenance Testing” on page 64</a>	Maintenance list of terminalLoopback, facilityLoopback, testSignal operations.
org-openroadm-network-types	Node and link type definitions, supported interfaces capability list.
org-openroadm-optical-channel-interfaces  See, <a href="#">“Interfaces” on page 48</a>	Augments interface with optical channel och container and attributes.
org-openroadm-otn-common-types	OTU and ODU rate and type identities and payload type def

Table 5: Summary of Open ROADM YANG Model Support on ACX6160 (continued)

Module	Description
org-openroadm-otn-common	Trail-trace degree-threshold attributes grouping
org-openroadm-otn-odu-interfaces <a href="#">“Interfaces” on page 48</a>	Augments interface with ODU attributes such as msi, trail-trace, parent odu allocation, deg-threshold, tcm opu, and so forth.
org-openroadm-otn-otu-interfaces <a href="#">“Interfaces” on page 48</a>	Augments interface with OTU attributes such as trail-trace, fec, tcm and so forth.
org-openroadm-physical-types	Definitions for Physical types
org-openroadm-pluggable-optics-holder-capability	Pluggable optics holder capabilities lists supported circuit packs, port references, port capabilities.
org-openroadm-pm-types See, <a href="#">“Performance Monitoring” on page 74</a>	Defines PM types and grouping of PM attributes
org-openroadm-pm See, <a href="#">“Performance Monitoring” on page 74</a>	Current and historical PM lists, clear PMs and collect historical file actions.
org-openroadm-port-capability	Augments circuit-packs ports with port capabilities, augments device with port-group-restrictions
org-openroadm-port-types	Definitions for port types
org-openroadm-probable-cause <a href="#">“Alarm Monitoring” on page 67</a>	Probable cause attributes and grouping
org-openroadm-resource-types	Definitions for resource types
org-openroadm-resource	Defines resource-type which is a choice of circuit-pack, port, shelf, physical-link, xponder, and so forth.
org-openroadm-swdl See, <a href="#">“Software Upgrades” on page 95</a>	Software download/installation module

Table 5: Summary of Open ROADM YANG Model Support on ACX6160 *(continued)*

Module	Description
org-openroadm-syslog  See, <a href="#">“Device Operations” on page 108</a> and <a href="#">“File System Operations” on page 91</a> .	System logging module
org-openroadm-user-mgmt  See, <a href="#">“User Administration” on page 89</a>	User account management module
org-openroadm-xponder  See, <a href="#">“Transponder Information” on page 62</a>	Syslog container, attributes, and selector
org-openroadm-wavelength-map	Wavelength map

## RELATED DOCUMENTATION

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[ACX6160 NETCONF Capabilities | 21](#)

[ACX6160 Overview | 17](#)

# Open ROADM Compliance Overview

## Introduction

Starting with Junos OS 19.2R2-evo, an [Open ROADM](#) Multi-Source Agreement (MSA) device model is added to Junos to support the ACX6160. This capability allows you to control and manage the ACX6160 using an Open ROADM compliant controller.

**NOTE:** There is no Junos CLI support for the ACX6160 in the Junos OS 19.2R2-evo release. All control and management of the ACX6160 is through an Open ROADM controller.

The Open ROADM MSA device model is a management model defined by the Open ROADM organization. Its goal is to provide a common management model to simplify the management of multi-vender optical network architectures. It defines optical interoperability requirements for the device hardware (Reconfigurable Optical Add/Drop Multiplexers (ROADM), transponders and pluggable optics) and a NETCONF API that uses Yet Another Next Generation (YANG)-based data models that abstract the management, control and provisioning of multi-vendor optical devices.

The interoperability requirements defined by the Open ROADM organization call for the control and management of the devices in the optical network be extracted from the device hardware and completely controlled by the Open ROADM controller. A one-touch provisioning process enables you simply cable and power-up the ACX6160, which then receives a temporary IP address from your DHCP server. After your controller discovers the ACX6160, you can define a permanent IP address to it and configure it using the ACX6160 YANG data models are described this guide.

## Open ROADM MSA Device Model Overview

The Open ROADM MSA defines a transponder device capable of mapping a single 100 Gbps Ethernet or OTU4 client signal into a 100 Gbps OTU4 DWDM signal for transport across an Open ROADM infrastructure. [Table 6 on page 25](#) describes each requirement and how the ACX6160 meets that requirement.

Table 6: Open ROADM YANG Model Requirements and ACX6160 Capabilities

Open ROADM MSA Requirement	ACX6160 Capability
API using a NETCONF interface with a YANG-based data model that abstracts the control management and provisioning of multi-vendor transponder devices	The ACX6160 supports a NETCONF API interface that enables you to use an Open ROADM controller to control and manage the ACX6160. We describe the YANG models for the ACX6160 in this guide.
Single-wave (W) interface which defines the optical specifications for the full C-band tunable DWDM optical line interface of the transponder that connects to a Wr add/drop port on the ROADM device. Line-side pluggable type must be CFP-DCO, CFP2-ACO or CFP2-DCO with LC connectors	The four Line ports on the ACX6160 are 100 Gbps/200 Gbps CFP2-DCO coherent DWDM pluggable transceivers using LC connectors  <b>NOTE:</b> This release supports only 100 Gbps Line ports.
Client ports must be pluggable QSFP28 with LC connectors and support 100GBASE-R mapped into OPU4 using PCS codeword transparent Ethernet mapping	The eight 100 Gbps Ethernet Client ports use pluggable QSFP28 transceivers  <b>NOTE:</b> This release supports only four Client ports

For complete details, see the Open ROADM MSA transponder specification at [Open ROADM.org](https://openroadm.org).



## Open ROADM YANG Data Model

The ACX6160 supports YANG model v1 defined in RFC 6020. [Table 7 on page 26](#) describes the Open ROADM YANG data model.

**Table 7: Open ROADM YANG Data Model**

What	Example
Database <i>Nodes</i> defined by configuration and operational data and, which you can query using your controller. Some nodes are read/write (configuration node), while others are read-only (operational data).	Shelf commissioning data, wavelength connections, and so forth.
<i>Notifications</i> for the purposes of reporting autonomous events to the controller.	Alarms, inventory changes, restarts, and so forth.
Remote Procedure Calls (RPC) that do not effect a change in the device configuration data	Get operations, file transfers, database backup, and so forth.

## Open ROADM Device YANG Model Support

The Open ROADM device YANG model defines the YANG nodes, described in [Table 8 on page 26](#), to abstract the implementation of the ROADM and transponder device.

**Table 8: Open ROADM Device YANG Data Model Support**

YANG node	Description
Information	Provides general node information including node name, IP address, and so forth
Shelves	Provide shelf information. A node can consist of one or more shelves
Circuit Packs	Represents a physical piece of equipment which contains a group of hardware functional blocks such as common equipment, cards, plug-in-units and/or pluggable optics.
Ports	The Ports container defines the ports associated with a circuit pack or pluggable optics and the associated port attributes
Internal Links	Reflect the connectivity within each circuit pack. These YANG nodes are read only and report attributes of the circuit pack themselves
Physical Links	Reflect the connectivity between ports across different circuit packs. The controller pushes this data to the device and reflects the actual inter-card fibering/cabling

Table 8: Open ROADM Device YANG Data Model Support (*continued*)

YANG node	Description
External Links	External link YANG nodes are placeholders for data about the far end device. Data for these YANG nodes is pushed from the controller
Degrees	Define the grouping of circuit packs that form a line degree
Shared Risk Groups	Define the grouping of circuit packs that form a colorless/ directionless add/drop bank
Wavelength Map	Defines the wavelength channel number and wavelength map
Connection Map	Wavelength agnostic and reflects any connectivity restrictions / blocking in the device (not wavelength contention)
Interfaces	Defines supported interface types and are associated with Port YANG nodes

## RELATED DOCUMENTATION

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[ACX6160 Overview | 17](#)


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[Open ROADM YANG Model Support Summary | 21](#)


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# 2

CHAPTER

## Management of Transport Services

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# System Commissioning

According to the [Open ROADM](#) organization, when a ROADM or transponder is powered up, it runs IPv4 and IPv6 DHCP clients and receives an IP address from the DHCP server sitting on the same LAN. The IP address may be either IPv4 or IPv6 depending on the operator's DCN configuration. This IP address is called temporary IP address. When a DHCP server allocates temporary IP address for a device, the controller is notified about this new IP address allocation. Now, the controller can log in to the device using a temporary address and define the permanent IP address for the device. The device also allows you to provision the default gateway, and that the IP address, prefix length and default gateway should be specified in the same edit configuration operation.

The ACX6160 supports the Open ROADM one-touch discovery procedure.

The [Open ROADM](#) organization describes device commissioning steps as:

1. The controller is loaded with the pre-planned device template for the device (node) that is to be commissioned. The template contains the information to provision the node beyond the auto-provisioning behavior, including: the final node-id, permanent IP address, shelf/circuit-pack/port attributes, and so forth. The device planning template is loaded into the Open ROADM controller. The planning template is not standardized by Open ROADM but provides data to the controller on how to commission the node using the Open ROADM device model. The planning template is a JSON file containing a subset of the device model, which you need to configure the Open ROADM device (ACX6160).
2. The Open ROADM controller may then generate inventory information.
3. A field technician installs and powers the equipment.
4. The Open ROADM device initializes, auto-provisions and requests an IP address from your DHCP server. The DHCP server responds with a temporary IP address.
5. The controller discovers the new IP address assignment by the DHCP server and attempts to connect and log into the device as an Open ROADM network element (NE). If the device is an Open ROADM device, then the controller discovers the Open ROADM NE as a temporary NE.
6. The field technician provides the correlation between the controller discovered temporary NE and the pre-loaded planning template [One Touch] by identifying the node based on its node-id being installed.
7. The controller then pushes device planning template configuration to the node and rediscovers the node (permanent node). Once the correlation is made, the controller begins to provision the node.

The planning template information is pushed to the node using the NETCONF edit-config RPC with the merge operation. There may be processing involved in the controller, which takes both the template and the current state of the device as input and determines the set of operations that need to be performed on the device. The use of the merge operation allows the provisioning to succeed even if the entity (for example, shelf, circuit-pack, port) was auto-provisioned due to the idempotent behavior.

To support the Open ROADM discovery and commissioning process:

- The default settings on the ACX6160 are:
  - The node-id is: **openroadm**
  - A user account with: **username=openroadm** and **password=openroadm**
  - DHCP is enabled by default on the management (**MGMT**) port of the ACX6160
- A reset button on the ACX6160, when pressed, reverts the device back to its default state as described above. This enables you to easily re-commission an ACX6160 after it has been used.
- The ACX6160 supports a NETCONF edit-config RPC function with the merge operation
- The ACX6160 exhibits idempotent behavior when it processes the edit-config merge RPC
- The ACX6160 supports the Open ROADM restart operation

#### RELATED DOCUMENTATION

[Open ROADM Compliance Overview | 24](#)

[Open ROADM YANG Model Support Summary | 21](#)

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## Equipment Provisioning

### Open ROADM Chassis Information and Device Components

Open ROADM organizes device components in a hierarchical structure starting with the top level *info* container:

- *Info*
  - *Shelves* — Each shelf has one or more slots that contain hardware components called *circuit-packs*.
    - *circuit-packs* — Provide slots for other circuit-packs to plug into, creating a hierarchy of components.
      - *ports*
      - *port containers*

It's important to understand this hierarchical structure because you'll need to follow this hierarchical structure when you configure the your transponding circuits on the ACX6160.

## ACX6160 Open ROADM Chassis Information

The *info* container provides top level device information representing the ACX6160 node itself. This information includes the node name, ip-address, default-gateway that identifies and describes a specific ACX6160 chassis.

## ACX6160 Shelf Naming

The ACX6160 is a simple 1 RU platform, so there is only a single shelf for the ACX6160: **shelf-0** as described in [Table 9 on page 33](#).

Table 9: ACX6160 Shelf Naming Convention

Name	Description	QTY	Meta-Tree Name
shelf-0	ACX6160	1	Chassis

## ACX6160 Circuit Packs

The ACX6160 consists of a single shelf (shelf-0). The shelf is populated with the hardwired components that, collectively make up the ACX6160 circuit-packs.

The ACX6160 supports one shelf with seven slots and several circuit-packs. The circuit-packs are made up of Flexible PIC Concentrator (FPC), Physical Interface Card (PIC)s, transceivers, power supply units (PSU), and fan tray units (FTU) components. Many of the circuit-pack components are hardwired in the ACX6160 chassis and are not assigned Model and Serial numbers. In the ACX6160 Open ROADM device model these circuit-packs simply inherit the Model and Serial number from the ACX6160 chassis.

[Table 10 on page 33](#) describes the ACX6160 circuit-pack naming convention.

Table 10: ACX6160 Circuit-Pack Naming Convention

Name	Description	Quantity	Meta-Tree Name
fpc-0	FPC (Hardwired)	1	FPC0
pic-0/[0-1]	PIC (Hardwired)	2	FPC0:PIC[0-1]

Table 10: ACX6160 Circuit-Pack Naming Convention (*continued*)

Name	Description	Quantity	Meta-Tree Name
xcvr-0/0/[0-7]	Eight Client ports pluggable QSFP28 transceiver on PIC-0/0	8	FPC0:PIC0:PORT[0-7]
xcvr-0/1/[0-3]	Four Line port pluggable CFP2-DCO transceiver on PIC-0/1	4	FPC0:PIC1:PORT[0-3]
psu-[0-1]	Power Supply Unit	2	Power Supply[0-1]
ftu-[0-4]	Fan Tray Unit (Hardwired)	5	Fan Tray

## ACX6160 Ports

[Table 11 on page 34](#) describes the ACX6160 port naming conventions.

Table 11: ACX6160 Port Naming Conventions

Name	Description	Meta-Tree Name
qsfp28-port	QSFP28 transceiver port	qsfp28-port
cfp2dco-port	CFP2DCO transceiver port	cfp2dco-port

## Open ROADM Device Info YANG Model Support

The info container provides top level device information representing the ACX6160 node itself. This information includes the node name, ip-address, default-gateway that identifies and describes a specific ACX6160 chassis.

[Table 12 on page 35](#) describes YANG nodes in the info container. The columns in [Table 12 on page 35](#) are defined as:

- **YANG node** — The node from the Open ROADM YANG model.
- **Access** — Access properties of the node. Can be:



- rw — read/write
- ro — read-only
- w — write-only
- x — RPC function
- n — notification
- *Supported* — Indicates ACX6160 support for the node.
  - Yes — ACX6160 supports the node
  - No — ACX6160 does not support the node
  - N/A — Node is not applicable to transponder device
- *Supported Values* — Describes the range of supported values on ACX6160.

Table 12 on page 35 describes ACX6160 compliance with the content of the Open ROADM info YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/info.

**Table 12: Open ROADM Device Info YANG Model Support**

YANG Node	Access	Supported	Supported Values
node-id	rw	yes	Value assigned by customer.
node-number	rw	yes	User-specified
node-type	rw	yes	Set to: xpdr
cli	rw	yes	Common Language Location Identifier
vendor	ro	yes	Hard coded value
model	ro	yes	Return chassis model number
serial-id	ro	yes	Return chassis serial number
ipAddress	rw	yes	Management port IP address
prefix-length	rw	yes	Management port subnet length
defaultGateway	rw	yes	Management network default gateway
source	ro	yes	How management IP was set by either: static or dhcp

Table 12: Open ROADM Device Info YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
current-ipAddress	ro	yes	Management port IP address
current-prefix-length	ro	yes	Management port subnet length
current-defaultGateway	ro	yes	Management network default gateway
macAddress	ro	yes	Management port MAC address
softwareVersion	ro	yes	JUNOS software version
openroadm-version	ro	yes	Version for Open ROADM package
template	rw	yes	JSON filename that contains the template
current-datetime	ro	yes	Current timestamp
geoLocation	rw	yes	Container
- latitude	rw	yes	User-specified
- longitude	rw	yes	User-specified
max-degrees	ro	yes	Not supported
max-srgs	ro	yes	Not supported
max-num-bin-15min-historical-pm	ro	yes	Hard coded value
max-num-bin-24hour-historical-pm	ro	yes	Hard coded value

## Open ROADM Device Shelves YANG Model Support

The Open ROADM model describes a device as having one or more shelves. To satisfy the Open ROADM model, the ACX6160 creates an abstraction of a single shelf called: shelf-0. The shelf slots are populated with top level entities such as FPC, PIC, XCVR, PSU, FTU that make up the ACX6160. All of the top level entities are hardwired into the chassis and are assigned a fixed slot position within the shelf. In the Open ROADM model, these entities are called *circuit-packs*.

Table 13 on page 37 describes ACX6160 compliance with the content of the Open ROADM shelves YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/info/shelves.

**Table 13: Open ROADM Device Shelves YANG Model Support**

YANG Node	Access	Supported	Supported Values
shelf-name	rw	yes	Set to: shelf-0
shelf-type	rw	yes	Set to: SHELF
Rack	rw	yes	User-specified
shelf-position	rw	yes	Set to: 0
Administrative-state	rw	yes	Set to: <ul style="list-style-type: none"> <li>• inService</li> <li>• outOfService</li> <li>• maintenance</li> </ul> <b>NOTE:</b> For ACX6160 ports to operate, the Administrative-state and the Operational-state must both = inService
vendor	ro	yes	Set to: Juniper Networks
model	ro	yes	Return chassis model number ACX6160
serial-id	ro	yes	Chassis serial-id
type	ro	yes	Hard coded to: SHELF
product-code	ro	yes	
manufacture-date	ro	yes	Chassis manufacture date
clei	ro	yes	
hardware-version	ro	yes	Chassis hardware version

Table 13: Open ROADM Device Shelves YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
operational-state	ro	yes	Return: <ul style="list-style-type: none"> <li>• inService – when administrativeStatus = inService</li> <li>• outOfService – when administrativeStatus = outOfService or maintenance</li> <li>• degraded – when faults are present</li> </ul>
equipment-state	rw	yes	User-specified
due-date	rw	yes	User-specified
slots	ro	yes	list
- slot-name	ro	yes	String value of position: 0 through 7
- label	ro	yes	Face plate label or "" if not no faceplate
- provisioned-circuit-pack	ro	yes	Reference to circuit-pack provisioned in this slot or unset.
- slot-status	ro	yes	Return: <ul style="list-style-type: none"> <li>• installed-not-prov</li> <li>• installed-prov-match</li> <li>• installed-prov-mismatch</li> </ul>

## Open ROADM Device Circuit-Packs and Ports YANG Model Support

The Open ROADM models FRUs and hard-wired components of a chassis as circuit-packs. A circuit-pack can have an arbitrary number of slots called *cp-slots*. Circuit-packs provide a hierarchical organization of hardware components. Each circuit-pack is either contained within a shelf slot or within a circuit-pack slot. When a circuit-pack's type is an XCVR it has a *port* and in this case the port container should be included in the configuration. Circuit packs are analogous to the OpenConfig components list.

## Open ROADM Device Circuit-Pack YANG Model Support

Table 14 on page 39 describes ACX6160 compliance with the content of the Open ROADM circuit-pack YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/circuit-pack.

Table 14: Open ROADM Device Circuit-Pack YANG Model Support

YANG Node	Access	Supported	Supported Values
circuit-pack-name	rw	yes	Name of circuit-pack, must be name from vendor list of components
administrative-state	rw	yes	User-specified administrative state. Set to: <ul style="list-style-type: none"> <li>• inService</li> <li>• outOfService</li> <li>• maintenance</li> </ul>
vendor	ro	yes	Return "Juniper Networks" for built-in components, vendor from FRU if pluggable.
model	ro	yes	Component model
serial-id	ro	yes	Component serial-id
type	ro	yes	Hard coded to FPC, PIC, XCVR, ETC.
product-code	ro	yes	
manufacture-date	ro	yes	Component manufacture date
clei	ro	yes	
hardware-version	ro	yes	Component's hardware version
operational-state	ro	yes	Return: <ul style="list-style-type: none"> <li>• inService – when administrativeStatus = inService and up</li> <li>• outOfService – when administrativeStatus = outOfService or maintenance or down</li> <li>• degraded – when administrativeStatus = inService and up and faults are present</li> </ul>
circuit-pack-category	ro	yes	Enum

Table 14: Open ROADM Device Circuit-Pack YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
- type	ro	yes	Derive from components part-number
- extension	ro	yes	
equipment-state	rw	yes	User-specified
circuit-pack-mode	rw	yes	
shelf	rw	yes	Reference to shelf-0
slot	rw	yes	Shelf slot
subSlot	rw	yes	Slot of parent circuit-pack
is-pluggable-optics	rw	yes	True for transceivers, otherwise false
due-date	rw	yes	User-specified
parent-circuit-pack	rw	yes	Container
- circuit-pack-name	rw	yes	Parent circuit pack name
- cp-slot-name	rw	yes	Slot position in parent circuit-pack
cp-slots[slot-name]	ro	yes	List
- slot-name	ro	yes	String value of position: 0 through 7
- label	ro	yes	Face plate label or "" if not no faceplate
- provisioned-circuit-pack	ro	yes	Reference to circuit-pack provisioned in this slot or unset.
- slot-status	ro	yes	Return: <ul style="list-style-type: none"> <li>• empty-not-prov</li> <li>• empty-prov-match</li> <li>• empty-prov-mismatch</li> <li>• installed-not-prov</li> <li>• installed-prov-match</li> <li>• installed-prov-mismatch</li> </ul>

Table 14: Open ROADM Device Circuit-Pack YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
- slot-type	ro	yes	Return: <ul style="list-style-type: none"> <li>• pluggable-optics-holder</li> <li>• other</li> </ul>
software-load-version	ro	yes	String: software version running on the circuit-pack. Return the JUNOS image version.
circuit-pack-features	ro	n/a	This list is empty.  ACX6160 circuit packs provide a single transponding feature.
- feature	ro	n/a	Container:
- - description	ro	n/a	String:
- - activated	ro	n/a	Boolean:
circuit-pack-components	ro	n/a	This list is empty.
- component	ro	n/a	Container
- - name	ro		Name of component on the circuit-pack.
- - current-version	ro	n/a	String: current version
- - version-to-apply	ro	n/a	String: target version. Version that is activated after a cold boot
ports	rw	yes	list, see ports list
circuit-pack-type	rw	yes	Mandatory string: Type of circuit-pack such as FPC, FTU, PSU, PIC, XCVR.
circuit-pack-product-code	rw	yes	Product-code

## Open ROADM Device Circuit-Pack-Type YANG Model Support

Table 15 on page 42 describes ACX6160 compliance with the content of the Open ROADM circuit-pack type YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is: `org-openroadm-device/circuit-packs[circuit-pack-name]/slots/pluggable-optics-holder-capability/supported-circuit-pack-types[supported-circuit-pack-type]`.

Table 15: Open ROADM Device Circuit-Pack-Type YANG Model Support

YANG Node	Access	Supported	Supported Values
<code>supported-circuit-pack-type</code>	ro	yes	Return "QSFP28" or "CFP2DCO"
<code>ports* [port-name]</code>	ro	yes	List
- <code>port-name</code>	ro	yes	Return "port-0/<PIC>/<XCVR>"
- <code>port-capabilities</code>	ro	yes	Container
- <code>supported-interface-capability</code>	ro	yes	List
- <code>if-cap-type</code>	ro	yes	Return: <ul style="list-style-type: none"> <li>• CLIENT: , , <ul style="list-style-type: none"> <li>• if-100GE</li> <li>• if-OTU4-ODU4</li> </ul> </li> <li>• LINE: <ul style="list-style-type: none"> <li>• if-OCH-OTU4-ODU4</li> </ul> </li> </ul>
- <code>otn-capability</code>	ro	yes	Container
- - <code>if-protection-capability</code>	ro	n/a	odu-one-plus-one – only identity-ref
- - - <code>proactive-DMp</code>	ro	yes	Boolean ODU PM delay measurement (DMp) (G.709 06-2016 15.8.2.1.6), hard code to false
- <code>tcm-capable</code>	ro	yes	false
- <code>mpdr-client-restriction</code>	ro	n/a	Container



Table 15: Open ROADM Device Circuit-Pack-Type YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
- network-ho-odu-circuit-pack-name	ro	n/a	Circuit-Pack identifier. Unique within the context of a device.
- - network-ho-odu-port-name	ro	n/a	port identifier.
- odu-type	ro	n/a	ODTU type, part of the MSI (Multiplex Structure Identifier)
- network-ho-odu-trib-port-number	ro	n/a	Tributary port number
- network-ho-odu-trib-slots	ro	n/a	Not supported
- odu-mux-hierarchy	ro	n/a	Not supported
- mux-capability	ro	n/a	Not supported

## Open ROADM Device Circuit-Pack Port YANG Model Support

Table 16 on page 44 describes ACX6160 compliance with the content of the Open ROADM circuit-pack port name. The location within the Open ROADM YANG model of the nodes listed in the table is: `org-openroadm-device/circuit-packs[circuit-pack-name]/ports[port-name]`.

Table 16: Open ROADM Device Circuit-Pack Port YANG Model Support

YANG Node	Access	Supported	Supported Values
port-name	rw	yes	<p>Key string: name of port.</p> <p>Example Client ports:</p> <p>port-0/0/0, port-0/0/2, ... port-0/0/7</p> <p>Example Line ports:</p> <p>port-0/1/0, port-0/1/1, port-0/1/2, and port-0/1/3</p> <p><b>NOTE:</b> In this release, the ACX6160 supports Client ports on:</p> <ul style="list-style-type: none"> <li>• 0/0</li> <li>• 0/2</li> <li>• 0/4</li> <li>• 0/6</li> </ul> <p>Clients ports 0/1, 0/3, 0/5, and 0/7 are not used in this release.</p>
port-type	rw	yes	Set to: QSFP28, CFP2DCO
port-qual	rw	yes	<p>Indicates if port is Line or Client. Used in When statement to select transponder-port container.</p> <ul style="list-style-type: none"> <li>• For Line port, set to: xpdr-network</li> <li>• For a Client port, set to: xpdr-client</li> </ul>
port-wavelength-type	ro	yes	<p>Type of wavelength.</p> <p>Set to: "wavelength" or "multi-wavelength" always "wavelength".</p>
port-direction	ro	yes	<p>Set to:</p> <ul style="list-style-type: none"> <li>• tx</li> <li>• rx</li> <li>• bidirectional</li> <li>• notApplicable</li> </ul> <p>Return hard coded value "bidirectional".</p>

Table 16: Open ROADM Device Circuit-Pack Port YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
label	ro	yes	Faceplate label example "0/1"
circuit-id	rw	yes	User-specified, you can use for alarm correlation and/or connection management.
administrative-state	rw	yes	User set administrative state: <ul style="list-style-type: none"> <li>• inService</li> <li>• outOfService</li> <li>• maintenance</li> </ul>
operational-state	ro	yes	Return: <ul style="list-style-type: none"> <li>• inService – when administrativeStatus = inService and up</li> <li>• outOfService – when administrativeStatus = outOfService or maintenance or down</li> <li>• degraded – when administrativeStatus = inService and up status, and faults are present</li> </ul>
supported-interface-capability	ro	yes	Leaf-list identity ref: if-100GE, if-OCH, if-100GE-ODU4, etc.
logical-connection-point	rw		String: The controller sets this value to the following format:  Line port: XPDR<n>-NETWORK<m>  Client port: XPDR<n>N-xpdrETWORK<m>  Where:  n is set to xpdr-number, key into xponder list
partner-port	ro		Not applicable for bidirectional port.

Table 16: Open ROADM Device Circuit-Pack Port YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
- circuit-pack-name	ro	n/a	Not applicable for bidirectional port.  Reference to transceiver circuit pack hosting the partner-port.
- port-name	ro	n/a	Not applicable for bidirectional port.  Reference to the port-name of the partner-port
parent-port	ro	n/a	Not applicable, ACX6160 does not have nested ports.
- circuit-pack-name	ro	n/a	Not applicable.
- port-name	ro	n/a	Not applicable.
interfaces	ro	yes	List of supported interface names
- interface-name	ro	yes	
transponder-port	rw	yes	Container describing port attributes on a transponder device.
- port-power-capability-min-rx	ro	yes	Hard coded value based on the type of port-type
- port-power-capability-min-tx	ro	yes	Hard coded value based on the type of port-type
- port-power-capability-max-rx	ro	yes	Hard coded value based on the type of port-type
- port-power-capability-max-tx	ro	yes	Hard code value based on the type of port-type
otdr-port	rw	n/a	Container Otdr is not supported. Excluded by when statement
- launch-cable-length	rw	n/a	Excluded with otdr-port
- port-direction	rw	n/a	Excluded with otdr-port

Table 16: Open ROADM Device Circuit-Pack Port YANG Model Support (continued)

YANG Node	Access	Supported	Supported Values
port-capabilities	ro	yes	container
- supported-interface-capability	ro	yes	list
-- if-cap-type	ro	yes	Return  CLIENT: if-100GE, if-OTU4-ODU4,  LINE: if-OCH-OTU4-ODU4
-- otn-capability	ro	yes	Container
--- if-protection-capability	ro	no	Leaf list: odu-one-plus-one – only identity-ref
--- proactive-DMp	ro	yes	Boolean ODU PM delay measurement (DMp) (G.709 06-2016 15.8.2.1.6), hard coded to false
--- tcm-capable	ro	yes	false  TCM – Tandem Connection Monitoring
--- proactive-DMt	ro	yes	Boolean
--- tcm-direction-capability	ro	n/a	Enum "up-tcm", "down-tcm", "up-down-tcm"
--- opu-payload-type-mapping	ro	n/a	Description "OPU payload-type mapping OPU."  Length 2 pattern "[0-9a-fA-F]*"
--- mpdr-client-restriction	ro	n/a	Container Analysis "N/A – Capabilities that apply only to ports that support OTN multiplexing."
---- network-ho-odu-circuit-pack-name	ro	n/a	Mandatory leafref:
---- network-ho-odu-port-name	ro	n/a	Mandatory leafref:
---- odtu-type	ro		odtu-type-identity

Table 16: Open ROADM Device Circuit-Pack Port YANG Model Support *(continued)*

YANG Node	Access	Supported	Supported Values
---- network-ho-odu-trib-port-number	ro	n/a	uint16
---- network-ho-odu-trib-slots	ro	n/a	uint16
--- odu-mux-hierarchy	ro	yes	Container Not supported

RELATED DOCUMENTATION

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# Interfaces

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- [Open ROADM Device Optical-Channel Interface YANG Model Support | 55](#)
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This section describes how to configure Client and Line port interfaces on the ACX6160 through your Open ROADM controller. It also describes the Open ROADM YANG model support for each interface type available on the ACX6160 Client and Line ports.

## Understanding the Hierarchical Relationship Between Ports and Interfaces

**TIP:** It's important to understand, in Open ROADM, Ports and Interfaces are two distinct entities, which have a hierarchical relationship to each other.

- Ports are the physical ports on the device, the Client and Line ports on the ACX6160 front panel. Client ports are labeled **0/0** through **0/7**. Line ports (labeled **1/0** through **1/3**.
- Interfaces are configured on a supporting physical port (or another supporting interface).

When configuring a transponding circuit, the required interfaces need to be configured in the hierarchical order, beginning with the interface directly supported by the port, then working upwards in the interface stack. For each interface configured, the supporting circuit pack, supporting port and supporting interface must be provisioned appropriately to reflect the hierarchical relationships. Additional details are provided in [Table 17 on page 49](#) below.

Client and Line ports on the ACX6160 use pluggable optics. All Client ports use pluggable QSFP28 transceivers that are 100 Gbps. All Line ports use pluggable CFP2-DCO transceivers that are 100 Gbps and support HGFECC.

[Table 17 on page 49](#) describes the various interfaces available for the ACX6160 Client and Line ports and the Management port, which is (1000BASE-T). The ACX6160 supports the Open ROADM model for interface configuration and status data. You can provision and monitor the all of these interface types on the ACX6160.

**Table 17: ACX6160 Supported Interface Types**

Interfaces Available On Transponder Client Port	On Transporter Line Port	On Management Port
100 Gigabit Ethernet interface See, see <a href="#">Table 19 on page 54</a>	Optical Channel interface See, see <a href="#">Table 20 on page 55</a>	Ethernet interface
OTN OTU4 interface See, <a href="#">Table 22 on page 58</a>	OTN OTU4 interface See, <a href="#">Table 22 on page 58</a>	
OTN OTU4 (100 Gbps) interface See, <a href="#">Table 21 on page 56</a>  An OTU4 interface, with an ODU4 interface supported by the OTU4 interface.	OTN ODU4 interface See, <a href="#">Table 21 on page 56</a>	

## Configuring Client Port Interfaces

The ACX6160 has eight Client ports (labeled **0/0** through **0/7** on the front panel) that support QSFP28 transceivers. These transceivers provide a speed of up to 100 Gbps, through four 25-Gbps channels. By default, Client ports are configured as 100-Gigabit Ethernet ports.

On Client ports, the interfaces that are provisioned depend on the transponding application required. To configure a 100 Gigabit Ethernet transponding circuit, an ethernet interface is provisioned on the Client port. To configure a OTU4 transponding circuit, both an OTU interface and an ODU interface are configured on the Client port. In the case of a 100 Gigabit Ethernet Client, the Ethernet interface is provisioned to be directly supported by the Client port. For an OTU4 Client, the OTU interface is supported by the port and the ODU interface is supported by the OTU interface.

As an example, let's look at what it would take to configure a 100 Gigabit Ethernet transponding circuit on the Client port of the ACX6160, again, looking at [Table 17 on page 49](#):

1. Configure the Shelf
2. Configure the FPC circuit-pack
3. Configure the PIC circuit-pack
4. Configure the XCVR circuit-pack (pluggable optics)
5. Configure the port on the XCVR

You must perform these steps in the order shown using your Open ROADM controller.

Again, referring to [Table 17 on page 49](#), let's look at what steps you need to take to configure an OTU4 Client:

1. Configure the port on the XCVR
2. Configure the XCVR circuit-pack (pluggable optics)
3. Configure the PIC circuit-pack
4. Configure the FPC circuit-pack
5. Configure the Shelf

In addition you'll need to configure:

- A single 100GE interface supported by the provisioned port
- A single OTU4 interface supported by the provisioned port
- A single ODU4 interface supported by the OTU4 interface.



## Configuring Line Port Interfaces

The ACX6160 has four Line CFP2 ports (labeled 1/0 through 1/3 on the front panel) that support C form-factor pluggable type 2 transceivers.

To configure a Line port"

1. Configure the port on the XCVR
2. Configure the XCVR circuit-pack (pluggable optics)
3. Configure the PIC circuit-pack
4. Configure the FPC circuit-pack
5. Configure the Shelf

These Line interfaces have a hierarchical relationship, with the optical channel interface (OCH) directly supported by the Line port, the OTU interface supported by the optical channel interface, and the ODU interface supported by the OTU interface.

These three interfaces are configured together on the Line side. It is the only arrangement of interfaces that is configured on the Line side.

On Line ports, you must provision all three interfaces:

1. A single OCH interface supported by the provisioned port
2. A single OTU4 interface supported by the OCH interface
3. A single ODU4 interface supported by the OTU4 interface

You must provision these Line interfaces in the order shown.

## Open ROADM Device Interface YANG Model Support

[Table 18 on page 52](#) describes ACX6160 compliance with the content of the Open ROADM device interface YANG model that is common to all interface types. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/interface.

The columns in [Table 18 on page 52](#) are defined as:

- **YANG node** – The node from the Open ROADM YANG model.
- **Access** – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only

- x – RPC function
- n – notification
- *Supported* – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- *Supported Values* – Describes the range of supported values on ACX6160.

Table 18 on page 52 describes ACX6160 compliance with the content of the Open ROADM interface YANG model that is common to all interface types. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/interface.

**Table 18: Open ROADM Device Interface YANG Model Support**

YANG Node	Access	Supported	Supported Values
name	rw	yes	User-specified string.
description	rw	yes	User-specified string.
type	rw	yes	<ul style="list-style-type: none"> <li>• opticalChannel – for optical-channel interfaces</li> <li>• otnOtu – for OTU4 Line and Client interfaces</li> <li>• otnOdu – for ODU4 Line and Client interfaces</li> <li>• ethernetCsmacd – for Client 100 Gigabit Ethernet interfaces and the management port interface</li> </ul>
administrative-state	rw	yes	<ul style="list-style-type: none"> <li>• inService – normal service enabled, alarm reporting enabled</li> <li>• outOfService – service disabled, alarm reporting disabled</li> <li>• maintenance – normal service enabled, alarm reporting disabled</li> </ul>

Table 18: Open ROADM Device Interface YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
operational-state	ro	yes	<ul style="list-style-type: none"> <li>• inService — interface is able to perform in normal function</li> <li>• outOfService — interface is unable to perform its normal function</li> <li>• degraded — ability of interface to perform its normal function is degraded</li> </ul>
circuit-id	rw	yes	User-specified string.
supporting-interface	rw	yes	<p>If interface type is otnOdu, this field must be set to name field of the supporting interface, which must be type otnOtu.</p> <p>If interface type is otnOtu on the Line-side port, this field must be set to name field of the supporting interface, which must be type opticalChannel.</p> <p>For all other interfaces, this attribute must not be configured.</p>
supporting-circuit-pack-name	rw	yes	If supporting-interface field is not specified, this attribute must be configured as the name of the interface's supporting circuit-pack.
supporting-port	rw	yes	If supporting-interface field is not specified, this attribute must be configured as the name of the interface's supporting port.

## Open ROADM Device Ethernet Interface YANG Model Support

Table 19 on page 54 describes ACX6160 compliance with the content of the augmentation for ethernet interfaces to the Open ROADM interface YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/interface/ethernet.

**NOTE:** In the column on supported values, the information that applies to 100 Gigabit Ethernet client interfaces is prefixed by “100GE” and the information that applies to the management port interface is prefixed by “Mgmt IF”.

**Table 19: Open ROADM Device Ethernet Interface YANG Model Support**

YANG Node	Access	Supported	Supported Values
ethernet	rw	yes	
- speed	rw	yes	<ul style="list-style-type: none"> <li>• 100GE – 100000</li> <li>• Mgmt IF – 10, 100, 1000, 10000</li> </ul>
- fec	rw	yes	<ul style="list-style-type: none"> <li>• 100GE – off</li> <li>• Mgmt IF – off</li> </ul>
- duplex	rw	yes	<ul style="list-style-type: none"> <li>• 100GE – full</li> <li>• Mgmt IF – half, full</li> </ul>
- mtu	rw	no	<ul style="list-style-type: none"> <li>• 100GE – not supported</li> <li>• Mgmt IF – 1518 through 9000</li> </ul>
- auto-negotiation	rw	no	<ul style="list-style-type: none"> <li>• 100GE – not supported</li> <li>• Mgmt IF – enabled, disabled</li> </ul>
- curr-speed	ro	yes	<ul style="list-style-type: none"> <li>• 100GE – 100000</li> <li>• Mgmt IF – 10, 100, 1000, 10000</li> </ul>
- curr-duplex	ro	yes	<ul style="list-style-type: none"> <li>• 100GE – full</li> <li>• Mgmt IF – half, full</li> </ul>

## Open ROADM Device Optical-Channel Interface YANG Model Support

Table 20 on page 55 describes ACX6160 compliance with the content of the augmentation for optical-channel interfaces to the Open ROADM interface YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/interface/och.

Table 20: Open ROADM Device Optical-Channel Interface YANG Model Support

YANG Node	Access	Supported	Supported Values
Och	rw	yes	
- rate	rw	yes	R100G
- frequency	rw	yes	ITU 50 GHz grid frequency within range 191.35 to 196.10
- width	ro	yes	50.00000 (for 50 GHz spacing)
- modulation-format	rw	yes	qpsk
- transmit-power	rw	yes	Range: -35.0 through +10.0  (power in dBm)

## Open ROADM Device OTN ODU Interface YANG Model Support

Table 21 on page 56 describes ACX6160 compliance with the content of the augmentation for OTN ODU interfaces to the Open ROADM interface YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/interface/odu.

Where the level of support differs between line-port and client-port ODU4 interfaces, the port-specific support is identified by “ODU4 line interface” and “ODU4 client interface” respectively.

**NOTE:** Descriptions for the maint-testsignal container within the odu container are excluded from this section and discussed in a later section of this document.

Table 21: Open ROADM Device OTN ODU Interface YANG Model Support

YANG Node	Access	Supported	Supported Values
Odu	rw	yes	Container
- rate	rw	yes	ODU4
- odu-function	rw	no	Not supported
- monitoring-mode	rw	yes	<ul style="list-style-type: none"> <li>• For Line-side ODU interface with 100GE Client interface – terminated</li> <li>• For Line-side ODU interface with OTU4 Client interface – monitored</li> <li>• For Client-side ODU interface - monitored</li> </ul>
- no-oam-function	ro	yes	This node is always absent.
- proactive-delay-measurement-enabled	rw	yes	False.
- parent-odu-allocation	rw	no	Not supported.
- tx-sapi	rw	yes	User-specific string, up to 15 characters
- tx-dapi	rw	yes	User-specific string, up to 15 characters
- tx-operator	rw	yes	User-specific string, up to 32 characters
- accepted-sapi	ro	yes	User-specific string, up to 15 characters
- accepted-dapi	ro	yes	User-specific string, up to 15 characters
- accepted-operator	ro	yes	User-specific string, up to 32 characters
- expected-sapi	rw	yes	User-specific string, up to 15 characters
- expected-dapi	rw	yes	User-specific string, up to 15 characters
- tim-act-enabled	rw	yes	True/false.
- tim-detect-mode	rw	yes	Disabled, SAPI, DAPI. SAPI-and-DAPI
- degm-intervals	rw	yes	Range: 2 through 10

Table 21: Open ROADM Device OTN ODU Interface YANG Model Support (*continued*)

- degthr-percentage	rw	yes	Range: 1 through 10000
- tcm	rw	no	Not supported
- opu	rw	yes	Container
-- payload-type	rw	yes	<ul style="list-style-type: none"> <li>• For Line-side ODU interface with 100GE Client interface – 07</li> <li>• For Line-side ODU interface with OTU4 Client interface – not supported</li> <li>• For Client-side ODU interface – not supported</li> </ul>
-- rx-payload-type	ro	no	Not supported
-- exp-payload-type	rw	yes	<ul style="list-style-type: none"> <li>• For Line-side ODU interface with 100GE Client interface – 07</li> <li>• For other ODU interfaces, range: 00 through FF</li> </ul>
-- payload-interface	rw	yes	User-specified string
-- msi	rw	no	Not supported

## Open ROADM Device OTN OTU4 Interface YANG Model Support

Table 22 on page 58 describes ACX6160 compliance with the content of the augmentation for OTN OTU interfaces to the Open ROADM interface YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is `/org-openroadm-device/interface/otu`.

Where the level of support differs between Line-port and Client-port OTU4 interfaces, the port-specific support is identified by “OTU4 Line interface” and “OTU4 Client interface” respectively.

**NOTE:** Descriptions for the maint-loopback container within the otu container are excluded from this section and discussed in a later section of this document.

Table 22: Open ROADM Device OTN OTU4 Interface YANG Model Support

YANG Node	Access	Supported	Supported Values
Otu	rw	yes	Container
- rate	rw	yes	OTU4
- fec	rw	yes	OTU4 Line interface – scfec OTU4 Client interface – rsfec, off
- tx-sapi	rw	yes	User-specific string, up to 15 characters
- tx-dapi	rw	yes	User-specific string, up to 15 characters
- tx-operator	rw	yes	User-specific string, up to 32 characters
- accepted-sapi	ro	yes	User-specific string, up to 15 characters
- accepted-dapi	ro	yes	User-specific string, up to 15 characters
- accepted-operator	ro	yes	User-specific string, up to 32 characters
- expected-sapi	rw	yes	User-specific string, up to 15 characters
- expected-dapi	rw	yes	User-specific string, up to 15 characters
- tim-act-enabled	rw	yes	True, false
- tim-detect-mode	rw	yes	Disabled, SAPI, DAPI. SAPI-and-DAPI
- degm-intervals	rw	yes	Range: 2 through 10
- degthr-percentage	rw	yes	Range: 1 through 10000

## RELATED DOCUMENTATION

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[Alarm Monitoring | 67](#)



# Connectivity

The Open ROADM device YANG model contains a number of lists and an RPC for configuring and retrieving connectivity information. This section describes the extent of support for this connectivity modeling on ACX6160.

*internal-link* – This list is not supported. All internal connectivity information is provided by the connection-map.

*physical-link* – This list is not supported. There are no links required to be setup between circuit packs on the ACX6160, thus there is nothing to configure for this list.

*external-link* – This list is supported. You can provision any data you wish to record on links between the ACX6160 and external devices.

*connection-map* – This list is supported. The connection-map list reports the traffic path connections between ACX6160 transponder Client and Line ports, identifying which Client and Line ports are paired together to provide 100 gigabit transponder units.

*get-connection-port-trail* – This RPC is not supported, because there are no internal or physical links required on ACX6160, the connection port trail is trivial and thus there is no need for this RPC. You can reference all internal connectivity information from the connection-map.

## ACX6160 Client to Line Port Fixed Mappings

Consistent with the Open ROADM connectivity model, there is a fixed linkage between Client and Line ports that is reported by the read-only connection-map list from the Open ROADM YANG model.. The ACX6160 supports the fixed port mapping described in [Table 23 on page 60](#).

**NOTE:** Although there are eight QSFP28 Client ports, only four of these ports, along with four Line ports are reported in the connection-map. These are the only ports that are available for use as Open ROADM transponder configurations.

Table 23: ACX6160 Client to Line Port Fixed Mapping

Client Side Ports	Line Side Port
Labeled: 0/0 - 0/7	Labeled 1/0-1/3
Client ports: 0/0/[0-7]	Line Ports: 0/1/[0-3]
Client port: 0/0/0	Line port: 0/1/0
Client port: 0/0/1	
<b>NOTE:</b> Not used in this release.	
Client port: 0/0/2	Line port: 0/1/1
Client port: 0/0/3	
<b>NOTE:</b> Not used in this release.	
Client port: 0/0/4	Line port: 0/1/2
Client port: 0/0/5	
<b>NOTE:</b> Not used in this release.	
Client port: 0/0/6	Line port: 0/1/3
Client port: 0/0/7	
<b>NOTE:</b> Not used in this release.	

## Open ROADM Connectivity YANG Model Support

The columns in the [Table 24 on page 61](#) are defined as:

- YANG *node* – The node from the Open ROADM YANG model.
- Access – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only
  - x – RPC function
  - n – notification

- *Supported* – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- *Supported Values* – Describes the range of supported values on ACX6160.

Table 24 on page 61 describes ACX6160 compliance with the connectivity-related lists of the Open ROADM YANG model. The location within the Open ROADM YANG model of the YANG nodes listed in the table is /org-openroadm-device.

**Table 24: Open ROADM Device Connectivity YANG Model Support**

YANG Node	Access	Supported	Supported Values
internal-link list	ro	no	Not supported
physical-link list	rw	no	Not supported
external-link list	rw	yes	User-specified string
- external-link-name			
- source <ul style="list-style-type: none"> <li>• - node-id</li> <li>• - circuit-pack-name</li> <li>• - port-name</li> </ul>	rw	yes	User-specified string
- destination <ul style="list-style-type: none"> <li>• - node-id</li> <li>• - circuit-pack-name</li> <li>• - port-name</li> </ul>	rw	yes	User-specified string
connection-map list	ro	yes	Returns fixed mapping of Client to Line ports.
- connection-map-number	ro	yes	Unsigned integer key into this table. This key is generated by the ACX6160.
- source <ul style="list-style-type: none"> <li>• - circuit-pack-name</li> <li>• - port-name</li> </ul>	ro	yes	The source container identifies the Client circuit-pack and port for this connection-map list entry.

Table 24: Open ROADM Device Connectivity YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
<ul style="list-style-type: none"> <li>- destination</li> <li>• - circuit-pack-name</li> <li>• - port-name</li> </ul>	ro	yes	The destination container identifies the Line circuit-pack and port for this connection-map list entry.

## RELATED DOCUMENTATION

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## Transponder Information

This section describes the ACX6160 compliance with the transponder list in the Open ROADM device YANG model.

The columns in the [Table 25 on page 63](#) are defined as:

- *YANG node* — The node from the Open ROADM YANG model.
- *Access* — Access properties of the node. Can be:
  - rw — read/write
  - ro — read-only
  - x — RPC function
  - n — notification
- *Supported* — Indicates ACX6160 support for the node.
  - Yes — ACX6160 supports the node
  - No — ACX6160 does not support the node
  - N/A — Node is not applicable to transponder device
- *Supported Values* — Describes the range of supported values on ACX6160.

[Table 25 on page 63](#) describes ACX6160 compliance with the device transponder in the Open ROADM YANG model.

Table 25: Open ROADM Transponder YANG Model Support

YANG Node	Access	Supported	Supported Values
xponder	rw	yes	
xpdr-number	rw	yes	Unsigned integer greater than 0
xpdr-type	rw	yes	Must be set to: tpdr
recolor	ro	yes	False
xpdr-port	rw	yes	
xpdr-port/index	rw	yes	Unsigned integer
xpdr-port/circuit-pack-name	rw	yes	Must match the name of an entry in the circuit-pack list. On ACX6160, all transponder ports are on transceiver circuit packs with names matching the pattern xcvr-0/X/Y
xpdr-port/port-name	rw	yes	Must match the name of an entry in the ports list that is nested within the circuit-pack entry identified by the circuit-pack-name field above. On ACX6160, all transponder ports are on transceiver circuit packs with names matching the pattern port-0/X/Y
xpdr-port/eqpt-srg-id	rw	yes	Unsigned integer

## RELATED DOCUMENTATION

[Open ROADM Compliance Overview | 24](#)
[Equipment Provisioning | 32](#)
[Connectivity | 59](#)

# Maintenance Testing

This section describes the maintenance testing support on ACX6160. The ACX6160 provides support for activation of traffic loopbacks on OTU interfaces, and supports the execution of Pseudo Random Binary Sequence (PRBS) tests on ODU interfaces.

## Supported ACX6160 Loopbacks

The ACX6160 supports facility and terminal loopbacks on OTU interfaces. You can activate loopbacks on both Client and Line OTU interfaces. For facility loopbacks, the loopback occurs post FEC termination.

**NOTE:** Note that for a Client port and Line port that are paired in a transponder circuit, you can only activate one loopback at a time on the interfaces in this transponder.

Table 26 on page 64 describes the loopbacks supported by the ACX6160 and the interfaces they can be used on to diagnose problems.

Table 26: Supported ACX6160 Loopbacks

Interface Type	Loopback Type	Description
Line OTU	fac	Loops back OTU traffic received from network on line side after FEC termination back towards traffic path transmitted to network direction.
Line OTU	term	Loops back traffic from host system back towards host and forwards as transmitted traffic on connected client interface.
Client OTU	fac	Loops back OTU traffic received from network on client side after FEC termination back towards traffic path transmitted to network direction.
Client OTU	term	Loops back traffic from host system back towards host and forwards as transmitted traffic on connected line client interface.

## Open ROADM Loopback YANG Model Support

The columns in [Table 27 on page 65](#) are defined as:

- **YANG node** – The node from the Open ROADM YANG model.
- **Access** – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only
  - x – RPC function
  - n – notification
- **Supported** – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- **Supported Values** – Describes the range of supported values on ACX6160.

[Table 27 on page 65](#) describes ACX6160 compliance with the content of the maint-loopback augmentation for OTU interfaces to the Open ROADM interface YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/interface/otu.

**Table 27: Open ROADM Loopback YANG Model Support**

YANG Node	Access	Supported	Supported Values
- maint-loopback	rw	yes	container
-- maint-testsignal/enabled	rw	yes	true, false
-- maint-testsignal/type	rw	yes	fac2, term (fac loopback type not supported)

## PRBS

The ACX6160 supports the conducting of PRBS tests on ODU interfaces. PRBS test signals and monitoring can be activated on both client and line ODU interfaces when a transponder circuit is configured for an OTU4 client. Note that due to a hardware limitation, PRBS tests are not supported for either the client or line side interfaces when the transponder client interface is configured as 100GE. Note that for a client

port and line port that are paired in a transponder circuit, only one PRBS test at a time can be activated on the interfaces in this transponder.

[Table 28 on page 66](#) describes the PRBS tests supported by the ACX6160.

**Table 28: Supported ACX6160 PRBS Tests**

Interface Type	PRBS Test Type	Description
Line ODU	Fac	Transmits a generated PRBS test signal towards the network direction on the line side and monitors for a matching PRBS test signal on the traffic received from the network direction.
Line ODU	Term	Transmits a generated PRBS test signal towards the host direction which is forwarded as transmitted traffic on the connected client interface, and monitors for a matching PRBS test signal on the traffic received from the host direction.
Client ODU	Fac	Transmits a generated PRBS test signal towards the network direction on the client side and monitors for a matching PRBS test signal on the traffic received from the network direction.
Client ODU	Term	Transmits a generated PRBS test signal towards the host direction which is forwarded as transmitted traffic on the connected line interface, and monitors for a matching PRBS test signal on the traffic received from the host direction.

[Table 29 on page 66](#) describes ACX6160 compliance with the content of the maint-testsignal augmentation for ODU interfaces to the Open ROADM interface YANG model. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-device/interface/odu.

**Table 29: Open ROADM PRBS Tests YANG Model**

YANG Node	Access	Supported	Supported Values
- maint-testsignal	rw	yes	Container
- maint-testsignal/enabled	rw	yes	true, false
- maint-testsignal/testPattern	rw	yes	PRBS, PRBS31
- maint-testsignal/type	rw	yes	fac, term
- maint-testsignal/bitErrors	ro	yes	Unsigned integer
- maint-testsignal/bitErrorsTerminal	ro	yes	Unsigned integer



Table 29: Open ROADM PRBS Tests YANG Model *(continued)*

YANG Node	Access	Supported	Supported Values
- maint-testsignal/syncSeconds	ro	yes	Unsigned integer
- maint-testsignal/syncSecondsTerminal	ro	yes	Unsigned integer

RELATED DOCUMENTATION

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<a href="#">Performance Monitoring   74</a>

# Alarm Monitoring

IN THIS SECTION

- [Interface Alarms and Notifications | 67](#)
- [ACX6160 Circuit Pack and Interface Type Alarm Summaries | 68](#)
- [Open ROADM Alarm YANG Model Support | 73](#)

This section describes the alarm reporting functionality on the ACX6160. Alarm monitoring is conducted for the ACX6160's provisioned circuit-packs, port and interfaces. The ACX6160 supports Open ROADM notifications for alarm raise and clear events, as well as the Open ROADM active-alarm-list, so that you can poll the list of currently active alarms.

## Interface Alarms and Notifications

An alarm notification is sent with the same information as stored in an alarm list entry. The notification sends the entire alarm structure. Alarm notifications contain all the same YANG nodes described in the tables below.

A cleared alarm has a severity level of clear.

## ACX6160 Circuit Pack and Interface Type Alarm Summaries

The tables in this section list the alarms and conditions modeled by Open ROADM specifications for circuit packs that are replaceable on the ACX6160, for circuit-pack ports, and for each ACX6160 interface type. For each alarm there is an indication of whether or not it is supported on the ACX6160.

All supported alarms and conditions are listed in the Open ROADM active-alarm-list container when the alarm or condition is active for a configured Open ROADM resource instance.

Active alarms/conditions are listed only if the resource instance they are active on is administratively **In-Service**, otherwise they are suppressed. An active alarm or condition may also be suppressed if a higher-severity alarm is also active.

Notifications are generated when each alarm or condition is raised and cleared. If an alarm/condition becomes suppressed due to the resource instance changing administrative status to **Out-of-Service** or a higher-severity alarm being raised, a notification is generated indicating that the alarm is cleared. Conversely, if a suppressed alarm/condition transitions to no longer being suppressed, a notification for the raising of that alarm is generated.

The following alarms are supported on the ACX6160:

- [Table 30 on page 69](#)
- [Table 31 on page 69](#)
- [Table 32 on page 70](#)
- [Table 33 on page 70](#)
- [Table 34 on page 71](#)
- [Table 35 on page 72](#)

[Table 30 on page 69](#) lists the OpenRoadm probableCause values that are supported for alarms that are raised against provisioned circuit-packs. Circuit-pack alarms are raised only against removable circuit-packs, which, on the ACX6160 system, include CFP2-DCO transceivers, QSFP28 transceivers, fan modules and power modules. The table explicitly indicates which alarms are supported for each removable circuit-pack type.

Table 30: Circuit-Pack Alarms

Probable Cause	Support by circuit-pack type				Severity	Notes
	CFP2-DCO	QSFP-28	Fan Mod.	Power Mod.		
equipmentFault	Yes	No	No	No	Critical	
equipmentRemoved	Yes	Yes	Yes	Yes	Critical	
equipmentMismatch	Yes	Yes	No	No	Critical	This alarm is evaluated if the <code>circuit-pack-product-code</code> is configured. If the configured product code does not match the actual product code read from the physical circuit pack, the alarm is raised.
firmwareInitInProgress	Yes	No	No	No	Minor	
firmwareDownloadOrActivationFailure	Yes	No	No	No	Major	

Table 31 on page 69 lists the OpenRoadm probableCause values that are supported for alarms that are raised against port objects.

Table 31: Port Alarms

Probable Cause	Supported on Client Port	Supported on Line Port	Severity	Notes
portLossOfLight	No	Yes	N/A	This alarm signifies a total absence of received optical power on the port at any frequency

Table 32 on page 70 lists the OpenRoadm probableCause values that are supported for alarms that are raised against opticalChannel type interfaces, which can be configured only on the Line side ports of the ACX6160.

Table 32: OCH Interface Alarms

Probable Cause	Supported on Client Port	Supported on Line Port	Severity	Notes
lossOfSignal	N/A	Yes	Critical	This alarm indicates that no optical channel is received for the configured frequency

Table 33 on page 70 lists the OpenRoadm probableCause values that are supported for alarms that are raised against otnOtu type interfaces.

Table 33: OTU Interface Alarms

Probable Cause	Supported on Client Port	Supported on Line Port	Severity	Notes
lossOfSignal	N/A	Yes	Critical	OTN: Indicates the input power has dropped.  Ethernet: (Ref IEEE 802.3ba)  <b>NOTE:</b> Indicates that received signal power has fallen below signal detection level.
lossOfFrame	Yes	Yes	Critical	(Ref G798: 6.2.5.1)
lossOfMultiframe	Yes	Yes	Critical	(Ref G798: 6.2.5.2)
backwardsDefectIndication	Yes	Yes	Major	(Ref G798: 6.2.6.6)
degradedDefect	Yes	Yes	Major	(Ref G798: 6.2.3.4)
backwardIncomingAlignmentError	Yes	Yes	Warning	(Ref G798: 6.2.6.11)
incomingAlignmentError	Yes	Yes	Warning	(Ref G798: 6.2.6.10)
trailTraceIdentifierMismatch	Yes	Yes	Critical	(Ref G798: 6.2.2.1)
alarmIndicationSignal	No	No	Major	(Ref G798: 6.2.6.3.2)
serverSignalFail	No	No	N/A	

**Table 33: OTU Interface Alarms (continued)**

Probable Cause	Supported on Client Port	Supported on Line Port	Severity	Notes
facilityLoopback2Active	Yes	Yes	Minor	Raised when fac loopback configured
terminalLoopbackActive	Yes	Yes	Minor	Raised when terminal loopback configured

Table 34 on page 71 lists the OpenRoadm probableCause values that are supported for alarms that are raised against otnOdu type interfaces.

**Table 34: ODU Interface Alarms**

Probable Cause	Supported on Client Port	Supported on Line Port	Severity	Notes
backwardsDefectIndication	Yes	Yes	Major	(Ref G798: 6.2.6.6)
degradedDefect	Yes	Yes	Major	(Ref G798: 6.2.3.4)
trailTraceIdentifierMismatch	Yes	Yes	Critical	(Ref G798: 6.2.2.1)
alarmIndicationSignal	Yes	Yes	Major	(Ref G798: 6.2.6.3.2)
openConnectionIndication	Yes	Yes	Major	(Ref G798: 6.2.6.8)
lockedDefect	Yes	Yes	Critical	(Ref G798: 6.2.6.9)
payloadMismatch	Yes	Yes	Critical	(Ref G798: 6.2.4.1)
clientSignalFailDefect	No	No	Critical	(Ref G798: 6.2.10)
facilityTestsignalActive	Yes	Yes	Minor	Raised when facility PRBS enabled.
terminalTestsignalActive	Yes	Yes	Minor	Raised when terminal PRBS enabled.

Table 35 on page 72 lists the OpenRoadm probableCause values that are supported for alarms that are raised against ethernetCsmacd type interfaces.

Table 35: Ethernet Interface Alarms

Probable Cause	Supported on Client Port	Supported on Line Port	Severity	Notes
lossOfSignal	Yes	N/A	Critical	Indicates that received signal power has fallen below signal detection level.
linkDown	No	N/A	N/A	
lossOfFECAlignment	No	N/A	N/A	Ethernet interface FEC is not supported on ACX6160
lossOfSynchronization - Rx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 45.2.3.11.5)
highBER - Rx	Yes	N/A	Major	(Ref IEEE 802.3ba: 45.2.3.11.4)
localFault - Rx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 81.3.4)
remoteFault - Rx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 81.3.4)
lossOfAlignment - Rx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 45.2.3.16c/d/e/f)
lossOfSynchronization - Tx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 45.2.3.11.5)
highBER - Tx	No	N/A	Major	(Ref IEEE 802.3ba: 45.2.3.11.4)
localFault - Tx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 81.3.4)
remoteFault - Tx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 81.3.4)
lossOfAlignment - Tx	Yes	N/A	Critical	(Ref IEEE 802.3ba: 45.2.3.16c/d/e/f)

## Open ROADM Alarm YANG Model Support

The columns in [Table 36 on page 73](#) are defined as:

- **YANG node** – The node from the Open ROADM YANG model.
- **Access** – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only
  - x – RPC function
  - n – notification
- **Supported** – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- **Supported Values** – Describes the range of supported values on ACX6160.

[Table 36 on page 73](#) describes ACX6160 compliance with the content of the active-alarm-list within the org-openroadm-alarm YANG module. This list will contain a row for each actively reported alarm on the ACX6160.

When alarms are raised or cleared an instance of the alarm-notification notification, defined in org-openroadm-alarm YANG module, is generated with same content as is provided in the corresponding active-alarm-list listing, but with severity reported as “clear” for alarm clearing notifications.

**Table 36: Open ROADM Alarm YANG Model Support**

YANG Node	Access	Supported	Supported Values
id	ro	Yes	Unique id for this alarm. This is a string set by the device.
resource	ro	Yes	Resource under alarm, specifies instance of a resource. Format depends on the resource type.
probableCause	ro	Yes	Enumeration of probable causes. This is the alarm name.
riseTime	ro	Yes	Timestamp alarm was raised.
severity	ro	Yes	Enumerated value of critical, major, minor, warning, clear, indeterminate.

Table 36: Open ROADM Alarm YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
circuit-id	ro	Yes	Circuit-id for alarm correlation. Reported only for alarms raised against interfaces, if a circuit-id value is configured for the interface.
additional-detail	ro	Yes	Provides additional descriptive text about the probable cause.
corrective-action	ro	No	

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## Performance Monitoring

## IN THIS SECTION

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- [Open ROADM Performance Monitor YANG Model Support | 81](#)

The ACX6160 supports the Open ROADM performance monitoring YANG data model for reporting current PM data. It also provides support for retrieving historical PM data by way of file transfer, and support for clearing PM data.

There are two main categories of performance monitoring parameter types:

- Counter performance monitors (PMs)
- Gauge PMs



Counter type PMs are collected for current 15-minute and 1-day granularities. You can also retrieve historical counter bins by way of file transfer. You can retrieve up to the last ninety-six 15-minute bins, as well as the previous 1-day bin.

Gauge type PMs report the current instantaneous value, as well as the minimum, maximum, and average value over the duration of the reported interval (15-minute or 1-day). For gauge type PMs, only the minimum, maximum and average values are reported for historical bins.

**NOTE:** For current instantaneous gauge-type PM values, use the bin granularity type of “notApplicable”.

## Performance Monitoring

This section provides the list of supported performance metrics (PMs) for each type of entity on the ACX6160 that supports performance monitoring.

The ACX6160 supports the following PMs:

- [Table 37 on page 75](#)
- [Table 38 on page 76](#)
- [Table 39 on page 76](#)
- [Table 40 on page 78](#)
- [Table 41 on page 80](#)

[Table 37 on page 75](#) lists the OpenRoadm performance monitoring parameters that are supported for transponder ports on the ACX6160.

**Table 37: Open ROADM Port Performance Monitor Support on ACX6160**

Open ROADM PM Name	Location	Direction	Support Line/Client	Comments
opticalPowerOutput	Near-end	Transmit	Yes/No	
opticalPowerOutputMin	Near-end	Transmit	Yes/No	
opticalPowerOutputMax	Near-end	Transmit	Yes/No	
opticalPowerOutputAvg	Near-end	Transmit	Yes/No	

Table 37: Open ROADM Port Performance Monitor Support on ACX6160 (continued)

Open ROADM PM Name	Location	Direction	Support Line/Client	Comments
totalOpticalPowerInput	Near-end	Receive	Yes/No	These PMs report on total optical input power, including signal and noise power.
totalOpticalPowerInputMin	Near-end	Receive	Yes/No	
totalOpticalPowerInputMax	Near-end	Receive	Yes/No	
totalOpticalPowerInputAvg	Near-end	Receive	Yes/No	

Table 38 on page 76 lists the OpenRoadm performance monitoring parameters that are supported for optical channel interfaces on the ACX6160.

Table 38: Open ROADM OCH Interface Performance Monitor Support

Open ROADM PM Name	Location	Direction	Support	Comments
opticalPowerInput	Near-end	Receive	Yes	These PMs report on signal optical input power.
opticalPowerInputMin	Near-end	Receive	Yes	
opticalPowerInputMax	Near-end	Receive	Yes	
opticalPowerInputAvg	Near-end	Receive	Yes	

Table 39 on page 76 lists the OpenRoadm performance monitoring parameters that are supported for OTU interfaces on the ACX6160.

Table 39: Open ROADM OTU Interface Performance Monitor Support on ACX6160

Open ROADM PM Name	Location	Direction	Support Line/Client	Comments
preFECCorrectedErrors	Near-end	Receive	Yes/No	These FEC PMs are available only when FEC is not set to "off". FECCorrectableBlocks PM is not supported.
FECCorrectableBlocks	Near-end	Receive	No/No	
FECUncorrectableBlocks	Near-end	Receive	Yes/No	

Table 39: Open ROADM OTU Interface Performance Monitor Support on ACX6160 (continued)

Open ROADM PM Name	Location	Direction	Support Line/Client	Comments
erroredBlockCount	Near-end	Receive	Yes/Yes	Count of BIP-8 errors. Counting suppressed during SES seconds.
backgroundBlockErrors	Near-end	Receive	Yes/Yes	Reported as a vendor extension.
erroredSeconds	Near-end	Receive	Yes/Yes	Count of seconds with BIP-8 errors or SES.
severelyErroredSeconds	Near-end	Receive	Yes/Yes	Count of seconds in which signal failure observed.
unavailableSeconds	Near-end	Receive	No/No	Not supported this release.
erroredBlockCount	Far-end	Receive	Yes/Yes	Count of BIP-8 errors. Counting suppressed during SES seconds.
backgroundBlockErrors	Far-end	Receive	Yes/Yes	Reported as a vendor extension.
erroredSeconds	Far-end	Receive	Yes/Yes	Count of seconds with BIP-8 errors or SES.

Table 39: Open ROADM OTU Interface Performance Monitor Support on ACX6160 (continued)

Open ROADM PM Name	Location	Direction	Support Line/Client	Comments
severelyErroredSeconds	Far-end	Receive	Yes/Yes	Count of seconds in which signal failure observed.
unavailableSeconds	Far-end	Receive	No/No	Not supported this release.

Table 40 on page 78 lists the OpenRoadm performance monitoring parameters that are supported for ODU interfaces on the ACX6160.

Table 40: Open ROADM ODU Interface Performance Monitors on ACX6160

Open ROADM PM Name	Location	Direction	Supported Line/Client	Comments
erroredBlockCount	Near-end	Receive	Yes/yes	Count of BIP-8 errors. Counting suppressed during SES seconds.
backgroundBlockErrors	Near-end	Receive	Yes/yes	Reported as a vendor extension.
erroredSeconds	Near-end	Receive	Yes/yes	Count of seconds with BIP-8 errors or SES.
severelyErroredSeconds	Near-end	Receive	Yes/yes	Count of seconds in which signal failure observed.

Table 40: Open ROADM ODU Interface Performance Monitors on ACX6160 (continued)

Open ROADM PM Name	Location	Direction	Supported Line/Client	Comments
unavailableSeconds	Near-end	Receive	No/no	Not supported this release.
erroredBlockCount	Far-end	Receive	Yes/yes	Count of BIP-8 errors. Counting suppressed during SES seconds.
backgroundBlockErrors	Far-end	Receive	Yes/yes	Reported as a vendor extension.
erroredSeconds	Far-end	Receive	Yes/yes	Count of seconds with BIP-8 errors or SES.
severelyErroredSeconds	Far-end	Receive	Yes/yes	Count of seconds in which signal failure observed.
unavailableSeconds	Far-end	Receive	No/no	Not supported this release.
delay	Near-end	Transmit	No/no	Not supported this release.

Table 41 on page 80 lists the OpenRoadm performance monitoring parameters that are supported for 100GE Client interfaces on the ACX6160.

Table 41: Open ROADM Ethernet Interface Performance Monitors on ACX6160

Open ROADM PM Name	Location	Direction	Support	Comments
erroredBlockCount	Near-end	Receive	No	(Ref IEEE 802.3ba: 45.2.3.12.4)
BIPErrorCounter	Near-end	Receive	Yes	(Ref IEEE 802.3ba: 45.2.3.36)
erroredSecondsEthernet	Near-end	Receive	Yes	Count of seconds with errored blocks or BIP errors or SES.
severelyErroredSecondsEthernet	Near-end	Receive	Yes	Count of seconds in which signal failure observed.
unavailableSecondsEthernet	Near-end	Receive	No	Not supported this release.
erroredBlockCount	Near-end	Transmit	No	(Ref IEEE 802.3ba: 45.2.3.12.4)
BIPErrorCounter	Near-end	Transmit	Yes	(Ref IEEE 802.3ba: 45.2.3.36)
erroredSecondsEthernet	Near-end	Transmit	Yes	Count of seconds with errored blocks or BIP errors or SES.
severelyErroredSecondsEthernet	Near-end	Transmit	Yes	Count of seconds in which signal failure observed.
unavailableSecondsEthernet	Near-end	Transmit	No	Not supported this release.

## Open ROADM Performance Monitor YANG Model Support

The columns in [Table 42 on page 81](#) are defined as:

- **YANG node** – The node from the Open ROADM YANG model.
- **Access** – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only
  - x – rpc function
  - n – notification
- **Supported** – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- **Supported Values** – Describes the range of supported values on ACX6160.

[Table 42 on page 81](#) describes ACX6160 compliance with the content of the current-pm-list list definition within the org-openroadm-pm YANG module. The location within the Open ROADM YANG model of the nodes listed in the table is /org-openroadm-pm/current-pm-list/current-pm-entry.

**Table 42: Open ROADM Current Performance Monitoring YANG Model Support**

YANG Node	Access	Supported	Supported Values
pm-resource-instance	ro	yes	Identifies specific resource instance reporting the PM data.
pm-resource-type	ro	yes	Port, interface
pm-resource-type-extension	ro	yes	None
retrieval-time	ro	yes	Time when data was read, does not include bin start or end time.
current-pm	ro	yes	List of PMs collected for this resource

Table 42: Open ROADM Current Performance Monitoring YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
- type	ro	yes	Enumerated value from Open ROADM pm-names-enum
- extension	ro	yes	Identifies ACX6160-specific extension to pm-names-enum or “none” if Open ROADM defined pm-name-enum reported for type value above.
- location	ro	yes	notApplicable, nearEnd, farEnd
- direction	ro	yes	tx, rx, bidirectional, notApplicable
- measurement	ro	yes	List of PM measurements for different granularities
-- granularity	ro	yes	notApplicable, 15min, 24Hour
-- pmParameterValue	ro	yes	<ul style="list-style-type: none"> <li>• Union uint64</li> <li>• int64</li> <li>• decimal64</li> </ul>
-- pmParameterUnit	ro	yes	String-valued indicator of units of the value reported, if applicable, for example “dBm”, “count”
-- validity	ro	yes	partial, suspect

### Open ROADM Historical Performance Monitoring YANG Model Support

The ACX6160 provides support for retrieval of historical PM data through the collect-historical-pm-file RPC, defined in the org-openroadm-pm.yang module. Open ROADM users can invoke this RPC to generate an output file containing the historical PM data that is queried, then download this file using the Open ROADM file transfer RPC.

See, [“File System Operations” on page 91](#)



**NOTE:** The ACX6160 does not provide support for retrieving historical PM data by Netconf get requests that target the historical-pm-list container.

Table 43 on page 83 describes ACX6160 compliance with the collect-historical-pm-file RPC definition within the org-openroadm-pm YANG module.

**Table 43: Open ROADM Historical Performance Monitoring RPC YANG Model Support**

YANG Node	Access	Supported	Supported Values
collect-historical-pm-file	x	Yes	
Input			
- from-bin-number	w	Yes	1 through 96
- to-bin-number	w	Yes	1 through 96
- granularity	w	Yes	15min, 24Hour
Output			
- pm-filename	ro	Yes	Name of file in which rpc output data is recorded
- status	ro	Yes	Successful, Failed
- status-message	ro	Yes	Textual description of rpc execution result

The output of the collect-historical-pm-file RPC is saved to a file in XML format based on the historical-pm-list definition, and the file is gzip compressed, as per the definition of the collect-historical-pm-file RPC.

Table 44 on page 83 describes ACX6160 compliance with the defined output data content as defined within the org-openroadm-pm YANG module.

**Table 44: Open ROADM Defined Output Data Content Support**

YANG Node	Access	Supported	Supported Values
historical-pm-list	ro	Yes	
- historical-pm-entry	ro	Yes	

Table 44: Open ROADM Defined Output Data Content Support (*continued*)

YANG Node	Access	Supported	Supported Values
-- pm-resource-instance	ro	Yes	Name of port or interface instance
-- pm-resource-type	ro	Yes	Port, interface
-- pm-resource-type-extension	ro	Yes	
-- historical-pm	ro	Yes	
--- type	ro	Yes	Enumerated value from Open ROADM pm-names-enum
--- extension	ro	Yes	Identifies ACX6160-specific extension to pm-names-enum or “none” if Open ROADM defined pm-name-enum reported for type value above.
--- location	ro	Yes	notApplicable, nearEnd, farEnd
--- direction	ro	Yes	tx, rx, bidirectional, notApplicable
--- measurement	ro	Yes	
---- granularity	ro	Yes	15min, 24Hour
---- bin-number	ro	Yes	1 through 96
---- pmParameterValue	ro	Yes	Union of uint64, int64 and decimal64
---- pmParameterUnit	ro	Yes	String-valued indicator of units of the value reported, if applicable, for example “dBm”, “count”
---- validity	ro	Yes	complete, suspect
---- completion-time	ro	Yes	Timestamp of end of bin time

### Open ROADM Clearing Performance Monitoring Data YANG Model Support

The ACX6160 provides support for clearing current and historical PM data through the clear-pm RPC defined in the org-openroadm-pm.yang module.

Table 45 on page 85 describes ACX6160 compliance with the clear-pm RPC definition within the org-openroadm-pm YANG module.

**Table 45: Open ROADM Clearing Performance Monitoring Data RPC YANG Model Support**

YANG Node	Access	Supported	Supported Values
clear-pm	x	Yes	
Input			
- device/node-id	w	Yes	If specified, must match configured ACX6160 node-id - resource/port
-- circuit-pack-name	w	Yes	If targeting a port, this field must be specified to match the name of a configured pluggable transceiver with traffic-bearing port, with name matching pattern xcvr-0/X/Y
-- port-name	w	Yes	If targeting a port, this field must be specified to match the name of a configured port on a pluggable transceiver, with name matching pattern port-0/X/Y
- resource/interface-name	w	Yes	If targeting an interface, this field must match the name of the interface as configured in the interface list
- resource-type	w	Yes	
-- type	w	Yes	Port, interface
-- extension	w	Yes	None, or leave unspecified
- pm-type	w	Yes	Current, all
- granularity	w	Yes	15min, 24Hour
Output			
- status	ro	Yes	Successful, Failed
- status-message	ro	Yes	Textual description of rpc execution result

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CHAPTER

## System Administration

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# User Administration

## User Account Management

ACX6160 user accounts are managed in the *users* container holding a list of user entries. You can add and delete user entries from this table. Adding a user to this table creates the user in the underlying Open ROADM controller's operating system. Deleting an entry in this table removes a user from the underlying operating system. The underlying operating system's user account database should remain in sync with this table so long as no back-door management takes place.

When you add or update a user entry, the password and group are validated against the data-model specified in the YANG data model.

Per the Open ROADM requirement, the ACX6160 default username and password are: .

- Username= openroadm
- Password= openroadm

## Open ROADM User Account YANG Model Support

When you add or update a user entry the password and group are validated against the data-model specified in the YANG model.

**Table 46: Open ROADM User Account Support on ACX6160**

Operation	Config	OS	Action
Set	No-exist	No-exist	User is created in the OS and in the Configuration
Set	No-exist	Exists	User account is updated in the OS with any changes to password or group. User is added to the configuration.
Set	Exists	No-exists	User is created in the OS and configuration is updated with any changes to password or group.
Set	Exists	Exists	User account and configuration is updated with any changes to password or group.
Delete	No-exist	Don't care	Netconf will error back.

Table 46: Open ROADM User Account Support on ACX6160 (continued)

Operation	Config	OS	Action
Delete	Exists	No-exists	Entry in the configuration is removed, no error is generated.
Delete	Exists	Exists	Entry in OS and Configuration is deleted

If the action results in an error from the OS, the operation fails and the configuration is unchanged. An error is returned in the set or delete response.

The columns [Table 47 on page 90](#) are defined as:

- **YANG node** – The node from the Open ROADM YANG model.
- **Access** – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only
  - x – RPC function
  - n – notification
- **Supported** – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- **Supported Values** – Describes the range of supported values on ACX6160.

[Table 47 on page 90](#) describes ACX6160 compliance with the content of the Open ROADM user account YANG model.

Table 47: Open ROADM User Account YANG Model Support

YANG Node	Access	Supported	Supported Values
users	rw	yes	container
- user	rw	yes	list
-- name	rw	yes	String: User-specified name
-- password	rw	yes	String: User-specified password
-- group	rw	yes	Enumeration: Must be set to "sudo"



## RELATED DOCUMENTATION

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## File System Operations

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- [Open ROADM Show Files YANG Model Support | 93](#)
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- [Open ROADM File Operation Notifications YANG Model Support | 94](#)

This topic describes the device file management YANG model supported by the ACX6160.

### Device File Management

The Open ROADM device model specifies a flat file structure on the device with no subdirectories that support simple file operations with the controller. When an operation generates multiple files, they are placed in a tarball and zipped in a single file which is stored locally in the flat file structure on the ACX6160. Examples of files that may reside in this flat file structure include debug, syslogs, database, software images, and so forth.

For Open ROADM a single directory or file system is created for the purpose of providing this flat directory structure. The controller accesses the ACX6160 flat directory structure through RPC calls. The ACX6160 supports the following RPC calls:

- *transfer* — provides file upload and download using an asynchronous SFTP from or to the ACX6160 respectively
- *show-file* — retrieves list of files from the ACX6160
- *delete-file* — deletes the specified file from the ACX6160

SFTP Client

An asynchronous SFTP client is included that allows you to initiate long file transfers while allowing you to continue management of the device within the same session.

Open ROADM RPC File Transfer YANG Model Support

The columns in [Table 48 on page 92](#), [Table 49 on page 93](#), [Table 50 on page 94](#) and [Table 51 on page 94](#) are defined as:

- *YANG node* – The node from the Open ROADM YANG model.
- *Access* – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only
  - x – RPC function
  - n – notification
- *Supported* – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- *Supported Values* – Describes the range of supported values on ACX6160.

[Table 48 on page 92](#) describes ACX6160 compliance with the content of the Open ROADM RPC file transfer YANG model.

Table 48: Open ROADM RPC File Transfer YANG Model Support

YANG Node	Access	Supported	Supported Values
transfer	x	yes	Action
- input	w	yes	
action	w	yes	Enumeration: upload, download

Table 48: Open ROADM RPC File Transfer YANG Model Support *(continued)*

YANG Node	Access	Supported	Supported Values
-- local-file-path	w	yes	String: local file to be source of upload or destination of download.  Description: Local file path. Ex: /var/shared/example.txt
-- remote-file-path	w	yes	String: remote file to be destination of upload or source of download.
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM Show Files YANG Model Support

Table 49 on page 93 describes ACX6160 compliance with the content of the Open ROADM RPC show-files YANG model.

Table 49: Open ROADM Show Files YANG Model Support

YANG Node	Access	Supported	Supported Values
show-file	x	yes	Action
- input	w	yes	
-- filename	w	yes	String: files to be listed (* is allowed wild-card)
-- remote-file-path	w	yes	String: remote file to be destination of upload or source of download.
- output	ro	yes	
-- status	ro	yes	Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM Delete Files YANG Model Support

Table 50 on page 94 describes ACX6160 compliance with the content of the Open ROADM RPC delete-file YANG model.

Table 50: Open ROADM Delete Files YANG Model Support

YANG Node	Access	Supported	Supported Values
delete-file	x	yes	Action
- input	w	yes	
-- filename	w	yes	String: local file to be deleted (* wild-card is not allowed).
- output	ro	yes	
-- status	ro	yes	Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM File Operation Notifications YANG Model Support

Table 51 on page 94 describes ACX6160 compliance with the content of the Open ROADM RPC file operation notification YANG model.

Table 51: Open ROADM File Operation Notifications YANG Model Support

YANG Node	Access	Supported	Supported Values
transfer-notification	n	yes	Notification
- local-file-path	ro	yes	String: local file to be deleted.
- status	ro	yes	Successful, Failed, In-progress
- status-message	ro	yes	String: provides more detail on status
- progress	ro	yes	
-- bytes-transferred	ro	yes	Count of bytes transferred

Table 51: Open ROADM File Operation Notifications YANG Model Support (continued)

YANG Node	Access	Supported	Supported Values
-- percentage-complete	ro	yes	Percent complete, 100% is done

RELATED DOCUMENTATION

<a href="#">User Administration</a>   <a href="#">89</a>
<a href="#">Software Upgrades</a>   <a href="#">95</a>
<a href="#">Database Save and Restore Operations</a>   <a href="#">102</a>

# Software Upgrades

IN THIS SECTION

- [Software Upgrade RPC Functions](#) | [95](#)
- [Manifest Files](#) | [96](#)

## Software Upgrade RPC Functions

The ACX6160 uses the following RPC functions for software upgrades:

- *Pending software container* — specifies the software version.
- *Software stage RPC* — stages the specified software package into the in-active software bank. This is done to prepare for software activation when the in-active bank is activated and for the new software package to take effect.
- *Software activate RPC* — activates the software previously staged to the in-active bank by switching the role of the software banks and reboots the device.
- *Software cancel validation timer RPC* — cancels the validation timer. The input parameter accept determines whether the load is committed or if the device reverts back to the previous load (cancel-validation-timer).

- *Software stage notification* — returns a success or fail notification.
- *Software activate notification* — returns the following notifications:
  - *Activate* — software image has been activated. This is sent upon successful completion of the **sw-activate** request.
  - *Commit* — software load has been committed. This is sent after a **cancel-validation-timer** request has been sent with **accept** = true.
  - *Cancel* — software load has been cancelled. This is sent after a **cancel-validation-timer** request has been sent with **accept** = false or expiration of the **cancel-validation-timer**.

## Manifest Files

### IN THIS SECTION

- [Open ROADM Pending Software YANG Model Support | 97](#)
- [Open ROADM Software Stage YANG Model Support | 97](#)
- [Open ROADM Software Activate YANG Model Support | 98](#)
- [Open ROADM Software Cancel-Validation-Timer YANG Model Support | 99](#)
- [Open ROADM Software Stage Notification YANG Model Support | 99](#)
- [Open ROADM Software Activate Notification YANG Model Support | 100](#)

Per the Open ROADM MSA, the ACX6160 uses manifest files to describe how the ACX6160 performs a software download, database backup, and database restore operations. This allows the controller to adapt to variations in how devices handle these operations. For each operation the manifest file provides a basic set of attributes and then an instruction set that describes the sequence of RPC requests required to perform the operation.

This section describes the various manifest files used for the ACX6160.

The columns in [Table 52 on page 97](#), [Table 53 on page 98](#), [Table 54 on page 98](#), [Table 55 on page 99](#), [Table 56 on page 100](#) [Table 57 on page 100](#) are defined as:

- *YANG node* — The node from the Open ROADM YANG model.
- *Access* — Access properties of the node. Can be:

- rw — read/write
- ro — read-only
- x — RPC function
- n — notification
- *Supported* — Indicates ACX6160 support for the node.
  - Yes — ACX6160 supports the node
  - No — ACX6160 does not support the node
  - N/A — Node is not applicable to transponder device
- *Supported Values* — Describes the range of supported values on ACX6160.

## Open ROADM Pending Software YANG Model Support

[Table 52 on page 97](#) describes ACX6160 compliance with the content of the Open ROADM RPC pending software YANG model..

**Table 52: Open ROADM Pending Software YANG Model Support**

YANG Node	Access	Supported	Supported Values
Pending-software	ro	yes	container
- sw-version	ro	yes	Package version in this bank
- sw-validation-timer	ro	yes	String: value of validation timer hh-mm-ss
- activation-date-time	ro	yes	date-and-time: Activation date and time

## Open ROADM Software Stage YANG Model Support

The software stage RPC function stages (installs) the specified software package into the in-active software bank. This is done to prepare for software activation when the in-active bank is activated and for the new software package to take effect.

The software package is validated prior to writing to the software bank to avoid installation of corrupted software into the in-active bank. If this operation fails an error is returned and no change is made to the contents of the in-active software bank or the device state.

[Table 53 on page 98](#) describes ACX6160 compliance with the content of the Open ROADM RPC software stage YANG model.

Table 53: Open ROADM Software Stage YANG Model Support

YANG Node	Access	Supported	Supported Values
Software-stage	x	yes	Stages software package into the in-active software bank
- input	w	yes	
-- filename	w	yes	String: name of package file to be staged.
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

### Open ROADM Software Activate YANG Model Support

This RPC activates the software previously staged to the in-active bank by switching the role of the software banks and reboots the device. The device comes up with the banks switched so that the software from the previously in-active bank takes effect.

If this operation fails an error is returned and the device is not be rebooted and no change is made to the ACX6160 device state.

describes ACX6160 compliance with the content of the Open ROADM RPC software activate YANG model.

Table 54: Open ROADM Software Activate YANG Model Support

YANG Node	Access	Supported	Supported Values
activate	x	yes	Activates software previously staged to the in-active bank.
- input	w	yes	
-- version	w	yes	String: version of the software to be activated
-- validationTimer	w	yes	String: specifies time hh-mm-ss the user has to validate the software and cancel this timer.
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed



Table 54: Open ROADM Software Activate YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
-- status-message	ro	yes	String: provides more detail on status

### Open ROADM Software Cancel-Validation-Timer YANG Model Support

Table 55 on page 99 describes the software cancel-validation-timer RPC YANG Model. This RPC cancels the validation timer on the ACX6160. The input parameter: **accept**, determines if the software load is committed or if the device reverts back to the previous load.

If this operation fails, you can try again, the ACX6160 software does not prevent subsequent attempts. Failure to complete this operation results in the cancel-validation-timer expiry at which time the ACX6160 reverts back to the previous software load.

Table 55 on page 99 describes ACX6160 compliance with the content of the Open ROADM RPC software cancel-validation-timer YANG model.

Table 55: Open ROADM Software Cancel-Validation-Timer YANG Model Support

YANG Node	Access	Supported	Supported Values
cancel-validation-timer	x	yes	Cancels the validation timer
- input	w	yes	
-- accept	w	yes	True - to accept the software load  False - to reject the software load, this reverts the software back to the previously installed version by switching the roles of the software banks and rebooting the device.
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

### Open ROADM Software Stage Notification YANG Model Support

Table 56 on page 100 describes ACX6160 compliance with the content of the Open ROADM RPC software stage notification YANG model. This RPC function returns a success or fail notification (sw-stage notification).

Table 56: Open ROADM Software Stage Notification YANG Model Support

YANG Node	Access	Supported	Supported Values
sw-stage-notification	n	yes	Notification
- status	ro	yes	Returns: Successful, Failed
- status-message	ro	yes	String: provides more detail on status

## Open ROADM Software Activate Notification YANG Model Support

[Table 57 on page 100](#) describes ACX6160 compliance with the content of the Open ROADM RPC software activate notification YANG model.

Table 57: Open ROADM Software Activate Notification YANG Model Support

YANG node	Access	Support	Description
sw-stage-notification	n	yes	Notification
sw-active-notification-type	ro	yes	Returns: <ul style="list-style-type: none"> <li>• activate – Notification that the software image has been activated. This is sent upon successful completion of the sw-activate request.</li> <li>• commit – Notification that software load has been committed. This is sent after a cancel-validation-timer request has been sent with accept = true.</li> <li>• cancel – Notification that software load has been cancelled. This is sent after a cancel-validation-timer request has been sent with accept = false or expiration of the cancel-validation-timer.</li> </ul>
- status	ro	yes	Returns: Successful, Failed, or In-progress
- status-message	ro	yes	String: provides more detail on status

## RELATED DOCUMENTATION

Firmware Upgrades   101
File System Operations   91
Database Save and Restore Operations   102

# Firmware Upgrades

## Firmware Upgrade

A firmware upgrade upgrades the firmware on the specified ACX6160 circuit pack.

**NOTE:** Firmware upgrades are service impacting and interrupt traffic.

## Open ROADM Firmware Upgrade for Circuit-Packs YANG Model Support

Firmware upgrade will upgrade firmware on the specified circuit pack. This operation is service impacting and can interrupt traffic.

The columns in [Table 58 on page 102](#) are defined as:

- **YANG node** – The node from the Open ROADM YANG model.
- **Access** – Access properties of the node. Can be:
  - rw – read/write
  - ro – read-only
  - x – RPC function
  - n – notification
- **Supported** – Indicates ACX6160 support for the node.
  - Yes – ACX6160 supports the node
  - No – ACX6160 does not support the node
  - N/A – Node is not applicable to transponder device
- **Supported Values** – Describes the range of supported values on ACX6160.

Table 58 on page 102 describes ACX6160 compliance with the content of the Open ROADM RPC software firmware upgrade for circuit-packs YANG model.

**Table 58: Open ROADM Firmware Upgrade for Circuit-Packs YANG Model Support**

YANG Node	Access	Supported	Supported Values
fw-update	x	yes	Updates firmware on the specified circuit pack
- input	w	yes	
-- circuit-pack-name	w	yes	String: name of circuit-pack to upgrade firmware
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## RELATED DOCUMENTATION

[File System Operations | 91](#)

[Database Save and Restore Operations | 102](#)

[Software Upgrades | 95](#)

# Database Save and Restore Operations

## IN THIS SECTION

- [Database Operations Open ROADM YANG Model Support | 103](#)

The ACX6160 database operations Open ROADM YANG model provides configuration database management operations for backing up the ACX6160 configuration to a file, to restore the configuration from a file, and restore to factory default.

## Database Operations Open ROADM YANG Model Support

The ACX6160 database operations Open ROADM YANG data models provide configuration database management RPC functions for backing up the ACX6160 configuration to a file, restoring the ACX6160 configuration from a file, and restoring the ACX6160 to factory default. Factory default returns the device configuration back to factory default.

- *Database backup RPC* — writes the current running configuration to the specified file.
- *Database restore RPC* — restores the configuration from the specified filename.
- *Database activate RPC* — activates the new configuration that was read in from a **db-restore** or from **db-init** (factory-default)
- *Cancel rollback timer* — sets candidate configuration to factory default.
- *Database init RPC* — Sets the candidate configuration to the factory default.

The columns in [Table 59 on page 104](#), [Table 60 on page 104](#), [Table 61 on page 105](#), [Table 59 on page 104](#), [Table 62 on page 106](#), and [Table 63 on page 107](#), are defined as:

- *YANG node* — The node from the Open ROADM YANG model.
- *Access* — Access properties of the node. Can be:
  - rw — read/write
  - ro — read-only
  - x — RPC function
  - n — notification
- *Supported* — Indicates ACX6160 support for the node.
  - Yes — ACX6160 supports the node
  - No — ACX6160 does not support the node
  - N/A — Node is not applicable to transponder device
- *Supported Values* — Describes the range of supported values on ACX6160.

### Open ROADM Database Backup YANG Model Support

[Table 59 on page 104](#) describes ACX6160 compliance with the content of the Open ROADM RPC database backup YANG model. This RPC writes the current running configuration to the specified file.

Table 59: Open ROADM Database Backup YANG Model Support

YANG Node	Access	Supported	Supported Values
db-backup	x	yes	Write configuration database to specified file.  Format in XML.
- input	w	yes	
-- filename	w	yes	String: name of file to save database
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

### Open ROADM Database Restore YANG Model Support

Table 60 on page 104 describes ACX6160 compliance with the content of the Open ROADM RPC database restore YANG model. This RPC restores the configuration from the specified filename.

If the **nodeIDCheck** is enabled, it compares the **nodeId** in the specified file to the current **nodeId** and the operation is rejected if they do not match.

Table 60: Open ROADM Database Restore YANG Model Support

YANG Node	Access	Supported	Supported Values
db-restore	x	yes	Read configuration from specified file into candidate configuration database.  <b>NOTE:</b> A <b>db-activate</b> is required to commit the factory default configuration.
- input	w	yes	
-- filename	w	yes	String: name of file to restore database from
-- nodeIDCheck	w	yes	True - sysNameCheck required. Verifies sysName in specified file matches the current sysName.  False – no check required

Table 60: Open ROADM Database Restore YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM Database Activate YANG Model Support

Table 61 on page 105 describes ACX6160 compliance with the content of the Open ROADM RPC database activate YANG model. This RPC activates the new configuration, which must previously be read in from a **db-restore** or from **db-init** (factory-default) RPC.

You can use the optional rollback timer (**rollBackTimer**) to rollback the configuration if not cancelled with **accept=true** prior to expiration.

Table 61: Open ROADM Database Activate YANG Model Support

YANG Node	Access	Supported	Supported Values
db-activate	x	yes	Activates the candidate configuration by performing a commit.
- input	w	yes	
-- rollBackTimer	w	yes	String: hh:mm:ss time which configuration is reverted.  <b>NOTE:</b> You must verify system is operational and cancel the rollback timer.
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM Cancel Rollback Timer YANG Model Support

Table 62 on page 106 describes the cancel rollback timer RPC YANG model.

**NOTE:** This RPC sets the candidate configuration to factory default.

Restoring to factory default returns the ACX6160 configuration back to factory defaults and:

- The static IP management address is deleted from the ACX6160
- DHCP is enabled, so that the device can receive a temporary IP address

**NOTE:** Activation of restore to factory default, results in loss of connectivity over the static IP address. You may want to re-configure the static IP address and disable DHCP on the management interface prior to activating the restore to factory default.

Table 62 on page 106 describes ACX6160 compliance with the content of the Open ROADM RPC cancel rollback timer YANG model.


**Table 62: Open ROADM Cancel Rollback Timer YANG Model Support**

YANG Node	Access	Supported	Supported Values
cancel-rollback-timer	x	yes	Set candidate configuration to factory default.  <b>NOTE:</b> A <b>db-activate</b> is required to commit the factory default configuration.
- input	w	yes	
-- accept	w	yes	True – accept activated configuration  False – revert configuration back to previous configuration.
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status



# Open ROADM Database Init YANG Model Support

Table 63 on page 107 describes ACX6160 compliance with the content of the Open ROADM RPC database init YANG model.



**WARNING:** This RPC sets the candidate configuration to factory default.

Activation of this RPC, results in loss of connectivity over the static IP address. You may want to re-configure the static IP address and disable DHCP on the management interface prior to activating the restore to factory default.

**NOTE:**

Restoring to factory default returns the ACX6160 configuration back to factory defaults and:

- The static IP management address is deleted from the ACX6160
- DHCP is enabled, so that the device can receive a temporary IP address

Table 63: Open ROADM Database init YANG Model Support

YANG Node	Access	Supported	Supported Values
db-init	x	yes	Set candidate configuration to factory default.  <b>NOTE:</b> A <b>db-activate</b> is required to commit the factory default configuration.
- input	w	yes	
-- filename	w	yes	String: name of file to restore database from
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## RELATED DOCUMENTATION

## Device Operations

### IN THIS SECTION

- [Open ROADM Device Operations YANG Model Support | 108](#)
- [Open ROADM LED Control YANG Model Support | 109](#)
- [Open ROADM Tech Support Info YANG Model Support | 110](#)
- [Open ROADM Create Tech Info Notification YANG Model Support | 111](#)
- [Open ROADM Set Current Date and Time YANG Model Support | 111](#)

## Open ROADM Device Operations YANG Model Support

The ACX6160 device operations Open ROADM YANG model includes RPC functions that control the ACX6160 LEDs, date and time, and restart functions. The following RPCs are available:

- *LED control RPC function* — controls the ACX6160 LEDs
- *Tech support information RPC function* — collects all log data for debugging and places it in a location accessible via FTP/SFTP.
- *Create tech info notification RPC function* — notification is sent when the create-tech-info RPC completes.
- *Set current datetime RPC function* — sets the current date and time on the ACX6160

The columns in [Table 64 on page 109](#), [Table 65 on page 110](#), and [Table 66 on page 111](#), are defined as:

- *YANG node* — The node from the Open ROADM YANG model.
- *Access* — Access properties of the node. Can be:
  - rw — read/write
  - ro — read-only

- x — RPC function
- n — notification
- *Supported* — Indicates ACX6160 support for the node.
  - Yes — ACX6160 supports the node
  - No — ACX6160 does not support the node
  - N/A — Node is not applicable to transponder device
- *Supported Values* — Describes the range of supported values on ACX6160.

## Open ROADM LED Control YANG Model Support

Table 64 on page 109 describes ACX6160 compliance with the content of the Open ROADM LED control YANG model. This RPC function is used to flash LED on the ACX6160 to help the technician find the device and entity in the device that needs service.

**Table 64: Open ROADM LED Control YANG Model Support**

YANG Node	Access	Supported	Supported Values
led-control	x	yes	RPC to flash LEDs to identify device/components  equipmentLedOn alarm is raised and cleared to provide this indication.
- input	w	yes	container
-- shelf		yes	Case shelf
--- shelf-name	w	yes	Set to shelf-0
-- circuit-pack		yes	Case circuit pack
--- circuit-pack-name	w	yes	Circuit pack name
-- enabled	w	yes	True — equipmentLedOn is raised  False — equipmentLedOn is cleared
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed

Table 64: Open ROADM LED Control YANG Model Support (*continued*)

YANG Node	Access	Supported	Supported Values
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM Tech Support Info YANG Model Support

Table 65 on page 110 describes the tech support info RPC YANG model. This RPC collects all log data for debugging and places it in a location accessible via FTP/SFTP. This model assumes ASYNC operation, in other words, the command is returned after the ACX6160 accepts the command, A **create-tech-info-notification** is sent out later for the result of the operation. The log-file is cleared at the start of every **create-tech-info** operation in order to ensure the up-to-date logs are collected.

Table 65 on page 110 describes ACX6160 compliance with the content of the Open ROADM RPC tech support info YANG model.

Table 65: Open ROADM Tech Support Info YANG Model Support

YANG Node	Access	Supported	Supported Values
create-tech-info	x	yes	Collect logs for debugging and places in location accessible via FTP/SFTP.
- input	w	yes	container
-- shelf-id	w	yes	Set to: shelf-0
-- log-option	w	yes	Set to all, to get all logs.
- output	ro	yes	
-- shelf-id	ro	yes	Returns shelf-id
-- log-file-name	ro	yes	Return "log-files.tgz"
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM Create Tech Info Notification YANG Model Support

Table 66 on page 111 describes ACX6160 compliance with the content of the Open ROADM RPC create tech info notification YANG model. This notification is sent when the **create-tech-info** RPC completes.

Table 66: Open ROADM Create Tech Info Notification YANG Model Support

YANG Node	Access	Supported	Supported Values
create-tech-info-notification	x	yes	Collect logs for debugging and places in location accessible via FTP/SFTP.
- output	ro	yes	
-- shelf-id	ro	yes	Returns shelf-id
-- log-file-name	ro	yes	Return "log-files.tgz"
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## Open ROADM Set Current Date and Time YANG Model Support

Table 67 on page 111 describes ACX6160 compliance with the content of the Open ROADM RPC set current data and time YANG model. This RPC sets the current date and time on the ACX6160.

Table 67: Open ROADM Set Current Date and Time YANG Model Support

YANG Node	Access	Supported	Supported Values
set-current-datetime			
- input	w	yes	container
-- current-datetime	w	yes	ietf-yang-types:date-and-time
- output	ro	yes	
-- status	ro	yes	Returns: Successful, Failed
-- status-message	ro	yes	String: provides more detail on status

## RELATED DOCUMENTATION

[Database Save and Restore Operations | 102](#)[File System Operations | 91](#)[One-Touch Factory Defaults Button | 112](#)

## One-Touch Factory Defaults Button

The **Reset** button on the ACX6160 Management Panel allows you to easily return the device to the factory default configuration. This configuration contains just enough configuration needed for commissioning the ACX6160, and no more.

For the ACX6160, the factory default configuration is set so that the device receives a temporary IP address from your DHCP server. Your Open ROADM controller takes over from there and sets a permanent IP address and configures the ACX6160 using the Open ROADM controller and the ACX6160 YANG data models.

## RELATED DOCUMENTATION

[Database Save and Restore Operations | 102](#)[File System Operations | 91](#)[Maintenance Testing | 64](#)

# 4

CHAPTER

## Maintenance Signaling

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Maintenance Signaling | 115

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# Maintenance Signaling

## IN THIS SECTION

- [Interface Alarm Signalling | 115](#)
- [SignalFail Signaling on the ACX6160 | 115](#)
- [Provisioning Related Signaling on the ACX6160 | 116](#)

## Interface Alarm Signalling

On the ACX6160 Client and Line port interface alarm signaling involves three areas:

- Signals generated during SignalFail conditions
- Signals generated during provisioning
- Signals passed from source to destination transparently

## SignalFail Signaling on the ACX6160

When an ACX6160 interface is fully provisioned, cross-connected, and administratively up, if a **SignalFail** condition is declared on a Client or Line interface, upstream and downstream alarm signals are generated to inform the upstream and downstream ACX6160 nodes.

### SignalFail Signaling on ACX6160 100 Gbps Ethernet Client Interfaces

100 Gbps Ethernet clients use GMP mapping to insert/retrieve Ethernet signaling within the Line side OTN OPU framing.

If SignalFail (Loss Of Signal, Loss Of Sync) is declared on the Client side 100 Gbps Ethernet interface, LFOS (Local Fault Ordered set) is sent over the Line side OTU4 interface.

If SignalFail (Loss Of Signal, Loss Of Frame) is declared on the Line side OTU4 interface, LF (Local Fault) is sent over the Client side 100 Gbps Ethernet interface, and BDI (Backward Defect Indication) is sent over the Line side OTU4 interface.

If BDI is received on the Line side OTU4 interface, LF (Local Fault) is sent over the Client side 100 Gbps Ethernet interface.

### **SignalFail Signaling on ACX6160 OTU4 Client and Line Interfaces**

If SignalFail (Loss Of Signal, Loss Of Frame) is declared on the Client side OTU4 interface, Alarm Indication Signal (ODU-AIS) is sent over the Line side of the OTU4 interface, and BDI is sent over the Client side of the OTU4 interface.

If SignalFail (Loss Of Signal, Loss Of Frame) is declared on the Line side OTU4 interface, ODU-AIS (Alarm Indication Signal) is sent over the Client side OTU4 interface, and BDI is sent over the Line side OTU4 interface.

If BDI is received on the Line side OTU4 interface, BDI is sent on the Client side OTU4 interface.

## **Provisioning Related Signaling on the ACX6160**

### **Provisioning Related Signaling on 100 Gbps Ethernet Client Interfaces**

If a Client side 100 Gbps Ethernet interface is administratively disabled, RF is sent on the Client side 100 GE interface, and LFOS is sent on the Line side OTU4 interface.

If Client side 100GE interface is then put into a loopback mode, the RF on the Client side 100 GE interface is removed.

### **Provisioning Related Signaling on OTU4 Client Interfaces**

If a Client side OTU4 interface is administratively disabled, ODU-LCK is sent on the Client side OTU4 interface, and ODU-LCK is sent on the Line side OTU4 interface.

If Client side OTU4 interface is then put into a loopback mode, ODU-LCK on the Client side OTU4 interface is removed, and ODU-LCK on the Line side OTU4 interface is removed

If a Client side OTU4 interface has been fully provisioned, and set administratively up, but NOT cross-connected (not carrying traffic), ODU-OCI (Open Connection Indication) is sent over the Client side OTU4 interface. When the cross-connect is provisioned, the ODU-OCI signal will stop being sent.

### **Provisioning Related Signaling on OTU4 Line Interfaces**

If a Line side OTU4 interface is administratively disabled, ODU-LCK is sent on the Line side OTU4 interface, and ODU-LCK is sent on the Client side OTU4 interface.

If Line side OTU4 interface is then put into a loopback mode, ODU-LCK on the Line side OTU4 interface is removed.

If a Line side OTU4 interface has been fully provisioned, and set administratively up, but NOT cross-connected (not carrying traffic), ODU-OCI is sent over the Line side OTU4 interface. When the cross-connect is provisioned, the ODU-OCI signal will stop being sent.

## Signal Transparency

### *Signal Transparency on 100GE Client Interfaces*

Any LF/RF signals received on the Client side 100GE interface are mapped into LF/RFOS (OrderedSets) on the Line side OTU4 interface. Any LF/RFOS received on the Line side OTU4 Client are mapped into LF/RF signals on the Client side 100GE interface.

### *Signal Transparency on OTU4 Client Interfaces*

Any ODU signals received on the Client side OTU4 interface are transparently mapped into ODU signals on the Line side OTU4 interface. Any ODU signals received on the Line side OTU4 interface are transparently mapped into ODU signals on the Client side OTU4 interface.

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