



Configuring Clear Channel SONET Controllers

This module describes the configuration of clear channel SONET controllers.

SONET controller configuration is a preliminary step toward Packet-over-SONET/SDH (POS) configuration on routers using Cisco IOS XR software.

SONET allows you to define optical signals and a synchronous frame structure for multiplexed digital traffic. It is a set of standards defining the rates and formats for optical networks specified in American National Standards Institute (ANSI) T1.105, ANSI T1.106, and ANSI T1.117.

The commands for configuring the Layer 1 SONET controllers are provided in the *Cisco IOS XR Interface and Hardware Component Command Reference*.

Feature History for Configuring SONET Controllers on Cisco IOS XR Software

Release	Modification
Release 2.0	This feature was introduced on the Cisco CRS-1 Router.
Release 3.3.0	Support was added on the Cisco CRS-1 Router for the Cisco 1-Port OC-768c/STM-256c POS PLIM.
Release 3.4.0	Support was added on the Cisco CRS-1 Router for the following hardware: <ul style="list-style-type: none">• Cisco 2 port OC-48/STM-16 POS SPA• Cisco 4 port OC-48/STM-16 POS SPA
Release 3.8.0	The delay trigger line command was updated to line delay trigger in the following sections : <ul style="list-style-type: none">• How to Configure Clear Channel SONET Controllers• Configuring a Hold-off Timer to Prevent Fast Reroute from being Triggered

Release 4.0.1	<p>Support for APS was added on the Cisco CRS-1 Router for the following hardware:</p> <ul style="list-style-type: none"> • 1-Port OC-192c/STM-64 POS/RPR XFP SPA • 2-Port and 4-Port OC-48c/STM-16 POS SPA • 4-Port OC-3c/STM-1 POS SPA • 4-Port and 8-Port OC-3c/STM-1 POS SPA • 8-Port OC-3c/STM-1 POS SPA
Release 4.3.0	<p>Support for APS was added on the Cisco CRS-3 Router for the following hardware:</p> <ul style="list-style-type: none"> • 1-Port OC-192c/STM-64 POS/RPR XFP SPA • 2-Port and 4-Port OC-48c/STM-16 POS SPA • 4-Port OC-3c/STM-1 POS SPA • 4-Port and 8-Port OC-3c/STM-1 POS SPA • 8-Port OC-3c/STM-1 POS SPA

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Prerequisites for Configuring Clear Channel SONET Controllers

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Before configuring SONET controllers, be sure that the following tasks and conditions are met:

- You have at least one of the following physical layer interface module (PLIM) cards installed in your chassis:
 - Cisco 4-Port OC-3c/STM-1 POS SPA
 - Cisco 8-Port OC-12c/STM-4 POS SPA
 - Cisco 16-Port OC-48c/STM-16c POS
 - Cisco 4-Port OC-192c/STM-64c POS
 - Cisco 1-Port OC-192c/STM-64 POS/RPR XFP SPA
 - Cisco 1-Port OC-768c/STM-256c POS PLIM

- You know how to apply the specify the SONET controller name and instance identifier with the generalized notation *rack/slot/module/port*. The SONET controller name and instance identifier are required with the **controller sonet** command.

Information About Configuring SONET Controllers

To configure SONET controllers, you must understand the following concepts:

SONET Controller Overview

In routers supporting Cisco IOS XR software, the physical ports on certain line cards are called controllers. Before you can configure a POS, SRP, or serial interface, you need to configure the SONET controller.

The commands used to configure the physical SONET port are grouped under the SONET controller configuration mode. To get to the SONET controller configuration mode, enter the **controller sonet** command in global configuration mode. You can also preconfigure a SONET controller using the **controller preconfigure sonet** global configuration command.

The router uses SONET controllers for Layer 1 and Layer 2 processing.



Note Path UNEQ is not supported on the OC-768 card. Therefore, UNEQ-P and PPLM alarms are not reported for any unequipped C2 byte that is received on an OC-768 interface. Cisco supports all error codes from the ERDI-P standard except for the UNEQ-P code.

Default Configuration Values for SONET Controllers

The table below describes some default configuration parameters that are present on SONET controllers.

Table 1: SONET Controller Default Configuration Values

Parameter	Default Value	Configuration File Entry
Reporting of the following alarms for a SONET controller: <ul style="list-style-type: none"> • Bit 1 (B1) bit error rate (BER) threshold crossing alert (TCA) errors • Bit 2 (B2) BER TCA errors • Signal failure BER errors • Section loss of frame (SLOF) errors • Section loss of signal (SLOS) errors 	enabled	To disable reporting of any alarms enabled by default, use the no report [b1-tca b2-tca sf-ber slof slos] command in SONET/SDH configuration mode. To enable reporting of line alarm indication signal (LAIS), line remote defect indication (LRDI), or signal degradation BER errors, use the report [lais lrdi sd-ber] command in SONET/SDH configuration mode.

Parameter	Default Value	Configuration File Entry
Reporting of the following alarms for a SONET path controller: <ul style="list-style-type: none"> • Bit 3 (B3) BER TCA errors • Path loss of pointer (PLOP) errors 	enabled	To disable B3 BER TCA or PLOP reporting on the SONET path controller, enter the no report b3-tca or no report plop command in SONET/SDH path configuration submode. To enable reporting of path alarm indication signal (PAIS), path payload mismatch (PPLM), path remote defect indication (PRDI), or path trace identity mismatch (PTIM) errors, use the report [pais pplm prdi ptim command in SONET/SDH path configuration submode.
Synchronous payload envelope (SPE) scrambling	enabled	To disable SPE scrambling on a SONET controller, enter the path scrambling disable command in SONET controller configuration submode.
Keepalive timer	enabled	To turn off the keepalive timer, enter the keepalive disable command in interface configuration mode.

SONET APS

The automatic protection switching (APS) feature allows switchover of interfaces in the event of failure, and is often required when connecting SONET equipment to telco equipment. APS refers to the mechanism of using a *protect* interface in the SONET network as the backup for *working* interface. When the working interface fails, the protect interface quickly assumes its traffic load. The working interfaces and their protect interfaces make up an *APS group*.

In Cisco IOS XR software, SONET APS configuration defines a working line and a protection line for each redundant line pair. The working line is the primary or preferred line, and communications take place over that line as long as the line remains operative. If a failure occurs on the working line, APS initiates a switchover to the protection line. For proper APS operation between two routers, a working line on one router must also be the working line on the other router, and the same applies to the protection line.

In a SONET APS group, each connection may be bidirectional or unidirectional, and revertive or non-revertive. The same signal payload is sent to the working and protect interfaces. The working and protect interfaces can terminate in two ports of the same card, or in different cards in the same router, or in two different routers.

The protect interface directs the working interface to activate or deactivate in the case of degradation, loss of channel signal, or manual intervention. If communication between the working and protect interfaces is lost, the working router assumes full control of the working interface as if no protect circuit existed.

In an APS group, each line is called a *channel*. In bidirectional mode, the receive and transmit channels are switched as a pair. In unidirectional mode, the transmit and receive channels are switched independently. For example, in bidirectional mode, if the receive channel on the working interface has a loss of channel signal, both the receive and transmit channels are switched.

How to Configure Clear Channel SONET Controllers

This section contains the following procedures:

Configuring a Clear Channel SONET Controller

This task explains how to configure SONET controllers as a prerequisite to configuring POS and SRP or serial interfaces.

Before you begin

- You need to have a supported POS line card or channelized SPA installed in a router that is running the corresponding supported Cisco IOS XR software release.
- If you want to ensure recovery from fiber or equipment failures, then configure SONET APS on the router as describe in the [Configuring SONET APS](#).

SUMMARY STEPS

1. **configure**
2. **controller sonet** *interface-path-id*
3. **clock source** {**internal** | **line**}
4. **line delay trigger** *value*
5. **line delay clear** *value*
6. **framing** {**sdh** | **sonet**}
7. **loopback** {**internal** | **line**}
8. **overhead** {**j0** | **s1s0**} *byte-value*
9. **path** *keyword* [*values*]
10. **end** or **commit**
11. **show controllers sonet** *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RP0/CPU0:router# <code>configure</code>	Enters global configuration mode.

	Command or Action	Purpose
Step 2	controller sonet <i>interface-path-id</i> Example: <pre>RP/0/RP0/CPU0:router(config)# controller sonet 0/1/0/0</pre>	Enters SONET controller configuration submode and specifies the SONET controller name and instance identifier with the <i>rack/slot/module/port</i> notation.
Step 3	clock source { internal line } Example: <pre>RP/0/RP0/CPU0:router(config-sonet)# clock source internal</pre>	Configures the SONET port transmit clock source, where the internal keyword sets the internal clock and line keyword sets the clock recovered from the line. <ul style="list-style-type: none"> Use the line keyword whenever clocking is derived from the network. Use the internal keyword when two routers are connected back-to-back or over fiber for which no clocking is available. The line clock is the default. <p>Note</p> <ul style="list-style-type: none"> Internal clocking is required for SRP interfaces.
Step 4	line delay trigger <i>value</i> Example: <pre>RP/0/RP0/CPU0:router(config-sonet)# line delay trigger 3000</pre>	(Optional) Configures the SONET line delay trigger values, where the trigger values are in the range from 0 through 60000 milliseconds, and the default delay trigger value is 0 milliseconds.
Step 5	line delay clear <i>value</i> Example: <pre>RP/0/RP0/CPU0:router(config-sonet)# line delay clear 4000</pre>	(Optional) Configures the amount of time before a SONET line delay trigger alarm is cleared. The range is from 1000 through 180000 milliseconds, and the default is 10 seconds.
Step 6	framing { sdh sonet } Example: <pre>RP/0/RP0/CPU0:router(config-sonet)# framing sonet</pre>	(Optional) Configures the controller framing with either the sdh keyword for Synchronous Digital Hierarchy (SDH) framing or the sonet keyword for SONET framing. SONET framing (sonet) is the default.
Step 7	loopback { internal line } Example: <pre>RP/0/RP0/CPU0:router(config-sonet)# loopback internal</pre>	(Optional) Configures the SONET controller for loopback, where the internal keyword selects internal (terminal) loopback, or the line keyword selects line (facility) loopback.
Step 8	overhead { j0 s1s0 } <i>byte-value</i> Example: <pre>RP/0/RP0/CPU0:router(config-sonet)# overhead s1s0</pre>	(Optional) Configures the controller's overhead, where the j0 keyword specifies the STS identifier (J0/C1) byte, and the s1s0 keyword specifies bits s1 and s0 of H1 byte. <ul style="list-style-type: none"> The default byte value for the j0 keyword is 0xcc, and the default byte value for the s1s0 keyword is 0.

	Command or Action	Purpose
		<ul style="list-style-type: none"> The range of valid values for j0 and s1s0 is 0 through 255.
<p>Step 9</p>	<p>path <i>keyword</i> [<i>values</i>]</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-sonet)# path delay trigger 25</pre>	<p>(Optional) Configures SONET controller path values.</p> <p>Keyword definitions are as follows:</p> <ul style="list-style-type: none"> ais-shut—Set sending path alarm indication signal (PAIS) when shut down. b3-ber-prdi—Enable sending of a path-level remote defect indication (PRDI) when the bit error rate (BER) bit interleaved parity (BIP) threshold is exceeded. delay clear <i>value</i>—Set the amount of time before a Synchronous Transport Signal (STS) path delay trigger alarm is cleared. Replace the <i>value</i> argument with a number in the range from 0 through 180000 milliseconds. The default value is 10 seconds. delay trigger <i>value</i> —Set SONET path delay values or delay trigger value. Replace the <i>value</i> argument with a number in the range from 0 through 60000 milliseconds. The default value is 0 milliseconds. overhead [c2 <i>byte-value</i> j1 <i>line</i>]—Set SONET POH byte or bit values. Enter the c2 keyword to specify STS SPE content (C2) byte, and replace the <i>byte-value</i> argument with a number in the range from 0 through 255. Enter the j1 keyword to configure the SONET path trace (J1) buffer, and replace the <i>line</i> argument with the path trace buffer identifier (in ASCII text). report [b3-tca pais plop pplm prdi ptim]—Set SONET path alarm reporting. Specifies which alarms are reported and which bit error rate (BER) thresholds will signal an alarm. By default, B3 BER threshold crossing alert (TCA) and path loss of pointer (PLOP) reporting are enabled. Specifying the pais keyword sets PAIS reporting status; pplm sets path payload mismatch (PPLM) defect reporting status; prdi sets path remote defect indication reporting status; and ptim sets path trace identity mismatch (PTIM) defect reporting status. <p>The no report b3-tca and no report plop commands in SONET/SDH path configuration submode disable B3 BER TCA and PLOP reporting status, respectively.</p> <ul style="list-style-type: none"> scrambling disable—Disable SPE scrambling. Note that SPE scrambling is enabled by default.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • threshold b3-tca BER—Set SONET path BER threshold value. Replace the <i>BER</i> argument with a number in the range from 3 through 9. The threshold value is interpreted as a negative exponent of 10 when determining the bit error rate. For example, a value of 5 implies a bit error rate of 10 to the minus 5. The default BER threshold value is 6. • uneq-shut—Sets sending Unequipped (UNEQ) when shut down.
Step 10	<p>end or commit</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-sonet)# end</pre> <p>or</p> <pre>RP/0/RP0/CPU0:router(config-sonet)# commit</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> • When you issue the end command, the system prompts you to commit changes: <pre>Uncommitted changes found, commit them before exiting (yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> - Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. - Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes. - Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.
Step 11	<p>show controllers sonet interface-path-id</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# show controllers sonet 0/1/0/0</pre>	Verifies the SONET controller configuration.

Configuring SONET APS

SONET APS offers recovery from fiber (external) or equipment (interface and internal) failures at the SONET line layer. This task explains how to configure basic automatic protection switching (APS) on the router and how to configure more than one protect or working interface on a router by using the **aps group** command.

To verify the configuration or to determine if a switchover has occurred, use the **show aps** command.

Before you begin

Before you configure SONET APS, be sure that you have a supported POS line card or channelized SPA installed in a router that is running Cisco IOS XR software.

Restrictions

Before you configure SONET APS, consider the following restrictions:

- For proper APS operation between two routers, a working line on one router must also be the working line on the other router, and the same applies to the protection line.

SUMMARY STEPS

1. **configure**
2. **aps group** *number*
3. **channel** {**0** | **1**} **local sonet** *interface*
4. Repeat Step 3 for each channel in the group.
5. **exit**
6. **interface loopback** *number*
7. **ipv4 address** *ip-address mask*
8. **exit**
9. Execute any one the following commands:
 - **interface pos** *interface-path-id*
 - **interface serial** *interface-path-id*
10. **ipv4 address** *ip-address mask*
11. Execute any one the following commands:
 - **pos crc** {**16** | **32**}
 - **crc** {**16** | **32**}
12. **encapsulation** {**frame-relay** | **hdlc** | **ppp**}
13. **keepalive** {*interval* | **disable**}[*retry*]
14. **no shutdown**
15. Repeat Step 9 through Step 13 for each channel in the group.
16. **exit**
17. **controller sonet** *interface-path-id*
18. **ais-shut**
19. **path scrambling disable**
20. **clock source** {**internal** | **line**}
21. Repeat Step 16 through Step 19 for each channel in the group.
22. **end** or **commit**
23. **exit**
24. **exit**
25. **show aps**
26. **show aps group** [*number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RP0/CPU0:router# configure	Enters global configuration mode.
Step 2	aps group number Example: RP/0/RP0/CPU0:router(config)# aps group 1	<p>Adds an APS group with a specified number and enters APS group configuration mode.</p> <ul style="list-style-type: none"> • Use the aps group command in global configuration mode. • To remove a group, use the no form of this command, as in: no aps group number, where the value range is from 1–255. <p>Note</p> <ul style="list-style-type: none"> • To use the aps group command, you must be a member of a user group associated with the proper task IDs for aps commands. • The aps group command is used even when a single protect group is configured.
Step 3	channel {0 1} local sonet interface Example: RP/0/RP0/CPU0:router(config-aps)# channel 0 local SONET 0/0/0/1	<p>Creates a channel for the APS group. 0 designates a protect channel, and 1 designates a working channel.</p> <p>Note</p> <ul style="list-style-type: none"> • If the protect channel is local, it must be assigned using the channel command <i>before</i> any of the working channels is assigned.
Step 4	Repeat Step 3 for each channel in the group.	—
Step 5	exit	Exits APS group configuration mode and enters global configuration mode.
Step 6	interface loopback number Example: RP/0/RP0/CPU0:router(config)# interface loopback 1	<p>(Optional) Configures a loopback interface if a two-router APS is desired and enters interface configuration mode for a loopback interface.</p> <p>Note</p> <ul style="list-style-type: none"> • In this example, the loopback interface is used as the interconnect.
Step 7	ipv4 address ip-address mask Example:	Assigns an IPV4 address and subnet mask to the loopback interface.

	Command or Action	Purpose
	RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.0.1 255.255.255.224	
Step 8	exit	Exits interface configuration mode for a loopback interface, and enters global configuration mode.
Step 9	Execute any one the following commands: <ul style="list-style-type: none"> • interface pos <i>interface-path-id</i> • interface serial <i>interface-path-id</i> Example: <pre>RP/0/RP0/CPU0:router(config)# interface POS 0/2/0/0 or RP/0/RP0/CPU0:router(config)# interface serial 0/1/1/0/0/0:0</pre>	Connects the interface for the channel selected in Step 3, and enters interface configuration mode. For serial interfaces, specifies the complete interface number with the <i>rack/slot/module/port/T3Num/T1num:instance</i> notation.
Step 10	ipv4 address <i>ip-address mask</i> Example: <pre>RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.0.1 255.255.255.224</pre>	Assigns an IPv4 address and subnet mask to the interface.
Step 11	Execute any one the following commands: <ul style="list-style-type: none"> • pos crc {16 32} • crc {16 32} Example: <pre>RP/0/RP0/CPU0:router(config-if)# pos crc 32 or RP/0/RP0/CPU0:router(config-if)# crc 32</pre>	Selects a CRC value for the channel. Enter the 16 keyword to specify 16-bit CRC mode, or enter the 32 keyword to specify 32-bit CRC mode. For POS interfaces, the default CRC is 32. For serial interfaces, the default is 16.
Step 12	encapsulation { frame-relay hdlc ppp } Example: <pre>RP/0/RP0/CPU0:router(config-if)# encapsulation ppp</pre>	(Serial interfaces only) Set the Layer 2 encapsulation of an interface.
Step 13	keepalive { <i>interval</i> disable }[<i>retry</i>] Example: <pre>RP/0/RP0/CPU0:router(config-if)# keepalive disable</pre>	Sets the keepalive timer for the channel, where: <ul style="list-style-type: none"> • <i>interval</i>—Number of seconds (from 1 to 30) between keepalive messages. The default is 10. • disable—Turns off the keepalive timer. • <i>retry</i>—(Optional) Number of keepalive messages (from 1 to 255) that can be sent to a peer without a response before transitioning the link to the down state. The default is 5 for interfaces with PPP

	Command or Action	Purpose
		encapsulation, and 3 for interfaces with HDLC encapsulation. The keepalive command does not apply to interfaces using Frame Relay encapsulation.
Step 14	no shutdown Example: RP/0/RP0/CPU0:router(config-if)# no shutdown	Removes the shutdown configuration. • The removal of the shutdown configuration removes the forced administrative down on the interface, enabling that interface to move to an up or down state (assuming the parent SONET layer is not configured administratively down).
Step 15	Repeat Step 9 through Step 13 for each channel in the group.	—
Step 16	exit	Exits interface configuration mode, and enters global configuration mode.
Step 17	controller sonet interface-path-id Example: RP/0/RP0/CPU0:router(config)# controller sonet 0/1/0/0	Enters SONET controller configuration mode and specifies the SONET controller name and instance identifier with the <i>rack/slot/module/port</i> notation.
Step 18	ais-shut Example: RP/0/RP0/CPU0:router(config-sonet)# ais-shut	Configures SONET path values such as alarm indication signal (AIS) at shut down.
Step 19	path scrambling disable Example: RP/0/RP0/CPU0:router(config-sonet)# path scrambling disable	(Optional) Disables synchronous payload envelope (SPE) scrambling. Note • SPE scrambling is enabled by default.
Step 20	clock source {internal line} Example: RP/0/RP0/CPU0:router(config-sonet)# clock source internal	Configures the SONET port TX clock source, where the internal keyword sets the internal clock and the line keyword sets the clock recovered from the line. • Use the line keyword whenever clocking is derived from the network; use the internal keyword when two routers are connected back-to-back or over fiber for which no clocking is available. • The line clock (line) is the default.
Step 21	Repeat Step 16 through Step 19 for each channel in the group.	—
Step 22	end or commit	Saves configuration changes.

	Command or Action	Purpose
	<p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-sonet)# end</pre> <p>or</p> <pre>RP/0/RP0/CPU0:router(config-sonet)# commit</pre>	<ul style="list-style-type: none"> When you issue the end command, the system prompts you to commit changes: <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes. Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.
Step 23	exit	Exits SONET controller configuration mode, and enters global configuration mode.
Step 24	exit	Exits global configuration mode, and enters EXEC mode.
Step 25	<p>show aps</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# show aps</pre>	(Optional) Displays the operational status for all configured SONET APS groups.
Step 26	<p>show aps group [number]</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# show aps group 3</pre>	<p>(Optional) Displays the operational status for configured SONET APS groups.</p> <p>Note</p> <ul style="list-style-type: none"> The show aps group command is more useful than the show aps command when multiple groups are defined.

Configuring a Hold-off Timer to Prevent Fast Reroute from Being Triggered

When APS is configured on a router, it does not offer protection for tunnels; because of this limitation, fast reroute (FRR) still remains the protection mechanism for Multiprotocol Label Switching (MPLS) traffic-engineering.

When APS is configured in a SONET core network, an alarm might be generated toward a router downstream. If the router downstream is configured with FRR, you may want to configure a hold-off timer at the SONET level to prevent FRR from being triggered while the CORE network is doing a restoration. Perform this task to configure the delay.

Before you begin

Configure SONET APS, as describe in the *Configuring SONET APS* section.

SUMMARY STEPS

1. **configure**
2. **controller sonet** *interface-path-id*
3. **line delay trigger** *value* or **path delay trigger** *value*
4. **end** or **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RP0/CPU0:router# configure	Enters global configuration mode.
Step 2	controller sonet <i>interface-path-id</i> Example: RP/0/RP0/CPU0:router(config)# controller sonet 0/6/0/0	Enters SONET configuration mode.
Step 3	line delay trigger <i>value</i> or path delay trigger <i>value</i> Example: RP/0/RP0/CPU0:router(config-sonet)# line delay trigger 250 or RP/0/RP0/CPU0:router(config-sonet)# path delay trigger 300	Configures SONET port delay trigger values in milliseconds. <ul style="list-style-type: none"> • Tip The commands in Step 2 and Step 3 can be combined in one command string and entered from global configuration mode like this: controller sonet <i>r/s/m/p</i> line delay trigger or controller sonet <i>r/s/m/p</i> path delay trigger.
Step 4	end or commit Example: RP/0/RP0/CPU0:router(config-sonet)# end or RP/0/RP0/CPU0:router(config-sonet)# commit	Saves configuration changes. <ul style="list-style-type: none"> • When you issue the end command, the system prompts you to commit changes: Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]: - Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. - Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes.

	Command or Action	Purpose
		<ul style="list-style-type: none"> - Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuration Examples for SONET Controllers

This section contains the following examples:

SONET Controller Configuration: Example

The following example shows the commands and output generated when you are performing the configuration of a SONET controllers following the steps outlined in the *Configuring a Clear Channel SONET Controller* section. This example shows the usage of every optional command, along with listings of options within commands where relevant. An actual configuration may or may not include all these commands.

```

configure
controller sonet 0/1/0/0
  ais-shut
  clock source internal
  framing sonet
  loopback internal
Loopback is a traffic-affecting operation
overhead s1s0 1
path ais-shut
path delay trigger 0
path overhead j1 line 11
path report pais
path scrambling disable
path threshold b3-tca 6
path uneq-shut
report pais
threshold b2-tca 4
commit

```

SONET APS Group Configuration: Example

The following example shows SONET Local (one router) APS configuration.

```

aps group 1
channel 0 local SONET 0/0/0/1
channel 1 local SONET 0/0/0/2
signalling sonet
commit
show aps
show aps group 3

```

The following example shows SONET Remote (two routers) APS configuration.

```
RP/0/0/CPU0:router(config)# aps group 1
channel 0 local SONET 0/0/0/1
channel 1 remote 172.18.69.123
signalling sonet
commit
show aps
show aps group 3
RP/0/0/CPU0:router(config)#
```