Building Integrated Timing Source for the Cisco 12000 Series Router

The Cisco 12816 and 12810 routers incorporate a Stratum 3E internal timing reference to provide system timing based on input received from an external Building Integrated Timing Supply (BITS) clock source. A holdover mode maintains timing accuracy in the event that external synchronization references become corrupted or unavailable.

Feature History for Building Integrated Timing Source for the Cisco 12000 Series Router

Release	Modification
12.0(31)S	This feature was introduced for Cisco 12816 and 12810 routers and Cisco 12000 Series Engine-6 Packet-over-SONET line cards.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Contents

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Prerequisites for BITS for the Cisco 12000 Series Router

The Cisco 12816 or Cisco 12810 Series router is required for operation of BITS. The supported hardware components to acquire a BITS signal from an external reference source are as follows:

- Performance Route Processor 2
  PN: PRP-2=
- 2-port OC-192c/STM-64c POS
  PNs: 2OC192/POS-SR-SC=, 2OC192/POS-IR-SC= I
- 8-port OC-48c/STM-16c POS with any pluggable optic module
  PN: 8OC48/POS-SFP=
- For Engine 3, BITS is only supported on ATM Engine 3 line cards
- BITS is supported on all Engine 5 and Engine 6 line cards
- BITS is supported on newer fabric cards 12810-SFC and 12816-SFC

Restrictions for BITS for the Cisco 12000 Series Router

- The primary and secondary BITS sources must be configured on different slots. The primary and secondary BITS sources cannot be from the same PRP-2 or PoS line card.
- Synchronous Status Messaging (SSM) is not supported.

Information About BITS for the Cisco 12000 Series Router

To eliminate SONET timing slips, a router with a BITS clock can synchronize traffic over all SONET interfaces to an external, highly stable Stratum 2 or better reference clock. The router can distribute the BITS clock signal among many network devices within a building to achieve POP-wide synchronization. Line cards that support BITS do not require manual configuration of internal or line timing because timing is automatically synchronized to the BITS signal. Thus, configuration errors are reduced. The Cisco 12000 Series router BITS implementation is compliant with Telecordia GR-1244-CORE and GR-253-CORE specifications.

BITS Clock Reference Input Sources

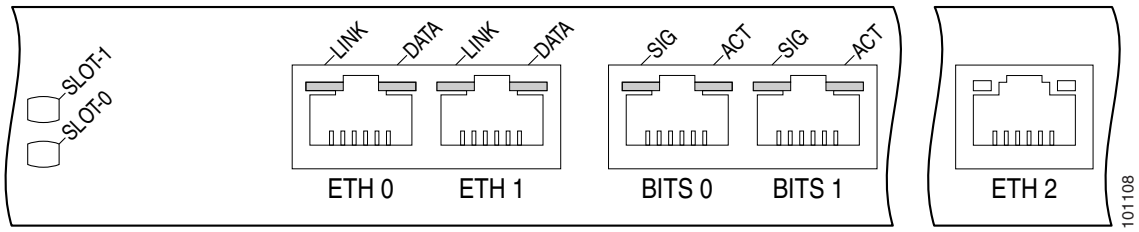
The Clock Scheduler Cards (CSCs) of the Cisco 12816 and 12810 routers can provide centralized BITS timing to BITS-supported line cards and can receive external BITS reference clock inputs from two independent sources as follows:

- T1 or E1 controller of the Performance Route Processor 2 (PRP-2)
- Ingress interface of a supported Packet-over-SONET line card

The CSC BITS clocks are present on both CSCs to provide 1+1 redundant BITS clock capability. The CSC BITS clock can synchronize to any combination of 8 kHz, 1.544 MHz, 2.048 MHz and 19.44 MHz signals in normal (locked) mode.

Figure 1 shows a portion of a Cisco 12000 PRP-2 front panel. The two BITS ports are for external BITS clock timing inputs. Port BITS 0 is hardwired as a T1 port, Port BITS 1 as an E1 port. Both have RJ-48 connectors.

Figure 1 BITS Ports on the PRP-2



Freerun, Normal, Fast-start, and Holdover Modes

The CSC BITS clock operates in four standard modes, freerun, normal, fast-start, and holdover. The modes relate to the behavior of the CSC BITS clock, as shown in the following table:

CSC BITS Clock Timing Mode	CSC BITS Clock Behavior
Freerun	Distributes a Stratum 3E precision clock signal throughout the router without reference to an external signal.
Normal	Synchronizes with one of the two external BITS clock sources so that the output signal and input signal are the same (locked).
Fast-start	Occurs when switching to an alternative external BITS clock source.
Holdover	Outputs a Stratum 3E precision clock signal conforming to timing data acquired when the CSC BITS clock was last synchronized to an external BITS reference source.

The Cisco term “autoselection” denotes the ability of the CSC BITS clock to switch among these operating modes automatically. Freerun and holdover modes can be manually selected (forced) with the Command Line Interface (CLI).

Primary, Secondary, Revertive and Non-revertive Operation

The preferred external BITS timing source is configured as the “primary,” an alternative source as the “secondary.” In normal mode, the CSC BITS clock synchronizes (locks) to the primary source by default. If the primary source becomes corrupted or disabled, the CSC BITS clock switches to the secondary external BITS timing source. A CSC BITS clock configured for revertive mode switches back to the primary if the primary source is restored. In non-revertive operation, the CSC BITS clock switches back to a restored primary only if the secondary also fails or becomes unavailable. Non-revertive is the default mode.

Holdover and Freerun Operation

The CSC BITS clock enters holdover mode if both external BITS timing references are lost. Stored timing data allows the CSC BITS clock to maintain the accuracy of the last external BITS timing source to which it was locked during normal operation. The holdover signal is maintained to the precision of the Stratum 3E clock. If the CSC BITS clock stored timing data is compromised or is not available, the CSC BITS clock enters freerun mode. The freerun signal is distributed to all supported line cards.

Manual Timing Mode Switching

The administrator can force the BITS clock to switch between primary and secondary reference signals or force the CSC BITS clock into holdover or freerun mode with the **bits-clock** privileged EXEC commands.

Note When the timing mode is forced with a privileged EXEC command, the CSC BITS clock does not return to normal operation until manually forced back to autoselection with the **clear bits-clock** privileged EXEC command.

How to Configure BITS for the Cisco 12000 Series Routers

The command line interface does not allow configuration or show commands for BITS features if the Clock Scheduler Cards do not support BITS. Line cards or route processors without BITS support cannot be configured as primary or secondary BITS clock sources. The PRP-2 can only provide the external BITS timing source to the CSC but the BITS-supported line cards can both synchronize to the CSC BITS clock and provide the external BITS timing source.

To comply with the Telecordia GR-1244 specification, CLI commands are provided to manually force timing modes.

The configuration tasks pertaining to the Building Integrated Timing Source for the Cisco 12000 Series Router feature are contained in the following sections:

- Configuring the T1 BITS Port on the PRP-2 to Receive External Timing, page 5 (optional)
- Configuring the E1 BITS Port on the PRP-2 to Receive External Timing, page 6 (optional)
- Configuring Primary and Secondary BITS Clock Sources, page 7 (required)
- Configuring BITS Timing Modes Globally, page 9 (optional)
- Forcing BITS Timing Modes, page 10 (optional)
- Disabling BITS Support for Line Cards (optional)

Configuring the T1 BITS Port on the PRP-2 to Receive External Timing

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller t1** *slot/port*
4. **framing** {**esf**|**sf**}
5. **linecode** {**ami**|**b8zs**}
6. **end**
7. **show controller t1**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller t1** *slot/port* **Example:** `Router(config)# controller t1 9/0`	Specifies the slot and port number of the PRP-2 interface to configure. Enters controller configuration mode. • The BITS 0 port is reserved as T1, BITS 1 port as E1.
Step 4	**framing** {**esf** | **sf**} **Example:** `Router(config-controller)# framing esf`	(Optional) Specifies the framing of the of the T1 or E1 signal—superframe or extended superframe. Default is superframe.
Step 5	**linecode** {**ami** | **b8zs**} **Example:** `Router(config-controller)# linecode b8zs`	(Optional) Selects Alternate Mark Inversion (AMI) or Bipolar with 8-zero Substitution (B8ZS). Default is AMI.

	Command or Action	Purpose
Step 6	**end** **Example:** `Router(config-bits)# end`	Exits to privileged EXEC mode.
Step 7	**show controller t1** **Example:** `Router# show controller t1`	(Optional). Displays the configuration and status of the T1 interface. **Note** The BITS0 port signifies T1 port and BITS1 signifies E1 port. The main significance and use of T1/E1 port is for sourcing BITS clock to the chassis. Because the T1/E1 ports do not pass any data traffic, you do not need to issue the commands 'shutdown' and 'no shutdown'. By default, it will be 'no shutdown' when T1/E1 settings appear.

Configuring the E1 BITS Port on the PRP-2 to Receive External Timing

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller e1** *slot/port*
4. **framing** {**crc4**|**no-crc4**}
5. **linecode** {**ami**|**hdb3**}
6. **end**
7. **show controller e1**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller e1** *slot/port* **Example:** `Router(config)# controller e1 9/1`	Specifies the slot and port number of the PRP-2 interface to configure. Enters controller configuration mode. • BITS 0 port is reserved as T1, BITS 1 port as E1.

	Command or Action	Purpose
Step 4	**framing** {**crc4**|**no-crc4**} **Example:** `Router(config-controller)# framing crc4`	(Optional) Specifies the framing of the of the E1 signal—Cyclic Redundancy Check 4, and no Cyclic Redundancy Check 4. Default is CRC4.
Step 5	**linecode** {**ami**|**hdb3**} **Example:** `Router(config-controller)# linecode hdb3`	(Optional) Selects Alternate Mark Inversion code (AMI) or High-density Bipolar Order 3 encoding (HDB3). Default is HDB3.
Step 6	**end** **Example:** `Router(config-bits)# end`	Exits to privileged EXEC mode.
Step 7	**show controller e1** **Example:** `Router# show controller t1`	(Optional). Displays the configuration and status of the T1. **Note** The BITS0 port signifies T1 port and BITS1 signifies E1 port. The main significance and use of T1/E1 port is for sourcing BITS clock to the chassis. Because the T1/E1 ports do not pass any data traffic, you do not need to issue the commands 'shutdown' and 'no shutdown'. By default, it will be 'no shutdown' when T1/E1 settings appear.

Configuring Primary and Secondary BITS Clock Sources

The primary and secondary external BITS clock reference sources can be of the following combinations:

- T1 or E1 port of a PRP-2 and a BITS-supported line card interface
- Two BITS-supported line card interfaces (interfaces on separate line cards)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bits-clock**
4. **primary controller t1** *slot*/*port*
5. **secondary interface pos** *slot*/*port*
6. **end**
7. **show bits-clock**
8. **end**
9. **show controller t1**
10. **show bits-clock**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**bits-clock** **Example:** `Router(config)# bits-clock`	Enters bits-clock configuration mode.
Step 4	**primary controller t1** *slot/port* **Example:** `Router(config-bits)# primary controller t1 9/0`	Specifies which external BITS clock signal source should be referenced first for normal mode operations. The primary reference can be a T1 or E1 port on the PRP-2 port, or an ingress port of a BITS-supported line card. In this example the primary reference is a T1 port. • The PRP-2 port labeled BITS 0 is a T1 interface, BITS 1 is an E1 interface.
Step 5	**secondary interface pos** *slot/port* **Example:** `Router(config-bits)# secondary interface pos 4/0`	Specifies which external BITS clock signal should be referenced for normal mode operations if the primary signal is unavailable or corrupted. The secondary reference can be a T1 or E1 port on the PRP-2 port, or an ingress port of a BITS-supported line card. In this example the secondary reference is a line card port. • The primary and secondary BITS clock source cannot be from the same slot.
Step 6	**end** **Example:** `Router(config-bits)# end`	Exits to privileged EXEC mode.
Step 7	**show bits-clock** **Example:** `Router# show bits-clock`	(Optional). Verifies that the primary and secondary sources are configured.

Configuring BITS Timing Modes Globally

All **no** forms of the BITS timing mode commands restore the default non-revertive mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bits-clock**
4. **mode** {**freerun** | **holdover** | **non-revertive** | **revertive**}
5. **end**
6. **show bits-clock**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**bits-clock** **Example:** `Router(config)# bits-clock`	Enters bits-clock configuration mode.
Step 4	**mode** {**freerun** | **holdover** | **non-revertive** | **revertive**} **Example:** `Router(config-bits)# revertive`	(Optional). Sets the BITS clock timing mode. Defaults are freerun and non-revertive.
Step 5	**end** **Example:** `Router(config-bits)# end`	Exits to privileged EXEC mode.
Step 6	**show bits-clock** **Example:** `Router# show bits-clock`	(Optional). Displays the current BITS clock configuration.

Forcing BITS Timing Modes

These commands disable autoselection and override global configurations.

Note When the timing mode is forced with a privileged EXEC command, the CSC BITS clock does not return to normal operation until manually forced back to autoselection with the **clear bits-clock** privileged EXEC command.

SUMMARY STEPS

1. **enable**
2. **bits-clock** {**freerun** | **holdover** | **primary** | **secondary**}
3. **end**
4. **show bits-clock**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**bits-clock** {**freerun** | **holdover** | **primary** | **secondary**} **Example:** `Router# bits-clock secondary`	(Optional). Manually switches the BITS operating mode and the external BITS timing source. In this example, the external BITS timing source is manually switched to the secondary source.
Step 3	**end** **Example:** `Router(config-bits)# end`	Exits to privileged EXEC mode.
Step 4	**show bits-clock** **Example:** `Router# show bits-clock`	(Optional). Verifies that the manual changes occurred.

Disabling BITS Support for Line Cards

BITS support can be disabled to BITS-supported line cards, forcing the line card to use its internal clock (as do line cards that do not support BITS).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bits-clock**
4. **disable slot** *slo*t
5. **end**
6. **show bits-clock**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**bits-clock** **Example:** `Router(config)# bits-clock`	Enters bits-clock configuration mode.
Step 4	**disable slot** *slot* **Example:** `Router(config-bits)# disable slot 6/0`	(Optional) Disables BITS clocking for specified slots. • The PRP-2 cannot be disabled. • To enable BITS support for the slot, use the **no** form of the command.
Step 5	**end** **Example:** `Router(config-bits)# end`	Exits to privileged EXEC mode.
Step 6	**show bits-clock** **Example:** `Router# show bits-clock`	(Optional) Displays which slots are disabled in the BITS Clock Configuration fields.

Configuration Examples for Building Integrated Timing Source for the Cisco 12000 Series Router

The following two show commands display the information necessary to monitor and verify the CSC BITS clock operation:

Verifying the BITS Clock Configuration: Example

To check the current clock source and the status of all configured network clock sources, use the privileged EXEC command **show bits-clocks**.

```
Router# show bits-clock

BITS Clock configuration:  Primary        = T1 6/0  ( RP )
                           Secondary      = POS5/0  ( LC )
                           Mode           = non-revertive (default switching-mode)
                           Disabled Slots =

Input Port Status:         Primary = DOWN,  Secondary = UP

System BITS Selection:     Auto

System BITS Config:        Primary slot 6  Secondary slot 5
System BITS Active Clock:  Freerun
System BITS Lock Failure:  None

BITS Clock Software State: Freerun

CSC 17 BITS details:       primary_slot: 6, secondary_slot: 5
                           primary_status: Out-of-range, secondary_status: Out-of-range
                           holdover: No, input_lock: Not Locked
                           clock_mode: Freerun, source: Invalid

CSC 16 BITS details:       primary_slot: 6, secondary_slot: 5
                           primary_status: Out-of-range, secondary_status: Out-of-range
                           holdover: No, input_lock: Not Locked
                           clock_mode: Freerun, source: Invalid

Slot 6  BITS details:      port 0
(Primary Slot)

Slot 5  BITS details:      port: 0, bits/local: BITS
(Secondary Slot)           holdover: No, input_lock: Locked
                           CSC0: Good, CSC1: Good
                           csc_select: CSC1, lock_detect: 1
```

Display BITS Clock Events Log: Example

To display a history of BITS clock events, use the **show monitor even-trace bits-clock** privileged EXEC command.

```
Router# show monitor event-trace bits-clock
    11.572 INIT: system configured in slot 9
    11.656 FSM: state S_INIT, event E_CFG_FREERUN, old state S_INIT
    11.660 FSM: already in freerun reg 0x4
    11.660 FSM: new state S_FREERUN, old state S_INIT
 83628.696 FSM: state S_FREERUN, event E_SELECT_FREERUN, old state S_FREERUN
 83628.696 FSM: already in freerun reg 0x64
 93802.656 FSM: state S_FREERUN, event E_SELECT_FREERUN
<snip> . . .
433663.816 SLOT: BITS clock disabled on slot 1
433668.796 SLOT: BITS clock disabled on slot 2
<snip> . . .
```

Additional References

The following sections provide references related to Building Integrated Timing Source for the Cisco 12000 Series Router.

Related Documents

Related Topic	Document Title
Frequently asked questions on optical timing.	Optical Timing: Frequently Asked Questions
Technical specifications or the Cisco 12000 PRP-2	Cisco 12000 Series Performance Route Processor-2 Data Sheet

Standards

Standards	Title
Telecordia GR-1244-core	Clocks for the Synchronized Network: Common Generic Criteria
Telecordia GR-253-core	Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria
ANSI T1.101-1994	Synchronization Interface Standards for Digital networks

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	—

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Command Reference

This section documents new commands only.

- **bits-clock** (privileged EXEC)
- **bits-clock disable**
- **bits-clock mode**
- **bits-clock primary**
- **bits-clock secondary**
- **show bits-clock**

bits-clock

To force the Clock Scheduler Card BITS clock to synchronize to a different external BITS reference signal or to switch the timing mode, use the **bits-clock** command in privileged EXEC mode.

bits-clock {**freerun**|**holdover**|**primary**|**secondary**}

Syntax Description

freerun	Sets the CSC BITS clock to freerun mode.
holdover	Sets the CSC BITS lock to holdover mode.
primary	Sets the preferred external clock reference source.
secondary	Sets the alternative external clock reference source.

Command Default

None

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(31)S	This command was introduced for the Cisco 12816 and 12810 routers, the Cisco 12000 PRP-2 and Engine 6 PoS line cards.

Usage Guidelines

This command overrides the global configuration settings for the Clock Scheduler Card (CSC) BITS clock. To restore the CSC BITS clock to the default non-revertive, autoselection operation, use the **clear bits-clock** privileged EXEC command. The following table describes the **bits-clock** command keywords:

BITS Clock Command	Explanation
bits-clock freerun	Forces the CSC BITS clock into freerun mode. In freerun mode, the CSC BITS clock is not synchronized to either of the two external BITS timing reference inputs. Freerun mode is typically enacted in the following circumstances: • Default state before network synchronization occurs, immediately following system power-up • When a Stratum 3E master clock source is required in the absence of a BITS clock source. For example, in point-to-point asynchronous mappings. • When timing history in holdover mode becomes corrupted or unavailable.
bits-clock holdover	Forces the CSC BITS clock into holdover mode. In holdover mode, the CSC BITS clock uses data from a history buffer to control its output frequency. The history data is acquired while the CSC BITS clock is locked to an external BITS timing signal. If the CSC BITS clock history buffer is compromised or contains no data, the CSC BITS clock enters freerun mode.
bits-clock primary	Selects the preferred external timing reference to which the CSC BITS clock synchronizes.
bits-clock secondary	Selects the alternative external BITS timing reference to which the CSC BITS clock signal synchronizes when the primary reference is disabled or corrupted.

Note The privileged EXEC **bits-clock** commands are not saved in the running-config or startup-config files as are the global configuration **bits-clock mode** commands.

Examples

The following example switches the BITS clock from the primary source to the secondary source:

```
Router# bits-clock secondary
```

The following example forces the BITS clock into holdover mode:

```
Router# bits-clock holdover
```

Related Commands

Command	Description
bits-clock disable	Disables BITS clock timing for specific line card slots.
bits-clock mode	Configures the Clock Scheduler Card BITS clocking modes.
bits-clock primary	Configures a line card interface or a PRP-2 T1/E1 controller to be a primary BITS clock source.
bits-clock secondary	Configures a line card interface or a PRP-2 T1/E1 controller to be a secondary BITS clock source.

Command	Description
clear bits-clock	Resets Clock Scheduler Card BITS clock defaults.
show bits-clock	Displays the status of the current BITS configuration.
show monitor event-trace bits-clock	Displays a log of Clock Scheduler Card BITS clock events.

bits-clock disable

To disable BITS clock timing to specific line card slots, use the **bits-clock disable** command in bits-clock configuration mode. To enable BITS clock timing to specific line card slots, use the **no** form of this command.

bits-clock {**disable slot** *slot*}

no bits-clock {**disable slot** *slot*}

Syntax Description

disable	Specifies that the BITS clock signal is to be disabled.
slot	Indicates a line card slot.
slot	Specifies the slot number of the line card to disable.

Command Default

None

Command Modes

Bits-clock configuration

Command History

Release	Modification
12.0(31)S	This command was introduced for the Cisco 12816 and 12810 routers, the Cisco 12000 PRP-2 and Engine 6 PoS line cards.

Usage Guidelines

Use this command with BITS-supported line cards that are not intended to synchronize with the Clock Scheduler Card (CSC) BITS clock. A BITS-supported line card automatically synchronizes to the CSC BITS clock signal when the signal is present. The **bits-clock disable** command causes the BITS-supported line card to use its onboard clock.

Examples

The following example disables BITS clock support to slot 6:

```
router# configure terminal
router(config)# bits-clock
router(config-bits)# disable slot 6
router(config-bits)# end
```

Related Commands

Command	Description
bits-clock	Forces the Clock Scheduler Card BITS clock to synchronize to a different external BITS reference signal or switches the clocking mode.
bits-clock mode	Configures the Clock Scheduler Card BITS clocking modes.
bits-clock primary	Configures a line card interface or a PRP-2 T1/E1 controller to be a primary BITS clock source.

Command	Description
bits-clock secondary	Configures a line card interface or a PRP-2 T1/E1 controller to be a secondary BITS clock source.
clear bits-clock	Resets Clock Scheduler Card BITS clock defaults.
show bits-clock	Displays the status of the current BITS configuration.
show monitor event-trace bits-clock	Displays a log of Clock Scheduler Card BITS clock events.

bits-clock mode

To configure the Clock Scheduler Card BITS clock timing mode, use the **bits-clock mode** command in global configuration mode. To restore the default timing mode, use the **no** form of this command.

bits-clock mode {**freerun | holdover | non-revertive | revertive**}

no bits-clock mode {**freerun | holdover | non-revertive | revertive**}

Syntax Description

mode	Configures the BITS timing modes.
freerun	Specifies freerun clocking mode.
holdover	Specifies holdover clocking mode.
non-revertive	Default. Specifies non-revertive clocking mode.
revertive	Specifies revertive clocking mode.

Command Default

normal, non-revertive

Command Modes

Bits-clock configuration

Command History

Release	Modification
12.0(31)S	This command was introduced for the Cisco 12816 and 12810 routers, the Cisco 12000 PRP-2 and Engine 6 PoS line cards.

Usage Guidelines

Upon power-up, the default timing modes are normal and non-revertive. In normal mode, the CSC BITS clock synchronizes to a configured primary or secondary external BITS clock signal and enters into freerun mode if an external signal is not found. If a signal is found and synchronization occurs for a sufficient duration, the CSC BITS clock enters holdover mode until an external clock source becomes available, or until the CSC BITS clock is manually switched to another mode. To restore the CSC BITS clock to the default non-revertive, normal mode, use the **clear bits-clock** privileged EXEC command. The **no** form of the mode command, regardless of the keyword, restores the mode to non-revertive. The following table describes the **bits-clock mode** keywords:

BITS Clock Mode Command	Explanation
freerun	Specifies freerun mode. In freerun mode, the CSC BITS clock is not synchronized to either of the two external BITS timing reference inputs. Freerun mode is typically used in the following circumstances: • Default state before network synchronization occurs, immediately following system power-up • When a Stratum 3E master clock source is required in the absence of a BITS clock source. For example in point-to-point asynchronous mappings. • There is no valid timing history for the holdover mode
holdover	Specifies holdover mode. In holdover mode, the CSC BITS clock uses data from a history buffer to control its output frequency. The history data is acquired while the CSC BITS clock is locked to an external BITS reference signal. If the CSC BITS clock history buffer is compromised or contains no data, the CSC BITS clock enters freerun mode.
revertive	Specifies revertive mode. If the primary external BITS clock source degrades or is unavailable, the CSC BITS clock switches over to the secondary external BITS clock source. If the primary source is restored, the CSC BITS clock switches back automatically to the primary.
non-revertive	(Default) Specifies non-revertive mode. If the primary external BITS clock source degrades or is unavailable, the CSC BITS clock switches over to the secondary external clock source, and remains synchronized with the secondary even if the primary is restored. An automatic switch back to the primary occurs only if the primary is restored and the secondary fails. If both primary and secondary fail, the CSC BITS clock enters holdover mode. If holdover mode is not possible, the CSC BITS clock enters freerun mode.

Examples

The following example configures the BITS clock revertive mode:

```
router(config)# bits-clock
router(config-bits)# mode revertive
router(config-bits)# end
```

The following example configures the BITS clock holdover mode:

```
router(config)# bits-clock
router(config-bits)# mode holdover
router(config-bits)# end
router#
```

The following example configures the BITS clock freerun mode:

```
router(config)# bits-clock
router(config-bits)# mode freerun
```

```
router(config-bits)# end
```

Related Commands

Command	Description
bits-clock	Forces the Clock Scheduler Card BITS clock to synchronize to a different external BITS reference signal or switches the clocking mode.
bits-clock disable	Disables BITS clock timing for specific line card slots.
bits-clock primary	Configures a line card interface or a PRP-2 T1/E1 controller to be a primary BITS clock source.
bits-clock secondary	Configures a line card interface or a PRP-2 T1/E1 controller to be a secondary BITS clock source.
clear bits-clock	Resets Clock Scheduler Card BITS clock defaults.
show bits-clock	Displays the status of the current BITS configuration.
show monitor event-trace bits-clock	Displays a log of Clock Scheduler Card BITS clock events.

bits-clock primary

To configure a line card interface or a PRP-2 controller to be a primary BITS clock source, use the **bits-clock primary** command in bits-clock configuration mode. To delete the configuration, use the **no** form of this command.

bits-clock primary {**controller**{**e1** *slot*|**t1** *slot*}| **interface pos** *slot*/*port*}

no bits-clock primary {**controller**{**e1** *slot*|**t1** *slot*}| **interface pos** *slot*/*port*}

Syntax Description

primary	Configures the BITS clock primary external clock source.
controller	Species the T1or E1 controllers of the PRP-2 as the BITS clock source.
e1	Specifies the E1 controller.
slot	Specifies the slot number of the E1 controller.
t1	Specifies the T1 controller.
slot	Specifies the slot number of the T1 controller.
interface	Configure line card interface as the BITS clock source
pos	Specifies a Packet-over-SONET interface
slot/*port*	Specifies the slot number of the Packet-over-SONET Ethernet interface.

Command Default

None

Command Modes

Bits-clock configuration

Command History

Release	Modification
12.0(31)S	This command was introduced for the Cisco 12816 and 12810 routers, the Cisco 12000 PRP-2 and Engine 6 PoS line cards.

Usage Guidelines

The **bits-clock primary** command configures the BITS clock to synchronize with an external clock signal source. The primary clock source can be either a T1 or E1 controller on the PRP-2, or a BITS-supported line card interface. The primary clock cannot be sourced from the same slot that has been configured for the primary clock source.

Examples

The following example configures the T1 port of a PRP-2 in slot 6 to be a primary BITS clock:

```
router# conf t
router(config)# bits-clock
router(config-bits)# primary controller T1 6/0
router(config-bits)# end
```

The following example configures the POS interface of a line card in slot 5 to be a primary BITS clock:

```
router# conf t
router(config)# bits-clock
```

```
router(config-bits)# primary interface pos 5/0
router(config-bits)# end
```

Related Commands

Command	Description
bits-clock	Forces the Clock Scheduler Card BITS clock to synchronize to a different external BITS reference signal or switches the clocking mode.
bits-clock disable	Disables BITS clock timing for specific line card slots.
bits-clock mode	Configures the Clock Scheduler Card BITS clocking modes.
bits-clock secondary	Configures a line card interface or a PRP-2 T1/E1 controller to be a secondary BITS clock source.
clear bits-clock	Resets Clock Scheduler Card BITS clock defaults.
show bits-clock	Displays the status of the current BITS configuration.
show monitor event-trace bits-clock	Displays a log of Clock Scheduler Card BITS clock events.

bits-clock secondary

To configure a line card interface or a PRP-2 controller to be a secondary BITS clock source, use the **bits-clock secondary** command in bits-clock configuration mode. To delete the configuration, use the **no** form of this command.

bits-clock secondary{**controller**{**e1** *slot*|**t1** *slot*}| **interface pos** *slot*/*port*}

no bits-clock secondary{**controller**{**e1** *slot*|**t1** *slot*}| **interface pos** *slot*/*port*}

Syntax Description

secondary	BITS primary clock configuration
controller	Species the T1or E1 controllers of the PRP-2 as the BITS clock source.
e1	Specifies the E1 controller.
slot	Specifies the slot number of the E1 controller.
t1	Specifies the T1 controller.
slot	Specifies the slot number of the T1 controller.
interface	Configure line card interface as the BITS clock source
pos	Specifies a Packet-over-SONET interface
slot/*port*	Specifies the slot number of the Packet-over-SONET Ethernet interface.

Command Default

None

Command Modes

Bits-clock configuration

Command History

Release	Modification
12.0(31)S	This command was introduced for the Cisco 12816 and 12810 routers, the Cisco 12000 PRP-2 and Engine 6 PoS line cards.

Usage Guidelines

The **bits-clock secondary** command configures the Clock Scheduler Card (CSC) BITS clock to synchronize with an alternative source for the external BITS clock signal in the event the primary source becomes corrupted or unavailable. The secondary clock source can be either a T1 or E1 controller on the PRP-2, or a BITS-supported line card interface. The secondary clock cannot be sourced from the same slot that has been configured for the primary clock source.

Examples

The following example configures the T1 port of a PRP-2 in slot 6 to be a secondary BITS clock:

```
router# conf t
router(config)# bits-clock
router(config-bits)# secondary controller T1 6/0
router(config-bits)# end
```

The following example configures the POS interface of a line card in slot 5 to be a secondary BITS clock:

```
router# conf t
router(config)# bits-clock
router(config-bits)# secondary interface pos 5/0
router(config-bits)# end
```

Related Commands

Command	Description
bits-clock	Forces the Clock Scheduler Card BITS clock to synchronize to a different external BITS reference signal or switches the clocking mode.
bits-clock disable	Disables BITS clock timing for specific line card slots.
bits-clock mode	Configures the Clock Scheduler Card BITS clocking modes.
bits-clock primary	Configures a line card interface or a PRP-2 T1/E1 controller to be a primary BITS clock source.
clear bits-clock	Resets Clock Scheduler Card BITS clock defaults.
show bits-clock	Displays the status of the current BITS configuration.
show monitor event-trace bits-clock	Displays a log of Clock Scheduler Card BITS clock events.

show bits-clock

To display the status of the current BITS configuration, use the **show bits-clock** command in privileged EXEC mode.

show bits-clock [**detail**]

Syntax Description

detail	Indicates that additional diagnostic information is included in the output.

Command Default

None

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(31)S	This command was introduced for the Cisco 12816 and 12810 routers, the Cisco 12000 PRP-2 and Engine 6 PoS line cards.

Usage Guidelines

The detail option displays bit-register information used by Cisco engineers for troubleshooting.

Examples

The following example displays the status of the BITS clock configuration:

```
Router# show bits-clock detail

BITS Clock configuration:  Primary        = T1 6/0  ( RP )
                           Secondary      = POS3/0  ( LC )
                           Mode           = revertive
                           Disabled Slots =

Input Port Status:         Primary = UP,  Secondary = UP

System BITS Selection:     Auto

System BITS Config:        Primary slot 6  Secondary slot 3
System BITS Active Clock:  Primary - Locked
System BITS Lock Failure:  None

BITS Clock Software State: state S_PRIMARY
                           old_state S_PRIMARY
                           event E_TIMEOUT

CSC 17 BITS reg value:     0x6310
CSC 17 BITS details:       primary_slot: 6, secondary_slot: 3
                           primary_status: Good, secondary_status: Good
                           holdover: No, input_lock: Locked
                           clock_mode: Normal, source: primary

CSC 16 BITS reg value:     0x6310
CSC 16 BITS details:       primary_slot: 6, secondary_slot: 3
```

```
                            primary_status: Good, secondary_status: Good
                            holdover: No, input_lock: Locked
                            clock_mode: Normal, source: primary

Slot 6  BITS details:       port 0
(Primary Slot)

Slot 3  BITS details:       port: 0, bits/local: BITS
(Secondary Slot)            holdover: No, input_lock: Locked
                            CSC0: Good, CSC1: Good
                            csc_select: CSC1, lock_detect: 1
```

Table 1 describes the significant fields shown in the display.

(

Table 1 show bits-clock Field Descriptions

Field	Description
BITS Clock configuration	• Primary—Interface and slot number of the primary external clock source. (Router Processor or Line Card) • Secondary—Interface and slot number of the primary external clock source. (Router Processor or Line Card) • Mode—The configured timing mode. • Disabled Slots—the slot numbers of the BITS disabled slots
Input Port Status	• Primary—UP, DOWN. Indicates status of the port from the primary external BITS clock signal is received. • Secondary—UP, DOWN. Indicates status of the port from the secondary external BITS clock signal is received.
System BITS Selection	Auto (default), Freerun, Holdover—Indicates the current clock mode.
System BITS Config	• Primary—Displays the slot number of primary external BITS clock source. • Secondary—Displays the slot number of the secondary BITS clock source.
System BITS Active Clock	Displays state of active CSC BITS clock—locked, freerun, or holdover
System BITS Lock Failure	Information for internal Cisco use only.
BITS Clock Software State	Information for internal Cisco use only.
CSC *slot* BITS reg value	Hexadecimal value of the register decoded in the details field.

Table 1 show bits-clock Field Descriptions (Continued)

Field	Description
CSC *slot* BITS details	Displays BITS values of the active clock Scheduler card. • primary_slot—Slot number of the primary clock source • secondary_slot— Slot number of the secondary clock source • primary_status—Good, Out-of-Range, Invalid. Indicates the quality of the primary external BITS clock source signal • secondary—Good, Out-of-Range, Invalid. Indicates quality of the secondary clock source signal. • holdover—Yes, No. Indicates CSC BITS clock is in holdover mode. • input_lock—Locked, Not Locked. Indicates if the CSC BITS clock is synchronized with the primary or secondary BITS clock source. • clock_mode—Normal, Freerun, Holdover. Displays the current clock mode. • source—Primary, Secondary. Displays the current external BITS clock source.
CSC *slot* BITS details	Displays BITS values of the redundant clock Scheduler card.
Slot 6 BITS details (Primary Slot)	Displays current status of the primary external BITS clock source. The following field is for a PRP-2: port—0,1. Displays the PRP-2 BITS port number that is configured to receive the external BITS clock signal.
Slot 5 BITS details (Secondary Slot)	Displays BITS current status of the secondary external BITS clock source. The following fields are for a line card: port—interface number of the line card configured to receive the external BITS clock signal. bits/local holdover: No input_lock—Locked, Not Locked. CSC0—Indicates quality of BITS clock signal from CSC1: Good, csc_select: CSC1 lock_detect: 1

Related Commands

Command	Description
bits-clock	Forces the Clock Scheduler Card BITS clock to synchronize to a different external BITS reference signal or switches the clocking mode.
bits-clock disable	Disables BITS clock timing for specific line card slots.
bits-clock primary	Configures a line card interface or a PRP-2 T1/E1 controller to be a primary BITS clock source.
bits-clock secondary	Configures a line card interface or a PRP-2 T1/E1 controller to be a secondary BITS clock source.
clear bits-clock	Resets Clock Scheduler Card BITS clock defaults.
show bits-clock	Displays the status of the current BITS configuration.