



External Timing Source

Clock interfaces are external connectors for connecting other timing signals, such as, GPS, BITS.

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GPS

The router can receive 1PPS, 10 MHz, and ToD signals from an external clocking and timing source. The three inputs are combined as a Sync-2 interface to form the external timing source or the GPS input.

The GPS front panel connector details are:

- ToD—RS422 format as input
- 1PPS—RS422 or DIN connector as input
- 10MHz—DIN connector as input

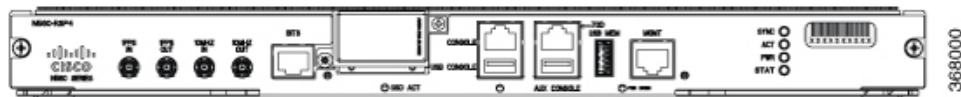
GPS input starts only when all the three signals – 1PPS, 10MHz, and ToD are UP.



Note Unlike the Ethernet interface, the Sync-2 interface cannot receive or transmit QL. Ensure that you assign a QL value to the Sync-2 interface.

By default, 1PPS and 10MHz are in output mode. ToD output mode is not configurable.

Figure 1: 1PPS, 10MHz, and ToD Ports on the N560-RSP4 Front Panel



Configuring GPS Settings for the Grandmaster Clock

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# clock-interface sync 2 location 0/RP0/CPU0
RP/0/RP0/CPU0:router(config-clock-if)# port-parameters
RP/0/RP0/CPU0:router(config-clk-parms)# gps-input tod-format cisco pps-input ttl
```

```
RP/0/RP0/CPU0:router(config-clk-parms)# exit
RP/0/RP0/CPU0:router(config-clock-if)# frequency synchronization
RP/0/RP0/CPU0:router(config-clk-freqsync)# selection input
RP/0/RP0/CPU0:router(config-clk-freqsync)# wait-to-restore 0
RP/0/RP0/CPU0:router(config-clk-freqsync)# quality receive exact itu-t option 1 PRC
RP/0/RP0/CPU0:router(config-clk-freqsync)# exit
RP/0/RP0/CPU0:router(config-clock-if)# frequency synchronization
RP/0/RP0/CPU0:router(config-clk-freqsync)# quality itu-t option 1
RP/0/RP0/CPU0:router(config-clk-freqsync)# clock-interface timing-mode system
RP/0/RP0/CPU0:router(config-clk-freqsync)# end
or
RP/0/RP0/CPU0:router(config-clk-freqsync)# commit
```

Verifying the GPS Input

```
RP/0/RP0/CPU0:R1# show controllers timing controller clock
```

```
SYNCC Clock-Setting: -1 -1 6 -1
  Port 0   Port 1   Port 2   Port 3
Config  :      No      No      Yes      No
Mode    :      -      -      GPS      -
Submode1 :      -      -      CISCO   -
Submode2 :      -      -      UTC     -
Submode3 :      0      0      0       0
Shutdown :      0      0      0       0
Direction : RX/TX   RX/TX   RX      RX/TX
Baud-Rate :      -      -      9600   -
QL Option : O1     O1     -       -
RX_ssm(raw) :      -      -      -       -
TX_ssm   :      -      -      -       -
If_state :   DOWN   DOWN   UP      DOWN  << Port 2 is UP when GPS input is
valid.
```

```
RP/0/RP0/CPU0:R1#
```

When the front panel timing LED is Green, it indicates that the GPS is configured and 1PPS, ToD, and 10M inputs are valid.

Timing LED Behavior:

- Timing LED is off: Indicates that no GPS is configured or the GPS port is down.
- Timing LED is green: Indicates that the GPS port is up.

SYNC LED Behavior:

- SYNC LED is applicable: Only when the timing configuration is applied.
- SYNC LED is green: Indicates that SyncE is locked.
- SYNC LED is amber: Indicates a holdover or free-running state.
- SYNC LED is off: Indicates that the configuration is removed.

Building Integrated Timing Supply (BITS)

Router supports receiving (Rx) and transmitting (Tx) of frequency via BITS interface. To receive and transmit BITS signals, configuration is done under the clock-interface sync 0 on the route processor (RP).

Prerequisite for BITS

Frequency synchronization must be configured with the required quality level option at the global level.

```
RP/0/RP0/CPU0:ios#show running-config frequency synchronization
Wed Aug 21 12:37:32.524 UTC
frequency synchronization
  quality itu-t option 1
!
```



Note BITS-In and BITS-Out on the peer nodes must be configured with the same mode and format.

Configuring BITS-IN

```
RP/0/RP0/CPU0:ios#configure
Wed Aug 21 12:29:59.162 UTC
RP/0/RP0/CPU0:ios(config)#clock-interface sync 0 location 0/RP0/CPU0
RP/0/RP0/CPU0:ios(config-clock-if)#port-parameters
RP/0/RP0/CPU0:ios(config-clk-parms)#bits-input e1 crc-4 sa4 ami
RP/0/RP0/CPU0:ios(config-clk-parms)#exit
RP/0/RP0/CPU0:ios(config-clock-if)#frequency synchronization
RP/0/RP0/CPU0:ios(config-clk-freqsync)#selection input
RP/0/RP0/CPU0:ios(config-clk-freqsync)#wait-to-restore 0
RP/0/RP0/CPU0:ios(config-clk-freqsync)#priority 1
RP/0/RP0/CPU0:ios(config-clk-freqsync)#commit
Wed Aug 21 12:30:53.296 UTC

RP/0/RP0/CPU0:ios#show running-config clock-interface sync 0 location 0/RP0/CPU0
Wed Aug 21 12:31:43.350 UTC
clock-interface sync 0 location 0/RP0/CPU0
  port-parameters
    bits-input e1 crc-4 sa4 ami
  !
  frequency synchronization
    selection input
    priority 1
    wait-to-restore 0
  !
!
```

Configuring BITS-OUT

```
RP/0/RP0/CPU0:ios#configure
Wed Aug 21 12:53:24.189 UTC
RP/0/RP0/CPU0:ios(config)#clock-interface sync 0 location 0/RP0/CPU0
RP/0/RP0/CPU0:ios(config-clock-if)#port-parameters
RP/0/RP0/CPU0:ios(config-clk-parms)#bits-output e1 crc-4 sa4 ami
RP/0/RP0/CPU0:ios(config-clk-parms)#commit
Wed Aug 21 12:53:39.411 UTC

RP/0/RP0/CPU0:ios#show running-config clock-interface sync 0 location 0/RP0/CPU0
Wed Aug 21 12:54:02.853 UTC
clock-interface sync 0 location 0/RP0/CPU0
  port-parameters
    bits-output e1 crc-4 sa4 ami
  !
!
```



Note Based on the quality level chosen in global configuration, E1/T1 modes can be changed as required. But in all the cases, both TX and RX side modes and submodes must be the same.

For non-CRC-4/D4 modes, SSM is not present in BITS and manual receive quality level must be configured.

Verifying BITS-IN Configuration

```
RP/0/RP0/CPU0:ios#show controllers timing controller clock
Wed Aug 21 12:38:20.394 UTC
```

```
SYNCC Clock-Setting: 1 -1 -1 -1
```

	Port 0	Port 1	Port 2	Port 3
Config	: Yes	No	No	No
Mode	: E1	-	-	-
Submode1	: CRC-4	-	-	-
Submode2	: AMI	-	-	-
Submode3	: 0	0	0	0
Shutdown	: 0	0	0	0
Direction	: RX	RX/TX	RX/TX	RX/TX
Baud-Rate	: -	-	-	-
QL Option	: O1	O1	-	-
RX_ssm(raw)	: 99	-	-	-
TX_ssm	: -	-	-	-
If_state	: UP	DOWN	DOWN	DOWN

Verifying BITS-OUT Configuration

```
RP/0/RP0/CPU0:ios#show controllers timing controller clock
Wed Aug 21 12:49:32.923 UTC
```

```
SYNCC Clock-Setting: 1 -1 -1 -1
```

	Port 0	Port 1	Port 2	Port 3
Config	: Yes	No	No	No
Mode	: E1	-	-	-
Submode1	: CRC-4	-	-	-
Submode2	: AMI	-	-	-
Submode3	: 0	0	0	0
Shutdown	: 0	0	0	0
Direction	: TX	RX/TX	RX/TX	RX/TX
Baud-Rate	: -	-	-	-
QL Option	: O1	O1	-	-
RX_ssm(raw)	: -	-	-	-
TX_ssm	: 22	-	-	-
If_state	: UP	DOWN	DOWN	DOWN

Verify Quality Level Received and Clock Interfaces

```
RP/0/RP0/CPU0:ios#show frequency synchronization clock-interfaces brief
```

```
Sat Mar 16 07:35:08.351 UTC
```

```
Flags: > - Up          D - Down          S - Assigned for selection
        d - SSM Disabled  s - Output squelched L - Looped back
```

```
Node 0/RP0/CPU0:
```

```
=====
```

F1	Clock Interface	QLrcv	QLuse	Pri	QLsnd	Output driven by
=====	=====	=====	=====	=====	=====	=====
>S	Sync0	PRS	PRS	5	n/a	n/a
D	Sync1	n/a	n/a	n/a	n/a	n/a
D	Sync2	n/a	n/a	n/a	n/a	n/a
>S	Internal0	n/a	ST3	255	n/a	n/a

