

# Grand Master Clock Support Using External GNSS Receiver for ACX7024 and ACX7024X

## IN THIS GUIDE

- [About this Guide | 1](#)
- [Overview | 1](#)
- [Install and Connect the FURUNO TB-1 GNSS Receiver | 3](#)
- [Antenna Cable Specifications | 8](#)
- [GNSS Configuration for ACX7024 and ACX7024X Routers | 12](#)
- [Configuration Statements | 17](#)
- [Administrative Commands | 20](#)
- [Monitoring Commands | 25](#)

## About this Guide

Use this guide to learn more about the Global Navigation Satellite System (GNSS) capabilities on a Juniper Networks® ACX7024 and ACX7024X Cloud Metro router. In this guide, you will learn how to connect an ACX7024 and ACX7024X router to a FURUNO TB-1 GNSS receiver.

As a network or system administrator you can use this guide to install the TB-1 receiver on a 19-inch (19-in.) rack and connect the receiver to an ACX7024 or ACX7024X router.

## Overview

Global Navigation Satellite System (GNSS) capability is essential for the Grand Master (GM) clock functionality. A GNSS receiver receives signals from a navigation satellite constellation. The GNSS receiver gains precise phase and time information by processing these signals and delivers the information across the network.

The ACX7024 and ACX7024X router supports telecom grandmaster (T-GM) functionality using an external GNSS receiver as a source for time information. The GNSS receiver obtains and processes the signals from a navigation satellite constellation to deliver precise phase and time information across the entire packet network. The T-GM functionality can be used, for example, to provide required synchronization to base stations in a data network. With this feature, the ACX7024 and ACX7024X routers can function as an edge T-GM by connecting to an external FURUNO TB-1 GNSS receiver (TB-1 receiver).

The TB-1 receiver supports the following timing standards:

- IEEE standard 1588-2008, [IEEE Standard for a Precision Clock Synchronization for Networked Measurement and Control Systems](#), July 2008.
- ITU-T G.8262, G.8263, G.8265, G.8272 PRTC Class A and G.8275.

The TB-1 receiver and the Telecom Grand Master (T-GM) functionality on the ACX7024 and ACX7024X routers provide several benefits including the following:

- Multi-constellation receiver that supports:
  - GPS L1C/A
  - GLONASS L1OF
  - GALILEO E1B/E1C
  - QZSS L1C/A
- Time traceability to GPS or UTC
- Coherent 10-MHz and 1- pulse per second (PPS) outputs
- OCXO-based receiver
- Anti-jamming and anti-spoofing support that includes multipath spoofing, jamming, interference detection and isolation mechanisms.
- Supported on 10G and 25G ports.
- Transmission of Ethernet Synchronization Message Channel (ESMC) and enhanced ESMC packets for synchronous Ethernet as per G.8264 standards.

For more information about the TB-1 receiver, see the [TB-1 Operation Manual](#).

# Install and Connect the FURUNO TB-1 GNSS Receiver

## IN THIS SECTION

- [GNSS Accessory Kit | 3](#)
- [Install the TB-1 Receiver in a Rack | 4](#)
- [Connect an ACX7024 or ACX7024X Router to the TB-1 Receiver | 7](#)
- [Install the GNSS Antenna | 8](#)
- [Gain and Noise Figure \(NF\) Calculation | 8](#)

Use the information in this topic to install the FURUNO TB-1 GNSS receiver (TB-1 receiver) on a 19 in. rack and connect the receiver to an ACX7024 or ACX7024X router.

Before you begin to install and connect the TB-1 receiver:

- Ensure that you have the GNSS accessory kit. For more information about the components inside the kit, see [Table 1 on page 4](#).
- Understand the required environmental conditions for normal router operation. For more information, see [ACX7024 Router Environmental Tolerances](#) and [ACX7024X Router Environmental Tolerances](#).
- Ensure that the ACX7024 or ACX7024X router is grounded. For more information, see [Connect Earth Ground to ACX7024 or ACX7024X Routers](#).
- Read ["Install the GNSS Antenna" on page 8](#).
- Ensure that you have the antenna cables. For more information about the antenna cables, see ["Antenna Cable Specifications" on page 9](#).
- Follow the instructions in ["Cabling Guidelines" on page 12](#).

## GNSS Accessory Kit

[Table 1 on page 4](#) lists the components that are included in the GNSS accessory kit.

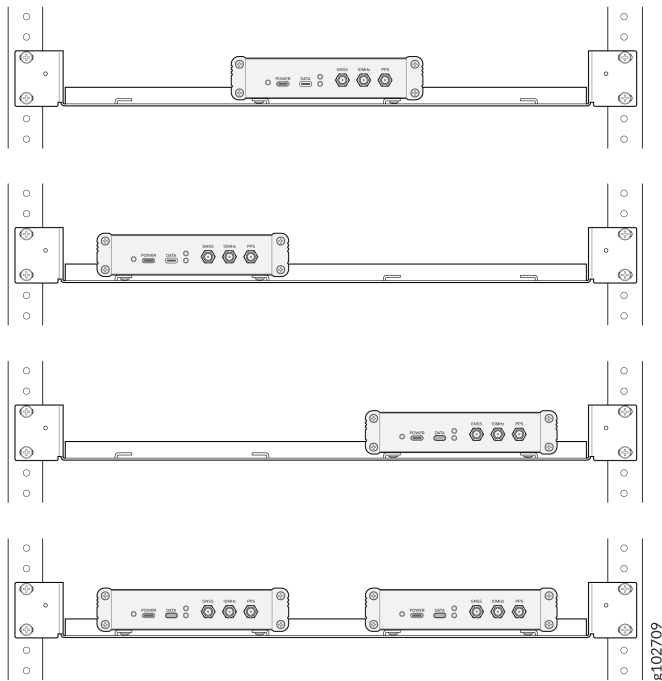
**Table 1: GNSS Accessory Kit**

Component	Quantity
TB-1 receiver	1
GNSS receiver mounting screws	4
USB-C to USB-C cable	1
Clock cables (RG58)	2
Rack mount tray	1

## Install the TB-1 Receiver in a Rack

To install the TB-1 receiver on a 19 in. rack, you must first secure the receiver to the mounting tray and then attach the mounting tray to the rack. The mounting tray has four fixed flanges that allow you to install the receiver in four different ways.

**Figure 1: Installation Patterns**

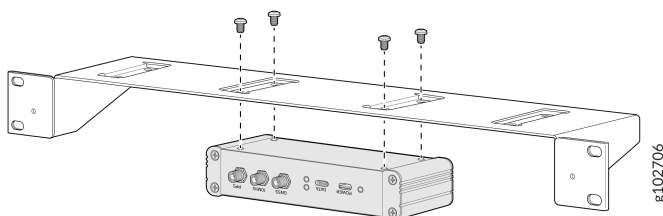


**NOTE:** You can install up to two TB-1 receivers on a mounting tray.

To install the TB-1 receiver in a rack, follow the steps given below:

1. Secure the TB-1 receiver to the mounting tray using the four mounting screws (provided).
  - a. Position the receiver upside down and place the tray (upside down) on the receiver, aligning the threaded holes on the receiver with the holes on the tray.
  - b. Tighten the mounting screws through the tray into the threaded holes of the receiver.

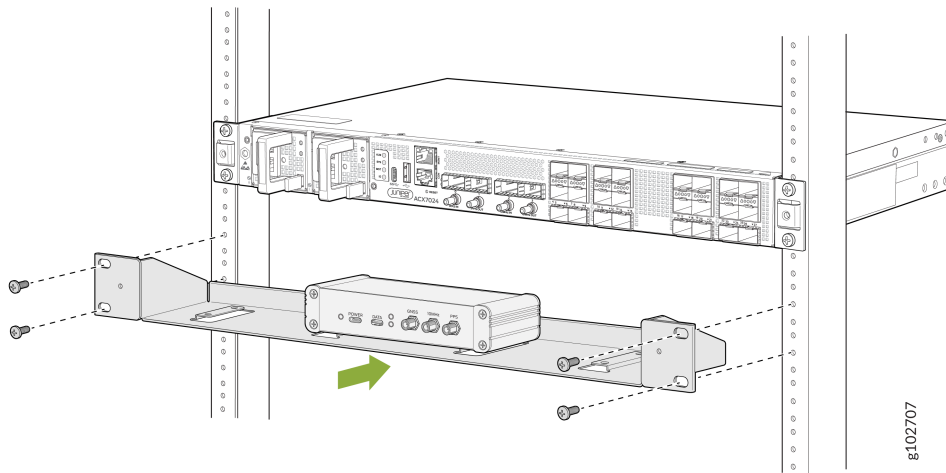
**Figure 2: Secure the Receiver**



2. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to a site ESD point.

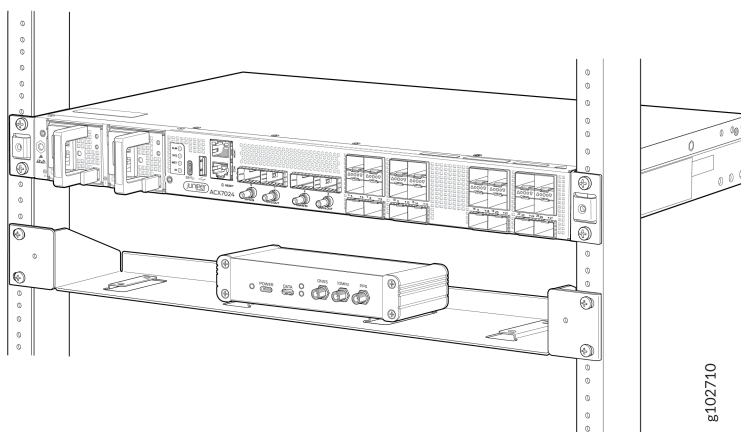
3. Position the mounting tray in front of the rack. Line up the bottom hole in each mounting bracket with a hole in each rack rail, making sure the mounting tray is level.
4. Secure the mounting tray to the rack using the rack mount screws (not provided). Tighten the screws at the bottom first, then tighten the screws at the top.

**Figure 3: Install the Mounting Tray**

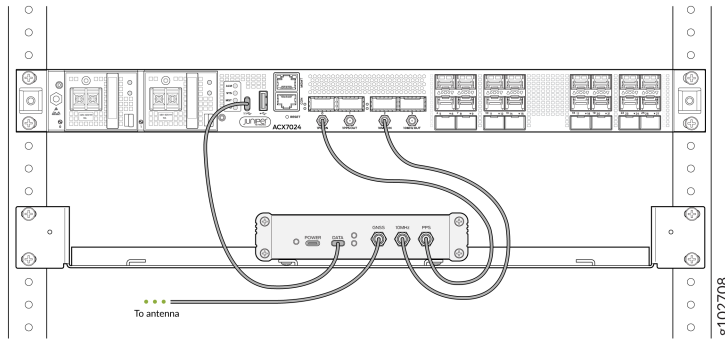


5. Visually inspect the alignment of the mounting tray. [Figure 4 on page 6](#) shows the TB-1 receiver fully secured and installed in a two-post rack.

**Figure 4: TB-1 Receiver Installed on a Rack**



6. After you have installed the TB-1 receiver, connect the ACX7024 or ACX7024X router to the TB-1 receiver. For more information, see ["Connect an ACX7024 or ACX7024X Router to the TB-1 Receiver" on page 7](#).



## Connect an ACX7024 or ACX7024X Router to the TB-1 Receiver

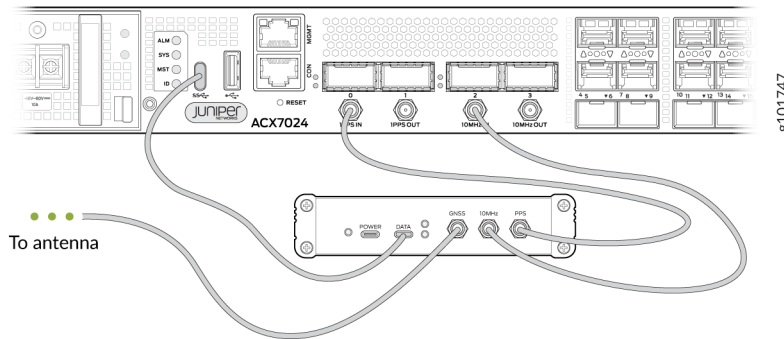
To connect an ACX7024 or ACX7024X router to a TB-1 receiver:

1. Connect one end of an RG-58 cable to the PPS connector port on the TB-1 receiver (labeled **PPS**) and the other end of the cable to the 1PPS connector port on the ACX7024 or ACX7024X router (labeled **1PPS IN**).
2. Connect one end of an RG-58 cable to the 10-MHz connector port on the TB-1 receiver (labeled **10MHz**) and the other end of the cable to the 10-MHz connector port on the ACX7024 or ACX7024X router (labeled **10MHz IN**).

**NOTE:** The RG-58 cable has an SMA male connector at one end and a DIN 1.0/2.3 connector at the other end. The DIN connector (male) in the RG-58 cable connects to the ACX7024 and ACX7024X router whereas the SMA (male) connector connects to the TB1 receiver.

3. Use a USB-C to USB-C cable to connect one end of the cable to the data port (labeled **DATA**) on the TB-1 receiver and the other end to the USB type C port on the ACX7024 or ACX7024X router.

4. Connect one end of the LMR400 cable to the GNSS connector port (labeled **GNSS**) on the TB-1 receiver and the other end to the GNSS antenna.



## Install the GNSS Antenna

You must install a Global Navigation Satellite System (GNSS) antenna to ensure optimal signal reception. For information about antenna installation guidelines, see *GNSS Antenna Installation* in the [TB-1 Operation Manual](#).

To enable the TB-1 receiver, connect to the FURUNO AU-300 antenna. For information about installing the AU-300 antenna, see [AU-300 Installation Procedure](#).

## Gain and Noise Figure (NF) Calculation

To calculate the total gain and NF, see GNSS Antenna Installation Appendix on the [FURUNO data download](#) page.

## Antenna Cable Specifications

### IN THIS SECTION

- [Antenna Cable Specifications](#) | 9
- [Cabling Guidelines](#) | 12



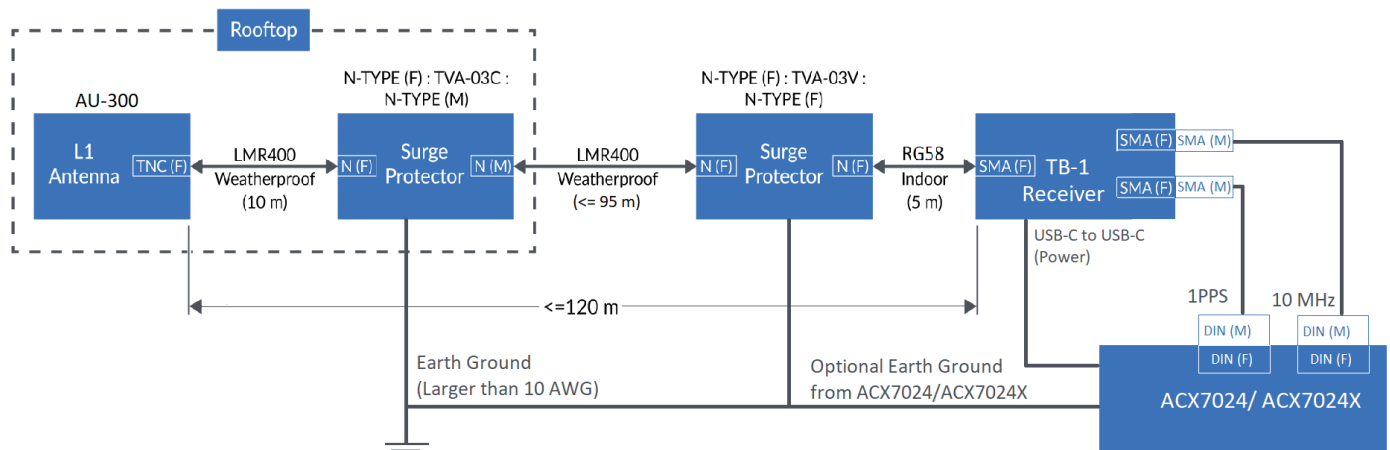
## Antenna Cable Specifications

## IN THIS SECTION

- LMR400 (10-m Segment) Cable Specifications | 10
- LMR400 (95-m Segment) Cable Specifications | 11
- RG-58 (5-m Segment) Cable Specifications | 11

The following topology ([Figure 5 on page 9](#)) depicts the antenna cable connections with connector types. Use this topology as an example to install the antenna cables.

### Figure 5: Cable Connections



Juniper has tested this topology with the following cables:

- LMR400 (10-m segment) from TE Connectivity (Part number: CD-2430293). For more information, see "[LMR400 \(10-m Segment\) Cable Specifications](#)" on page 10.
- LMR400 (95-m segment) from TE Connectivity (Part number: CD-2430295). For more information, see "[LMR400 \(95-m Segment\) Cable Specifications](#)" on page 11.

**NOTE:** The cable length can be less than or equal to 95 m.

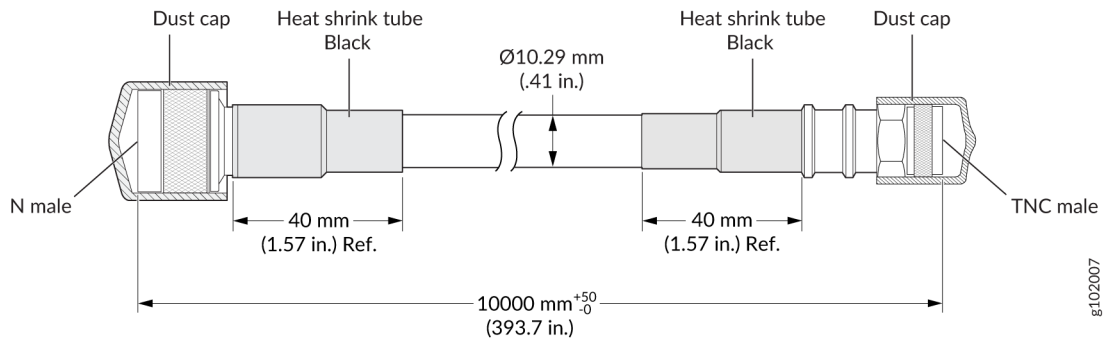
- RG-58 (5-m segment) from TE Connectivity (Part number: CD-2430297). For more information, see "[RG-58 \(5-m Segment\) Cable Specifications](#)" on page 11.

You must ensure that you install surge protectors to protect the GNSS receiver from lightning surges. The surge protector next to the outdoor antenna must be a safety-certified antenna surge protector (certified to UL 497B or its IEC equivalent). The topology shown in [Figure 5 on page 9](#) uses TVA-03C and TVA-03V surge protectors. For more information about the TVA surge protectors, see [Coaxial lightning arrestor TVA-03](#).

**NOTE:** You must ensure that the surge protectors are grounded. To ground the TVA-03C and TVA-03V surge protectors, use a 10 AWG to 12 AWG grounding wire. For more information about grounding surge protectors, see [Surge Protective Device Document Download](#).

The following sections describe the antenna cable specifications:

## LMR400 (10-m Segment) Cable Specifications

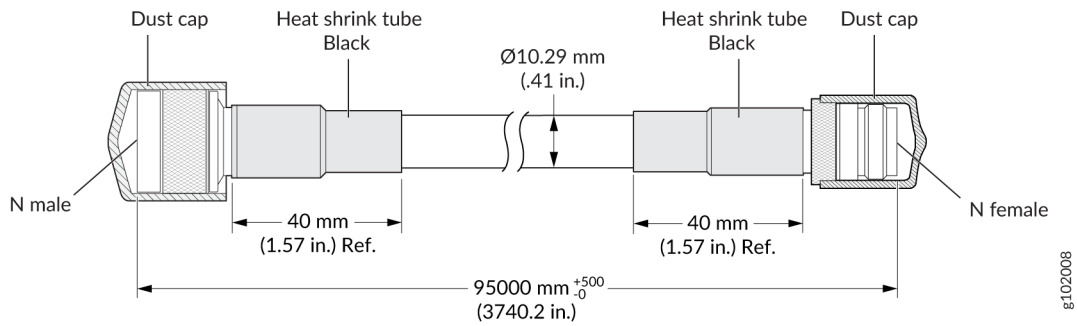


g102007

### Electrical Characteristics

Impedance	50 $\Omega$
Frequency	DC-3GHz
Voltage Rating	335 Vrms
Dielectric Withstanding Voltage	> 1000 V
Insulation Resistance	> 5000 M $\Omega$

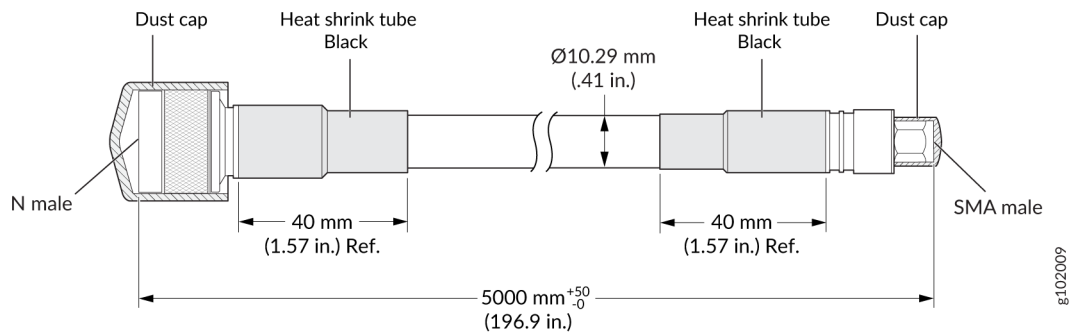
## LMR400 (95-m Segment) Cable Specifications



### Electrical Characteristics

Impedance	50 $\Omega$
Frequency	DC-3GHz
Voltage Rating	335 Vrms
Dielectric Withstanding Voltage	> 1000 V
Insulation Resistance	> 5000 M $\Omega$

## RG-58 (5-m Segment) Cable Specifications



RG58	
Impedance	$50 \pm 2 \Omega$
Capacitance	100 pF/m
Velocity Ratio	66 %
Resistance	Inner Conductor- 36, 5 $\Omega$ /Km Braid- 14 $\Omega$ /Km
Tension	Sheath and Spark testing- 4,0 kV

## Cabling Guidelines

Follow these guidelines when you install cables:

- Ensure that the GNSS dongle can track the satellites and can acquire a lock.
- Examine the cable end points and connectors for any bends or damage.
- Check the electrical continuity of the cable for both inner and outer conductors.
- Check for any electrical short in cables.
- Inspect the cable outer sheath for any damage.

# GNSS Configuration for ACX7024 and ACX7024X Routers

## SUMMARY

This topic describes how to configure GNSS Receiver for ACX7024 and ACX7024X Routers.

## IN THIS SECTION

- [Configure GNSS Receiver | 14](#)
- [Troubleshoot GNSS Receiver | 16](#)

The ACX7024 and ACX7024X routers support the G.8275.1 profile—Telecom Grand Master (T-GM) functionality using an external TB-1 GNSS receiver. Several benefits of the TB-1 receiver with the T-GM functionality include:

- Compliance to ITU-T G.8272 (Unified functional architecture for transport networks) PRTC Class A.
- Support for multiple constellations such as GPS, GLONAS, QZSS and Galileo.
- Support for multipath spoofing, jamming, interference detection and isolation mechanisms.
- Supported on 10G and 25G ports for all devices in the network.

Use the following commands to configure the T-GM functionality:

- `set chassis synchronization gnss-receiver <(0/1)> receiver-type <name>`
- `set chassis synchronization gnss-receiver <(0/1)> interface`

Use the following commands to enable GM functionality:

- `set protocols ptp clock-mode ordinary`
- `set protocols ptp profile-type g.8275.1`
- `set protocols ptp master interface <interface-name> multicast-mode transport ieee-802.3`
- `ptp-mode`
- `gnss-receiver`
- `show chassis synchronization gnss-receiver extensive`
- `show chassis synchronization extensive`
- `show ptp lock-status detail`

In T-GM mode router functions as an ordinary clock and all PTP configured ports are in "Master only" state. Up to 512 master ports are supported on both ACX7024 and ACX7024X routers.

#### NOTE:

- A synchronous Ethernet (SyncE) input is not allowed when system is functioning as a T-GM. Use the following command to configure a wait-to-restore check for SyncE input:

```
set chassis synchronization source interfaces et-0/0/4 quality-level prc wait-to-restore 0
```

- Ensure that at least one of configured master port link is up, else the `show ptp lock-status` command will keep displaying the status as `Initializing` and `show chassis synchronization extensive` command will keep displaying the current clock status as `Freerun`.

## Configure GNSS Receiver

The TB-1 GNSS receiver is designed to operate with multiple constellations. When connected to an external GNSS antenna, the receiver contains all the circuitry necessary to automatically acquire GNSS satellite signals, track GNSS satellites, and acquire precise position and timing solutions. It provides 1 pulse-per-second (PPS) precision timing and stable 10-MHz frequency output.

To optimize the GNSS capability, establish a common time scale and coordinated system between all the systems. This coordinated system simplifies network synchronization, provides flexibility and resiliency.

Table 1 describes the steps to configure GNSS receiver on ACX7024 and ACX7024X routers.

**Table 2: GNSS Receiver Configuration**

Configuration Step	Command
<p>Step 1: (Mandatory) Enable GNSS receiver and grandmaster clock functionality.</p> <p>Enable the GNSS receiver by using the <code>gnss-receiver 0</code> interface statement at the <code>edit chassis synchronization</code> hierarchy level. By enabling the GNSS receiver, you establish communication between the ACX7024 or ACX7024X router with the GNSS receiver.</p> <p>Configure the satellite constellation by using the <code>gnss-receiver 0</code> constellation statement at the <code>edit chassis synchronization</code> hierarchy level. Various constellations are available. Through this configuration, you can configure the GNSS receiver to explicitly use a specific constellation or combination of constellations.</p> <p>For more information, see <a href="#">"clock-mode" on page 17</a>, <a href="#">"profile-type" on page 18</a>, <a href="#">"transport-ieee-802.3" on page 24</a>, <a href="#">"gnss-receiver" on page 21</a>, and <a href="#">"ptp-mode" on page 20</a>.</p> <p><b>NOTE:</b> When <code>ptp-mode</code> is enabled, port 27 is no longer available for use.</p>	<ol style="list-style-type: none"> <li>Set clock mode.           <pre>[edit protocols ptp] user@host# set clock-mode ordinary</pre> </li> <li>Set G.8275.1 profile type.           <pre>[edit protocols ptp] user@host# set profile-type g.8275.1</pre> </li> <li>Set transport protocol as IEEE 802.3.           <pre>[edit protocols ptp master interface interface-name multicast-mode] user@host# set transport ieee-802.3</pre> </li> <li>Set the GNSS receiver interface.           <pre>[edit chassis synchronization gnss-receiver number] user@host# set interface</pre> </li> <li>Configure the GNSS receiver type as TB-1.           <pre>[edit chassis synchronization gnss-receiver number] user@host# set receiver-type tb-1</pre> </li> <li>Set the GNSS receiver constellation.           <pre>[edit chassis synchronization gnss-receiver number] user@host# set constellation</pre> </li> <li>Set PTP mode for FPC and PIC.           <pre>[edit chassis fpc 0 pic 0] user@host# set ptp-mode</pre> </li> </ol>

Table 2: GNSS Receiver Configuration (*Continued*)

Configuration Step	Command
<p>Step 2: (Optional) Specify the position mode. TB-1 as timing receiver has two different position modes— position-fix-mode and survey-mode. The default position mode is survey-mode if no specific mode is configured.</p> <ul style="list-style-type: none"> <li>• <b>position-fix-mode:</b> Use this mode when you know the accurate antenna location.</li> <li>• <b>survey-mode:</b> Use this mode when you do not know the fixed location of the antenna.</li> </ul> <p>For more information about position mode, see <a href="#">"gnss-receiver" on page 21</a>.</p>	<pre>[edit chassis synchronization gnss-receiver <i>number</i>] user@host# set position-mode</pre>
<p>Step 3: (Optional) Specify the antenna cable delay compensation value. This configuration is used to compensate the delay introduced due to RF cable which is routed from antenna to TB-1 RF input.</p> <p>You can also use this command to compensate the PPS cable delay by adding both RF cable and PPS cable delays.</p> <p>For long cable runs, this delay can be significant. The range is from -1000000 to 1000000 nanoseconds.</p> <p>For more information about cable delay compensation, see <a href="#">"gnss-receiver" on page 21</a>.</p>	<pre>[edit chassis synchronization gnss-receiver <i>number</i>] user@host# set cable-delay-compensation <i>value</i></pre> <p><b>NOTE:</b> Refer <a href="https://timesmicrowave.com/calculator/">https://timesmicrowave.com/calculator/</a> to calculate the antenna cable delay compensation value and mention it in the command.</p> <p>For example, if the antenna cable delay compensation is <i>1000</i> nanoseconds, then the command should be <b>set cable-delay-compensation -1000</b>. Note the negative value for the delay.</p>
<p>Step 4: (Optional) Specify the Signal-to-Noise Ratio (SNR) threshold value.</p> <p>The SNR is the ratio of the signal power to the noise power. GNSS receiver measures SNR value to indicate the signal strength of the received satellite signal and the noise density. You can configure the SNR threshold value. Satellites with the signal level equal to or above the threshold value can only be used for positioning.</p> <ul style="list-style-type: none"> <li>• range: 0 - 99 dBHz</li> </ul> <p>For more information about SNR threshold, see <a href="#">"gnss-receiver" on page 21</a>.</p>	<pre>[edit chassis synchronization gnss-receiver <i>number</i>] user@host# set snr-threshold <i>value</i></pre>
<p>Step 5: Commit the configuration.</p>	<pre>[edit] user@host# commit</pre>

Table 2: GNSS Receiver Configuration (*Continued*)

Configuration Step	Command
<p>Step 6: Verify the configuration.</p> <p>For more information about the operational commands, see <a href="#">"show chassis synchronization gnss-receiver extensive" on page 30</a>, <a href="#">"show chassis synchronization extensive" on page 25</a>, and <a href="#">"show ptp lock-status detail" on page 28</a>.</p> <p><b>NOTE:</b> Ensure that at least one of configured master port link is up, else the show ptp lock-status command will keep displaying the status as Initializing and show chassis synchronization extensive command will keep displaying the current clock status as Freerun.</p>	<pre>[edit] user@host# run show chassis synchronization gnss-receiver extensive  [edit] user@host# run show chassis synchronization extensive  [edit] user@host# run show ptp lock-status detail  [edit] user@host# run show ptp clock detail</pre>

## Troubleshoot GNSS Receiver

### IN THIS SECTION

- [Alarms | 16](#)

## Alarms

In case of any issues, run the `show chassis alarms` command to verify the following:

- TB-1 is not detected or not connected in the USB port.
- 1PPS is not detected or connected.
- 10 MHz is not detected or connected.

### Sample Output

```
root@abc> show chassis alarms
3 alarms currently active
```



```
2024-05-29 23:14:58 PDT Major GNSS dongle removed
2024-05-29 23:14:59 PDT Minor GNSS 1 PPS link LOS set
2024-05-29 23:14:59 PDT Minor GNSS 10 MHz link LOS set
```

## Configuration Statements

### SUMMARY

This topic describes the various configuration statements required to enable the T-GM functionality on ACX7024 and ACX7024X routers.

### IN THIS SECTION

- [clock-mode | 17](#)
- [profile-type | 18](#)

## clock-mode

### IN THIS SECTION

- [Syntax | 17](#)
- [Hierarchy Level | 18](#)
- [Description | 18](#)
- [Options | 18](#)
- [Required Privilege Level | 18](#)

## Syntax

```
clock-mode (ordinary);
```

## Hierarchy Level

[edit protocols ptp]

## Description

Configure the clock mode as ordinary clock with GNSS configuration. The clock mode determines whether the node behaves as a client or primary node. This attribute is mandatory and has no default value.

## Options

ordinary—The clock mode of the node is a system clock that acts either as a primary node or as a client node.

## Required Privilege Level

routing—To view this statement in the configuration.

routing-control—To add this statement to the configuration.

## profile-type

### IN THIS SECTION

- [Syntax | 19](#)
- [Hierarchy Level | 19](#)
- [Description | 19](#)
- [Options | 19](#)
- [Required Privilege Level | 19](#)

## Syntax

```
profile-type (g.8275.1);
```

## Hierarchy Level

```
[edit protocols ptp]
```

## Description

On ACX7024 and ACX7024X routers, configure the G.8275.1 profile for GNSS receiver that requires accurate phase and time synchronization. This profile supports the architecture defined in ITU-T G.8271.1 specification to enable the distribution of phase and time with full timing support. This profile requires all devices in the network to operate in combined or hybrid modes. To fulfill this requirement, you must enable Precision Time Protocol (PTP) and Synchronous Ethernet on all devices.

## Options

`g.8275.1`—Enable the G.8275.1 PTP profile.

## Required Privilege Level

`routing`—To view this statement in the configuration.

`routing-control`—To add this statement to the configuration.

# Administrative Commands

## SUMMARY

This topic describes the administrative commands required to enable the T-GM functionality on ACX7024 and ACX7024X routers.

## IN THIS SECTION

- [ptp-mode | 20](#)
- [gnss-receiver | 21](#)
- [transport-ieee-802.3 | 24](#)

## ptp-mode

### IN THIS SECTION

- [Syntax \(ACX7024 and ACX7024X Routers\) | 20](#)
- [Hierarchy Level | 20](#)
- [Description | 21](#)
- [Required Privilege Level | 21](#)

## Syntax (ACX7024 and ACX7024X Routers)

```
ptp-mode;
```

## Hierarchy Level

```
[edit chassis fpc name pic name]
```

## Description

The PTP mode configuration is mandatory to enable the PTP ordinary clock feature in ACX7024 and ACX7024X routers.

When you enable PTP mode on ACX7024 and ACX7024X routers, port 27 is no longer available for use.

For more information about valid port configurations on ACX7024 and ACX7024X routers, see [Port Speed Overview](#).

## Required Privilege Level

interface—To view this statement in the configuration.

interface-control—To add this statement to the configuration.

## gnss-receiver

### IN THIS SECTION

- [Syntax \(ACX7024 and ACX7024X Routers\) | 21](#)
- [Hierarchy Level | 22](#)
- [Description | 22](#)
- [Options | 22](#)
- [Required Privilege Level | 23](#)

## Syntax (ACX7024 and ACX7024X Routers)

```
gnss-receiver {
  cable-delay-compensation;
  constellation {
    galileo (e1);
    glonass (l1of);
    gps (l1ca);
    qzss (l1ca);
  }
  interface;
```

```

position-mode {
    position-fix-mode (latitude | longitude | altitude);
    survey-mode (survey-length);
}
receiver-type;
snr-threshold
}

```

## Hierarchy Level

[edit chassis synchronization]

## Description

Configure GNSS receiver with ACX7024 and ACX7024X routers. The GNSS receiver receives signals from a navigation satellite constellation. The receiver gains precise phase and time information by processing these signals and delivers the information across the packet network.

## Options

**cable-delay-compensation**—GNSS receiver unit to router RF cable delay compensation in nanoseconds. You can specify a value in nanoseconds to compensate the delay that the cable introduces.

- Range: -1000000 through 1000000 nanoseconds

**constellation**—Various constellations are available. You can configure the GNSS receiver to explicitly use a specific constellation or combination of constellations.

The following constellations are available:

- **gps**: Enables detection and locking to the GPS constellation.

GPS signals enable you to determine the position of the receiver on earth and maintain a high level of time accuracy. The GPS L1CA receiver with 10MHz clock frequency output synchronized to a GPS satellite.

**NOTE:** You can use only GPS L1CA to configure the GNSS receiver.

- **galileo**: Enables detection and locking to the GALILEO constellation.

- `glonass`: Enables detection and locking to the GLONASS constellation.
- `qzss`: Enables detection and locking to the QZSS constellation.

`interface`—Enable/Disable GNSS port/slot communication.

**NOTE:** For ACX7024 and ACX7024X routers, only one port of GNSS receiver is supported.

`position-mode`—GNSS receiver's position modes. You can configure two position modes of GNSS receiver— `position-fix-mode` and `survey-mode`.

- `position-fix-mode`: Use this mode when you know the accurate antenna location.
  - `Latitude`— Latitude in degrees.
    - Range: -90.00000000 to 90.00000000 degrees
  - `Longitude`— Longitude in degrees.
    - Range: -180.00000000 to 180.00000000 degrees
  - `Altitude`— Altitude in meters.
    - Range: -1000 to 18000 meters

**NOTE:** Be cautious when you use this mode. Ensure that you configure the correct position. Configuring the wrong position might cause erroneous receiver function and faulty grandmaster clock performance.

- `survey-mode`: Use this mode when you do not know the fixed location of the antenna.

GNSS receiver does a self survey of its own position for a period mentioned in survey length and then moves to position fix mode. This is the default mode and the default survey length is 120 minutes.

`receiver-type`— Only TB-1 is supported as the GNSS receiver.

`snr-threshold`— GNSS receiver measures the Signal-to-Noise Ratio (SNR) value to indicate the signal strength of the received satellite signal and the noise density. You can configure the SNR threshold value. You can perform positioning by using only those satellites that have signal level equal to or above the threshold value with a range of 0 to 99 dBHz.

## Required Privilege Level

`interface`—To view this statement in the configuration.

`interface-control`—To add this statement to the configuration.

## transport-ieee-802.3

### IN THIS SECTION

- [Syntax | 24](#)
- [Hierarchy Level | 24](#)
- [Description | 24](#)
- [Options | 24](#)
- [Required Privilege Level | 25](#)

## Syntax

```
transport ieee-802.3;
```

## Hierarchy Level

```
[edit protocols ptp master interface <interface-name> multicast-mode]
```

## Description

Configure Ethernet as the encapsulation type for transport of Precision Time Protocol (PTP) packets. Ethernet encapsulation type is supported for transmission of PTP packets in multicast mode.

**NOTE:** The `transport` statement is mandatory in the configuration of a primary clock.

## Options

802.3—Enable encapsulation for PTP packet transport in multicast mode.



`link-local`—Enable primary or client to choose either of the two MAC addresses defined in the IEEE 1588-2008 standard. When you configure this option, the system attempts to use the MAC address (link-local multicast address) for multicast transmission.

If the link-local multicast address is not available, the system uses the standard Ethernet multicast address as a second priority. The link-local multicast MAC address ensures complete end-to-end support of PTP and eliminate the chance of packet transmission through any network element that does not support PTP. The address is the default address for G.8275.1 (PTP profile for time or phase distribution), and a node with this MAC address is a node that supports processing of PTP packets.

## Required Privilege Level

`routing`—To view this statement in the configuration.

`routing-control`—To add this statement to the configuration.

# Monitoring Commands

## SUMMARY

This topic describes the monitoring commands to view and troubleshoot the T-GM configuration on ACX7024 and ACX7024X routers.

## IN THIS SECTION

- [show chassis synchronization extensive | 25](#)
- [show ptp lock-status detail | 28](#)
- [show chassis synchronization gnss-receiver extensive | 30](#)

## show chassis synchronization extensive

### IN THIS SECTION

- [Syntax | 26](#)
- [Description | 26](#)
- [Options | 26](#)
- [Required Privilege Level | 26](#)
- [Output Fields | 26](#)

## Syntax

```
show chassis synchronization extensive  
<interface interface-name>  
<no-forwarding>
```

## Description

Display detailed clock synchronization information.

## Options

**interface *interface-name*** (Optional) Display clock synchronization information for the specified interface.

**no-forwarding** (Optional) Display clock synchronization information for interfaces configured with no-forwarding option.

## Required Privilege Level

maintenance

## Output Fields

Table 1 lists the output fields for the `show chassis synchronization extensive` command. Output fields are listed in the approximate order in which they appear.

**Table 3: show chassis synchronization extensive Output Fields**

Field Name	Field Description
Current clock status	<p>Indicates the current status of chassis synchronization:</p> <ul style="list-style-type: none"> <li>• Locked—Clock is operational.</li> <li>• Holdover—Clock is not operational.</li> <li>• Freerun—Clock is locked to the free-run local oscillator.</li> <li>• Acquiring—Clock is attempting to acquire a lock on the specified clock source.</li> </ul>
Clock locked to	The source to which the clock is locked. The clock can be locked to either the primary source or the secondary source.
SNMP trap status	Indicates whether the SNMP trap generation status is Enabled or Disabled on the router.

## Sample Output

### show chassis synchronization extensive

```

user@host> show chassis synchronization extensive
Current clock status : LOCKED
Clock locked to      : Primary
SNMP trap status     : Disabled

Configured ports:

Name                  : gnss-rx-0
Current ToD           : Sat Nov 12 14:14:19 2022 PST
Last ToD update       : Sat Nov 12 14:14:18 2022 PST
GPS receiver status   : Synchronized
UTC Pending           : FALSE
UTC Offset             : 37

One PPS status : Active

```

## show ptp lock-status detail

### IN THIS SECTION

- [Syntax | 28](#)
- [Description | 28](#)
- [Options | 28](#)
- [Required Privilege Level | 28](#)
- [Output Fields | 29](#)
- [Sample Output | 29](#)

## Syntax

```
show ptp lock-status detail
```

## Description

Display information about the lock status of the client. The output verifies whether the ACX7024 or ACX7024X router is locked to GNSS receiver.

## Options

This command has no options.

## Required Privilege Level

view

## Output Fields

Table 1 lists the output fields for the `show ptp lock-status detail` command. Output fields are listed in the approximate order in which they appear.

**Table 4: show ptp lock-status detail Output Fields**

Field Name	Field Description
Lock State	<p>State of the client clock with respect to its primary clock:</p> <ul style="list-style-type: none"> <li>• Freerun</li> <li>• Holdover</li> <li>• Phase Aligned</li> <li>• Acquiring</li> <li>• Initializing</li> </ul>
State since	<p>Date, time, and how long ago the lock status of the PTP client or client clock changed. The format is State since: year-month-day hour:minute:second:timezone (hour:minute:second ago). For example, 2022-11-10 04:18:40 PST (00:47:10 ago).</p>
Source	<p>Information about external clock sources.</p>

## Sample Output

### show ptp lock-status detail

```

user@host> show ptp lock-status detail
Lock Status:

Lock State      : 5 (PHASE ALIGNED)
State since     : 2022-11-10 04:18:40 PST (00:47:10 ago)

Source: GNSS

```

## show chassis synchronization gnss-receiver extensive

### IN THIS SECTION

- [Syntax | 30](#)
- [Description | 30](#)
- [Options | 30](#)
- [Output Fields | 30](#)
- [Sample Output | 33](#)

## Syntax

```
show chassis synchronization gnss-receiver extensive  
<time>
```

## Description

Display information about the status of the GNSS receiver.

## Options

**time** (Optional) Display GNSS receiver time information in detail.

## Output Fields

Table 1 lists the output fields for the `show chassis synchronization gnss-receiver extensive` command. Output fields are listed in the approximate order in which they appear.

**Table 5: show chassis synchronization gnss-receiver extensive Output Fields**

Field Name	Field Description
Lock status	<p>Indicates the lock status of the GNSS receiver:</p> <ul style="list-style-type: none"> <li>• Warmup—In this state the GNSS receiver waits for internal clock synchronization after you turn on the power supply.</li> <li>• Pull-in—In this state the receiver receives the signal from a satellite constellation.</li> <li>• Coarse-lock—In this state the receiver is locked to a satellite constellation but requires further synchronization.</li> <li>• Fine-lock—In this state the receiver is locked accurately to the satellite constellation and starts synchronizing.</li> <li>• Holdover—In this state the GNSS RF signals are lost or not strong enough to enable locking.</li> <li>• Out of Holdover—In this state 10-MHz frequency and 1-PPS signal are beyond holdover specification.</li> </ul>
Receiver-type	<p>Indicates the type of the receiver.</p> <p><b>NOTE:</b> Only TB-1 is supported.</p>
Port Status	<p>Indicates the status of the configured port.</p> <ul style="list-style-type: none"> <li>• Up— TB-1 is connected to ACX7024 or ACX7024X router (as applicable) and can communicate over channel.</li> <li>• Down— TB-1 is not connected.</li> </ul>
Port Details	GNSS receiver port details, type of interface, and speed.
Current TOD	The current time of the day indicated by the receiver.
UTC Pending	<p>The status of UTC leap collection by the receiver.</p> <ul style="list-style-type: none"> <li>• True— UTC parameters are not available.</li> <li>• False— UTC parameters are available.</li> </ul>
UTC offset (TAI-UTC)	UTC offset between International Atomic Time (TAI) scale and Coordinated Universal Time (UTC) scale.

**Table 5: show chassis synchronization gnss-receiver extensive Output Fields (Continued)**

Field Name	Field Description
Future leap sec & schedule	<p>Indicates the schedule and leap second correction values.</p> <p>A leap second is a one-second adjustment that is occasionally applied to Coordinated Universal Time (UTC) in order to keep its time of day close to the solar time.</p>
1PPS STATUS	<p>Indicates PPS signal received on the GPS interface of ACX7024 or ACX7024X router (as applicable).</p> <ul style="list-style-type: none"> <li>• Available— 1PPS from TB-1 is received on the GPS interface.</li> <li>• Not available—1PPS from TB-1 is not received on the GPS interface.</li> </ul>
10mhz status	<p>Indicates frequency output status of 10-MHz availability from receiver.</p> <ul style="list-style-type: none"> <li>• Available—10-MHz frequency from TB-1 is received on the GPS interface.</li> <li>• Not available—10-MHz frequency from TB-1 is not received on the GPS interface.</li> </ul>
Time source	The standard time source to which the receiver current time is aligned.
Alarms	<p>Alarm signals or messages. Possible messages are:</p> <ul style="list-style-type: none"> <li>• Spoofing detected</li> <li>• Jamming detected</li> <li>• Antenna short circuit</li> <li>• Receiver oscillator error</li> <li>• Receiver data errors</li> <li>• No PPS</li> <li>• No 10MHz</li> </ul>
Antenna port status	<p>Status of the configured antenna.</p> <ul style="list-style-type: none"> <li>• Open— No antenna is connected.</li> <li>• Good— Antenna is connected and detected.</li> <li>• Bad— Antenna is connected but failed to detect due to less antenna power circuitry within receiver.</li> </ul>



**Table 5: show chassis synchronization gnss-receiver extensive Output Fields (Continued)**

Field Name	Field Description
Constellation	Satellite constellation that GNSS detects and locks to.
Position mode	Position modes of the GNSS receiver.
Self Survey Length	Duration for which the GNSS receiver can survey its own position before moving to position-fix-mode. The Self-survey length is specified in minutes.
Cable Delay Compensation	Indicates the time duration to compensate the delay introduced due to RF cable which is routed from the antenna to TB1 RF input. Cable delay compensation is specified in nanoseconds.
Latitude	GNSS receiver's latitude in degree minutes.
Longitude	GNSS receiver's longitude in degree minutes.
Altitude	GNSS receiver's altitude in meters.
No. of Satellites Used	Number of satellites are used for position and time solutions.
Visible Satellite List	The current tracking satellite number, its signal strength in dBHz, and the constellation to which the satellite belongs.

## Sample Output

### show chassis synchronization gnss-receiver extensive

```
user@host> show chassis synchronization gnss-receiver extensive
```

```

Lock status           : warmup / pull-in / coarse-lock / fine-lock / holdover / out of holdover
Receiver-type         : TB-1
Port Status           : Up / Down
Port Details          : UART 9600 bps / USB
Current ToD           : 05:02:15 29/11/2019
UTC Pending           : FALSE
UTC offset (TAI-UTC)  : 37
Future leap sec & schedule : -99/+99 date and Time

```

```

1PPS STATUS           : Available /Not available
10MHz status          : Available /Not available
Time source           : GPS/UTC/USNO/SU/Eu/NCIT
Alarms                : NONE
Antenna port status:   : Open/Good(connected)/Bad
Constellation         : GPS L1CA
Position mode         : Position-fix-mode/survey-mode
Self Survey Length    : 120 mins
Cable Delay Compensation : 0 ns
Snr-threshold         : 0 dBHz
Latitude              : 37 33' 0.036000'' N
Longitude              : 126 58' 23.483999'' E
Altitude              : 976 m
No. of Satellites Used : 13

```

Visible Satellite List:

Sat-Num	Signal-level	Status	Type
222	41 dBHz	Acquired	GPS
216	40 dBHz	Acquired	GPS
213	40 dBHz	Acquired	GPS
209	39 dBHz	Acquired	GPS
202	39 dBHz	Acquired	GPS
221	38 dBHz	Acquired	GLONASS
205	37 dBHz	Acquired	Galileo