System Release 7.17
ASTRO® 25
INTEGRATED VOICE AND DATA

Network Time Protocol Server

NOVEMBER 2016

MN003337A01-A

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Document History

Version	Description	Date
MN003337A01-A	Original release of the *Network Time Protocol Server* manual.	November 2016

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About Network Time Protocol Server

This manual provides an introduction to the components that comprise the Network Time Protocol (NTP) server. Included are detailed procedures for installation and configuration of the TRAK 9100 NTP server, and procedures for replacing Field Replaceable Units (FRUs).

This manual is used by field service managers and field service technicians.

What Is Covered In This Manual?

This manual contains the following chapters:

- NTP Server Description on page 21, provides a high-level description of the Network Time Protocol (NTP) server and the function it serves on your system.
- NTP Server Theory of Operations on page 33, explains how the NTP server works in the context of your system.
- NTP Server Installation on page 37, describes installation procedures relating to the NTP server.
- NTP Server Configuration on page 43, contains configuration procedures relating to the NTP server.
- NTP Server Operation on page 59, describes tasks that you perform once the NTP server is installed and operational on your system.
- NTP Server Management on page 61, details management procedures relating to the NTP server.
- NTP Server Troubleshooting on page 63, provides fault management and troubleshooting information relating to the NTP server.
- NTP Server FRU/FRE Procedures on page 77, lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs), and includes replacement procedures applicable to the NTP server.
- TRAK 9100 NTP Server Reference on page 89, contains supplemental reference information relating to the NTP server.
- Configurations and Re-configuration Mechanisms for the NTP on page 95, contains information about NTP elements and their configuration.
- TRAK Devices on page 127 lists all TRAK models and explains where the devices are used.

Helpful Background Information

Motorola Solutions offers various courses designed to assist in learning about the system. For information, go to http://www.motorolasolutions.com/training to view the current course offerings and technology paths.

Related Information

For associated information about the Network Time Protocol (NTP) Server, see the following documents:

Related Information	Purpose
Standards and Guidelines for Communication Sites	Provides standards and guidelines that should be followed when setting up a Motorola communications site. Also known as the R56 manual. This manual may be purchased on CD 9880384V83, by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842)
System Documentation Overview	For an overview of the ASTRO® 25 system documentation, open the graphical user interface for the ASTRO® 25 system documentation set and select the **System Documentation Overview** link. It opens a file that includes: • ASTRO® 25 system release documentation descriptions • ASTRO® 25 system diagrams • ASTRO® 25 system glossary For an additional overview of the system, review the architecture and descriptive information in the manuals that apply to your system configuration.
ASTRO® 25 system *MOSCAD Network Fault Management Feature Guide*	Provides information about an optional solution that provides tools to collect and forward data concerning the state of devices in ASTRO® 25 systems. Includes information about installation, configuration, management, and use of MOSCAD® Network Fault Management (NFM).
SDM3000 (Site Device Manager) Owner's Manual	Provides information for the Motorola SDM3000 hardware-based devices and SDM3000 Input/Output Expansion Unit models. This documentation is installed with the SDM3000 Builder application on the MOSCAD® NFM Graphical Master Computer (GMC) and on some service laptop.
SDM3000 Builder User Guide	Provides information required to install, configure, manage, and use the SDM3000 Builder software used to set up and configure SDM3000 hardware-based devices (SDM3000 Remote Terminal Unit (RTU) and SDM3000 Network Translator (SNT). This documentation is installed with the SDM3000 Builder application on the MOSCAD® NFM Graphical Master Computer (GMC) and on some service laptops.

Chapter 1

NTP Server Description

The Network Time Protocol (NTP) performs time-synchronization of devices on a network. Time synchronization is critical because activities to manage, secure, and troubleshoot network devices often involve determining the timing of the alarms, events, and other information captured by event logs and software applications used to manage and support the system.

The NTP can provide synchronization within several milliseconds of Coordinated Universal Time (UTC), and NTP servers often employ Global Positioning System (GNSS) receivers to provide time synchronization.

1.1
Overview of NTP Servers in ASTRO 25 Systems

Most network devices in an ASTRO® 25 system are configured with a primary and secondary Network Time Protocol (NTP) source.

Zone Core and NTP

- Virtual Management Servers (VMSs) at the master site are used as first and second NTP servers providing time synchronization to NTP clients.
- Optionally, a TRAK device can also provide NTP services. If a TRAK device is used for NTP in a zone core, the VMSs typically obtain NTP from the TRAK device.
- Windows® devices joined to their active directory zone obtain their time from the domain controllers. The domain controllers are typically configured to obtain NTP services from the VMSs, or TRAK if present.
- For an M3 zone core, NTP services are mandatory and only the TRAK 9100-8E or TRAK 8835-3M devices are supported.
- For an L1, L2, M1, or M2 zone core, NTP services are optional and only the TRAK 9100-8E or TRAK 8835-3M devices are supported.
- For a K1 or K2 core, NTP services are optional and can be customer provided.

For the various TRAK devices supporting NTP in an ASTRO® 25 system, see TRAK Devices on page 127.

The TRAK can provide stratum 1 frequency and time reference for the servers and the network transport equipment on the master site LAN to ensure that the fault logging services, statistics, and other time-critical activities and procedures are synchronized.

Simulcast Subsystem and NTP

At the Prime Site, the NTP source (primary and secondary) varies depending on the device, but if a TRAK is used at the prime site, devices at the prime site obtain the NTP from the TRAK.

If the Prime Site is colocated with the Master Site, the TRAK could be used to provide both the Simulcast Site Reference and the NTP server functions.

For information about Simulcast Site Reference equipment, see the ASTRO® 25 system *Simulcast Site Reference* manual.

Other Devices and NTP

If supported, system elements capable of NTP operation are configured with one or two NTP server addresses. Motorola Solutions balances the number of devices assigned to NTP servers.

If the servers are powered down, disconnected from the rest of the network, or are physically damaged, a device uses its internal clock instead of one of the designated NTP servers.

The Motorola Supervisory Control and Data Acquisition (MOSCAD) Network Fault Management (NFM) Remote Terminal Units (SDM3000 RTU), can monitor the relay outputs from the TRAK NTP server.

For a detailed list of NTP servers assigned to NTP clients in ASTRO® 25 systems, see Configurations and Re-configuration Mechanisms for the NTP on page 95.

For a list of TRAK devices supporting NTP, see TRAK Devices on page 127.

1.2 TRAK 9100 NTP Server Introduction

The TRAK 9100 Network Time Protocol (NTP) server uses GNSS satellite signals to derive high-precision 1PPS and 5 MHz references.

The modules installed in the TRAK 9100 NTP Server include:

- GNSS receiver with Rubidium oscillator
- GNSS receiver with double oven oscillator
- AC/DC power supplies
- Digital Distribution Modules (DDMs)
- Telecommunications Modules (TEL module/Telco module)
- Fault Sense Unit (FSU) Module

The TRAK 9100 NTP Server supports high-availability by using redundant GNSS reference modules and redundant power supply modules.

Figure 1: TRAK 9100 NTP Server Front View

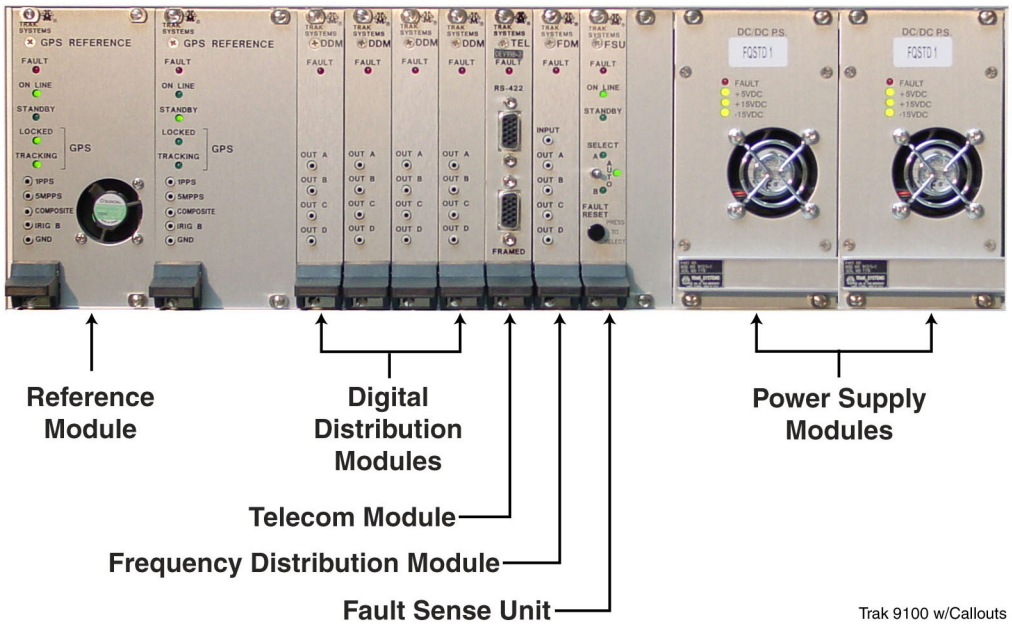
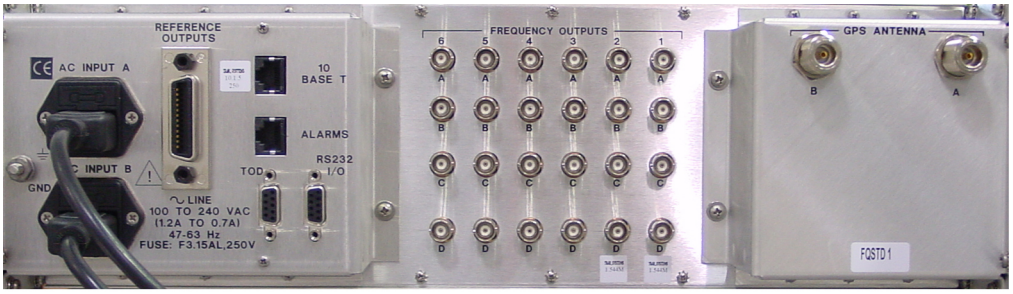


Figure 2: TRAK 9100 NTP Server Rear View



TRAK9100_Rear

1.2.1
TRAK 9100 NTP Server Operating Specifications

This table provides the physical and operating specifications for the TRAK 9100 Network Time Protocol (NTP) server.

Table 1: TRAK 9100 Physical and Operating Specifications

Specification	Value or Range
Physical Dimensions	Height: 13.34 cm (5.25 in.) (3 Rack Units)
	Width: 48.26 cm (19 in.)
	Depth: 38.1 cm (15 in.)
Weight	Approximately 11.3 kg (25 lb) with all modules installed
Operating Temperature	–30 °C to +60 °C (–22 °F to +140 °F)
Power Requirements	100-240 VAC ± 10%, 48-63 Hz, single-phase; 20-60 VDC
Heat Dissipation	120 W at power-up; tapers to approximately 80 W within 15 minutes of power-up at 25 °C (77 °F)

1.3
TRAK 8835 Site Reference Introduction

Overview of the TRAK 8835 Site Reference

The TRAK 8835 Site Reference is used in a conventional analog subsystem, high availability, receive-only (optional) remote site and ASTRO® 25 repeater sites that support 10Base-T Ethernet Epic IV or Epic VI QUANTAR® stations or a mix of QUANTAR® stations with standalone GTR 8000 Base Radios or GTR 8000 Expandable Site Subsystem cabinets/racks configurations.

IMPORTANT: The TRAK 8835 Site Reference device is certified only for use at an ASTRO® 25 repeater site and circuit-based or IP-based analog-only voting subsystems.

The TRAK 8835 functions as a:

- Network Timing Protocol (NTP) services (TRAK 8835-3M)
- Global receiver, that supplies stratum 1 frequency and time reference for equipment at the prime/hub site and remote base radio site in an analog-only conventional distributed subsystem (TRAK 8835-2M/8M and TRAK 8835-3M)

- The GNSS receiver that supplies stratum 1 frequency and time reference for equipment at the remote base radio site in a digital-only conventional distributed subsystem (with QUANTAR® stations) (TRAK 8835-2M/8M and TRAK 8835-3M)
- Backup 1PPS signal frequency holdover at both trunked IP simulcast remote high availability sites and trunked receive-only remote sites with Time Division Multiple Access (TDMA) or Enhanced Data operation (TRAK 8835-3M)
- 5 MHz reference to QUANTAR® stations at an ASTRO® 25 repeater site
- 5 MHz reference to standalone GTR 8000 Base Radios at an ASTRO® 25 repeater site
- Composite (1PPS + 5 MHz) reference to standalone GTR 8000 Base Radios and 1PPS reference to standalone GCP 8000 Site Controllers for TDMA and Enhanced Data at an ASTRO® 25 repeater site

The TRAK 8835-8M and TRAK 8835-3M Site Reference hardware with a dongle adapter provides:

- Time and frequency stability (Stratum 1 accuracy when tracking GNSS)
- DOCXO or Rubidium Oscillator
- 48 VDC option: [36 to 72 VDC]
- 10 MHz on a BNC connector
- 1PPS on a BNC connector
- RS–232 and 10 / 100 base-T Ethernet Port
- Dongle Adapter:
  - Composite on a BNC connector (1PPS + 5 MPPS) signal
  - 5 MHz signal on a BNC connector
  - RS-232 I/O on a 9-Pin “D” Connector

TRAK 8835-8M and TRAK 8835-3M Site Reference devices support SNMPv3 and send Simple Network Management Protocol (SNMP) traps to the Unified Event Manager (UEM) to provide centralized fault management.

TRAK 8835-2M devices are not certified for Secure SHell (SSH), Telnet, SNMP, or NTP. TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.

Overview of TRAK 9100 Simulcast Site Reference and NTP Services

The TRAK 8835-3M Site Reference provides precise time and frequency output signals to support NTP services and simulcast site (frequency) reference functionality. The NTP services ensure that fault logging services, statistics, and other time-critical procedures are synchronized. The following NTP servers (TRAK devices) can be installed as an option based on the following zone cores:

- For an M3 zone core, NTP services are mandatory and only the following TRAK devices are supported: TRAK 9100-8E or TRAK 8835-3M.
- For an L1, L2, M1, or M2 zone core, NTP services are optional and only the following TRAK devices are supported: TRAK 9100-8E or TRAK 8835-3M.
- K1 or K2 core, NTP services are optional, and simulcast site reference devices are customer provided.

For additional information on NTP services, see the *Network Time Protocol Server* manual.

Overview of TRAK 8835 in an IP Simulcast Remote Site with High Availability in a GTR 8000 Expandable Site Subsystem and Receive-only Remote Site with TDMA

For a GTR 8000 Expandable Site Subsystem at an IP simulcast remote site with high-availability, and a receive-only remote site with TDMA or Enhanced Data operation, an optional backup for the frequency and time references is supplied to the base radios and is available through a TRAK 8835-3M Site Reference. The backup Simulcast Site Reference (SSR) provides an extended holdover of at least 72 hours when redundant GNSS or certain GPB 8000 Reference Distribution Module (RDM) failures occur. If an optional TRAK SSR at the remote site is used as an extended holdover backup, the RDM can be configured in the following configurations to either provide support or act as a replacement for the GNSS units:

- Each RDM connected to a GNSS unit
- One RDM connected to a GNSS unit
- No RDMs connected to a GNSS unit

Overview of TRAK 8835 in a Receive-only or Single Transmitter Receiver Voting Remote Site Subsystem with TDMA or Enhanced Data

In a receive-only or Single Transmitter Receiver Voting (STRV) remote site subsystem with TDMA or Enhanced Data operation, two GNSS receivers and a TRAK (optional) are used for a longer duration frequency holdover to provide reference through the RDM. An optional backup for the frequency and time references supplied to the receiver is available either through a TRAK 8835-3M or TRAK 9100 Site Reference. The backup TRAK 8835-3M or TRAK 9100 Site Reference provides an extended holdover of at least 72 hours when redundant GNSS or certain RDM failures occur.

Overview of TRAK 8835 in an ASTRO 25 Repeater Site with Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with standalone GTR 8000 Base Radios, and standalone GCP 8000 Site Controllers controlling more than six base radios, a 5 MHz frequency reference is supplied to the base radios. For a site with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the base radios, and 1PPS time reference to the GCP 8000 Site Controllers.

The TRAK 8835 is supported in the following configurations:

- Standalone GCP 8000 Site Controllers controlling more than six standalone GTR 8000 Base Radios – External Reference Only
- Standalone GCP 8000 Site Controllers controlling more than six standalone GTR 8000 Base Radios – GCP 8000 Site Controllers and External Reference

Both the site controllers and the TRAK 8835 together can provide a redundant LAN interface and a redundant time and frequency reference interface. Base radios one through six connect directly to the site controllers. The base radio transceiver generates the station reference, which typically must be locked onto the site controller TDMA clocks for time and frequency reference. Base radios seven through 28 connect to the TRAK 8835 to provide a 5 MHz frequency reference. See the *ASTRO 25 Repeater Site Infrastructure Reference Guide* for further details.

NOTICE: The TRAK 9100 must be used when more than eight base radios requiring external references are at the site.

Overview of TRAK 8835 in an ASTRO 25 Repeater Site with QUANTAR Stations With or Without Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with QUANTAR® stations with or without standalone GTR 8000 Base Radios:

- Standalone GCP 8000 Site Controllers controlling six or less QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal Ultra-High Stability Oscillator (UHSO) or an external TRAK 8835 device.
- Standalone GCP 8000 Site Controllers controlling more than six QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers.

NOTICE: The TRAK 9100 must be used when more than eight channels are at the site.

Overview of TRAK 8835 in an ASTRO 25 Repeater Site with QUANTAR Stations and GTR 8000 Expandable Site Subsystem

In an ASTRO® 25 repeater site with QUANTAR® stations and GTR 8000 Expandable Site Subsystem, TRAK devices are used in the following configurations:

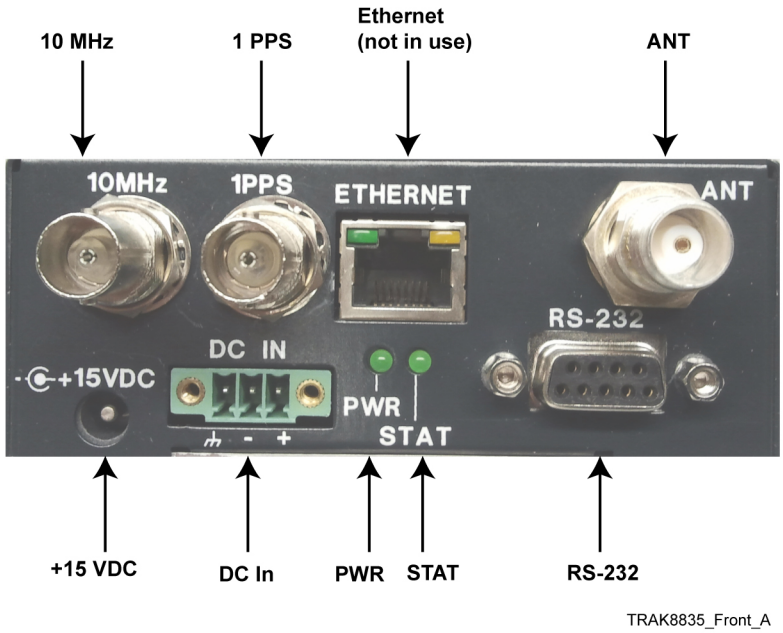
- A GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device.
- A GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device.
- A GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device.
- A GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external or TRAK 8835 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations requiring external references are at the site.

1.3.1 TRAK 8835 Site Reference Front View

The Network Ethernet interface port supports 10 / 100 Base T Protocols: Telnet, Secure SHell (SSH), FTP, Simple Network Management Protocol (SNMP), and Network Time Protocol (NTP). TRAK 8835-2M devices are not certified for SSH, Telnet, FTP, SNMP, or NTP. TRAK 8835-8M devices are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support. All TRAK 8835-3M devices are fully certified for SSH, Telnet, SNMP, or NTP.

Figure 3: TRAK 8835 Front View



1.3.1.1

TRAK 8835 Site Reference Front Connections

This table provides descriptions of the TRAK 8835 connections and their functions.

Table 2: TRAK 8835 Connections

Port Label	Connector Type	Port Function	Mating Connection
10 MHz	BNC female	10 MHz signal	BNC male
1PPS	BNC female	1PPS time reference	BNC male
ETHERNET	RJ-45	10 / 100 Base T Protocols: Telnet, SSH, FTP, SNMP, and NTP. TRAK 8835-2M devices are not certified for Secure SHell (SSH), Telnet, Simple Network Management Protocol (SNMP), or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.	RJ-45
ANT	TNC-female	Global Navigation Satellite System (GNSS) antenna input and antenna +5 VDC power	TNC-male
+15 VDC	2.5 mm jack	+15 VDC power input from external AC/DC power supply	2.5 mm plug
DC IN	Header	DC power input, 48 VDC, customer supplied voltage	Terminal block

Table continued…

Port Label	Connector Type	Port Function	Mating Connection
RS-232	DB-9 female	RS-232 port is configured for 9600 baud, 8 data bits, 1 stop bit, and no parity. Additional ports are available through the Dongle Adapter: • Composite (1PPS + 5 MHz) time and frequency reference • 5 MHz signal • RS-232 I/O	Dongle adapter mating connections: • BNC male • BNC male • DB-9 male

1.3.1.2 TRAK 8835 Site Reference LEDs

The two status indicator LEDs on the front of the TRAK 8835 Site Reference are:

PWR
Power indicator, green shows the state of the TRAK 8835 power supply.

STAT
Status indicator, green shows the state of the TRAK 8835 Global Navigation Satellite System (GNSS) signal

1.3.2 TRAK 8835 Site Reference Power Supply

The TRAK 8835 Site Reference is supplied with an internal DC/DC converter option for 48 VDC operation. Power input floats with respect to ground, therefore can be connected to a positive or negative supply voltage. The 48 VDC operates for 36 to 72 VDC.

Power consumption for an optional, external AC/DC power supply is available for the TRAK 8835 Site Reference to operate the unit from AC power. This power supply operates from 100 to 240 VAC, 47 to 63 Hz, and supplies 15 VDC at a maximum power output of 30 W.

1.3.3 TRAK 8835 Site Reference Operating Specifications

This table provides physical and operating specifications for the TRAK 8835 Site Reference.

Table 3: TRAK 8835 Physical and Operating Specifications

Specification	TRAK 8835-8M Value or Range	TRAK 8835-3M Value or Range
Physical Dimensions, Models TRAK 8835	Crystal Oscillators (inches): 5 L x 4 W x 1.6 H	Rubidium Oscillators (inches): 10.4 L x 4.04 W x 1.6 H
Weight	approximately 1.5 lb	
Mounting	Six #6–32 screw holes in a base. For mounting screw locations, see Chapter 2 in the *TRAK Technical Manual (D001571) Model 8835 GNSS Clock* manual.	

Table continued…

Specification	TRAK 8835-8M Value or Range	TRAK 8835-3M Value or Range
Optional Mounting	1 U rack mounting adapter	
Operating Temperatures	– 30 ºC to +60 ºC	
Storage Temperatures	– 45 ºC to +85 ºC	
Humidity	95% non-condensing	
DC power operating range	48 VDC (source); 36 to 72 VDC (maximum) DOCXO options: 15 W at power-up / 7.5 W steady state	48 VDC (source); 36 to 72 VDC (maximum) Rubidium option: 23 W at power-up / 12.5 W steady state
DC power current draw	Less than 1.0 A at 48 VDC	
AC power operating range	100 to 240 V, 47 – 63 Hz	
Power Consumption	15 – 80 W	

1.3.4
TRAK 8835 Site Reference Power Supply Operating Specifications

This table provides the operating specifications for the TRAK 8835 AC-DC power supply. For additional Input, Output, General, EMC, and Safety specifications for the AC-DC Power Supply, see the *TRAK Technical Manual (D001571) Model 8835 GNSS Clock* manual.

Table 4: TRAK 8835 AC-DC Power Supply Operating Specifications

Specification	AC-DC Power Supply
Input Voltage	90 – 264 VAC
Input Frequency	46 – 63 Hz
Operating Temperature	–20 °C to +70 °C, derate linearly from 100% power at +40 °C to 50% power at +70 °C
Watts	15 – 80 W
Storage Temperature	–40 °C to +85 °C
Cooling	Convection cooled
Operating Humidity	5 – 95% RH, non-condensing
Operating Altitude	3000 m
Shock	10 g. 10 ms on 3 axes

1.3.5
TRAK 8835 Site Reference DC In Connector Wiring

Table 5: TRAK 8835 +15 VDC In Connector Wiring

Pin Number	Signal
1	Ground
2	– DCV (not ground referenced)
3	+ DCV (not ground referenced)

1.3.6
TRAK 8835 Site Reference 15 VDC In Connector Wiring

Table 6: TRAK 8835 +15 VDC In Connector Wiring

Pin	Signal
Center	+15 VDC
Shell	Ground

For additional Input, Output, General, EMC, and Safety specifications for the AC-DC Power Supply, see *TRAK Technical Manual (D001571) Model 8835 GNSS Clock* manual.

1.4
GNSS Receiver Operating Specifications

Table 7: GNSS Receiver Operating Specifications

Specification	Value or Range
Frequency	L1 (1575.42 MHz) C / A code
Channels	50 channels, independent and continuous tracking
Acquisition time	< 1 minute, cold start
External gain	15 dB to 50 dB
Antenna power	+ 5 VDC (5 – 80 mA)
Connector	TNC female

1.5
GNSS Antenna Operating Specifications

Table 8: GNSS Antenna Operating Specifications

Specification	Value or Range
Physical Dimensions	Diameter: 8.89 cm (3.5 in)
	Height: 10.16 cm (4.0 in)
Weight	0.32 kg (0.7 lb) (excluding mast)

Table continued…

Specification	Value or Range
Operating Temperature	–40 °C to +85 °C (–40 °F to +185 °F)

1.6

No Lock on GNSS Signal Alarm Indication

If a system alarm indicates that the GNSS signal cannot be located, reposition the antenna.

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Chapter 2

NTP Server Theory of Operations

This chapter explains how the Network Time Protocol (NTP) server works in the context of your system.

2.1 TRAK 9100 Modules and Slot Assignments

The number and type of modules varies based on the system requirements of your organization.

The modules and slot assignments for your TRAK 9100 Network Time Protocol (NTP) Server may be different from those presented in this table.

Table 9: Modules for TRAK 9100

TRAK 9100 Chassis Slot	Module
A1	Global Positioning System (GNSS) Reference Module 1 • 10 MHz Rubidium Oscillator • GNSS Receiver • Front-panel fan for cooling
A2	GNSS Reference Module 2 • 10 MHz Double Oven Oscillator • GNSS Receiver • No front-panel fan In non-redundant configurations, GNSS reference module A2) is omitted.
A3 – A8	Digital Distribution Module (DDM) • 1 Pulse Per Second (PPS), 5 MPPS, or Composite distribution • Four outputs of one signal type, per module Telecommunications Module (Telco Module) • Two High-Density (HD) 15-pin D-sub connectors in the front • Provides T1 frame reference for the Digital Access Cross-connect Switch (DACS) (when supporting conventional channels)
A9	Fault Sense Unit (FSU) with Network Time Server (NTS)/NTP option • Detects system module faults • Provides switching signals to output modules • Contains alarm, RS232, and NTS/NTP circuitry
A10	blank
A11 – A12	Power Supply Modules • Provides power for modules • Two power supplies are used for redundancy

TRAK 9100 Chassis Slot	Module
	In non-redundant configurations, power supply module A12 is omitted.

2.2

TRAK 9100 Components and Architecture

Each TRAK 9100 Network Time Protocol (NTP) Server includes redundant GNSS receiver modules, a Fault Sense Unit (FSU), and redundant power supplies. If the TRAK 9100 is used as an NTP server at the Master Site, it includes a Telecommunications module to support T1/E1 time clocking.

Figure 4: NTP Server Architecture

This figure shows the NTP server configuration at the Master Site.

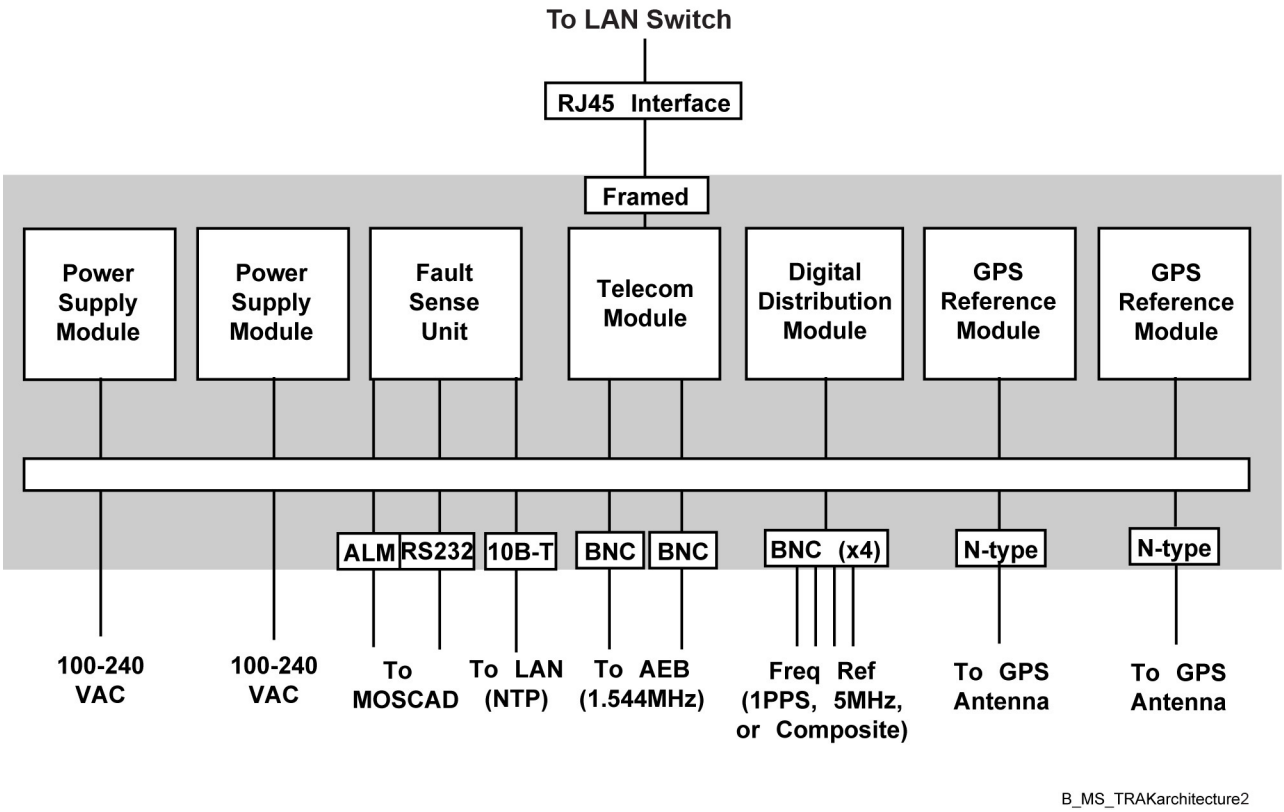

Table 10: NTP Server Components

The number and type of modules vary based on your system requirements.

Component	Description
GNSS Reference Module	Redundant GNSS reference modules are installed in the NTP server. The left module includes an oscillator and built-in fan. The right module includes a 10 MHz crystal oscillator. Each GNSS reference module includes a receiver which tracks and locks onto satellites for GNSS discipline of their internal clocks. Each GNSS reference module provides 1PPS, 5 MPPS, and a composite 1PPS + 5 MPPS outputs to the backplane, for use by other modules in the chassis. The modules can be manually switched through the FSU

Table continued…

Component	Description
	module, or automatically switched when an output failure or other fault occurs.
Digital Distribution Module (DDM)	Some DDMs can be configured to provide 1PPS, 5 MPPS, or composite (1PPS + 5 MPPS) references to other components in the system. These modules are used to support the ASTRO-TAC™ 9600 comparators/QUANTAR® (1PPS and 5 MPPS inputs) and STR 3000/GTR 8000 Base Radio for Multi-Site (composite inputs).
Telecommunications Module	Provides T1 frame reference for Digital Access Cross-connect Switch (DACS) (when supporting conventional channels).
Fault Sense Unit (FSU)	Monitors the overall system activities within the NTP server and reports any events through the RS232 I/O port or alarm relay present in the rear of the chassis. The FSU determines the active GNSS reference module through a switch on the front of the module, which can be set to A, B, or AUTO.
Power Supply Module	Redundant 100-240 VAC input power supply modules provide +5 VDC, +15 VDC, and -15 VDC reference output to other components in the NTP server. Each AC input has a 3 A slow blow fuse.

2.3 NTP Server Signal Outputs Configuration

The Network Time Protocol (NTP) server requires configuration before the system can use it. Use your as-built documentation for the specific settings.

2.4 TRAK 9100 Hardware Modules

This table lists and describes the TRAK 9100 Network Time Protocol (NTP) Server Hardware Modules.

Table 11: TRAK 9100 NTP Server Hardware Modules

The number and type of modules varies based on your system requirements.

Module	Description
Antenna	Global Positioning System (GNSS) antenna.
GNSS Reference (A1)	Contains a Rubidium oscillator and generates 1 PPS and 5 MPPS reference signals. This module has a fan that cools and stabilizes the oscillator.
GNSS Reference (A2)	Contains a double oven crystal oscillator included for redundancy.
Power Supply	Converts AC input to DC voltages that all other NTP server modules use.
Fault Sense Unit	Detects system failures and provides control, alarm, and status information.
Telecom Signal Generator	Provides four outputs: 1.544 MHz, 2.048 MHz, T1/E1 framed signals, and E1 framed signals that connect to the channel bank for T1/E1 or E1 synchronization.
Digital Distribution Module (DDM)	Can be configured for 1PPS, 5 MPPS, or composite signals that the ASTRO-TAC™ 3000/6900 Comparators and Base Radios use. The DDMs provide the time reference for comparators and Base Radios and are used for 1PPS and 5 MPPS signals.

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Chapter 3

NTP Server Installation

This chapter details installation procedures relating to the Network Time Protocol (NTP) server.

3.1 TRAK 9100 NTP Server Equipment Rack

The TRAK 9100 Network Time Protocol (NTP) Server is a rack-mounted assembly that you install on 48.26 cm (19 inch) equipment racks. The TRAK 9100 is secured to an equipment rack before shipment.

Figure 5: TRAK 9100 NTP Server in Equipment Rack

This figure shows a TRAK 9100 NTP Server installed in a standard 48.26 cm (19 inch) equipment rack along with a small interface panel.

TRAK_9100_mastersite

The TRAK 9100 provides framed T1 or E1 output signal to a High Density (HD) 15-pin female connector on the front of the Telecommunications (Telco) module. The Digital Access Cross-connect Switch (DACS) serves as a clock reference when mutual aid is required. Access to the 15 pins is accomplished by running a cable from this connector to a small interface panel attached to the rack (as shown in the figure). The interface panel acts as an adapter to connect the RJ-45 Ext Clk ports on the DACS to the Telco module on the TRAK 9100. The HD 15-pin connector for the RS422 outputs rarely appear in the ASTRO® 25 systems.

3.2 Installing the TRAK 9100 NTP Server

Perform this procedure to install the TRAK 9100 Network Time Protocol (NTP) Server at your site.

Procedure:

1. Install the TRAK 9100 NTP Server in a standard EIA/TIA 48.26 cm (19 inch) rack.
2. Ground the chassis by connecting the grounding cable to the ground lug. The ground lug is a screw on the back of the chassis and is located to the left of the AC power receptacles.

   Use #6 AWG wire to connect the appropriate lug (connected to chassis ground) to the Rack Grounding Bar (RGB).

3 Connect power wiring to two AC input connectors on the rear of the panel provide power to all the modules in the TRAK 9100.

4 Install the GNSS antenna. See Installing the GNSS Antenna on page 38.

5 Cable the server:

- For the TRAK 9100 hardware cables, see TRAK 9100 NTP Server Cabling on page 38.
- For the TRAK 8835 hardware cables, see TRAK 8835 Site Reference Cabling on page 42.

3.3 Installing the GNSS Antenna

Perform this procedure to install the GNSS antenna.

Procedure:

1 Mount the GNSS antenna with an unrestricted aerial down view to within 10° of the horizon in all directions.

2 Mount the antennas high enough to clear the peak of the site roof using the following guidelines:

- For systems in the northern hemisphere, mount the GNSS antennas such that a clear view of the southern sky is maintained.
- For systems in the southern hemisphere, mount the GNSS antennas such that a clear view of the northern sky is maintained.

3 Isolate the GNSS antennas from RF interference by mounting the antennas at a distance of at least 3.66 m (12 ft) horizontally from the other antennas.

4 Mount the GNSS antennas such that they do not have any obstructions and have a clear path.

Adjacent structures (such as trees or buildings) are considered obstructions due to their wide and solid profiles.

Adjacent antenna towers at the RF site which protrude into the required view are not considered obstructions. They have a minimal effect on GNSS satellite reception due to their narrow, largely open profiles.

3.4 TRAK 9100 NTP Server Cabling

All output signal connections interfacing to the network are made through the TRAK 9100 Network Time Protocol (NTP) Server rear panel. The connections are:

- Two power supply (AC or DC) connectors
- Two GNSS antenna N-type connectors
- An RJ-45 connector for 10Base-T to distribute Coordinated Universal Time (UTC) through NTP
- An RJ-45 connector for alarm (relay contacts) reporting
- A DB-9 connector for Time of Day (TOD) output
- An RS-232 DB-9 connector for diagnostics (VT1/E100)
- A BNC connector board with four ports. Six boards can be used for a total of 24 BNC connectors depending on the number of channels. The boards are used for:
  - 1PPS
  - 5 MPPS
  - 1PPS + 5 MPPS composite signals, framed 1.544/2.048 Mbps TTL, and IRIG-B (or 10 MHz if desired) outputs depending on the type of modules plugged at the front panel.

Depending on your system configuration, IRIG-B time code may not be present at the Prime Site.

All cables are connected between the BNC T-adapters mounted to the appropriate module connector.

3.4.1
TRAK 9100 NTP Server Connections

These tables list the front and rear connections and their descriptions for the TRAK 9100 Network Time Protocol (NTP) Server.

Table 12: TRAK 9100 NTP Server Front Connections

Port	Connector Type	Link Type	Port	Connector Type	Description
Telco Framed	DB-15 Female	Framed T1/E1	Any device requiring a framed clocking reference	Varies by device	Connection based on whether a Telecommunications (Telco) module was ordered. More than one Telco module may be present depending on your configuration in your organization.
Telco RS422	DB-15 Female	RS422	N/A	N/A	On the same card as the Framed output, but is not used.

Table 13: TRAK 9100 NTP Server Rear Connections

Port	Connector Type	Link Type	Port	Connector Type	Description
AC inputs: A and B	AC power	100-240 VAC	100-240 VAC	Standard AC plug	Connects to an external AC power supply (user supplied).
DC inputs: A and B	DC power	20-60 VDC	20-60 VDC	DC power	Available for DC powered sites.
Frequency outputs	BNC Female	Configured for 1PPS, 5 MHz, or composite distribution	Devices requiring reference frequencies	BNC Female	Used for the outputs of Dynamic Dual Mode (DDM) devices. The ports are labeled as A, B, C, and D. All four ports are configured for the same frequency output. Each port is configured for one of the following frequency outputs: 1PPS, 5 MHz, or composite.
10Base-T	RJ-45	Ethernet	LAN switch	RJ-45	Path for the NTP data. The LAN switch port number varies depending on the site type.
RS232 I/O	DB-9 Female	RS232	Three possible connections are: • To the Terminal Server • To the Network Fault Manage-	RJ-45	This port is the console port for the TRAK 9100. Connect an adapter DB-9 to RJ-45; then connect it to the terminal server for remote access to the TRAK 9100; or connect it to the SDM3000 RTU for routing diagnostic information (alarms). It cannot do both at the same time. It is also possi-

Table continued…

Port	Connector Type	Link Type	Port	Connector Type	Description
			ment (NFM) XC Remote Terminal Unit (RTU) or SDM3000 RTU • No connection		ble to leave this port open and only connect to it locally for service.
Alarms	RJ-45	N/A	N/A	N/A	N/A
TOD	DB-9 Female	N/A	N/A	N/A	N/A
GNSS Antennas: A and B	N-Connector	Coax	GNSS Antenna system	Dependent on GNSS antenna used	Connects the TRAK 9100 with the GNSS antennas. They are the antenna inputs for the GNSS reference modules.

3.5
TRAK 9100 Cable Connections to Devices

The TRAK 9100 Network Time Protocol (NTP) Server installation involves setting up the cable connections with the following devices:

- Ethernet LAN Switch
- Digital Access Cross-connect Switch (DACS)

These devices are only at the Master Site.

If the Prime Site and Master Site are colocated, the connections described in this section apply to the Prime Site. The TRAK 9100 NTP Server covers the Master Site and Prime Site.

3.5.1
Connections to the Ethernet LAN Switch

NTS is a daughter board installed on the Fault Sense Unit (FSU) module (its presence depends on your system configuration). It provides time synchronization for Ethernet devices using the Network Time Protocol (NTP) Server.

The port that physically connects the TRAK 9100 NTP Server to the Ethernet LAN switch at the Master Site is the 10Base-T port (an RJ-45 connector) on the rear of the TRAK 9100 NTP Server.

The default IP address of the NTP server (10Base-T connector) takes the format x.**<*Z*>**.x.x, where **<*Z*>** is the zone number. Contact your system administrator for this IP.

Table 14: Ethernet LAN Switch Connection Interface Requirements

From Device	Port/Type	Cable	To Device	Port/Type
TRAK 9100	10Base-T Ethernet / RJ-45 (rear)	Cat 5	Ethernet LAN Switch	See the *Master Site Infrastructure Reference Guide* .

3.5.2
Connections to Digital Access Cross-Connect Switch

Follow the instructions in this section to connect the TRAK 9100 Network Time Protocol (NTP) Server to the Digital Access Cross-connect Switch (DACS).

3.5.2.1
Framed T1 or E1 Output Telco Module

When mutual aid is a requirement at the Master Site, the TRAK 9100 Network Time Protocol (NTP) Server provides synchronization signals to the Digital Access Cross-Connect Switch (DACS) at the Master Site through a framed T1 or E1 output connector on the Telecommunications (Telco) Module. The framed T1 or E1 output signal is provided to a High-Density (HD) 15-pin (female) connector on the front of the TRAK 9100 NTP Server.

Table 15: Telco Module Framed T1 or E1 HD 15-Pin Connector Pinouts

Pinouts for this HD 15-pin connector are listed in this table.

Pin	Function	Pin	Function
1	Output A, +	6	Output A, –
2	Output B, +	7	Output B, –
3	Output C, +	8	Output C, –
4	Output D, +	9	Output D, –
11 - 15	Ground	5 and 10	No Connection

3.5.2.2
Digital Access Cross-Connect Switch

The Front Connector, Alarm, and Power Feed (FCAPF) panels on the Digital Access Cross-Connect Switch (DACS) provide two external clock inputs, Ext Clk1 and Ext Clk2.

Table 16: External Clock Connector Pinouts

This table provides pinouts for the RJ-45 connectors used for the Ext Clk1 and Ext Clk2 ports on the front panel of the DACS.

Pin	Function	Pin	Function
1	Reserved	5	Not used
2	Reserved	6	Not used
3	T1/E1 clock	7	BITS +
4	T1/E1 clock	8	BITS –

3.5.2.3
TRAK 9100 NTP Server Cable and Port Connection Requirements

This table provides connection information for the TRAK 9100 Network Time Protocol (NTP) Server Digital Access Cross-Connect Switch (DACS).

Table 17: Digital Access Cross-Connect Switch

From Device	Module	Port Type/Cable	To Device
TRAK 9100	Telecommunications (Telco) Module - Framed T1 or E1 Output connector (HD 15-pin on the front)	Framed T1 or E1 HD 15-pin output connector (front)	Ext Clk 1 on the front panel
TRAK 9100	Telco Module - Framed T1 or E1 Output connector (HD 15-pin on the front)	Framed T1 or E1 HD 15-pin output connector (front)	Ext Clk 2 on the front panel

3.5.2.3.1
RJ-45 Interface Panel to EXT CLK1 and EXT CLK2 Ports

Connect a CAT 5 cable (terminated at both ends with male RJ-45 connectors) from one of the female ports on the RJ-45 interface panel to the Ext Clk1 port on the Digital Access Cross-Connect Switch (DACS). Connect another CAT 5 cable (terminated at both ends with RJ-45 connectors) from the other female port on the RJ-45 interface panel to the Ext Clk2 port on the DACS.

3.5.2.3.2
Telco Module HD 15 Connector to RJ-45 Interface Panel

Connect a cable from the TRAK 9100 Network Time Protocol (NTP) Server to the pin side of an RJ-45 interface panel. It supports access to the HD 15 pins required by the Digital Access Cross-Connect Switch (DACS). Terminate the cable at one end with an HD 15-pin male connector, then terminate the other end with two female RJ-45 connectors attached to an RJ-45 interface panel.

3.6
TRAK 8835 Site Reference Cabling

All output signal connections interfacing to other devices are made through the front panel. The TRAK 8835 Site Reference connections are:

- Two power supply (AC or DC) connectors.
- One GNSS antenna N-type connector.
- One DB–9 connector supports dongle adapter connection used for 5 MPPS (5 MHz) signal, Composite (1PPS + 5 MPPS) time and frequency reference and RS-232 I/O for a remote setup and monitoring (RQBT Request BIT Status).
- Two BNC connectors – 10 MHz signal and 1PPS signal.
- RJ-45 connector for device connections.
- A network interface port that provides Secure SHell (SSH), Telnet, Simple Network Management Protocol (SNMP), and Network Time Protocol (NTP) is available on the TRAK 8835-3M and TRAK 8835-8M.

Chapter 4

NTP Server Configuration

Before it is used by the system, configure the TRAK 9100 Network Time Protocol (NTP) Server. See the system-specific configuration documentation provided by Motorola Solutions.

Few parameters need programming in an NTP server. These parameters include: IP address and subnet mask of the NTP engine, and the holdover time, daylight savings, local time, antenna cable length, and so on, in the GNSS engine.

Configure the Digital Distribution Module (DDM) and Telecommunications (Telco) module using jumper settings.

4.1 Network Time Server Configuration

The Network Time Server (NTS) board installed on the Fault Sense Unit (FSU) module requires configuration for proper system operation.

Change the default IP address and netmask address of the NTP server so that it can operate on the system network.

Follow the appropriate procedure in the list to change the IP address of the NTP server for your system, if necessary:

- See Configuring IP Address with Default IP on page 43 for the NTP server that uses its stored, factory-default IP address
- See Configuring IP Address Without Default IP on page 44 in the following scenarios:
  - The factory-default IP address is in use on the network by another device
  - A non-valid IP address is loaded into the NTS engine by mistake
  - The IP address is unknown

Address Resolution Protocol (ARP) is required to change the address in Configuring IP Address Without Default IP on page 44.

The NTP source for any device capable of being configured with two NTP servers in the network is dependent on the state of the NTP servers configured for the device. The NTP algorithm automatically uses the better of the NTP timing resources. In all cases, Motorola Solutions balances the number of devices between the NTP servers. A device uses its internal clock instead of one of the designated NTP servers in the following instances: the servers are powered down; disconnected from the rest of the network; or physically damaged.

4.1.1 Configuring IP Address with Default IP

Configure the IP address when the Network Time Protocol (NTP) server uses its stored, factory-default IP address.

Prerequisites:
Obtain the following:

- The default IP address (contact your system administrator)
- The system IP plan or system-specific configuration documentation provided by Motorola Solutions for the appropriate number of bits (required in step 7 of this procedure)

Procedure:

1. Establish a telnet session with the Network Time Server (NTS). Use the default IP address (in the format `x.<Z>.x.x`, where **<*Z*>** is the zone number) and enter Port `9999`.
2. When logged on, press ENTER quickly within 3 seconds to enter ACOLA setup mode.

   The following message appears:

   ```
   Change setup (0 Basic configuration, 1 NTS configuration,
   7 Factory defaults, 8 Exit without save, 9 Save, and exit)?
   ```

3. Select **Basic Configuration**. Press ENTER.
4. Enter the IP address: `x.<Z>.x.x`
5. At the **Set Gateway IP address Default (Y)** prompt, press ENTER.
6. Enter the gateway IP address: `x.<Z>.x.x`
7. Enter the number of bits used for the network class. Setting the network class requires that you know the class of the network your system is using:
   - 8 for Class A network
   - 16 for Class B network
   - 24 for Class C network
8. At the `Telnet configuration Default (N)` prompt, press ENTER.
9. To exit and save these entries, enter 9

The IP address setup completes. The NTS on the Fault Sense Unit (FSU) module is now ready for NTP.

4.1.2
Configuring IP Address Without Default IP

Perform this procedure under the following conditions:

- When the factory-default IP address is in use on the network by another device
- When a non-valid IP address is loaded into the Network Time Server (NTS) engine by mistake
- When the IP address is unknown

Prerequisites: Obtain the following:

- The IP address and subnet mask assignments for your system (contact your system administrator)
- The system IP plan or system-specific configuration documentation provided by Motorola Solutions for the correct IP addresses

Procedure:

1. Remove the Fault Sense Unit (FSU) Model 9104 from the main frame and locate the serial number of the NTS engine. For example, NTS SER No. 126–159
2. Replace the FSU Model 9104.
3. Convert the serial number of the NTS engine to hex. For example, NTS SER No. 126–159 to 7e-9f
4. Calculate the MAC address (00 – 20 – 4a – 01 - **<*xx* – *xx*>**, where **<*xx* - *xx*>** is the hex number you calculated in step 3). For example, 00 – 20 – 4a – 01 – 7e – 9f
5. Locate the appropriate IP address from the system IP plan or the system-specific configuration documentation provided by Motorola Solutions.

6 At the DOS prompt, change a directory to `C:\windows` and enter: `arp -s` ***<IP address>*** `00-20-4a-01-7e-9f`

7 Enter: `trak`

8 In the **TRAK** window, click **Connect** → **Remote System**.

9 Enter the following values:

- Host: ***<IP address>***
- Port: `1`
- Term Type: `VT100`

10 Press ENTER.

Connection fails.

11 Click **OK**.

12 Click **Connect** → **Remote System**.

13 Enter the following values:

- Host: ***<IP address>***
- Port: `9999`
- Term Type: `VT100`

When logged on, the following message appears:

```
*** NTS ***
Serial Number 6301542 MAC Address 00:20:4A:63:06:06
Software version 04.52 (0112119)
Press Enter to go into Setup Mode
```

14 Press ENTER quickly within 3 seconds to enter ACOLA setup mode.

The following message appears:

```
Change setup (0 Basic configuration, 1 NTS configuration, 7 Factory
defaults, 8 Exit without save, 9 Save, and exit)?
```

15 Select **Basic configuration**. Press ENTER.

16 Enter: ***<IP address>***

17 At the `Set Gateway IP address (N)` prompt, press ENTER.

18 Select **1 (FunkUhr)**.

19 Select **1** to enter the NTS Setup.

20 Press **0** to disable the User Datagram Protocol (UDP) port.

21 To send a block every n minutes, enter: `000`

22 To send UDP broadcast (N), enter: `N`

23 Enter up to eight target addresses for UDP block (***<IP address>***)

24 To exit and save these entries, enter: `9`

The IP address setup completes. The NTS on the FSU module is now ready for NTP.

4.2 Fault Sense Unit Configuration

The TRAK 9104-9 Fault Sense Unit (FSU) is set up to replace the TRAK 9104-2 FSU module. The FSU 9104-9 module has the same functionality as the existing FSU module.

Your system may have TRAK 9104-2 or TRAK 9104-9 FSU module. Identify the FSU module by the label in front of the module. It indicates REV D or REV D-1 for TRAK 9104-2 and REV-9 for TRAK 9104-9 FSU modules, respectively.

4.2.1 Configuring TRAK 9104-9 Fault Sense Unit

Perform this procedure to configure the TRAK 9104–9 Fault Sensor Unit (FSU).

Prerequisites: Obtain the following:

- IP address
- Netmask address
- Gateway address

Procedure:

1. Connect the computer/laptop to the RS232 I/O port at the rear of the TRAK 9100 Network Time Protocoal (NTP) Server using a DB-9 to DB-9 straight-through cable.
2. Start **ProComm** or **HyperTerm** session with data rate of 9600 baud, 8, 1, and N.
3. Press ENTER.

   The following prompt appears: `9100`
4. Enter: `CFG`

   When logon is completed, the following message appears:

```
*****************************************
* CONFIGURATION SETTINGS *
*****************************************
NETWORK SETTINGS
================
IPADDR x.x.x.x
NETMASK x.x.x.x
GATEWAY *
INETD PROTOCOLS
===============
IDLE-TIMEOUT (MINS)
------ ---------- -------
ON/OFF DISCONNECT DISABLE
SSH ON 30 --
TELNET OFF 30 0
HTTP OFFTFTP OFF -- 0
SYSTEM SETTINGS
---------------
RQFS ON
```

```
SYSLOG SETTINGS
---------------
REMOTE *
LOG_MASK 7F -> (7) LOG_DEBUG OFF
(6) LOG_INFO ON
(5) LOG_NOTICE ON
(4) LOG_WARNING ON
(3) LOG_ERR ON
(2) LOG_CRIT ON
(1) LOG_ALERT ON
(0) LOG_EMERG ON
```

5. To configure the IP address, enter: `9100 CFG IPADDR` ***<IP address>***
6. To configure the netmask address, enter: `9100 CFG NETMASK` ***<IP address>***
7. To configure the gateway address, enter: `9100 CFG GATEWAY x.`***<Z>***`.x.x` where ***<Z>*** is the zone number.
8. To change the default telnet idle time, enter: `9100 CFG TELNET IDISCONN 30`

   Enables the telnet with 30 minutes of idle time.
9. To change the default telnet disconnect setup, enter: `9100 CFG TELNET IDISABLE 0`

   This action permits the telnet to disconnect the session after time-out without disabling.

Postrequisites:

- To remove a setting, enter an asterisk (*) for an IP address, netmask address, or gateway address.
- When the TELNET is set to ON, the IDLE-TIMEOUT DISCONNECT time can be set from 1 minute to 99 minutes. When this time expires, the telnet session is disconnected. However, it is possible to telnet after the DISABLE time is set to 0. If the DISABLE time (up to 99 minutes) is set to other than 0, the telnet is disabled after the DISABLE time expires.
- Consult with your system administrator for the IP address and subnet mask assignments for your system.

4.3 Digital Distribution Module Configuration

Configure the output selector switch on the Digital Distribution Module (DDM) appropriately for your system.

Table 18: DDM Reference Output Configuration Switch Settings

This table provides the switch settings used to configure the DDM to the appropriate reference output value.

SW1 Setting	Reference Output
0	1PPS
1	Composite
2	5 MPPS

4.4 Telecommunications Module Configuration

The Telecommunications (Telco) module has an eight-pole, two-position (ON or OFF) switch (S1), and four strap options. It enables the user to select between several different T1 and E1 options, allowing for flexibility in the way the board may be used.

The Telco module is factory configured for either T1 or E1 telecommunication outputs and cannot be changed in the field. It includes both clock and framed signals.

- T1 or E1 framing configuration (factory configure only):
  - Output ground isolation: R33 - R36, 0 Ω resistors not installed (isolated)
  - Clock select: J3, jumper pins 1 and 2 (1.544 Mbps)
  - Output transformer impedance selection: J5 - J8, jumper pins 1 and 2 (120 Ω)
- E1 framing configuration (factory configure only):
  - Output ground isolation:
    + R33 - R36, 0 Ω resistors not installed (isolated), for balanced 120 Ω output
    + R33 - R36, 0 Ω resistors installed (non-isolated), for unbalanced 75 Ω output
  - Clock select: J3, jumper pins 2 and 3 (2.048 Mbps)
  - Output transformer impedance selection:
    + J5 - J8, jumper 1 and 2 (120 Ω)
    + J5 - J8, jumper 2 and 3 (75 Ω)

4.4.1 T1 Framing Format Configuration Telco Module

The T1 options for switch S1, positions 4 through 8, allow for enabling or disabling **Transmit Yellow Alarm**, selecting **193E** or **193S** framing modes, 193S framing mode S-bit insertion through **internal** or **external**, enabling or disabling **B8ZS**, and **transparent** or **bit 7** Zero Suppression stuffing. The factory settings are S1–2, S1–3, and S1–7 are **OFF**, and all others are **ON**. It provides a 0-133 ft line length and 193E Framing Mode select.

Table 19: TEL Framing Format Switch Positions for T1

Use this table to configure the T1 framing format parameters for the Telecommunications (Telco) module.

S1 Settings	On	Off
S1–4	B8ZS Disabled	B8ZS Enabled
S1–5	Transparent Zero Suppression	Bit 7 Stuffing Zero Suppression
S1–6	Yellow Alarm Transmit Disabled	Yellow Alarm Transmit Enabled
S1–7	193S Select	193E Select
S1–8	Internal 193S Bit Selection	External 193S Bit Selection

4.4.2 E1 Framing Format Configuration Telco Module

The E1 (CEPT) options for switch S1, positions 4 through 8, allow for Transmit Remote Alarm **enabled** or **normal** operation, Transmit Distant Multiframe Alarm **enabled** or **normal** operation, I/O data either **AMI** or **HDB3** coded, Transmit and Receive CRC4 Multiframe **enabled** or **normal**, and Transmit and

Receive CAS Multiframe **enabled** or **normal**. The factory settings are S1–2, S1–3, and S1–7 are **OFF**, and all others are **ON**. It provides a 0-133 ft line length and 193E Framing Mode select.

Table 20: TEL Framing Format Switch Positions for E1

Use this table to configure the E1 framing format parameters for the Telecommunications (Telco) module.

S1 Settings	On	Off
S1–4	Transmit CAS M frame enabled	Transmit CAS M frame disabled
S1–5	Transmit CRC4 M frame disabled	Transmit CRC4 M frame enabled
S1–6	Data AMI encoded	Data HDB3 encoded
S1–7	Transmit Distant Multiframe Alarm normal	Transmit Distant Multiframe Alarm enable
S1–8	TRA normal	TRA alarm enable

4.4.3
T1 or E1 Line Length Compensation Telco Module

Switch positions S1–1 through S1–8 settings allow for different T1 and E1 modes, and for selecting different line lengths (0-655 ft). Appropriate line length settings (of switch S1 positions 1, 2, and 3) allow you to select the correct output pulse shape to meet DSX-1 or Channel Service Unit (CSU) templates.

Table 21: Line Length Compensation Switch Positions for T1 or E1

Use this table to configure the T1 line length compensation parameters for the Telecommunications (Telco) module.

S1–1 Settings	S1–2 Settings	S1–3 Settings	Line Length
On	Off	Off	1-133 ft
Off	On	On	133-266 ft
Off	On	Off	266-399 ft
Off	Off	Off	399-533 ft
Off	Off	Off	533-655 ft

4.5
Terminal and Fault Logic Module

The Terminal and Fault Logic (TFL) module cannot be configured.

4.6
Configuring TRAK 9104-14 Fault Sense Unit and TRAK 8835 in the Command Line

Perform this procedure to configure the TRAK 9104–14 (Fault Sense Unit (FSU) card of TRAK 9100 Network Time Protocol (NTP) Server), TRAK 8835-8M, or TRAK 8835-3M to enable SNMPv3.

Prerequisites:

Obtain the following passwords and account information:

- username/password
- Authentication and Privacy passwords for the SNMPv3
- System Contact, System Name, and System Location required for System Information Setup
- The SNMPv3 trap user password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9)
- Simple Network Management Protocol (SNMP) password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z), numeric characters (0-9), and any of the allowed special characters (! % & ( ) * + , - . / : ; < = >?)
- SNMPv3 Manager addresses, for example, 10.x.233.20
- Consult with the System Administrator

Obtain the following hardware:

- Command-line configuration supported on the following TRAK models only: TRAK 9100 NTP Server (with FSU TRAK 9104-14), TRAK 8835-3M, and TRAK 8835-8M
- Computer with Internet Browser (Internet Explorer), ProCom, or HyperTerm Terminal Emulator, and a PuTTY application for a Secure SHell (SSH) logon
- RS232 DCE to DTE cable to connect the computer to the TRAK devices console port. The cable is a straight through DB9 to DB9 (M-F) cable. The regular RSR232 Null modem cable does not work
- Ethernet cable

CAUTION: The existing TRAK 9100 Time and Frequency reference device uses an FSU TRAK 9104–9 to communicate with the entire device. This FSU card must be replaced with the FSU TRAK 9104–14 model before proceeding to deployment of new configurations.

When and where to use:

Procedure:

1. Install the TRAK 9104-14 FSU card for the TRAK 9100. See Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module on page 85. For TRAK 8835 device, go to step 2.
2. Connect the computer/laptop to the RS232 I/O port at the rear of the TRAK 9100 and through the dongle RS-232 connector of the TRAK 8835 devices using a DB-9 to DB-9 straight-through cable.
3. For TRAK 9100 NTP Server and 8835 devices, start ProComm or HyperTerm session with data rate of 9600 baud, 8, 1, and N. Press ENTER.
4. Set the IP/Netmask address for the TRAK 9100 NTP Server and 8835 devices. Perform the following actions:
   - At the command line, enter `9100>ip4 <IP address><subnet mask>` (for example: 10.1.233.88/24).
   - At the command line, enter `8835>ip4 <IP address><subnet mask>` (for example: 10.1.233.88/24)

   To verify the exact IP address, see your system IP plan or contact your system administrator.
5. Set the gateway address for the TRAK 9100 NTP Server and 8835 devices. Perform the following actions:
   - At the command line, enter `9100>ip4 gw <gateway address>` (for example: 10.1.233.254).
   - At the command line, enter `8835>ip4 gw <gateway address>` (for example: 10.1.233.254).

To verify the exact gateway address, see your IP plan or contact your system administrator.

6 Enable SNMP. Perform the following actions.

- For TRAK 9100 NTP Server: At the command line, enter `9100>SNMP on`. Press ENTER. The success message appears after the command-line entry for the TRAK 9100 NTP Server.
- For TRAK 8835 device, at the command line, enter `8835>SNMP on`. Press ENTER. A successful message appears after the command-line entry for the TRAK 8835.

7 Set up System Information for the TRAK 9100 NTP Server. Perform the following actions.

a Enter `9100>snmp contact`***<contact name>***. Press ENTER.

b Enter `9100>snmp name`***<system name>***. Press ENTER.

c Enter `9100>snmp location`***<location name>***. Press ENTER.

A successful message appears after each command-line entry for the TRAK 9100 NTP Server.

8 Set up System Information for the TRAK 8835 device. Perform the following actions.

a Enter `8835>snmp contact`***<contact name>***. Press ENTER.

b Enter `8835>snmp name`***<system name>***. Press ENTER.

c Enter `8835>snmp location`***<location name>***. Press ENTER.

A successful message appears after each command-line entry for the TRAK 8835.

9 Enable SNMP Trap for TRAK 9100 NTP Server. Perform the following actions.

a Enter `9100>snmp trap fault on`. Press ENTER.

b Enter `9100>snmp trap login on`. Press ENTER.

c Enter `9100>snmp trap cfg on`. Press ENTER.

d Enter `9100>snmp trap ntp on`. Press ENTER.

e Enter `9100>snmp trap tu` ***<Trap username>***. Press ENTER

f Enter `9100>snmp trap FSU on`. Press ENTER

g Enter `9100>snmp trap GNSS on`. Press ENTER.

h Enter `9100>snmp trap DISTMOD on`. Press ENTER.

i Enter `9100>snmp trap PS on` . Press ENTER.

A successful message appears after each command-line entry for the TRAK 9100 NTP Server.

The SNMPv3 user authentication or encryption passphrase ***<Trap username>*** must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).

10 Enable SNMP Trap for TRAK 8835 device. Perform the following actions.

a Enter `8835>snmp trap fault on` Press ENTER.

b Enter `8835>snmp trap login on` Press ENTER.

c Enter `8835>snmp trap cfg on` Press ENTER.

d Enter `8835>snmp trap ntp on` Press ENTER.

e Enter `8835>snmp trap tu` ***<Trap username>*** Press ENTER.

A successful message appears after each command-line entry for the TRAK 8835.

11 Enable Secure SHell (SSH). Perform the following action.

a At the command line, enter `9100>SSH on`. Press ENTER.

b At the command line, enter `8835>SSH on`. Press ENTER.

A successful message appears after the command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

12 Customize the Login Banner Message. Perform the following actions.

a At the command line, enter `9100>banner` and edit the text of the banner. Press ENTER.

b At the command line, enter `8835>banner` and edit the text of the banner. Press ENTER.

Use `"\n"` for sentence breaks when necessary.

13 Enable HTTP/HTTPS. Perform the following actions.

a For TRAK 9100 NTP Server: At the command line, enter `9100>HTTP` Press ENTER.

b For TRAK 9100 NTP Server: At the command line, enter `9100>HTTPS` . Press ENTER.

c For TRAK 8835 device: At the command line, enter `8835>HTTP` Press ENTER.

d For TRAK 8835 device: At the command line, enter `8835>HTTPS` Press ENTER.

A successful message appears after each command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

14 Enable Telnet (if Information Assurance (IA) system Telnet is disabled). Perform the following actions.

a For TRAK 9100 NTP Server: At the command line, enter `9100>telnet on` Press ENTER.

b For TRAK 8835 device: At the command line, enter `8835>telnet on` Press ENTER.

A successful message appears after the command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

15 Generate SSH Key using the key size 2048 bits. Perform the following actions.

a For TRAK 9100 NTP Server: At the command line, enter `9100>SSHKEY GEN Fortitoken 2048` Press ENTER.

b For TRAK 8835 device: At the command line, enter `8835>SSHKEY GEN Fortitoken 2048` Press ENTER.

A successful message appears after each command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

The SSH key generation depends key length (1024, 2048, 4096). The “success” response completes within a few minutes up to 45 minutes. Verify SSH Key is generated by entering SSHKEY at the prompt of the TRAK 9100 NTP Server or TRAK 8835.

16 Configure User and SNMPv3 trap account with Authentication and Privacy setup. Perform the following actions:

a Add User Account for the TRAK 9100/TRAK 8835. Enter `9100>user` or `8835>user add` ***<username>*** `pwd` ***<password>*** `AP sha` ***<Authentication_Passphrase>*** `pp AES` ***<Privacy_Passphrase>*** `ro` Press ENTER.

For example:

`9100>user add <S&h 1umBurgH> pwd <S&h 1umBurgH> ap sha <SHA PQtQ $Qla> pp AES <MzFt!6qst> ro`

Obtain the username, Authentication_Passphrase, and Privacy_Passphrase from your System Administrator. Username and password passphrase length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).

b Modify User Account for the TRAK 9100/TRAK 8835. Enter `9100>user mod` or `8835>user mod <username> pwd <password> ap sha <Authentication_Passphrase> pp AES <Privacy_Passphrase> ro`
Press ENTER.

Obtain the username, Authentication_Passphrase, and Privacy_Passphrase from your System Administrator. Username and password passphrase length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).

c Configure SNMPv3 trap account for the TRAK 9100/TRAK 8835. Enter `9100>snmp tap SHA tapw` or
`8835>snmp tap SHA tapw <trap_Auth_Passphrase> tpp AES tppw <trap_privacy_Passphrase>`
Press ENTER.

For example: Enter `9100>snmp tap SHA tapw` or `8835>snmp tap SHA tapw <PQtQ $Qla> tpp AES tppw <MzFt!6qst>`

- Obtain the username, Authentication_Passphrase, and Privacy_Passphrase from your System Administrator.
- SNMP passphrase length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z), numeric characters (0-9), and any of the allowed special characters (! % & ( ) * + , - . / : ; < = >?).

17 Configure SNMP Get requests and Trap clients.

a For SNMP Get requests, enter `gc<get client number 0 – 3><ip (v6 or v4) addr>/<netmask>`

b For Trap clients enter `tc<trap client number 0 – 3><ip (v6 or v4) addr>`

The following Get requests and Trap client configuration and IP addresses are provided as an example:

- `Client 1`
- `gc0 10.1.233.20/24`
- `tc0 10.1.233.20`

The following Get requests and Trap client configuration and IP addresses are provided as an example:

- `Client 2`
- `gc1 10.1.237.20/24`
- `tc1 10.1.237.20`

Locate the IP addresses used. Contact your system administrator for assistance.

4.7

Configuring the TRAK 9104-14 Fault Sense Unit and TRAK 8835 Through Web Browser

Perform this procedure for configuring the TRAK 9104-14 Fault Sense Unit (FSU) card of TRAK 9100 Network Time Protocoa (NTP) Server, TRAK 8835-8M, or TRAK 8835-3M to enable SNMPv3.

Prerequisites:
Using Web GUI to configure the TRAK devices is optional. To configure using Web GUI using HTTPS, disconnect the Ethernet from the network and connect to the laptop/computer. Do not attempt to access the TRAK device from a remote computer/Network Management (NM) client.

The following passwords and account information is required:

- username/password
- Authentication and Privacy passwords for the SNMPv3
- System Contact, System Name, and System Location required for System Information Setup
- The SNMPv3 trap user password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9)
- SNMP password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z), numeric characters (0-9), and any of the allowed special characters (! % & ( ) * + , - . / : ; < = >?)
- SNMPv3 Manager addresses for example, 10.x.233.20
- When setting up the preceding parameters see the system requirement setup for the Universal Element Manager being used in the system
- Consult with he System Administrator.

The following hardware is required:

- Web browser configuration is supported on the following TRAK models only: TRAK 9100 NTP Server (with FSU TRAK 9104-14), TRAK 8835-3M, and TRAK 8835-8M
- Computer with Internet Browser (Internet Explorer), ProCom, or HyperTerm Terminal Emulator, and a PuTTY application for a Secure SHell (SSH) login
- RS232 DCE to DTE cable to connect the computer to the TRAK devices console port. Cable is a straight through DB9 to DB9 (M-F) cable. The regular RSR232 Null modem cable does not work
- A straight through or crossover Ethernet cable

CAUTION: The existing TRAK 9100 Time and Frequency reference device uses an FSU TRAK 9104-9 to communicate with the entire device. This FSU card must be replaced with the new FSU TRAK 9104-14 model before proceeding to deployment of new configurations.

Procedure:

1. Install the TRAK 9104-14 FSU card for the TRAK 9100 NTP Server. See Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module on page 85.
2. Connect the computer/laptop using a DB-9 to DB-9 straight-through cable to:
   a. The RS232 I/O port at the rear of the TRAK 9100 NTP Server.
   b. The dongle RS-232 connector of the TRAK–8835.
3. Open **Internet Explorer** on the client computer.
4. In the browser address field, enter the URL of the TRAK device, `https://10.1.233.88`, and press ENTER. Each time the **Security Alert** dialog box appears, select **Yes**. The Windows login banner appears.

5 In the Windows login banner, enter the valid TRAK 9100 NTP Server or TRAK 8835 user name and password. Click **Connect**.

The TRAK client GUI appears.

6 Setup user name and password for Universal Element Manager. In the **TRAK Microwave** navigation window, in the first **User Name** section in the **Settings** field, specify the required criteria.

a **User Name** and **Password** field, the default username/password is already set (do not delete the default username/password).

b **Public Key** field, leave empty.

c **SNMP Authentication Protocol** field, select **None** from the drop-down menu. A password is not required.

d **Privacy Protocol** field, select **None** from the drop-down menu. A password is not required.

e **SNMP Access** field, select **None** from the drop-down menu.

f Select **Save**

Modification of a user causes Simple Network Management Protocol (SNMP) to generate a cold trap.

7 In the **TRAK Microwave** navigation window in the second **User Name** section, specify the required criteria.

a **User Name** field, enter ***<user name>*** (for example: SystemMaster).

b **Password** field, enter ***<password>*** (for example: SystemPass12).

c **Public Key** field, leave empty.

d **SNMP Authentication Protocol** field, select **SHA** from the drop-down menu. Enter the password (for example enter “Motorola1234”).

e **SNMP Privacy Protocol** field, select **AES** from the drop-down menu. Enter the password (for example enter “Motorola1234”).

f **SNMP Access** field, select `RO` from the drop-down menu.

g Select **Save**

- Leave the remaining two username/password fields empty.
- User Name can be clear (noAuth/NoPriv), AuthOnly, AutPriv, and username/access must match the Universal Element Manager being used in the system.
- Modification of a user causes SNMP to generate a cold trap.

8 Enable SNMP. Specify the required fields.

a **SNMP** field, select on

b **System Contact** field, enter ***<contact name>***.

c **System Name** field, enter `8835–8m-Zone1` or `8835-3m-Zone1` or `9100-Zone1`.

d **System Location** field, enter `PRNE_Lab`.

e **Get Client 1, 2, 3, 4** fields, enter ***<addresses>***. For example: `10.1.233.20/24, 10.1.237.20/24, 10.z.233.20.24, .....`

f **Set Client 1, 2, 3, 4** field, leave blank.

g **Trap Client 1, 2, 3, 4** fields, enter ***<addresses>*** For example: `10.1.233.20, 10.1.237.20, 10.z.233.20,...`

h **Trap SNMP Authentication Protocol** field, select **SHA** from the drop-down field and enter **<*password*>**.

i **Trap SNMP Privacy Protocol** field, select **AES** from the drop-down field and enter **<*password*>**

j Select **Save**

The Trap username MotoMaster must match with Universal Element Manager.

9 Verify the configured Get and Trap clients in the TRAK device using Telnet/SSH. See Verifying the Configurations of the TRAK 9100 and TRAK 8835 Through Telnet on page 56.

Example of Get and Trap clients.

- Get Client 0: ::ffff:`10.2.237.20/120`
- Get Client 1: ::ffff:`10.1.233.20/120`
- Get Client 2: ::fffff:`10.1.237.20/120`
- Get Client 3: ::fffff:`10.2.233.20/120`
- Trap Client 0: ::ffff:`10.2.237.20`
- Trap Client 1: ::ffff:`10.1.233.20`
- Trap Client 2: ::ffff:`10.1.237.20`
- Trap Client 3: ::ffff:`10.2.233.20`

10 Verify that Fortitoken key Fingerprint in the TRAK devices supports SSH-Fortitoken with 2048 key length. See “Verifying Fingerprint in SSH Session Warning Banner” in the *Securing Protocols with SSH* manual.

11 The following password change procedures are common to all the TRAK devices. Only maintenance personnel can use or change these passwords. To change the password on the TRAK devices, log on as the user at the console port using Web Browser.

a In the navigation panel **SERAUTH Server**, select **off**.

b In the **Idle Disconnect** field, enter 25.

c Select **Save** after making selections.

CAUTION: Use caution when enabling this feature. When passwords are changed from the factory default settings and are misplaced or forgotten, they cannot be recovered. If this situation occurs, return the TRAK device to the vendor so it can be reset to its factory defaults.

4.8 Verifying the Configurations of the TRAK 9100 and TRAK 8835 Through Telnet

After the configuration changes, perform this procedure for verification.

Prerequisites:
Contact your system administrator for the administrator ID and TRAK 9100 Simulcast Site Reference (SSR) and 8835 Site Reference device IP address.

For non-secure systems, enable Telnet by performing the following actions:

- **For TRAK 9100 NTP Server:** At the command line, enter: `9100>telnet on`
- **For TRAK 8835 device:** At the command line, enter: `8835>telnet on`

Procedure:

1. Start a Telnet session with TRAK 9100 SSR or 8835 Site Reference using the IP address from your system administrator.
2. Enter a user name and a password:
   a. Remote login: ***<administrator ID>***
   b. Password: ***<password>***
3. At the `9100> or 8835>` prompt, enter: `CFG` and verify that the configuration is changed.

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Chapter 5

NTP Server Operation

This chapter details tasks to perform after the Network Time Protocol (NTP) server is installed and operational on your system.

5.1 Powering Up the TRAK 9100 NTP Server

The TRAK 9100 Network Time Protocol (NTP) Server has three power outputs:

- +5 VDC
- +15 VDC
- –15 VDC

All the three power outputs have an LED indicator that turns green after the TRAK 9100 NTP Server powers up.

Procedure:

1. Apply the +5 VDC to the logic devices.
2. Apply the +15 VDC/–15 VDC to the analog (audio) circuitry.

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Chapter 6

NTP Server Management

Managing the Network Time Protocol (NTP) server includes viewing the configuration, and backup and restore procedures for this unit.

No Backup for Configuration

You cannot back up or restore the configuration. The configuration is stored in nonvolatile memory and can be viewed after a power cycle.

If the configuration is lost, re-enter the configuration.

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Chapter 7

NTP Server Troubleshooting

This chapter provides fault management and troubleshooting information relating to the Network Time Protocol (NTP) server.

7.1 Troubleshooting Applications Overview

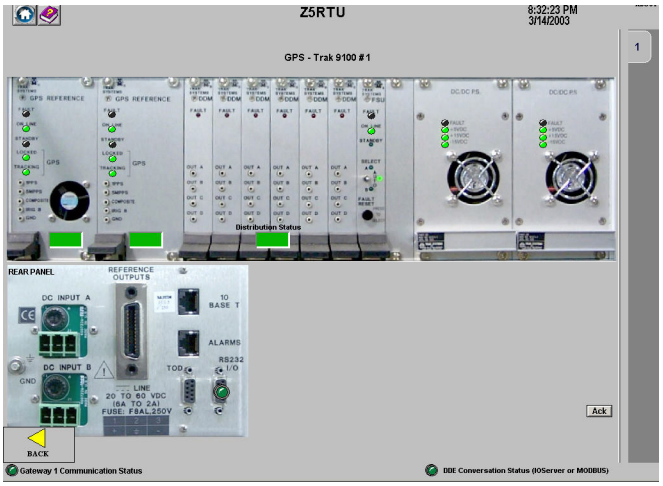
You can use various applications for Network Time Protocol (NTP) server troubleshooting, as described in this section.

IMPORTANT: Synchronize the NTP source to the Global Positioning System (GNSS) before connecting it to the system to avoid data loss. The system rejects files with future dates, relative to the current time.

7.1.1 MOSCAD Network Fault Management

This figure shows an example from the MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application. It provides a graphical interface for component status and reports local alarm information by a MOSCAD NFM XC Remote Terminal Unit (RTU) or SDM3000 RTU. The RTU is locally connected to the TRAK Network Time Protocol (NTP) server over a serial link.

Figure 6: MOSCAD Network Fault Management Interface for TRAK 9100



7.1.2 Interface Commands

Some interface commands can be run through the MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application or through a local connection to the RS–232 I/O port (9600, 8, N, 1) or by using the Out of Band Management (OB Man) terminal connection. These commands can be used to check the status and configuration of different attributes. When connected to TRAK 9100 Network Time Protocol (NTP) Server, press ENTER three times to access the command line.

The following table lists the interface command requests used to check the different status and configuration settings for the TRAK 9100 NTP Server.

For example, entering RQFS at the command line gives the overall status through a series of indicator bits, such as RQFS GA GNSS GGGGGGGGGA PWR G DST GGGG. This status response includes information for the active GNSS reference module, various GNSS reference status indicators, power supply status, and frequency output status.

A telnet connection through the NTP connection causes all NTP output to cease. Use a connection through MOSCAD NFM XC Remote Terminal Unit (RTU), SDM3000 RTU, or the RS–232 I/O port.

Table 22: Interface Commands Requests

Command	Description
<A or B>. RQAP	Request results of average position computation for a GNSS reference module (A or B). The following response appears for this command: A.RQAP ***<latitude>***, ***<longitude>***, ***<height>***
<A or B>. RQBT	Request bit status for a GNSS reference module (A or B). Ten individual bit positions are listed in the response, indicating Good or Fail. The following response appears for this command: A.RQBT ***<1><2><3><4><5><6><7><8><9><10>***A.RQBT FGGGGGGFGN **1** GNSS status (Good or Fail) **2** Rubidium clock or 10 MHz status (Good or Fail) **3** 5 MPPS status (Good or Fail) **4** Composite status (Good or Fail) **5** IRIG-B status (The presence of this output depends on your system configuration) **6** 1PPS status (Good or Fail) **7** CPU status (Good or Fail) **8** Antenna status (Good or Fail) **9** Oscillator calibration (Good or Fail) **10** Module online (Yes or No)
<A or B>. RQDR	Request oscillator Digital/Analog Converter (DAC) value for a GNSS reference module (A or B). The display shows: A.RQDR ***<DAC setting (0-65535)>***
<A or B>. RQIR	Request difference between internal 1PPS and selected time reference for a GNSS reference module (A or B). The display shows: A.RQIR ***<time ref>*** REF GNSS ***<status message>***
<A or B>. RQLK	Request 1PPS locked status for a GNSS reference module (A or B). The display shows: A.RQLK ***<lock status and time affected>***
<A or B>. RQLN	Request navigation solution for a GNSS reference module (A or B). The display shows: A.RQLN ***<latitude>***, ***<longitude>***, ***<height>***
<A or B>. RQLP	Request user-selected position for a GNSS reference module (A or B). The display shows:

Table continued…

Command	Description
	A.RQLP ***<latitude>***, ***<longitude>***, ***<height>*** **NOTICE:** This command is used only if the position source is set to “User entered position” (U).
<A or B>. RQLS	Request leap second status for a GNSS reference module (A or B). The display shows: A.RQLS ***<yy,mm,dd>***
<A or B>. RQSS	Request list of selected satellites for a GNSS reference module (A or B). The display shows: A.RQSS ***<list of satellites or NONE>***
<A or B>. RQST	Request list of satellites being tracked by GNSS reference module (A or B). The display shows: A.RQST ***<list of satellites or NONE>***
<A or B>. RQTO	Request current time offset values for a GNSS reference module (A or B). The display shows: A.RQTO UTC***<+/->******<hours>***, ***<minutes>*** DST+h
RQFS	Request fault status from an FSU module. The display shows: RQFS ***<1><2>*** GNSS ***<3><4><5><6><7><8><9><10><11><12>***PWR ***<13>*** DST ***<14><15><16><17>*** **1** CPU status on Fault Sense Unit (FSU) (Good or Fail) **2** Online FSU status (A or B) **3** GNSS status (Good or Fail) **4** Rubidium clock or 10 MHz status (Good or Fail) **5** 5 MPPS status (Good or Fail) **6** Composite status (Good or Fail) **7** IRIG-B status (The presence of this output depends on your system configuration) **8** 1 PPS status (Good or Fail) **9** CPU status (Good or Fail) **10** Antenna status (Good or Fail) **11** Oscillator calibration (Good or Fail) **12** Module online (A or B) **13** Power supply status (Good or Fail) **14** Distribution frequency output status (Good or Fail) **15** TTL output status (Good or Fail) **16** TAFL status (Good or Fail) **17** TEL output status (Good or Fail)
RQSW	Request software version and compile data.

7.1.3

LED Indicators for Troubleshooting

The LED indicators for the GNSS reference module, Digital Distribution Module (DDM), Telecommunications module, Fault Sense Unit (FSU), and the power supply module provide information about the functioning of these devices, including notifications about failures in the system.

7.1.3.1

GNSS Reference Module LEDs

The GNSS reference module tracks and locks onto a set of satellites and synchronizes its internal clock to supply a stratum 1 frequency reference and Network Time Protocol (NTP) services to system devices. Redundant GNSS reference modules provide high-availability of time reference and NTP services to the network and components. The left GNSS reference module includes a built-in fan. The GNSS reference module includes LEDs that indicate the condition of the module and the tracking and locking status for the GNSS satellites. One GNSS reference module must be online, while the other module is in standby mode. The GNSS reference module also includes test points for 1PPS, 5 MPPS, composite, and ground.

Table 23: GNSS Reference Module Troubleshooting

Status	Description
Fault LED is red	The GNSS reference module is reporting a failure. See Troubleshooting GNSS Reference Module Failure on page 66 for troubleshooting actions.
Online LED is green	The GNSS reference module is online (not standby). No action necessary.
Online LED is off	The GNSS reference module is not online (the standby LED is illuminated). The online LED for the other GNSS reference module should be illuminated. To force the module to come online, set the Fault Sense Unit (FSU) select switch to the appropriate module (A or B). Typically, the FSU select switch must be set to Auto.
Standby LED is green	The GNSS reference module is in standby mode. No action necessary.
Standby LED is off	The GNSS reference module is in active mode. No action necessary.
Locked LED is green	The GNSS reference module has locked onto the satellites and is operating within appropriate reference tolerance. No action necessary.
Locked LED is off	The GNSS reference module is not locked onto the satellites. If the GNSS reference module was recently installed, it may take up to 1 hour for the receiver to lock onto the satellites. See Troubleshooting Satellite Lock Failure on page 67 for troubleshooting actions.
Tracking LED is green	The satellites are currently being tracked. No action necessary.
Tracking LED is off	The satellites are not successfully being tracked. If the GNSS reference module was recently installed, it may take up to 10 minutes to successfully begin tracking satellites. If a tracking problem occurs, see Troubleshooting Satellite Lock Failure on page 67 for troubleshooting actions.

7.1.3.1.1

Troubleshooting GNSS Reference Module Failure

Perform this procedure to troubleshoot the GNSS reference module.

Procedure:

1 Check the status of the objects and check for any traps. Also, check the condition of the TRAK 9100 Network Time Protocol (NTP) Server in the MOSCAD Network Fault Management (NFM)

Graphical Master Computer (GMC) Application on the GMC or in the MOSCAD NFM XC Remote Terminal Unit (RTU) or SDM3000 RTU web pages.

2 Visually inspect the condition of the GNSS antenna input cable and connection on the rear of the chassis.

3 Verify that the GNSS antenna is cleared from obstruction. If the antenna is obstructed, the GNSS reference module may occasionally lose its locking status, which can eventually result in a failure if it exceeds the selected time-out interval.

4 Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.

5 Through the MOSCAD NFM GMC Application on the GMC, through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man) terminal connection, enter: **<*A or B*>.** RQBT.

To check the GNSS bit status, press ENTER for GNSS reference module A or B.

Step example: The system reports a string of ten different status indicators for the GNSS reference module, such as the following (G indicates a good condition, F indicates a failed condition): A.RQBT FGGGGGGFGN
These status bits indicate the status of the following (in order):

a GNSS receiver

b Rubidium clock

c 5 MPPS

d Composite

e IRIG-B (Depending on your system configuration, IRIG-B may not be present)

f 1PPS

g CPU

h Antenna

i Oscillator calibration

j Module online

This example indicates a GNSS receiver problem and an antenna problem, and reveals that the GNSS reference module is not online. Check the possible cause for any troubled indicator bits.

6 Check the antenna input cabling for continuity, attenuation, and crosstalk.

7 Replace the GNSS reference module, antenna cable, or GNSS antenna, as necessary. Press the fault reset switch on the Fault Sense Unit (FSU) module to clear all fault LEDs.

7.1.3.1.2
Troubleshooting Satellite Lock Failure

Perform this procedure to troubleshoot a satellite lock failure.

Procedure:

1 Check the status of the objects and check for any traps. Also, check the condition of the TRAK 9100 Network Time Protocol (NTP) Server in the MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC or in the MOSCAD NFM XC Remote Terminal Unit (RTU) or SDM3000 RTU web pages.

2 Visually inspect the condition of the GNSS antenna input cable and connection on the rear of the chassis.

3 Verify that the GNSS antenna is cleared from obstruction. If the antenna is obstructed, the GNSS reference module may occasionally lose its locking status. If it exceeds the selected time-out interval, it can eventually result in a failure.

4 Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.

5 Through MOSCAD NFM GMC Application on the Graphical Master Computer (GMC), through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man) terminal connection, type the command: **<*A or B*>.** RQBT.

   Press ENTER to check the GNSS bit status, for GNSS reference module A or B.

   Step example: The system reports a string of ten different status indicators for the GNSS reference module, such as the following (G indicates a good condition, F indicates a failed condition): A.RQBT FGGGGGGFGN
   These status bits indicate the status of the following (in order):

   1 GNSS receiver

   2 Rubidium clock

   3 5 MPPS

   4 Composite

   5 IRIG-B (Depending on your system configuration, IRIG-B may not be present)

   6 1PPS

   7 CPU

   8 Antenna

   9 Oscillator calibration

   10 Module online

   This example indicates a GNSS receiver problem and an antenna problem, and reveals that the GNSS reference module is not online. Check the possible cause for any troubled indicator bits.

6 To check the list of satellites being tracked by the GNSS reference module, enter: **<*A or B*>.** RQST

7 To check the 1PPS reference locked status, which may indicate the time when locking started or ended, enter: **<*A or B*>.** RQLK

   Step example: A.RQLK NO LOCK SINCE POWERUP

8 Check the antenna input cabling for continuity, attenuation, and crosstalk.

9 Replace the GNSS reference module, antenna cable, or GNSS antenna, as necessary. Press the fault reset switch on the Fault Sense Unit (FSU) module to clear all fault LEDs.

7.1.3.2
Telecommunications Module LEDs

The Telecommunications (Telco) module outputs 1.544 MHz or 2.048 MHz square wave output signaling as a reference for T1 and E1 framing by networking equipment. The Telco module has a single fault LED to indicate module failure.

If the fault LED is red, a fault condition is detected on the Telco module.

7.1.3.2.1
Troubleshooting Faults on the Telecommunications Module

Perform this procedure to troubleshoot the Telecommunications (Telco) module.

Procedure:

1. Check the status of the objects and check for any traps. Also, check the condition of the TRAK 9100 Network Time Protocol (NTP) Server in the MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC or in the MOSCAD NFM XC Remote Terminal Unit (RTU) or SDM3000 RTU web pages.
2. Check the LEDs on the Fault Sense Unit (FSU) module, GNSS reference modules, and power supply modules for other problems.
3. Visually inspect the condition of the Telco module connection and the connection to the junction device.
4. Remove and inspect the failed module and the interior of the chassis. Verify the jumper and switch settings on the module according to your system documentation. Fully reinsert the module into the chassis.
5. Through MOSCAD NFM GMC Application on the GMC, through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man) terminal connection, enter the command: RQFS

   Press ENTER to check the fault status. The last portion of the response indicates: DST <1><2><3><4>. The second bit indicates the RS422 output status on the Telco module, which should be G (good).
6. Remove the output cabling from the Telco module. Press the fault reset button on the FSU module. If the fault LED goes out on the Telco module, the cable or remotely connected device has a problem. Check the cabling for continuity, attenuation, and crosstalk. Also, check the connection and termination at the remote device.
7. Replace the Telco module or cabling, as necessary. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.1.3.3

Fault Sense Unit Module LEDs

The Fault Sense Unit (FSU) monitors overall system operations. The FSU communicates alarm information out the rear of the chassis through the RS-232 I/O port and alarm port. The FSU module has a switch for setting a GNSS reference module to active mode (A, B, or Auto). The FSU module also has a fault reset button, used to clear all the fault LEDs throughout the chassis.

The Network Time Protocol (NTP) server may have TRAK 9104-2 or TRAK 9104-9 FSU module. Identify the FSU module by the label in front of the module, which indicates REV D or REV D-1 for TRAK 9104-2 and REV-9 for TRAK 9104-9 FSU modules, respectively.

Table 24: Fault Sense Unit Troubleshooting

Status	Description
Fault LED is red	A fault condition is detected on the FSU. See Troubleshooting Faults on the FSU on page 70 for troubleshooting actions.
Online LED is green	The FSU is online (not standby). No action necessary.
Online LED is off	The FSU module is not online. If the FSU module cannot be brought on-line, troubleshoot the FSU module with the instructions for the fault LED.
Standby LED is green	The FSU is in standby mode. The FSU should always be online. If the FSU cannot be brought online, see Troubleshooting Faults on the FSU on page 70 for troubleshooting actions.
Standby LED is off	The GNSS reference module is in active mode. No action necessary.

Table continued…

Status	Description
Any of the Select LEDs (A, B, or Auto) is green	GNSS reference module A or B is manually selected, or the GNSS reference module is automatically selected by the FSU. Typically, the select switch must be set to Auto. If a particular GNSS reference module must be made active, then select A or B as necessary.

7.1.3.3.1

Troubleshooting Faults on the FSU

Perform this procedure to troubleshoot the Fault Sense Unit (FSU) module.

Procedure:

1. Check the status of the objects and check for any traps. Also, check the condition of the TRAK 9100 Network Time Protocol (NTP) Server in the MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC or in the MOSCAD NFM XC Remote Terminal Unit (RTU) or SDM3000 RTU web pages.
2. Through MOSCAD NFM GMC Application on the GMC, through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man) terminal connection, type the command:

   `RQFS` to check the fault status.

   The first portion of the response indicates:

   `RQFS FSU <FSU CPU status><FSU online status>`

   The FSU CPU status should indicate `G` (good), and the FSU online status should indicate `Y`.
3. Check the LEDs on the power supply modules for other problems.
4. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
5. Replace the FSU module.

7.1.3.4

Power Supply Module LEDs

Redundant AC input power supply modules installed in the Network Time Protocol (NTP) Server chassis supply +5 VDC, +15 VDC, and –15 VDC output reference voltages to the other modules in the chassis. Each power supply includes a built-in fan. The power supply LEDs indicate the DC voltage output status for the module and a fault LED to indicate a power supply failure.

Table 25: Power Supply Module LEDs

Status	Description
Fault LED is red	A fault condition is detected on the power supply module. For troubleshooting actions, see Troubleshooting Faults on the Power Supply Module on page 71.
Any of the voltage LEDs (+5 VDC, +15 VDC, or –15 VDC) is green	The voltage reference outputs are within appropriate tolerance. No action necessary.
Any of the voltage LEDs (+5 VDC, +15 VDC, or –15 VDC) is off	The voltage reference outputs are not within appropriate tolerance for operation. For troubleshooting actions, see Troubleshooting Faults on the Power Supply Module on page 71.

7.1.3.4.1

Troubleshooting Faults on the Power Supply Module

Perform this procedure to troubleshoot the power supply module.

Procedure:

1. Check the status of the objects and check for any traps. Also, check the condition of the TRAK 9100 Network Time Protocol (NTP) Server in the MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC or in the MOSCAD NFM XC Remote Terminal Unit (RTU) or SDM3000 RTU web pages.
2. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
3. Through MOSCAD NFM GMC Application on the GMC, through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man) terminal connection, enter: `RQFS`

   To check the fault status, press ENTER. A portion of the response indicates: `PWR <G or F>`

   The bit can indicate `G` (good) or `F` (fail).
4. Check the power cable and connections between the power supply and outlet. Plug it into a different outlet.

   If possible, maintain the two power supplies on separate circuits to guard against a single point of failure.
5. Check circuit breakers, verify grounding, and check if any other equipment is experiencing power problems.
6. Remove and inspect the power supply and interior of the chassis, then fully reinsert the power supply into the chassis.
7. Check the power input fuse in the rear of the chassis. Replace with a 3 A slow blow fuse if necessary (a spare fuse may be located in the fuse compartment).
8. Replace the power supply or power cable as necessary.

7.1.4

GNSS Alarms

MOSCAD XC Network Fault Management (NFM) Remote Terminal Unit (RTU) or SDM3000 RTU collects alarm information through the RS–232 I/O and alarm ports on the rear of the TRAK 9100 Network Time Protocol (NTP) server.

Table 26: GNSS Alarms

This table defines the various alarms.

Object	State	Severity / Values	Description
Power	Power OK	Normal	All power supply modules are OK. No action necessary.
	Secondary Power	Minor	One power supply module has failed. For troubleshooting actions, see Troubleshooting Failure in a Power Supply Module on page 72.
	Power Fail	Critical	All power supply modules have failed (or communication error). Troubleshoot the power supply modules as explained for the secondary power state.

Table continued…

Object	State	Severity / Values	Description
GNSS	GNSS OK	Normal	Both GNSS reference modules are OK. No action necessary.
	Secondary GNSS	Minor	One GNSS reference module has failed. For troubleshooting actions, see Troubleshooting Failure in a GNSS Reference Module on page 73.
	GNSS Fail	Critical	Both GNSS reference modules have failed. Troubleshoot both GNSS reference modules using Troubleshooting Failure in a GNSS Reference Module on page 73.
DST	DST OK	Normal	All distribution outputs are OK. No action necessary.
	DST Fail	Major	One of the distribution devices failed. For troubleshooting actions, see Troubleshooting Failure in a Distribution Device on page 73.
Comm. Status	Comm OK	Normal=0	Communication between TRAK 9100 NTP Server and SDM3000 RTU is normal. No action necessary.
	Comm Fail	Critical=1	MOSCAD NFM SDM3000 RTU has lost communication with the TRAK 9100 NTP Server. For troubleshooting actions, see Troubleshooting Loss of Communication on page 74.

7.1.4.1

Troubleshooting Failure in a Power Supply Module

Perform this procedure to troubleshoot a failure in the Power Supply.

Procedure:

1. Through MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC, through a local connection to the RS232 I/O port (9600, 8, N, 1), or using the Out of Band Management (OB Man) terminal connection, enter:`RQFS`.

   To check the fault status, press ENTER.

   A portion of the response indicates `PWR <G or F>`. The bit can indicate `G` (good) or `F` (fail).
2. Check the power supply LEDs.
3. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
4. Check the power cable and connections between the power supply and outlet. Plug it into a different outlet.

   If possible, maintain the two power supplies on separate circuits to guard against a single point of failure.
5. Check circuit breakers, verify grounding, and see if any other equipment is experiencing power problems.
6. Remove and inspect the power supply and interior of the chassis, then fully reinsert the power supply into the chassis.
7. Check the power input fuse in the rear of the chassis. Replace with a 3 A slow blow fuse if necessary (a spare fuse may be located in the fuse compartment).
8. Replace the power supply or power cable as necessary.

7.1.4.2

Troubleshooting Failure in a GNSS Reference Module

Perform this procedure to troubleshooting a failure in a GNSS Reference Module.

Procedure:

1. Through MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC, through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man) terminal connection, enter: ***<A or B>.*** `RQBT`

   To check the GNSS bit status, for GNSS reference module A or B, press ENTER.

   The system reports a string of different status indicators for the GNSS reference module, such as the following (`G` reflects good condition, `F` reflects failed condition): `A.RQBT FGGGGGGFGN`. These status bits indicate the status of the following (in order):

   1. GNSS receiver
   2. Rubidium clock
   3. 5 MPPS
   4. Composite
   5. IRIG-B (Depending on your system configuration, IRIG-B may not be present)
   6. 1 PPS
   7. CPU
   8. Antenna
   9. Oscillator calibration
   10. Module online

   This example indicates a GNSS receiver problem and an antenna problem, and reveals that the GNSS reference module is not online. Check the possible cause for any troubled indicator bits.
2. Check the LEDs for the failed GNSS reference module. Also, check the LEDs for the Fault Sense Unit (FSU) module and power supplies.
3. Visually inspect the condition of the GNSS antenna input cable and connection on the rear of the chassis.
4. Verify that the GNSS antenna is cleared from obstruction. If the antenna is obstructed, the GNSS reference module may occasionally lose its locking status, which can eventually result in a failure if it exceeds the selected time-out interval.
5. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
6. Check the antenna input cabling for continuity, attenuation, and crosstalk.
7. Replace the GNSS reference module, antenna cable, or GNSS antenna, as necessary. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.1.4.3

Troubleshooting Failure in a Distribution Device

Perform this procedure to troubleshooting a failure in a Distribution Device.

Procedure:

1. Through MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC, through a local connection to the RS–232 I/O port (9600, 8, N, 1), enter: `RQFS`

To check the fault status, press ENTER.

The last portion of the response indicates: DST ***<1><2><3><4>***. The first bit indicates the Dynamic Dual Mode (DDM) output status, which should be G (good). The second bit indicates the RS422 output status on the Telecommunications (Telco) module, which should be G (good).

2. Check the LEDs on the DDM modules, Telco module, Fault Sense Unit (FSU) module, GNSS reference modules, and power supply modules.
3. Visually inspect the condition of the connections on the failed module.
4. Remove and inspect the failed module and the interior of the chassis. Verify that the switches and jumpers on the Telco module or DDM are properly configured. Fully reinsert the module into the chassis.
5. Remove the output cabling from the troubled module. Press the fault reset button on the FSU module. If the fault LED goes out on the troubled module, the cable or remotely connected device has a problem. Check the cabling for continuity, attenuation, and crosstalk. Also, check the connection and termination at the remote device.
6. Replace the DDM, the Telco module, or the cabling as necessary. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.1.4.4
Troubleshooting Loss of Communication

Perform this procedure to troubleshooting a loss of communication.

Procedure:

1. Through MOSCAD Network Fault Management (NFM) Graphical Master Computer (GMC) Application on the GMC, through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man) terminal connection, type: RQFS

   To check the fault status, press ENTER.

   The first portion of the response indicates: RQFS FSU ***<FSU CPU status><FSU online status>***. The Fault Sense Unit (FSU) CPU status should indicate G (good), and the FSU online status should indicate Y.
2. Verify that the TRAK 9100 Network Time Protocol (NTP) Server is powered. Verify that other services are operating properly. Check the condition and LEDs for the FSU module. The FSU module supplies the relay control for the RS232 I/O and alarm outputs.
3. Visually inspect the RS232 I/O, alarm connections on the rear of the TRAK 9100 NTP Server, NFM XC Remote Terminal Unit (RTU), SDM3000 RTU, and MOSCAD MUX units. Use a cable tester to check the continuity and pinouts for the cabling.
4. Check the LEDs and connections on the MOSCAD MUX or SDM3000 RTU units.
5. Replace the FSU module or cabling as required.

7.2
TRAK 8835 Site Reference Remote Operation

The RQBT Request BIT Status is the only remote operation command available for the TRAK 8835 Site Reference.

The TRAK 8835 Site Reference can be set up and monitored remotely through the RS-232 or Ethernet port. Two modes can be set:

Local Echo
A mode where each character input is echoed back to the host.

Computer

A mode where the input characters are not echoed. This mode is the default mode.

Before using the RS-232 port, ensure that the remote computer or terminal is set to 9600 baud, eight data bits, 1-stop bit, and no parity.

For configuration and instructions on remote operation, computer mode, and remote interface commands, see Chapter 3, in the *TRAK Technical Manual (D001571) Model 8835 GPS Clock* manual.

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Chapter 8

NTP Server FRU/FRE Procedures

This chapter lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs), and includes replacement procedures applicable to the Network Time Protocol (NTP) server.

8.1 Required FRU/FRE Tools and Equipment

Take the following Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs) items to the replacement site when replacing any equipment in the TRAK 9100 Network Time Protocol (NTP) Server:

- Electrostatic Discharge (ESD) strap (Motorola Solutions part number RSX4015A or equivalent)
- Phillips and slotted screwdrivers
- Set of TORX® drivers

8.2 NTP Server Field Replaceable Units

This table lists each Field Replaceable Unit (FRU) available along with its FRU part number and the appropriate procedure for replacing the FRU. The vendor number is also listed to help identify the parts. Use the FRU part number for the item while ordering.

WARNING: The TRAK 9100 Network Time Protocol (NTP) Server chassis contain dangerous voltages that cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

Table 27: Field Replaceable Units

Component Type	Part Number	Vendor Number	Replacement Procedure
Global Positioning Satellite (GNSS) Reference Module with Rubidium Oscillator	RLN5356A	DSTRAK91013	Replacing the GNSS Reference Module on page 78
GNSS Reference Module with Double Oven Oscillator	RLN5357A	DSTRAK91015	Replacing the GNSS Reference Module on page 78
Digital Distribution Module (DDM)	RLN5359A	DSTRAK91061	Replacing the Digital Distribution Module on page 79
Telecom Signal Generator Module, T1	RLN5361A	DSTRAK91111	Replacing the Telecom Signal Generator Module on page 80
Telecom Signal Generator Module, E1	RLN5362A	DSTRAK91112	Replacing the Telecom Signal Generator Module on page 80

Table continued…

Component Type	Part Number	Vendor Number	Replacement Procedure
Fault Sense Unit (FSU) Module with Network Time Server (NTS) Option	RLN5358A	DSTRAK91042	Replacing the Fault Sense Unit Module on page 81
Fault Sense Unit (FSU) Module (TRAK 9104-9)	DSTRAK91049	DSTRAK91049	Replacing the Fault Sense Unit Module on page 81
Power Supply, 85-260 VAC (for TRAK 9100)	RLN5363A	DSTRAK91202	Replacing the Power Supply Module on page 83
Power Supply, 48 VDC (for TRAK 9100)	RLN5370A	DSTRAK91211	Replacing the Power Supply Module on page 83
TRAK 9100 Chassis	RLN5365A	DSTRAK9100MF	Replacing the Server Chassis on page 83
Distribution shelf for 9100 AC	DSTRAK93007	TRAK93007	Replacing the Power Supply Module on page 83
Distribution shelf for 9100 DC	DSTRAK93007DC	TRAK93007DC	Replacing the Power Supply Module on page 83
GNSS Reference Module w/Rubidium oscillator	DSTRAK910115	TRAK910115	Replacing the GNSS Reference Module on page 78
GNSS Reference Module w/DOXCO	DSTRAK910116	TRAK910116	Replacing the GNSS Reference Module on page 78
Fault Sense Unit (FSU) with NTS/NTP and SNMP Network Management capability	DSTRAK910414	TRAK910414	Replacing the Fault Sense Unit Module on page 81
Terminator and Fault Logic Module (TAFL)	DSTRAK93507	TRAK93507	N/A

8.2.1
Replacing the GNSS Reference Module

Perform this procedure to replace a Global Positioning Satellite (GNSS) reference module (RLN5356A or RLN5357A).

The TRAK Network Time Protocol (NTP) Server includes redundant GNSS reference modules. The GNSS reference module receives the GNSS signals and generates the reference signals (1PPS and 5 MPPS). These signals support the time reference output through the Fault Sense Unit (FSU) module, and the T1/E1 clocking output through the Telecommunications module.

The primary GNSS reference module in the left-most slot has a Rubidium oscillator and includes a cooling fan on the front of the module. The backup GNSS reference module in the chassis has a double oven crystal oscillator and does not include a cooling fan.

WARNING: The TRAK 9100 NTP Server chassis contains dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

CAUTION: Wear an Electrostatic Discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

IMPORTANT: The GNSS reference module can be replaced while the TRAK 9100 NTP Server is powered. As the TRAK 9100 NTP Server includes redundant GNSS reference modules, removing a single GNSS reference module does not cause a disruption in radio services or network services.

Procedure:

1. If the **Online LED** is illuminated on the GNSS reference module you are replacing, perform the following actions to switch to the redundant module:
   - **a** Press and hold the **Fault Reset** button on the FSU module.
   - **b** Set the **Select** switch to the redundant module (A is the left module, B is the right module).
   - **c** Release the **Fault Reset** button.

   The Standby LED illuminates on the GNSS reference module being replaced. The Online LED is illuminated on the other GNSS reference module.
2. Remove the GNSS reference module:
   - **a** Remove the four screws securing the GNSS reference module.
   - **b** Gently pull down on the handle to unlock the module.
   - **c** Pull the module out from the chassis.
3. Verify that the jumpers and switches are set correctly on the replacement module:
   - **a** Note any jumper or switch settings on the removed module.
   - **b** Verify that the replacement module jumper and switch settings match those settings on the removed module.
4. Install the replacement GNSS reference module:
   - **a** Slide the module into the chassis.
   - **b** Firmly seat the module connectors into the backplane. Do not force the module in.
   - **c** Press up on the handle to lock the module in place.
   - **d** Secure the GNSS reference module into the chassis with the four retaining screws.
5. On the Fault Sense Unit (FSU) module, press and release the **Fault Reset** button.
6. Allow up to one hour for the GNSS reference module to track and lock onto satellites.

   After approximately 10 minutes, the Tracking LED illuminates on the new GNSS reference module. After 30 minutes to 60 minutes, the Locked LED illuminates on the module.
7. After the Tracking LED and Locked LED are illuminated on the new GNSS reference module, switch to automatic switchover mode:
   - **a** On the FSU module, press and hold the **Fault Reset** button.
   - **b** Set the **Select** switch to **Auto**.
   - **c** Release the **Fault Reset** button.

Postrequisites: Verify that the TRAK 9100 NTP Server is operating properly. See Verifying Serviced Equipment on page 86 for tests and verifications that can be performed for the device.

8.2.2
Replacing the Digital Distribution Module

Perform this procedure to replace a Digital Distribution Module (DDM) (RLN5359A).

Configure the DDM for 1PPS, 5 MPPS, or composite (1PPS + 5 MPPS) reference signals. When configured, it distributes these references through the ports on the rear of the chassis to supported Master Site equipment.

WARNING: The TRAK 9100 Network Time Protocol (NTP) Server chassis contains dangerous voltages that cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

CAUTION: Wear an Electrostatic Discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

IMPORTANT: The DDM can be replaced while the TRAK 9100 NTP Server is powered. Any reference signal ports on the rear of the chassis supported by the DDM, are inoperable while the DDM is removed. Any supported equipment loses its reference signals until the DDM is replaced in the chassis. Supported devices revert to their secondary or internal clocking source.

Procedure:

1. Remove the DDM:
   a. Loosen the two screws securing the DDM.
   b. Gently pull down on the handle to unlock the module.
   c. Pull the module out from the chassis.
2. Verify that the jumpers and switches are set correctly on the replacement module:
   a. Note any jumper or switch settings on the removed module.
   b. Verify that the replacement module jumper and switch settings match those settings on the removed module.
3. Install the replacement DDM:
   a. Slide the module into the chassis.
   b. Firmly seat the module connectors into the backplane. Do not force the module in.
   c. Press up on the handle to lock the module in place.
   d. Secure the DDM into the chassis with the two retaining screws.
4. On the Fault Sense Unit (FSU) module, press and release the **Fault Reset** button.

Postrequisites: Verify that the TRAK 9100 NTP Server is operating properly. See Verifying Serviced Equipment on page 86 for tests and verifications that can be performed for the device.

8.2.3
Replacing the Telecom Signal Generator Module

Perform this procedure to replace a T1 Telecom Signal Generator (Telco) module (RLN5361A) or E1 Telco module.

The Telco module generates and distributes clocking signals for T1/E1 multiplexing. The Telco module supports T1/E1 clocking in the Wide Area Network (WAN) switch (and Cooperative WAN Routing in the Prime Site only), Digital Access Cross-connect Switch (DACS).

WARNING: The TRAK 9100 Network Time Protocol (NTP) Server chassis contains dangerous voltages that cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

CAUTION: Wear an Electrostatic Discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

IMPORTANT: The Telco module can be replaced while the TRAK 9100 NTP Server is powered. Any reference signal ports on the rear of the chassis supported by this module, are inoperable while the module is removed. Any supported equipment loses its reference signals until the Telco module is replaced in the chassis. All supported equipment reverts to their secondary or internal clocking source.

Procedure:

1. Remove the Telco module:
   a. Disconnect the DB-15 cable from the FRAMED port on the front of the module.
   b. Loosen the two screws securing the Telco module.
   c. Gently pull down on the handle to unlock the module.
   d. Pull the module out from the chassis.
2. Verify that the jumpers and switches are set correctly on the replacement module:
   a. Note any board jumper or switch settings on the removed board.
   b. Verify that the replacement board jumper and switch settings match those settings on the removed board.
3. Install the replacement Telco module:
   a. Slide the module into the chassis.
   b. Firmly seat the module connectors into the backplane. Do not force the module in.
   c. Press up on the handle to lock the module in place.
   d. Secure the Telco module into the chassis with the two retaining screws.
   e. Connect the DB-15 cable to the FRAMED port on the module.
4. On the Fault Sense Unit (FSU) module, press and release the **Fault Reset** button.

Postrequisites: Verify that the TRAK 9100 NTP Server is operating properly. See Verifying Serviced Equipment on page 86 for tests and verifications that can be performed for the device.

8.2.4
Replacing the Fault Sense Unit Module

Perform this procedure to replace a Fault Sense Unit (FSU) module (RLN5358A).

The FSU module supports TRAK 9100 Network Time Protocol (NTP) Server functions, reports faults, and provides redundancy switchover for the GNSS reference modules. The FSU module delivers the NTP time reference packets through the 10Base-T port on the rear of the chassis.

WARNING: The TRAK 9100 NTP Server chassis contains dangerous voltages that cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

CAUTION: Wear an Electrostatic Discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

IMPORTANT: The FSU module can be replaced while the TRAK 9100 NTP Server is powered. When the FSU module is removed from the chassis, the TRAK 9100 NTP Server stops sending references, including network time. Radio services are affected and the TRAK 9100 NTP Server function is inoperable. Any NTP clients that use the frequency reference (such as the Base Radios and the comparators) stop transmitting until the FSU module is back in service.

Your system may have a TRAK 9104-2 or a TRAK 9104-9 FSU module. Identify the FSU module by the label in front of the module. The label indicates REV D or REV D-1 for TRAK 9104-2, and REV-9 for TRAK 9104-9 FSU modules, respectively.

Procedure:

1. Remove the FSU module:
   - **a** Loosen the two screws securing the FSU module.
   - **b** Gently pull down on the handle to unlock the module.
   - **c** Pull the module out from the chassis.
2. Verify that the jumpers and switches are set correctly on the replacement module:
   - **a** Note any board jumper or switch settings on the removed board.
   - **b** Verify that the replacement board jumper and switch settings match those settings on the removed board.
3. Install the replacement FSU module:
   - **a** Slide the module into the chassis.
   - **b** Firmly seat the module connectors into the backplane. Do not force the module in.
   - **c** Press up on the handle to lock the module in place.
   - **d** Secure the FSU module into the chassis with the two retaining screws.
4. Press and release the **Fault Reset** button on the FSU module.
5. Re-configure the NTP connection:
   - **a** Access the command window.

     Step example: To open the **Run** dialog box, press WINDOWS ICON KEY + R. Enter `cmd` in the text field.
   - **b** In the dialog box, enter `telnet <IP address> 9999`. Press ENTER until the introductory message is displayed.
   - **c** To enter the setup mode, press ENTER.To select the basic setup, press ENTER.
   - **d** When prompted for an IP address, type the proper **<*IP address*>** for the TRAK 9100 NTP Server (according to the information supplied with your system). Press ENTER.
   - **e** When prompted for the gateway IP address, type the proper gateway **<*IP address*>**. Press ENTER.
   - **f** When prompted for the netmask address, type the appropriate number of bits in the mask. Press ENTER.
   - **g** Choose the option to save the changes and quit.

Postrequisites: Verify that the TRAK 9100 NTP Server is operating properly. See Verifying Serviced Equipment on page 86 for tests and verifications that can be performed for the device.

8.2.5

Replacing the Power Supply Module

Perform this procedure to replace a power supply module (RLN5363A or RLN5370A) in the TRAK 9100 Network Time Protocol (NTP) Server.

The power supply module provides power to the TRAK 9100 NTP Server chassis. Both AC and DC input power supply modules are available.

WARNING: The TRAK 9100 NTP Server chassis contains dangerous voltages that cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

CAUTION: Wear an Electrostatic Discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

IMPORTANT: A power supply module can be replaced while the TRAK 9100 NTP Server is powered. Because the power supply modules are in a redundant configuration in the chassis, the chassis switches to the secondary power supply module. Radio services are not affected.

Procedure:

1. Remove the power input for the impaired power supply:
   - If the chassis is using AC power, disconnect the AC power cable for the impaired power supply module.
   - If the chassis is using DC power, note the wiring and disconnect the DC power wires for the impaired power supply module.

   Input A is the left power supply module and Input B is the right power supply module (as viewed from the front of the chassis).
2. Remove the power supply module:
   a. Loosen the four screws securing the impaired power supply module.
   b. Gently pull down on the handle to unlock the module.
   c. Pull the module out from the chassis.
3. Install the replacement power supply module:
   a. Slide the module into the chassis.
   b. Firmly seat the module connectors into the backplane. Do not force the module in.
   c. Press up on the handle to lock the module in place.
   d. Secure the power supply module into the chassis with the four retaining screws.
4. Connect the power input for the replaced power supply module:
   - If the chassis is using AC power, reconnect the AC power cable for the replaced power supply module.
   - If the chassis is using DC power, reconnect the DC power wires for the replaced power supply module.

Postrequisites: Verify that the TRAK 9100 NTP Server is operating properly. See Verifying Serviced Equipment on page 86 for tests and verifications that can be performed for the device.

8.3

Replacing the Server Chassis

Perform this procedure to replace the TRAK 9100 Network Time Protocol (NTP) Server chassis (RLN5365A).

The main NTP Server chassis is the TRAK 9100. This chassis supports the normal time reference functions at the Master Site.

WARNING:
The TRAK 9100 NTP Server chassis contains dangerous voltages that cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

An empty chassis weighs approximately 20 lb (9 kg). Have another person help you support and carry the chassis as you remove and replace the chassis in the rack.

Prerequisites: Power down the TRAK 9100 to replace the chassis. Powering down the simulcast site reference (for Prime Site)/site reference (for Remote Site) causes all supported devices to revert to their secondary or internal clocking mechanism. Radio services should remain in wide area trunked operation during the replacement.

Procedure:

1. Power down the unit:
   - **a** If the chassis is using AC power, disconnect the AC power cables from the rear of the chassis.
   - **b** If the chassis is using DC power, note the wiring and disconnect the DC power wires from the rear of the chassis.
   - **c** Disconnect the ground cabling from the chassis.
2. Wear an Electrostatic Discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
3. Label and disconnect all cabling from the chassis.
4. Remove the modules from the chassis and install them in the replacement chassis.
5. With another person supporting the chassis, remove the screws securing the chassis to the rack. Remove the chassis from the rack.
6. With the help of another person, lift the replacement chassis into the rack and secure the chassis with the screws previously removed.
7. Reconnect the GNSS units to the GNSS antenna.
8. Power up the unit.
   - **a** Reattach the ground cable to the grounding connection on the rear of the chassis.
   - **b** If the chassis is using AC power, reconnect the AC power cables to the chassis.
   - **c** If the chassis is using DC power, reconnect the DC power wires into the rear of the chassis.

   The GNSS performs automatic synchronization. During this activity, the GNSS unit seeks out and locks on to GNSS satellites. Allow up to one hour for the GNSS reference module to track and lock onto the satellites. When the GNSS is locked onto the satellites, both the Tracking LED and the Locked LED light up.

   IMPORTANT: Wait for the GNSS unit to find and lock on to a GNSS satellite signal before you continue connecting the TRAK 9100 to the ASTRO® 25 system. It may take up to an hour for the GNSS unit to lock onto the satellite signals.

   After the Tracking LED and Locked LED are illuminated on the new GNSS reference module, continue with step 9.
9. Reattach the communication cabling to the chassis.
10. Switch the GNSS unit to automatic switchover:
    - **a** On the FSU module, press and hold the **Fault Reset** button.

b Set the **Select** switch to **Auto**.

c Release **Fault Reset**.

Postrequisites: Verify that the TRAK 9100 NTP Server is operating properly. See Verifying Serviced Equipment on page 86 for tests and verifications that can be performed for the device.

8.4

Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module

Perform this procedure to replace a Fault Sense Unit (FSU) module (RLN5358A) in the Simulcast Site Reference (SSR).

The FSU module supports Network Time Protocol (NTP) server functions, reports faults, and provides redundancy switchover for the GNSS reference modules. The FSU module delivers the NTP time reference packets through the 10Base-T port on the rear of the chassis.

WARNING: The TRAK 9100 SSR and the 9300 expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

CAUTION: Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

IMPORTANT: The FSU module can be replaced while the TRAK 9100 SSR is powered. When the FSU module is removed from the chassis, the SSR stops sending references, including network time. Radio services are affected, the NTP server function is inoperable, and any NTP clients that use the frequency or time reference (such as the base radios, comparators, and site controllers) do not transmit until the FSU module is back in service.

The SSR may have TRAK 9104-2 or TRAK 9104-9 or TRAK 9104-14 FSU module. Identify the FSU module by the label in front of the module, which indicates REV D or REV D-1 for TRAK 9104-2, and REV-9 for TRAK 9104-9 FSU modules, respectively.

Procedure:

1. Remove the FSU module:
   - **a** Loosen the two screws securing the FSU module.
   - **b** Gently pull down the handle to unlock the module.
   - **c** Pull the module out from the chassis.
2. Verify that the jumpers and switches are set correctly on the replacement module:
   - **a** Note any board jumper or switch settings on the removed board.
   - **b** Verify that the jumper for the replacement board and the switch settings match those settings on the removed board.
3. Install the replacement FSU module:
   - **a** Slide the module into the chassis.
   - **b** Firmly seat the module connectors into the backplane. Do not force the module in.
   - **c** Press up on the handle to lock the module in place.
   - **d** Secure the FSU module into the chassis with the two retaining screws.
4. On the FSU module, press and release the **Fault Reset** button.
5. Re-configure the NTP connection:

a From the keyboard on the client computer, press the WINDOWS ICON key + R to access the **Run** command prompt.

b In the dialog box, type `telnet <IP address> 9999` Press ENTER until the introductory message is displayed.

c Press ENTER for setup mode. To select basic setup, press ENTER.

d When prompted for an IP address, type the proper **<IP address>** for the NTP server (according to the information supplied with your system). Press ENTER.

e When prompted for the gateway IP address, type the proper gateway: **<IP address>** Press ENTER.

f When prompted for the netmask address, type the appropriate number of bits used in the mask. Press ENTER.

g Choose the option to save the changes and quit.

6 Verify that the SSR is operating properly. See Verifying Serviced Equipment on page 86 for tests and verifications that can be performed for the device.

8.5 Verifying Serviced Equipment

After the equipment is serviced and restored to normal operation, verify that the original problem is resolved and that all other components are working properly.

This procedure lists several verification methods that can be applied to serviced equipment. Use any applicable steps in the procedure to verify the equipment that has been serviced. If a device cannot be restored to normal operation, see NTP Server Troubleshooting on page 63 to determine the problem, or contact the Motorola Solution Support Center (SSC).

When verifying equipment, some devices which have been serviced may take some time before they are operational and back in service.

The names EMC Smarts and VoyenceControl are used interchangeably for this product.

Procedure:

1 Check the physical condition of the unit:

a Verify that all affected components are fully and appropriately installed.

b Verify that all cabling is securely connected to the correct ports and that there are no stray wires near the unit.

c Verify no tools or hardware (including nuts, bolts, or screws) are in or around the unit.

d Listen to verify that all mechanical equipment such as hard drives, fans, and other equipment are operating properly in the unit.

2 Check LED indicators:

a Verify that the LEDs are indicating each component to be in good condition and operating properly. Indicators should show that the device is powered, enabled, and performing operations.

b For equipment such as processor cards, networking cards, and hard drives, verify that the activity LEDs are neither fully on or fully off. They appear to fluctuate as traffic is being handled or as processes are taking place.

Detailed LED descriptions are listed in TRAK 9100 NTP Server Reference on page 89.

3 Verify the configuration and condition of the unit:

a Use VoyenceControl to check if the device is available on the network.

b Use the Network Fault Management (NFM) Graphical Master Computer (GMC) Application to observe the condition of the device and its components and take note of any reported events for the device.

c If available, access the administration environment of the device and verify that the configuration is set appropriately. Verify that the device is able to access any required resources from the network such as Network Time Protocol (NTP) services, or database downloads.

4 Verify that the device is operating properly:

a Verify that the device is supporting its intended function in the system. Use a subscriber radio, client computer, or other applicable device to determine that the call services or network services supported by the device are working.

b For fixed-radio equipment, use the appropriate test equipment and applications such as Configuration/Service Software (CSS) to perform transmission tests and determine signal integrity.

c Verify that other related equipment at the site which may have been affected by the serviced device are now operating properly.

Detailed diagnostic procedures for equipment are listed in NTP Server Troubleshooting on page 63.

8.6 TRAK 8835 Site Reference Field Replacement Units and Parts

This table lists the Field Replaceable Units (FRUs) and replacement parts for the TRAK 8835 Site Reference. When replacing a FRU or part, obtain the precise FRU Kit Number or Part Number and review the replacement procedures provided, including all safety precautions and system impact information.

To place an order for replacement parts, contact Motorola Solutions Solutions America Parts Organization at:

- Phone: 1-800-422-4210 and (302) 444–4892 for international calls
- TTY Phone: 1-866-522-5210
- Motorola Solutions Online users: https://businessonline.motorolasolutions.com
- Fax: 1-800-622-6210

To place an order for an FRU, contact Motorola Solutions Support Center (SSC) at: Phone: (800) 221-7144 for domestic calls and (302) 444–9800 for international calls.

Table 28: TRAK 8835 Field Replacement (FRE)

Component Type	FRE Kit Number
Simulcast Site Reference GNSS Clock, Rubidium, 48 VDC, 10 MHz BNC, 1PPS on BNC Ethernet	DSTRAK88353M
Simulcast Site Reference GNSS Clock, DOXCO, 48 VDC, 10 MHz BNC, 1PPS on BNC Ethernet	DSTRAK88358M

Table 29: TRAK 8835 Parts Replacement

Component Type	Part Number
Mounting Shelf for GNSS Clock	DSTRAK4008245101
AC Power Supply for GNSS Clock	DSTRAKP001134
Dongle Adapter Cable provides composite, 5 MHZ, and RS-232 connections	DSTRAKP002220
Enhanced Filter Antenna (N Conn) for TRAK 9100	DSTRAKP002111
Lightening / Surge Suppressor (N-N) for TRAK GNSS	DSTRAK4702354
Molex connector for DC power in	DSTRAK4702727T
100 ft LMR 400 Coaxial Cable with two N-Connectors for TRAK 9100	DSTRAK100LMR400

Chapter 9

TRAK 9100 NTP Server Reference

This chapter contains supplemental reference information relating to the Network Time Protocol (NTP) server.

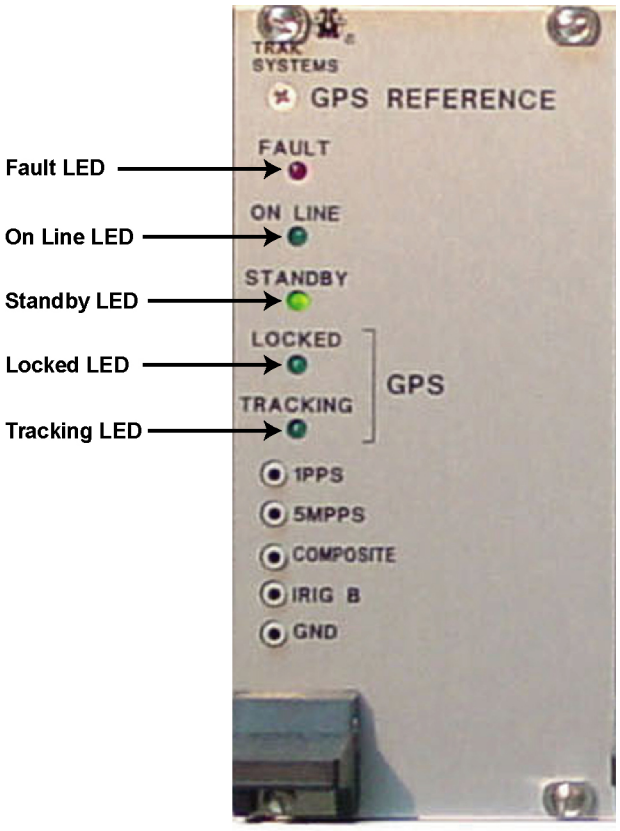
9.1 TRAK 9100 LED Indicators

The LED indicators visible on the GNSS reference module, Digital Distribution Module (DDM), Telecommunications (Telco) module, Fault Sense Unit (FSU), and the power supply module, provide information about the status of these devices.

9.1.1 GNSS Reference Module

The GNSS Reference module LEDs are shown in the figure and defined in the table.

Figure 7: GNSS Reference Module LEDs



TRAK_9100_GPS_reference

Table 30: GNSS Reference Module LEDs

This table provides a description of the LEDs for the GNSS Reference Module and the status information indicated by the LED.

LED	Description	Indication	Status
Fault LED	Indicates that a fault is detected for the GNSS reference module.	Red	The GNSS reference module is reporting a failure. See NTP Server Troubleshooting on page 63 for troubleshooting actions.
Online LED	Indicates whether the module is online or in standby mode (as selected through the FSU module).	Green	The GNSS reference module is online (not standby). No action necessary.
		Off	The GNSS reference module is not online (the standby LED is illuminated). See NTP Server Troubleshooting on page 63 for troubleshooting actions.
Locked LED	Indicates that the GNSS receiver is tracking the satellites and its internal oscillator is within 1 µs of GNSS.	Green	The GNSS reference module has locked onto the satellites and is operating within appropriate reference tolerance. No action necessary.

Table continued...

LED	Description	Indication	Status
		Off	The GNSS reference module is not locked onto the satellites. If the GNSS reference module was recently installed, it may take up to 1 hour for the receiver to lock on to the satellites. See NTP Server Troubleshooting on page 63 for troubleshooting actions.
Tracking LED	Indicates that the GNSS reference module is successfully tracking the satellites.	Green	The satellites are currently being tracked. No action necessary.
		Off	The satellites are not successfully being tracked. If the GNSS reference module was recently installed, it may take up to 10 minutes to successfully begin tracking satellites. See NTP Server Troubleshooting on page 63 for troubleshooting actions.

9.1.2
Digital Distribution Module

The Digital Distribution Module (DDM) LED is shown in the figure and defined in the table.

Figure 8: Digital Distribution Module LEDs

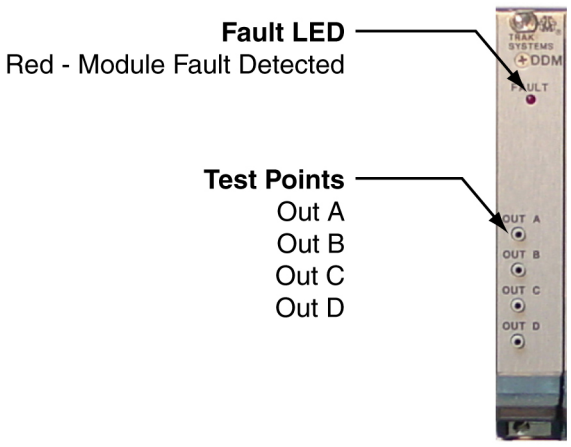


Table 31: Digital Distribution Module LED

This table provides a description of the LED for the DDM and the status information indicated by the LED.

LED	Description	Indication	Status
Fault LED	Indicates a DDM failure is detected.	Red	A fault condition is detected on the DDM. See NTP Server Troubleshooting on page 63 for troubleshooting actions.

9.1.3
Telecommunications Module

The LED for the Telecommunications Module is shown in the figure and defined in the table.

Figure 9: Telecommunications Module LED

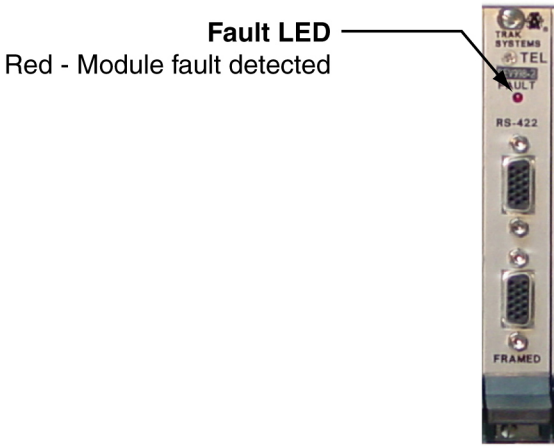


Table 32: Telecommunications Module LED

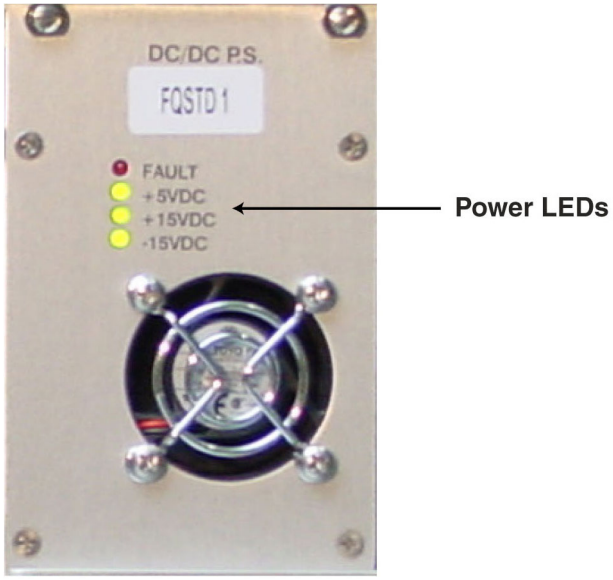
This table provides a description of the LED for the Telecommunications module and the status information indicated by the LED.

LED	Description	Indication	Status
Fault LED	Indicates a failure is detected for this module.	Red	A fault condition is detected on the Telecommunications module. See NTP Server Troubleshooting on page 63 for troubleshooting actions.

9.1.4
Power Supply Module LED

The Power Supply LEDs are shown in the figure and defined in the table.

Figure 10: Power Supply Module LEDs



TRAK_9100_powerLEDs.jpg

Table 33: Power Supply Module LEDs

This table provides a description of the LEDs for the power supply module and the status information indicated by the LEDs.

LED	Description	Indication	Status and Troubleshooting Action
Fault LED	Indicates that the power supply has failed.	Red	A fault condition is detected on the power supply module. See NTP Server Troubleshooting on page 63.
+5 VDC, +15 VDC, and –15 VDC LEDs	Indicates the status of the voltage reference output (+5 VDC, +15 VDC, or –15 VDC).	Green	The voltage reference outputs (+5 VDC, +15 VDC, or –15 VDC) are within appropriate tolerance. No action necessary.
		Off	The voltage reference outputs (+5 VDC, +15 VDC, or –15 VDC) are not within appropriate tolerance for operation.

9.2
Frequency Output Connectors

Front panel modules share relative position for a column of BNC connectors found on the rear panel.

For example, frequency outputs for a module installed in slot A3 are accessible from BNC connectors found in the first column on the rear panel. The panel is labeled Frequency Output 1A through 1D (the right-most column of BNC connectors), when facing the rear panel.

Table 34: Frequency Output Connectors for Modules

This table provides a module to output (BNC connector) reference list.

TRAK 9100 – Front Slot	TRAK 9100 BNC Connectors (Rear)
Module in Slot A3	Frequency Output 1A through 1D
Module in Slot A4	Frequency Output 2A through 2D
Module in Slot A5	Frequency Output 3A through 3D
Module in Slot A6	Frequency Output 4A through 4D
Module in Slot A7	Frequency Output 5A through 5D
Module in Slot A8	Frequency Output 6A through 6D

9.3 Terminal Server Cabling and Pinout

This table lists the cabling and pinout reference for the terminal server to the TRAK 9100 Network Time Protocol (NTP) Server.

Table 35: Terminal Server Cabling

Terminal Server Serial Port RJ-45	TRAK 9100 Device Console Port DB-9 M
3 - Tx	3 - Tx
Tx & Rx GND 4 & 5	GND 5
6 - Rx	2 - Rx

9.4 Network Time Protocol Settings

For a complete list of Network Time Protocol (NTP) settings and sources for various elements in an ASTRO® 25 system, see NTP Elements and Configuration on page 96.

Appendix A

Configurations and Re-configuration Mechanisms for the NTP

Network Time Protocol (NTP) provides a clock synchronization mechanism for various network devices and computers. NTP is provided through a hierarchical set of time servers with the most accurate time sources being at the top of the hierarchy.

The hierarchy of NTP servers is given strata designations with stratum-0 being the most accurate. As the stratum of the time server increases, the accuracy of time decreases in relation to Universal Time Clock (UTC).

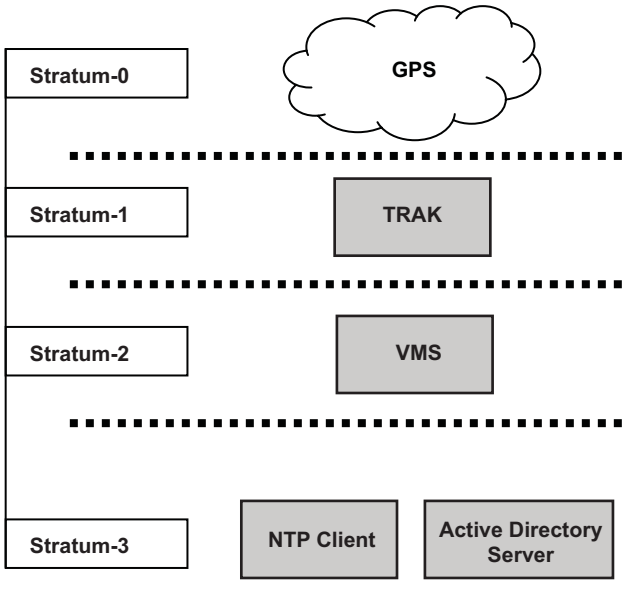
A stratum-0 device is a reference clock assumed to be accurate, using use long wave radio signals, GNSS transmissions, and Code Division Multiple Access (CDMA) technology. Stratum-0 servers are not on the network. Stratum-0 reference clocks have little to no delay from UTC.

Stratum-1 time servers receive time from stratum-0 devices. Stratum-1 time servers act as a primary network time standard. Stratum-1 time servers usually have less than 1 millisecond of delay in relation to UTC.

Higher stratum levels are distanced from the stratum-1 server over a network path. For example, a stratum-2 server gets its time over a network link, using NTP, from a stratum-1 server. Because of network delays, stratum-2 time servers may have from 10 millisecond to 100 millisecond delays from UTC. Each subsequent time server adds an extra 10 milliseconds to 100 milliseconds of inaccuracy from UTC.

Figure 11: ASTRO NTP Strata

The figure shows how a TRAK NTP server (stratum 1) provides an accurate clock and time-of-day service by being directly connected to a stratum-0 GNSS time source. As the stratum increases, the accuracy of time (delay from UTC) decreases.



For systems deployed without a TRAK in the zone core, the Virtual Management Server (VMS) use their own internal hardware clock as a source of simulated UTC time. Whether in a system without a

TRAK, or with a TRAK that has failed, the servers supplying simulated UTC time report a higher stratum level than the one reported by an accurate UTC time provider, such as a TRAK. This reporting allows the same configuration to handle both the case in which a system is deployed without a TRAK, and the case in which a TRAK is deployed but fails to supply time.

NTP Elements and Configuration on page 96 shows configurations for systems with and without the Dynamic System Resilience (DSR) feature implemented. The table contains the mechanisms used for initial configuration of NTP on elements in the ASTRO® 25 radio system. On rows that include an entry in the **Re-configuration Mechanism for DSR** column, NTP redundancy is impacted if a zone core is out-of-service for an extended time. The NTP re-configuration mechanism can be used to restore redundancy of NTP. No single method for switching over NTP to restore redundancy exists in the event of the failure of the Primary Master Site.

IMPORTANT: The effort required to affect the switchover to restore NTP redundancy is considerable. Therefore, use switchover methods only after serious consideration has been given to how long the Primary Master Site remains unavailable versus the effort to restore redundancy.

Windows-based devices joined to Active Directory receive their time from the domain controllers.

You may join the other Windows devices in the domain. The non-Windows devices do not get their time from the domain controllers even if they are joined to Active Directory.

When referring to NTP Elements and Configuration on page 96, if the element cannot use the fully qualified domain name to look up the NTP server, use the *System Configuration Plan* to derive the IP address of the NTP server. The Service Installer/Service Technician must complete IP address lookups before leaving for the remote site.

Virtual Machines (VMs) in a VMS boot to the command prompt login when powered on. To put the VM onto the network, use the **Set Identity interface**. This interface prompts you for various inputs, such as Zone ID, Application ID, DSR. The NTP time sources for the VM are auto-calculated and configured using this information.

A.1 NTP Server for Devices in the CEN

The Customer Enterprise Network (CEN) may contain ASTRO or other Motorola-Solutions devices that provide functionality for the ASTRO system. The customer owns and dictates CEN IP address space. CEN devices that require Network Time Protocol (NTP) may either be configured to receive time from an NTP source in the ASTRO Radio Network Infrastructure (RNI) or from an alternate time source designated by the customer such as a time server in the CEN. This configuration choice must be considered during system planning stages. Individual device installation documentation contains information pertinent to NTP configuration.

A.2 NTP Elements and Configuration

Table 36: NTP Elements and Configuration

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
Air Traffic Router	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone#	Primary Core: ntp03.zone#	Set Identity (driven by	N/A

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
			Backup Core: ntp05.zone#	Backup Core: ntp06.zone#	user or Opsware)	
Alerting LAN Computer	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated
Alerting Master Computer	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated	Not configured if standalone or handled by hosting device if collocated
Authentication Center Client	Receives time from Domain Controller. If cohab, see NM Client	Receives time from Domain Controller. If cohab, see NM Client	Receives time from Domain Controller. If cohab, see NM Client	Receives time from Domain Controller. If cohab, see NM Client	Join to Active Directory. If cohab, see NM Client	N/A — Receives time from Domain Controller. If cohab, see NM Client
Authentication Center Server	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A - Receives time from Domain Controller
Authentication Server (MCC 7500 Domain Controller)	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Calculated automatically during install	N/A
Border Router	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	TNCT	UNC
Peripheral Router, DMZ/SAA Ethernet Switch	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp03.zone#	TNCT	UNC
Console Alias Manager (CAM) Server	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A –Receives time from Domain Controller
Centralized Event Logging Server	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
Certificate Management Facility Server (CMF)	ntp02.zone# or customer CEN NTP source	ntp03.zone# or customer CEN NTP source	Does not support DSR	Does not support DSR	Configured manually during device install	Configured manually during device install
Certificate Repository (CR)	ntp02.zone# or customer CEN NTP source	ntp03.zone# or customer CEN NTP source	Does not support DSR	Does not support DSR	Configured manually during device install	Configured manually during device install
Conventional GCP 8000 Site Controller (CSC)	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	CSS or UNC	CSS or UNC
Core Security Management Server (CSMS)	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A — Receives time from Domain Controller
Core, Exit, Gateway, GGSN Routers	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	TNCT	UNC
Direct Attached Storage (DAS)	ntp02.zone#	N/A – supports only one NTP source	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	N/A – supports only one NTP source	Configured manually during a device install	Configured manually during a device install
DMZ Firewall	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Secure Web Interface	Secure Web Interface
Ethernet Switches (Core, IDS, Mediation, RF, Console Site)	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core:ntp03.zone# Backup Core: ntp06.zone#	TNCT	UNC
Ethernet Switches - Multi-Solution Subsystem (MSS)	ntp02.zone# or customer MSS NTP source	ntp03.zone# or customer MSS NTP source	Primary Core: ntp02.zone# or customer MSS NTP source Backup Core: ntp05.zone# or customer	Primary Core: ntp03.zone# or customer MSS NTP source Backup Core: ntp06.zone# or customer	UNC	UNC

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
			MSS NTP source	MSS NTP source		
Firewall Management Server	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp03.zone#	Set Identity (driven by user or Opsware)	N/A — only available at Primary Master Site
Graphical Master Computer (GMC)	*If AAA:* Domain Controller *No AAA:* Not configured	*If AAA:*Domain Controller *No AAA:* Not configured	*If AAA:* Domain Controller *No AAA:* Not configured	*If AAA*: Domain Controller *No AAA:* Not configured	*If AAA:* Join AD *No AAA:* Not configured	*If AAA*: AD handles *No AAA:* Not configured
Graphical Workstation (GWS)	*If AAA:* Domain Controller *No AAA:* Not configured	*If AAA:* Domain Controller *No AAA:* Not configured	*If AAA:* Domain Controller *No AAA:* Not configured	*If AAA*: Domain Controller *No AAA:* Not configured	*If AAA:* Join AD *No AAA:* Not configured	*If AAA*: AD handles *No AAA:* Not configured
iLO (Integrated Lights Out Management)	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Configured manually during a device install	Configured manually during a device install
InfoVista Server	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A — Receives time from Domain Controller
Install and Backup Server/ NM/ZC Backup Server	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
IP Packet Capture	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
ISSI.1 Site Gateway	Not configured – obtains from GAS	Not configured – obtains from GAS	Does not support DSR	Does not support DSR	Not configured – obtains from GAS	Does not support DSR
	NOTICE: The ISSI.1 feature may be supported on a Generic Application Server (GAS) server platform. For detailed information regarding the GAS server and ISSI.1, see the *Generic Application Server* and *ISSI.1 Network Gateway Feature Guide* manuals.					
Inter-System Gateway (ISGW)	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone#	Primary Core: ntp03.zone#	Set Identity (driven by	N/A

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
			Backup Core: ntp05.zone#	Backup Core: ntp06.zone#	user or Opsware)	
License Manager	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
MCC 7100 Dispatch Console (inside the RNI)	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A – Receives time from Domain Controller
MCC 7100 Dispatch Console (outside the RNI)	Configured to a third-party time source	Configured to a third-party time source	Configured to a third-party time source	Configured to a third-party time source	Configured to a third-party time source	Configured to a third-party time source
MCC 7100 Dispatch Console (configured as Perm Patch Console)	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A – Receives time from Domain Controller
MCC 7500 Archiving Interface Server (AIS)	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A — Receives time from Domain Controller
MCC 7500 Dispatch Console	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A — Receives time from Domain Controller
MCC 7500 VPM	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	CSS or UNC	Does not support DSR
Network Time Server (TRAK)	Not Configured –Receives time from GNSS	Not Configured –Receives time from GNSS	Not Configured – Receives time from GNSS	Not Configured – Receives time from GNSS	Not Configured – Receives time from GNSS	Not Configured – Receives time from GNSS
NICE IP Logger	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A – Receives time from Domain Controller
NICE Replay Station	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A – Receives time from Domain Controller

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
NM Client	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A – Receives time from Domain Controller
PDEG	ntp02.zone#	ntp03.zone#	Does not support DSR	Does not support DSR	Configured manually during device install	Does not support DSR
PDG	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
PN Server	(M3) ntp01.zone# (M1, M2) ntp02.zone#	(M3) ntp01.zone# (M1, M2) ntp02.zone#	Does not support DSR	Does not support DSR	NTP Setup documented in the installation CD README file	Does not support DSR
PTP-600	ntp02.zone#	Does not support the second NTP source	Does not support DSR	Does not support DSR	Configured manually during device install	Does not support DSR
SDM3000 Network Translator	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Configured by SDM3000 Builder	Configured by SDM3000 Builder
SDM3000 RTU	Simulcast Prime: ntp01.site#.zone# IP Simulcast Standard Configuration SubSite: ntp01.site#.zone# IP Simulcast High Availability Configuration SubSite: ntp01.site#.zone# Circuit Simulcast SubSite:	Simulcast Prime: ntp02.zone# IP Simulcast High Availability Configuration Subsite: ntp02.zone# Circuit Simulcast SubSite: ntp01.site#.zone# Other Types: ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone# Simulcast Prime: ntp01.site#.zone# IP Simulcast Standard Configuration SubSite: ntp01.site#.zone# IP Simulcast High Availability Configuration Sub-	Primary Core: ntp03.zone# Backup Core: ntp06.zone# Simulcast Prime: ntp02.zone# IP Simulcast Standard Configuration SubSite: ntp01.site#.zone# IP Simulcast High Availability Configuration SubSite: ntp02.zone#	Configured by SDM3000 Builder	Configured by SDM3000 Builder

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
	ntp01.ss#.site#.zone# Other Types: ntp02.zone#		Site: ntp01.site#.zone# Circuit Simulcast SubSite: ntp01.ss#.site#.zone# Other Types: ntp02.zone#	Circuit Simulcast SubSite: ntp01.site#.zone# Other Types: ntp05.zone#		
Site Devices: Site Controller (SC)* * excluding HPDSC which has no NTP configuration options because it has its own GNSS module	Simulcast: ntp01.site#.zone# Other types: ntp02.zone#	Simulcast: ntp02.zone# Other types: ntp03.zone#	Simulcast: ntp01.site#.zone# Other types: ntp02.zone#	Simulcast: ntp02.zone# Other types: ntp05.zone#	CSS or UNC	CSS or UNC
Site Devices: RDM	IP Simulcast High Availability Configuration SubSite: ntp01.site#.zone#	IP Simulcast High Availability Configuration SubSite: ntp02.zone#	IP Simulcast High Availability Configuration SubSite: ntp01.site#.zone#	IP Simulcast High Availability Configuration SubSite: ntp02.zone#	CSS or UNC	CSS or UNC
Site Devices: MLC 8000 Link Converter	ntp01.site#.zone#	ntp02.zone#	ntp01.site#.zone#	ntp02.zone#	CT	CT
Site Devices: BR (MsBR)	ntp01.site#.zone#	ntp02.zone#	ntp01.site#.zone#	ntp02.zone#	CSS or UNC	CSS or UNC
Site Devices: BR (SmartX 3600 MsBR)	ntp01.site#.zone#	Does not support second NTP source	Does not support DSR	Does not support DSR	CSS	Does not support DSR
Site Devices: BR (Conventional)	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp03.zone#	CSS or UNC	CSS or UNC
Site Devices: BR (HPDBR) at an HPD standalone	dsc1.site#.zone#	dsc2.site#.zone#	dsc1.site#.zone#	dsc2.site#.zone#	CSS or UNC	CSS or UNC

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
site and at an HPD overlay at Simulcast Sites						
Site Devices: BR (HPDBR) (HPD overlay at IntelliSite Repeater Site)	sc1.site#.zone#	sc2.site#.zone#	sc1.site#.zone#	sc2.site#.zone#	CSS or UNC	CSS or UNC
Site Devices: BR (IntelliSite Repeater Site)	sc1.site#.zone#	sc2.site#.zone#	sc1.site#.zone#	sc2.site#.zone#	CSS or UNC	CSS or UNC
Site Devices: BR (SmartX 3600 IR)	sc1.site#.zone#	sc2.site#.zone#	Does not support DSR	Does not support DSR	CSS	Does not support DSR
Site Devices: Comparator (Trunked and Conventional)	ntp01.site#.zone#	ntp02.zone#	ntp01.site#.zone#	ntp02.zone#	CSS or UNC	CSS or UNC
Site Devices: MLC 8000 Analog Conventional Comparator	ntp01.site#.zone#	nptp02.zone#	ntp01.site#.zone#	ntp02.zone#	CT	CT or UNC
Site Devices: Dispatch/ Console (non-Windows)	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	CSS or UNC	CSS or UNC
Site Devices: Routers – (Non-Simulcast: Site, NM, NM Dispatch, Console, Control Room, CCGW)	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	TNCT	UNC
Simulcast Prime Site Router Including CCGW	ntp01.site#.zone#	ntp02.zone#	ntp01.site#.zone#	ntp02.zone#	TNCT	UNC

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
Simulcast SubSite Router Including CCGW	IP Simulcast Standard Configuration SubSite: ntp01.site#.zone# IP Simulcast High Availability Configuration SubSite: ntp01.site#.zone# Circuit Simulcast SubSite: ntp01.ss#.site#.zone#	IP Simulcast Standard Configuration-SubSite: ntp02.site#.zone# IP Simulcast High Availability ConfigurationSubSite: ntp02.zone# Circuit Simulcast SubSite: ntp01.site#.zone#	IP Simulcast Standard Configuration SubSite: ntp01.site#.zone# IP Simulcast High Availability ConfigurationSubSite: ntp01.site#.zone# Circuit Simulcast SubSite: ntp01.ss#.site#.zone#	IP Simulcast Standard Configuration SubSite: ntp02.site#.zone# IP Simulcast High Availability Configuration SubSite: ntp02.zone# Circuit Simulcast SubSite: ntp01.site#.zone#	TNCT	UNC
Simulcast SubSite Switch	IP Simulcast Standard Configuration SubSite: ntp01.site#.zone# Circuit Simulcast SubSite: ntp01.ss#.site#.zone#	IP Simulcast Standard Configuration SubSite: ntp02.site#.zone# Circuit Simulcast SubSite: ntp01.site#.zone#	IP Simulcast Standard Configuration SubSite: ntp01.site#.zone# Circuit Simulcast SubSite: ntp01.ss#.site#.zone#	IP Simulcast Standard Configuration SubSite: ntp02.site#.zone# Circuit Simulcast SubSite: ntp01.site#.zone#	TNCT	UNC
SmartX Site Convertor	ntp02.zone#	ntp03.zone#	Does not support DSR	Does not support DSR	CSS or UNC	Does not support DSR
System Statistical Server	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
Telephony Server	Receives time from Domain Controller	Receives time from Domain Controller	Does not support DSR	Does not support DSR	Join to Active Directory	Does not support DSR
Terminal Server	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	TNCT	UNC
TMG	ntp02.zone#	ntp03.zone#	Does not support DSR	Does not support DSR	CSS or UNC	Does not support DSR

Table continued...

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
TMS Client	Receives time from TMS Server	N/A	Does not support DSR	Does not support DSR	Receives time from TMS Server	Does not support DSR
TMS Server	PN Server or your organization Domain Controller in CEN	PN Server or your organization Domain Controller in CEN	Does not support DSR	Does not support DSR	NTP Setup documented in installation CD README file	Does not support DSR
Transcoder	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A — Receives time from Domain Controller
Unified Event Manager	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
Unified Network Configurator	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
User Configuration Server	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
vCenter	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Configured manually through the VMware vCenter client	Configured manually through the VMware vCenter client
Virtual Management Server Pre-CSA	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Configured manually through the VMware vSphere client during a device install	Configured manually through the VMware vSphere client
Virtual Management Server - RNI (NTP client only)	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Configured manually via VMware vSphere client during device install	Configured manually via VMware vSphere client

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
Virtual Management Server - CEN (NTP client only)	ntp02.zone# or customer CEN NTP source	ntp03.zone# or customer CEN NTP source	Does not support DSR	Does not support DSR	Configured manually via VMware vSphere client during device install	Configured manually via VMware vSphere client
VPN Gateway	ntp02.zone# or customer CEN NTP source	ntp03.zone# or customer CEN NTP source	Does not support DSR	Does not support DSR	Configured manually during device install	Configured manually during device install
Vortex VPM	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	CSS or UNC	Does not support DSR
ZCP Firewall	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	TNCT	Secure Web Interface
Zone Controller	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
Zone Database Server	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
Zone Statistics Server	ntp02.zone#	ntp03.zone#	Primary Core: ntp02.zone# Backup Core: ntp05.zone#	Primary Core: ntp03.zone# Backup Core: ntp06.zone#	Set Identity (driven by user or Opsware)	N/A
Tsub Zone Controller	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	Set Identity (driven by user or Opsware)	N/A
Tsub Transcoder	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Receives time from Domain Controller	Join to Active Directory	N/A - Receives time from Domain Controller
Tsub Domain Controller	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	Calculated automatically during install.	N/A
IP Packet Capture	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	Set Identity (driven by user or Opsware)	N/A

Table continued…

Element	Non-DSR First NTP Source	Non-DSR Second NTP Source	DSR First NTP Source	DSR Second NTP Source	NTP Initial Configuration Mechanism	NTP Re-configuration Mechanism for DSR
Virtual Management Server	ntp02.zone#	ntp03.zone#	ntp02.zone#	ntp05.zone#	Set Identity (driven by user or Opsware)	N/A

A.2.1
NTP Servers and Their Time Sources

This table defines the Network Time Protocol (NTP) servers and their time sources in the appropriate Virtual Management Server (VMS). These tables assume a primary NTP time source (TRAK) in the system. Because the TRAK is optional for L1, L2, M1, and M2 core systems, the VMSs are configured using NTPv4 orphan mode to supply a simulated source of Universal Coordinated Time (UTC) time. Orphan Mode allows a group of Network Time Protocol (NTP) servers to autonomously select a leader when all real-time sources become unreachable (when no TRAK servers or the TRAK servers are inaccessible). The server pairs of ntp02/ntp03 and ntp05/ntp06 in Dynamic System Resilience (DSR) systems are configured as peers of one another and with a common orphan mode stratum. The orphan pairs select a single server to serve as the simulated source of UTC time to all NTP clients. To ensure the orphan is used only when a legitimate source of time is not available, the stratum level must be higher than any stratum level that gets its time from a legitimate source, and low enough to prevent downstream stratum levels from becoming higher than 16. To ensure that orphan mode takes precedence over any servers configured with undisciplined local clocks default to stratum 5, the stratum number used for orphan mode servers is 4. This configuration is shown in the table as “orphan 4”. Additionally, because NTP ignores configuration files that refer to itself as a source of time, it is possible to configure the orphan peers identically.

NOTICE: A TRAK device is required for M1 DSR systems.

The VMware vSphere client does not allow for configuration of NTP settings other than references to time sources. The VMware vSphere client is not used to configure NTP on the VMSs.

The Common Server Architecture (CSA) feature does not affect the NTP servers in K1 and K2 core systems, therefore those systems are not shown in the tables.

Table 37: NTP Servers and Their Time Sources

	L1	L2	M1 non-DSR	M1 DSR	M2	M3 (non-DSR) Single Zone	M3 (non-DSR) Add-on Zone	M3 DSR Single Zone	M3 DSR Add-on - Zone
VMS01	Host: ntp02.zone#, ntp03.zone# Time Sour-	Host: ntp02.zone# Time Sources: ntp01.	Host: ntp02.zone#, ntp03.zone# Time Sour-	Host: ntp02.zone# Time Sources: ntp01.	Host: ntp02.zone# Time Sources: ntp01.	Host: ntp02.zone# Time Sources: ntp01.	Host: ntp02.zone# Time Sources: ntp01.	Host: ntp02.zone# Time Sources: ntp01.	Host: ntp02.zone# Time Sources: ntp01.

Table continued…

	L1	L2	M1 non-DSR	M1 DSR	M2	M3 (non-DSR) Single Zone	M3 (non-DSR) Add-on Zone	M3 DSR Single Zone	M3 DSR Add-on - Zone
	ces: ntp01. zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	ces: ntp01. zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	zone# (in Primary Core), ntp01. zone# (in Backup Core), ntp01. zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	zone# (in Primary Core), ntp01. zone# (in Backup Core), (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	zone# (in Primary Core), ntp01. zone# (in Primary Core of Collocated Zone), (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4
VMS02	N/A	Host: ntp03. zone# Time Sources: ntp01. zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	N/A	N/A	Host: ntp03. zone# Time Sources: ntp01. zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	Host: ntp03. zone# Time Sources: ntp01. zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	Host: ntp03. zone# Time Sources: ntp01. zone# (server) ntp02. zone# (peer), ntp03. zone# (peer) orphan 4	Host: ntp03. zone# Time Sources: ntp01. zone# (server - in Primary Core), ntp01. zone# (server - in Backup Core) ntp02. zone# (peer),	Host: ntp03. zone# Time Sources: ntp01. zone# (server in Primary Core), ntp01. zone# (server in Primary Core of Collocated

Table continued...

	L1	L2	M1 non-DSR	M1 DSR	M2	M3 (non-DSR) Single Zone	M3 (non-DSR) Add-on Zone	M3 DSR Single Zone	M3 DSR Add-on - Zone
								ntp03.zone# (peer) or-phan 4	Zone) ntp02.zone# (peer), ntp03.zone# (peer) or-phan 4
VMS09	N/A	N/A	N/A	Host: ntp05.zone# Time Sour-ces: ntp01.zone# (serv-er in Back-up Core), ntp01.zone# (serv-er in Pri-mary Core) ntp05.zone# (peer), ntp06.zone# (peer) or-phan 4	N/A	N/A	N/A	Host: ntp05.zone# Time Sour-ces: ntp01.zone# (serv-er in Back-up Core), ntp01.zone# (serv-er in Pri-mary Core) ntp05.zone# (peer), ntp06.zone# (peer) or-phan 4	Host: ntp05.zone# Time Sour-ces: ntp01.zone# (serv-er in Pri-mary Core of Col-loca-ted Zone) ntp05.zone# (peer), ntp06.zone# (peer) or-phan 4
VMS10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Host: ntp06.zone# Time Sour-	Host: ntp06.zone# Time Sour-

	L1	L2	M1 non-DSR	M1 DSR	M2	M3 (non-DSR) Single Zone	M3 (non-DSR) Add-on Zone	M3 DSR Single Zone	M3 DSR Add-on - Zone
								ces: ntp01.zone# (in Back-up Core), ntp01.zone# (in Pri-mary Core) ntp05.zone# (peer), ntp06.zone# (peer) or-phan 4	ces: ntp01.zone# (serv-er in Pri-mary Core), ntp01.zone# (serv-er in Pri-mary Core of Col-loca-ted Zone) ntp05.zone# (peer), ntp06.zone# (peer) or-phan 4

A.3
ASTRO 25 Radio Communication System Architectures

An ASTRO® 25 radio communication system is supported by various zone core or core architectures where the Network Time Protocol (NTP) supports system network devices.

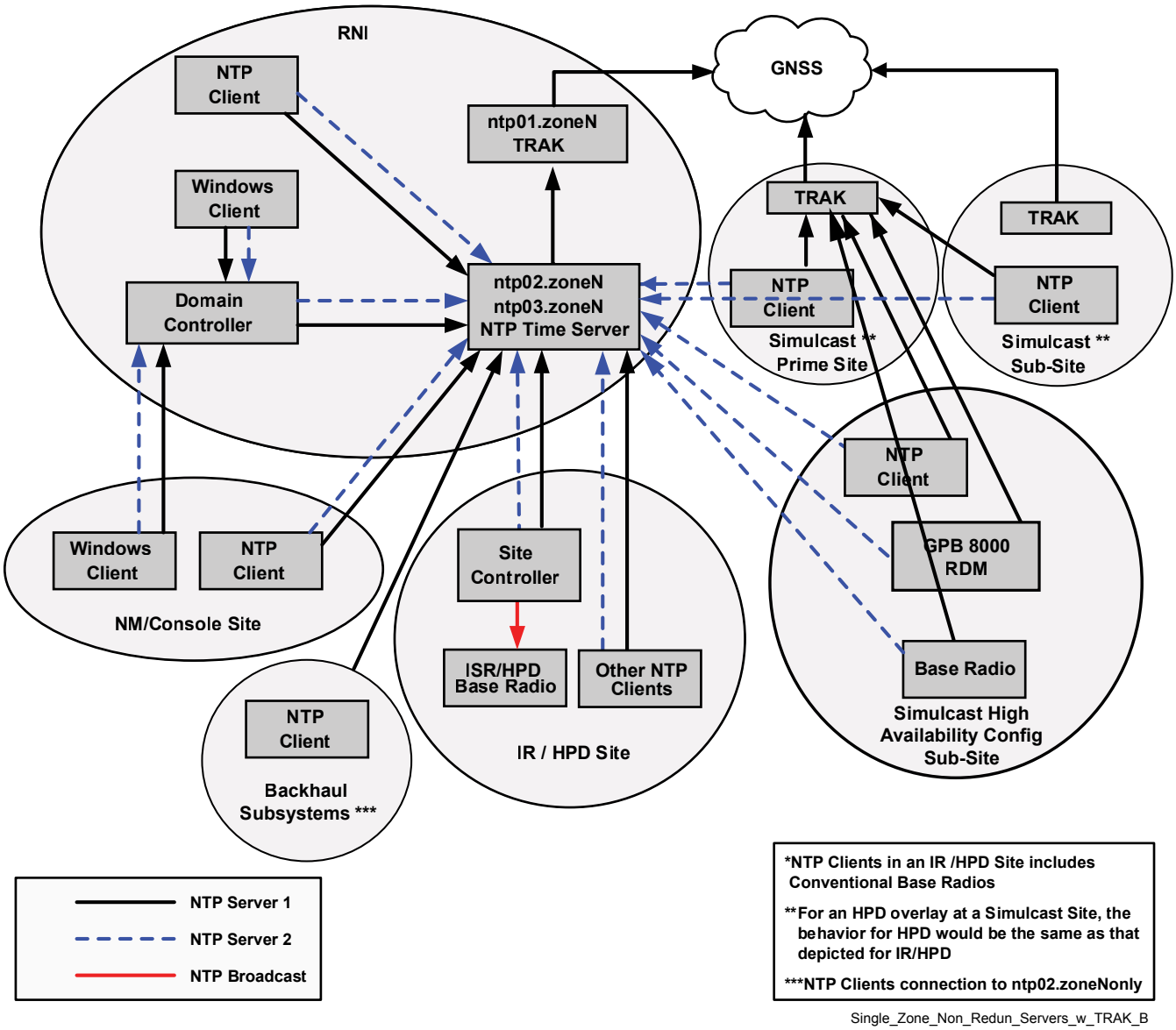
- K1 and K2 zone core – a non-redundant (K1) or redundant (K2) conventional system architecture
- L1 and L2 zone core – a single zone, small scale non-redundant (L1) or redundant (L2) system architecture
- M1 and M2 zone core – a single zone non-redundant (M1) or redundant (M2) system architecture
- M3 zone core – a multi-zone-capable redundant system architecture

This section includes exemplary diagrams which can be used as reference for configuring time servers in the ASTRO® radio systems.

A.3.1
Non-Redundant NTP Server with RNI TRAK in the Single Zone

This figure shows a Non-Redundant Network Time Protocol (NTP) Server with a Radio Network Infrastructure (RNI) TRAK in the Single Zone.

Figure 12: Single Zone Non-Redundant NTP Server with RNI TRAK



In an ASTRO® 25 radio system with a Virtual Management Server (VMS), the VMS hosts both time servers ntp02 and ntp03. The VMS references the TRAK for time. Ntp02 and ntp03 are respectively the first and second time sources for elements in the RNI and at Network Management (NM)/Dispatch Console sites with the notable exception being Windows® devices joined to an Active Directory (AD) Domain. Windows® devices joined to AD receive their time from the Domain Controller (DC). The DC references ntp02 and ntp03 as time sources.

Simulcast Prime Site Non-Geographically Redundant

NTP Clients point to the collocated TRAK for their first-time source and ntp02 in the RNI for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

Simulcast Prime Site Geographically Redundant

A geographically redundant prime site has a TRAK at each prime site half. NTP Clients from both prime site locations point to the TRAK at the Primary Prime Site (ntp01) for their first-time source and ntp02 in the RNI for their second time source. The TRAK at the Secondary Prime Site is not used as an NTP time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03 in the RNI.

Simulcast Sub-Site

NTP clients point to the Simulcast Prime Site TRAK for their first-time source and ntp02 for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

IntelliRepeater Site

The IVD Site Controller points to ntp02 and ntp03 in the RNI. The IntelliSite Repeater Site Base Radios receive NTP through broadcast from the IVD Site Controllers. The Base Radios are configured to only listen to the Site Controllers. Other IntelliRepeater Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

HPD Site

High Performance Data (HPD) Site Controllers have GNSS modules and retrieve NTP from that module. The Configuration/Service Software (CSS) does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP through broadcast from the HPD Site Controllers. The HPD Base Radios are configured to listen only to the HPD Site Controllers. Other HPD Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

HPD Overlay at IntelliRepeater Site

The IVD Site Controller points to ntp02 and ntp03 in the RNI. The HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Site Controllers detect NTP broadcast from the IVD Site Controllers, and disable their own HPD Site Controller NTP Broadcast Mechanisms. The HPD and IVD Base Radios receive NTP through broadcast from the IVD Site Controllers. The HPD and IVD Base Radios are configured to listen only to the IVD Site Controllers. Other HPD and IVD Site elements receive their time from ntp02 and ntp03.

HPD Overlay at IP Simulcast sites

HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP through broadcast from the HPD Site Controllers. The HPD Base Radios are configured to only listen to the HPD Site Controllers. Other HPD Site elements receive their time from ntp02 and ntp03.

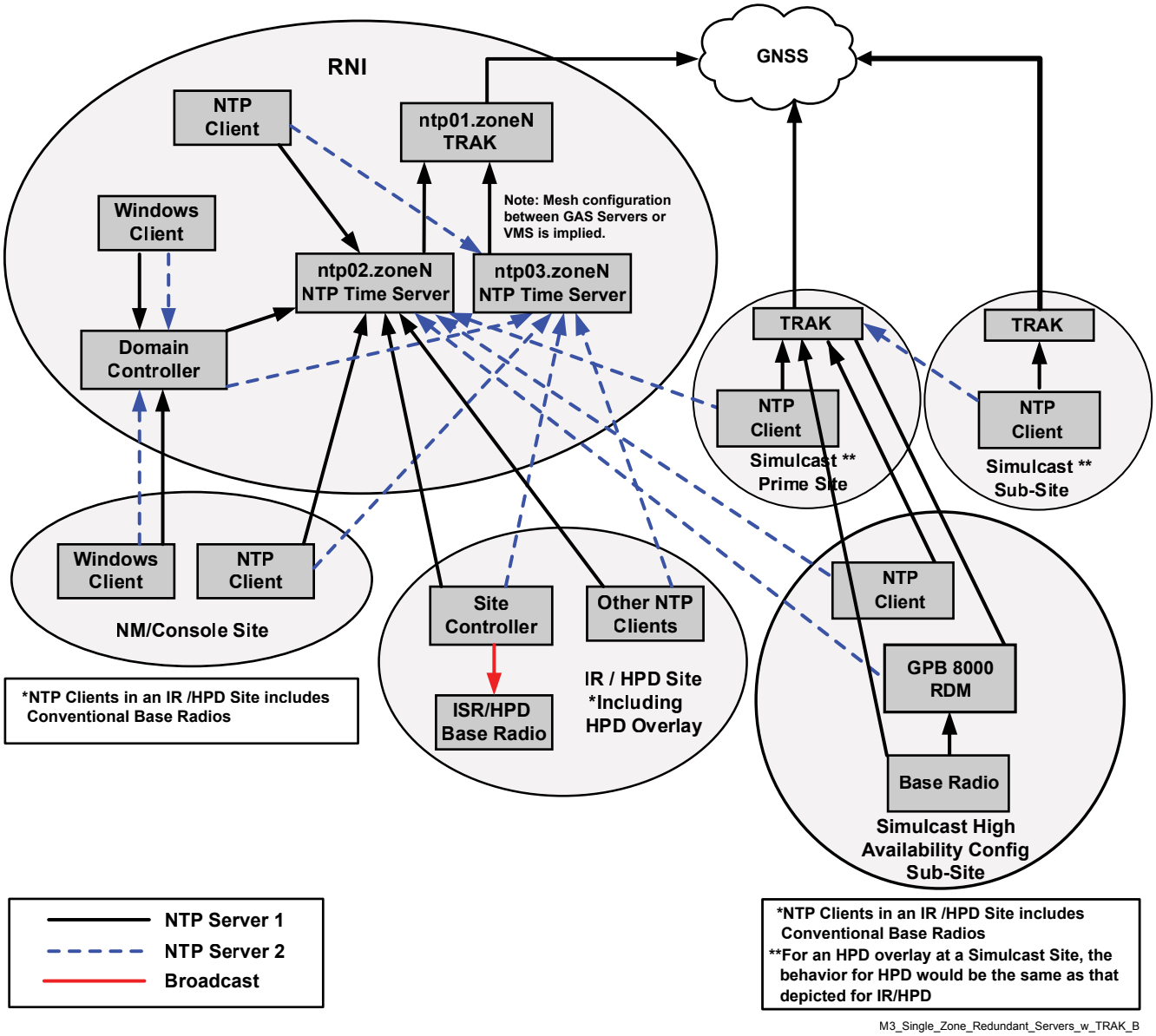
Backhaul Subsystem

The Point-to-Point (PTP) devices (for example, PTP 600 and PTP 800) point to ntp02 for their first-time source. The PTP devices support connection to only one NTP time source. M1, M2, M3, L1, and L2 System types support the Backhaul Subsystem for PTP devices.

A.3.2
Redundant NTP Servers with TRAK in the Single M3 Zone

This figure shows redundant Network Time Protocol (NTP) Servers with TRAK in the Single M3 Zone.

Figure 13: M3 Single Zone Redundant NTP Servers with TRAK



See the *Dynamic System Resilience* manual for additional configurations.

The redundant Virtual Management Servers (VMSs) host the time servers ntp02 and ntp03, and reference the TRAK for time, and reference one another as NTP peers.

Ntp02 and ntp03 are the first and second time sources for elements in the Radio Network Infrastructure (RNI) and at Network Management (NM)/Dispatch Console sites with the notable exception being Windows® devices joined to an Active Directory (AD) Domain. Windows® devices joined to AD receive their time from the Domain Controller. Domain Controllers receive time from ntp02 and ntp03.

Simulcast Prime Site Non-Geographically Redundant

NTP Clients point to the collocated TRAK for their first-time source, and ntp02 in the RNI for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

Simulcast Prime Site Geographically Redundant

A geographically redundant prime site has a TRAK at each prime site half. NTP Clients from both prime site locations point to the TRAK at the Primary Prime Site (ntp01) for their first-time source and ntp02 in the RNI for their second time source. The TRAK at the Secondary Prime Site is not used as an NTP time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03 in the RNI.

Simulcast Sub-Site

NTP clients point to Simulcast Prime Site TRAK for their first-time source, and ntp02 for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

IntelliRepeater Site

The IVD Controller points to ntp02 and ntp03 in the RNI. The ISRIntelliSite Repeater Site Base Radios receive NTP via broadcast from the IVD Site Controllers. The Base Radios are configured to listen only to the Site Controllers. Other IntelliRepeater Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

HPD Site

High Performance Data (HPD) Site Controllers have GNSS modules and retrieve NTP from that module. The Configuration/Service Software (CSS) does not allow NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP via broadcast from the HPD Site Controllers. The HPD Base Radios are configured to listen only to the HPD Site Controllers. Other HPD Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

HPD Overlay Site at IntelliRepeater Site

The IVD Site Controller points to ntp02 and ntp03 in the RNI. The HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Site Controllers detect NTP broadcast from the IVD Site Controllers, and disable their own HPD Site Controller NTP Broadcast Mechanisms. The HPD and IVD Base Radios receive NTP via broadcast from the IVD Site Controllers. The HPD and IVD Base Radios are configured to listen only to the IVD Site Controllers. Other HPD and IVD Site elements receive their time from ntp02 and ntp03.

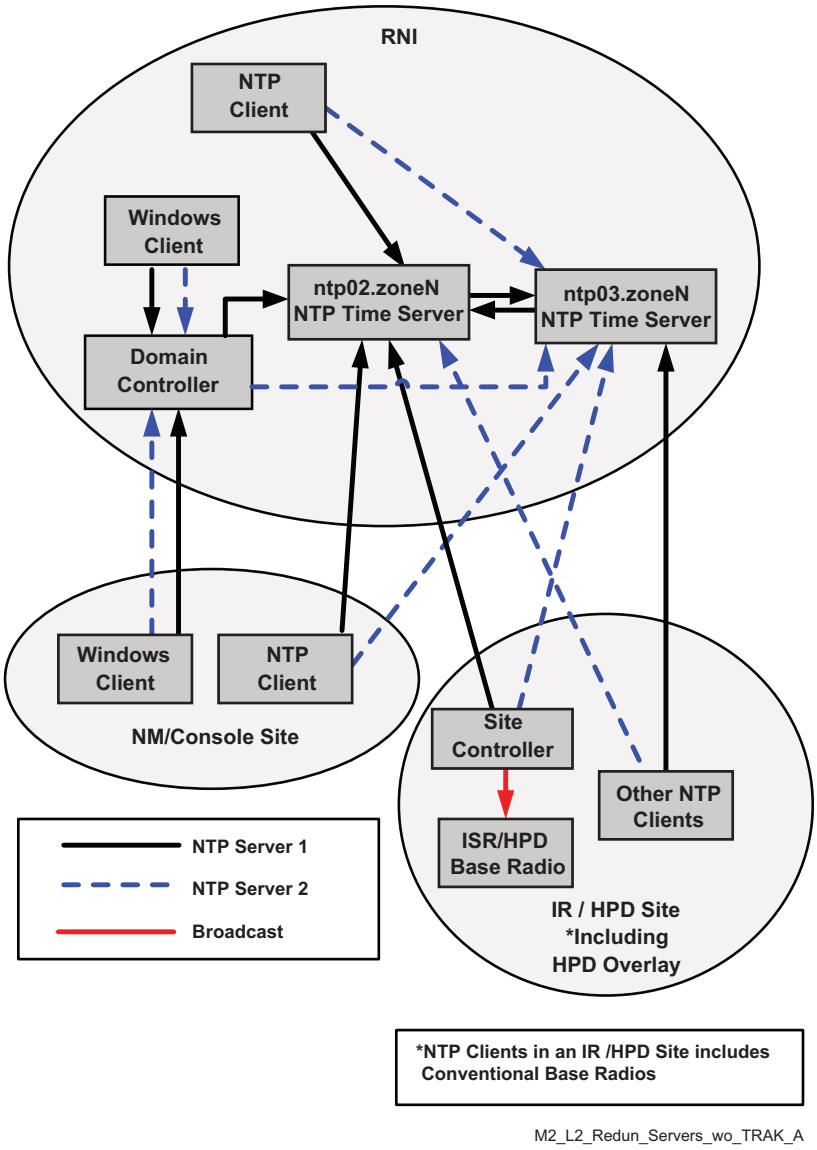
HPD Overlay at IP Simulcast Sites

HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP via broadcast from the HPD Site Controllers. The HPD Base Radios are configured to listen only to the HPD Site Controllers. Other HPD Site elements receive their NTP from ntp02 and ntp03.

A.3.3
Redundant NTP Servers without TRAK in the M2 Single Zone

This figure show redundant Network Time Protocol (NTP) Servers without TRAK in the M2 Single Zone.

Figure 14: M2 Single Zone Redundant NTP Servers (no TRAK)



Redundant Virtual Management Servers (VMSs) host the time servers ntp02 and ntp03. In this configuration, nt02 and ntp03 also reference each other in a peer configuration.

Ntp02 and ntp03 are the first and second time sources for elements in the Radio Network Infrastructure (RNI) and at Network Management (NM)/Dispatch Console sites with the notable exception being Windows® devices that are joined to an Active Directory (AD) Domain. Windows® devices joined to AD receive their time from the Domain Controller.

Simulcast Prime Site Non-Geographically Redundant

NTP Clients point to the collocated TRAK for their first-time source, and ntp02 in the RNI for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

IntelliRepeater Site

The IVD Controller points to ntp02 and ntp03 in the RNI. The IntelliSite Repeater Site Base Radios receive NTP through broadcast from the IVD Site Controllers. The Base Radios are configured to only

listen to the Site Controllers. Other IntelliRepeater Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

HPD Site

High Performance Data (HPD) Site Controllers have GNSS modules and retrieve NTP from that module. The Configuration/Service Software (CSS) does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP via broadcast from the HPD Site Controllers. The HPD Base Radios are configured to listen only to the HPD Site Controllers. Other HPD Site elements including Conventional Base Radios receive their time from ntp02 and ntp03.

HPD Overlay Site

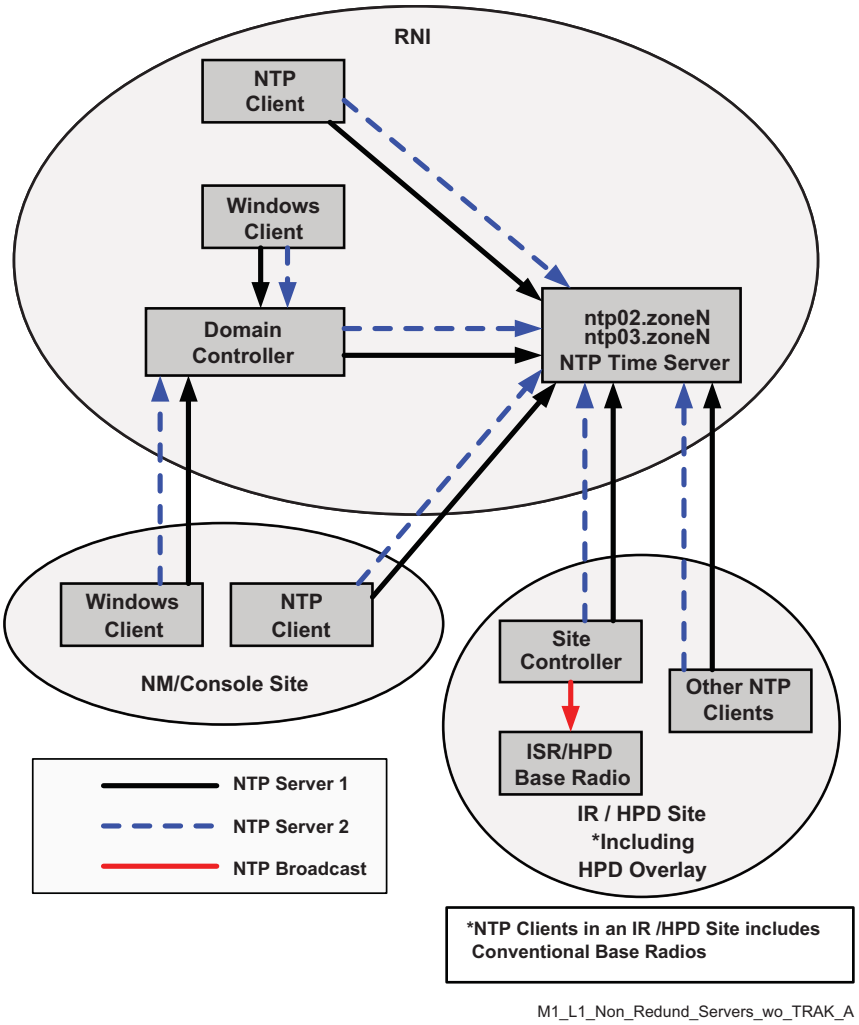
The IVD Site Controller point to ntp02 and ntp03 in the RNI. The HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Site Controllers detect NTP broadcast from the IVD Site Controllers, and disable their own HPD Site Controller NTP Broadcast Mechanisms. The HPD and IVD Base Radios receive NTP via broadcast from the IVD Site Controllers. The HPD and IVD Base Radios are configured to listen only to the IVD Site Controllers. Other HPD and IVD Site elements receive their time from ntp02 and ntp03.

When no TRAK is present in the system, the peering relationship between the two Virtual Management Server NTP servers ensures a consistent clock. The peer relationship causes the VMS NTP servers to negotiate the time between them.

A.3.4
Non-Redundant NTP Servers without TRAK in the M1 Single Zone

This figure shows non-redundant Network Time Protocol (NTP) Servers without TRAK in the M1 Single Zone.

Figure 15: M1 Single Zone Non-Redundant NTP Servers (no TRAK)



The figure shows an M1 or L1 system with a single Virtual Management Server. The Virtual Management Server (VMS) hosts both time servers ntp02 and ntp03.

Ntp02 and ntp03 are the first and second time sources for NTP clients in the Radio Network Infrastructure (RNI) and at Network Management (NM)/Dispatch Console sites with the notable exception being Windows® devices joined to an Active Directory (AD) Domain. Windows® devices joined to AD receive their time from the Domain Controller. The Domain Controllers reference ntp02 and ntp03.

Simulcast Prime Site Non-Geographically Redundant

NTP Clients point to the collocated TRAK for their first time source and ntp02 in the RNI for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

Simulcast Sub-Site

NTP clients point to the Simulcast Prime Site TRAK for their first time source and ntp02 for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03 in the RNI.

IntelliRepeater Site

The IVD Controller points to ntp02 and ntp03 in the RNI. The IntelliSite Repeater Site Base Radios receive NTP from broadcast from the IVD Site Controllers. The Base Radios are configured to only listen to the Site Controllers. Other IntelliRepeater Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

HPD Site

High Performance Data (HPD) Site Controllers have GNSS modules and retrieve NTP from that module. The Configuration/Service Software (CSS) does not allow NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP from broadcast from the HPD Site Controllers. The HPD Base Radios are configured to listen only to the HPD Site Controllers. Other HPD Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

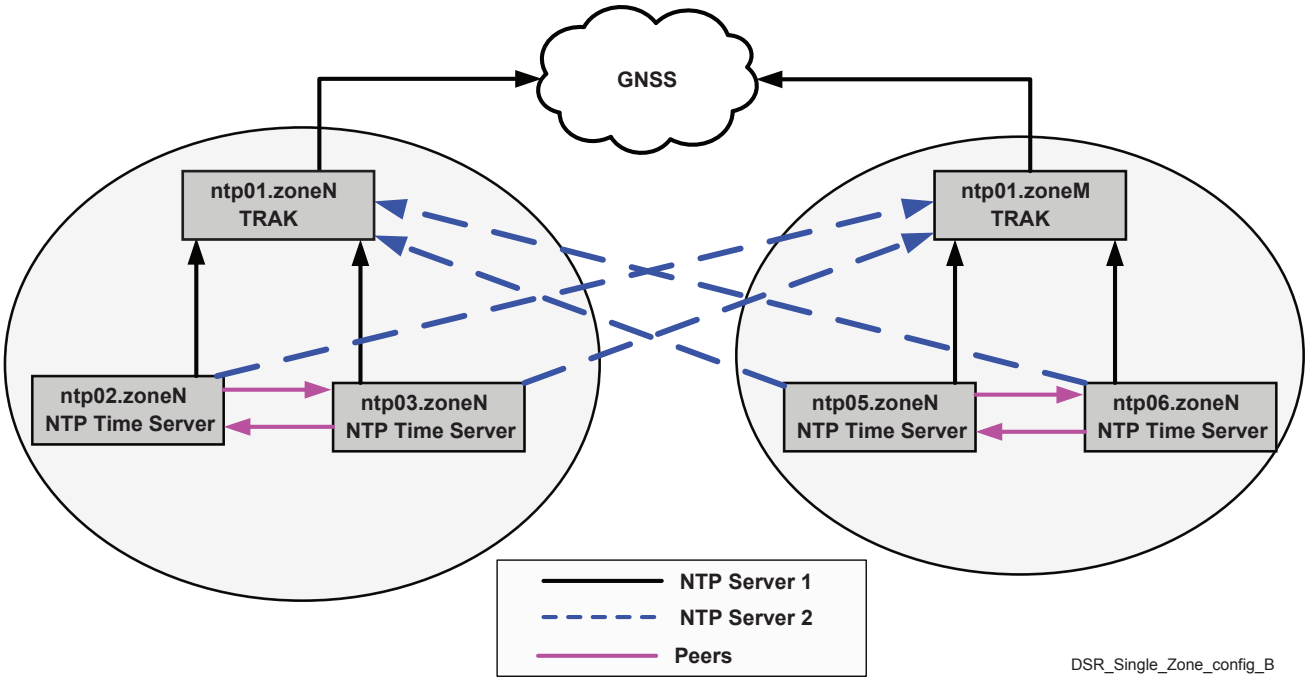
HPD Overlay Site

The IVD Site Controllers point to ntp02 and ntp03 in the RNI. The HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Site Controllers detect NTP broadcast from the IVD Site Controllers, and disable their own HPD Site Controller NTP Broadcast Mechanisms. The HPD and IVD Base Radios receive NTP from broadcast from the IVD Site Controllers. The HPD and IVD Base Radios are configured to listen only to the IVD Site Controllers. Other HPD and IVD Site elements receive their time from ntp02 and ntp03.

A.3.5
DSR NTP Server Configuration in the Single Zone

This figure shows a Dynamic System Resilience (DSR) Network Time Protocol (NTP) Server configuration in the Single Zone.

Figure 16: DSR Single Zone NTP Server Configuration



The Virtual Management Server (VMS) hosts the time servers ntp02, ntp03, ntp05, and ntp06. TRAK servers ntp01.zoneN and ntp01.zoneM are at the Primary and Secondary Master sites, respectively.

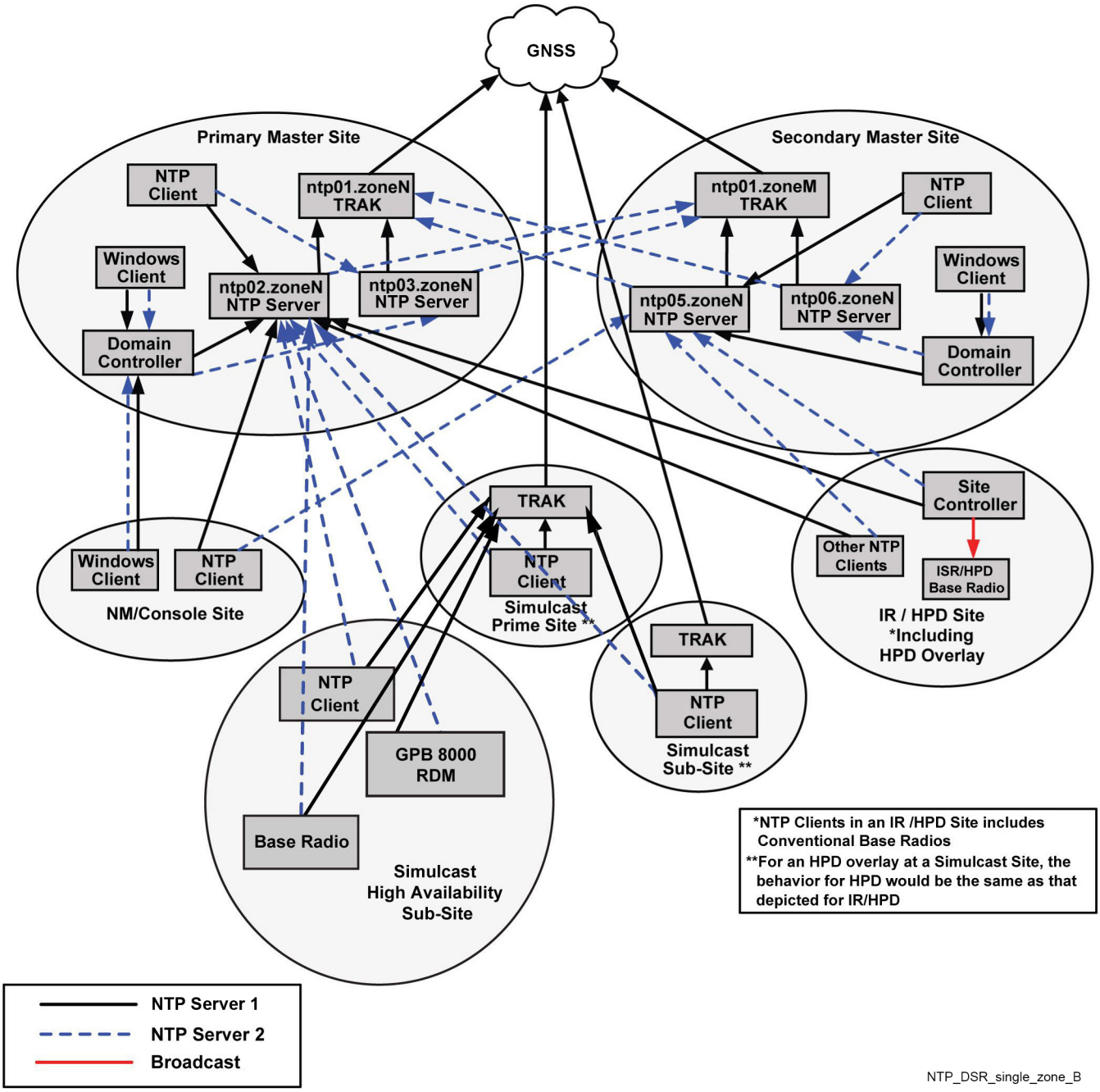
The time servers ntp02 and ntp03 reference the stratum 1 time server ntp01.zoneN where N is the zone number. At the Secondary Master Site ntp05.zoneN and ntp06.zoneN reference ntp01.zoneM, where M is the zone number of the standalone backup core.

The VMS NTP time servers collocated in a master site reference each other in a peer configuration for redundancy but do not reference the VMS NTP servers at other master sites.

A.3.6
DSR Single Zone

This figure shows the Dynamic System Resilience (DSR) feature in a Single Zone.

Figure 17: DSR Single Zone



In the DSR feature, the TRAK at the Primary Master site is named ntp01.zoneN where N is the zone number. The TRAK at the Secondary Master is named ntp01.zoneM where M is the zone number of the standalone backup core.

In an ASTRO 25 radio system with a redundant Master Sites and redundant Virtual Management Servers (VMSs), the VMSs are the first and second time servers for elements at the collocated site. In this configuration, nt02 and ntp03 reference each other in a peer configuration at the primary core. At the backup core, ntp05 and ntp06 reference each other in a peer configuration. However, ntp02 and ntp03 do not reference ntp05 and ntp06.

Windows® devices joined to Active Directory (AD) receive their time from the Domain Controller. ADs point to the collocated VMSs.

Network Management/Dispatch Console Sites

Elements point to ntp02 at the Primary Master Site and ntp05 at the Secondary Master Site except for Windows® devices. Windows® devices joined to AD receive their time from Domain Controller.

Simulcast Prime Site Non-Geographically Redundant

Network Time Protocol (NTP) Clients point to the collocated TRAK for their first-time source and ntp02 in the Prime Master Site for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

Simulcast Sub-Site

NTP Clients point to the Simulcast Prime Site TRAK for their first-time source and ntp02 at the Primary Master site for their second time source. For conventional overlay configurations, Conventional Base Radios receive their time from ntp02 and ntp03.

IntelliRepeater Site

The IVD Controller points to ntp02 and ntp03 in the RNI. The ISRIntelliSite Repeater Site Base Radios receive NTP through broadcast from the IVD Site Controllers. The Base Radios are configured to only listen to the Site Controllers. Other IntelliRepeater Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp03.

HPD Site

High Performance Data (HPD) Site Controllers have GNSS modules and retrieve NTP from that module. The Configuration/Service Software (CSS) does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP through broadcast from the HPD Site Controllers. The HPD Base Radios are configured to listen only to the HPD Site Controllers. Other HPD Site elements, including Conventional Base Radios, receive their time from ntp02 and ntp05.

HPD Overlay at IntelliRepeater Site

The IVD Site Controller points to ntp02 and ntp03 in the RNI. The HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Site Controllers detect NTP broadcast from the IVD Site Controllers, and disable their own HPD Site Controller NTP Broadcast Mechanisms. The HPD and IVD Base Radios receive NTP through broadcast from the IVD Site Controllers. The HPD and IVD Base Radios are configured to listen only to the IVD Site Controllers. Other HPD and IVD Site elements receive their time from ntp02 and ntp03.

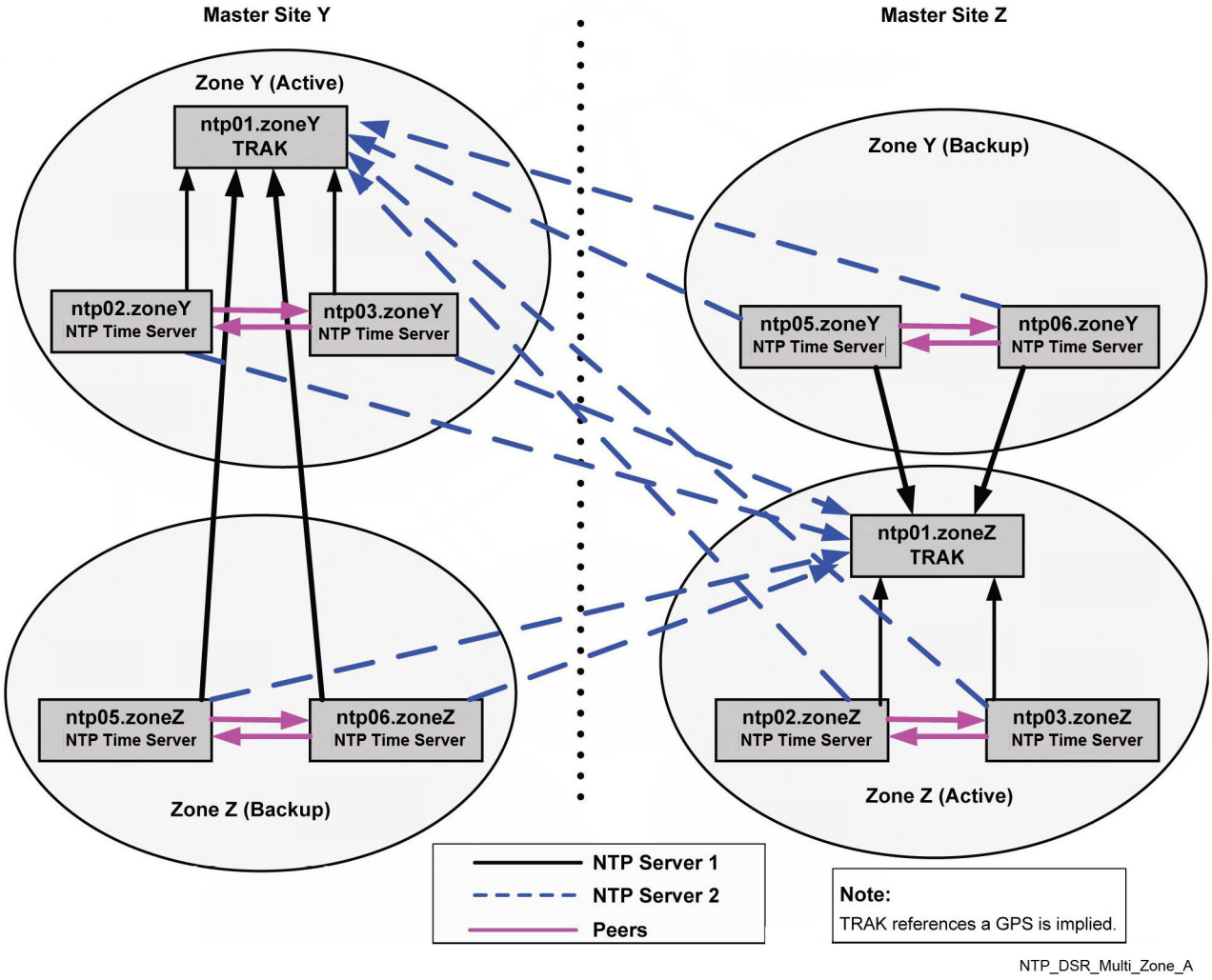
HPD Overlay at IP Simulcast Sites

HPD Site Controllers have GNSS modules and retrieve NTP from that module. The CSS does not allow the NTP server IP addresses to be configured for the HPD Site Controllers. The HPD Base Radios receive NTP through broadcast from the HPD Site Controllers. The HPD Base Radios are configured to only listen to the HPD Site Controllers. Other HPD Site elements receive their time from ntp02 and ntp03.

A.3.7
DSR Multi-Zone NTP Server

This figure shows the Dynamic System Resilience (DSR) feature in a multi-zone Network Time Protocol (NTP) Server.

Figure 18: DSR Multi-Zone NTP Server



A TRAK is present at each Master Site and uses the service name ntp01 and the domain name of the Primary zone at the Master Site.

The Virtual Management Servers (VMSs) in the primary core host time servers ntp02 and ntp03. In this figure, the primary cores are referenced as Zone Y (primary) and Zone Z (primary). Ntp02 and ntp03 point to the collocated stratum 1 time server, ntp01.zoneY and to the stratum 1 time server, ntp01.zoneZ, at the alternate site.

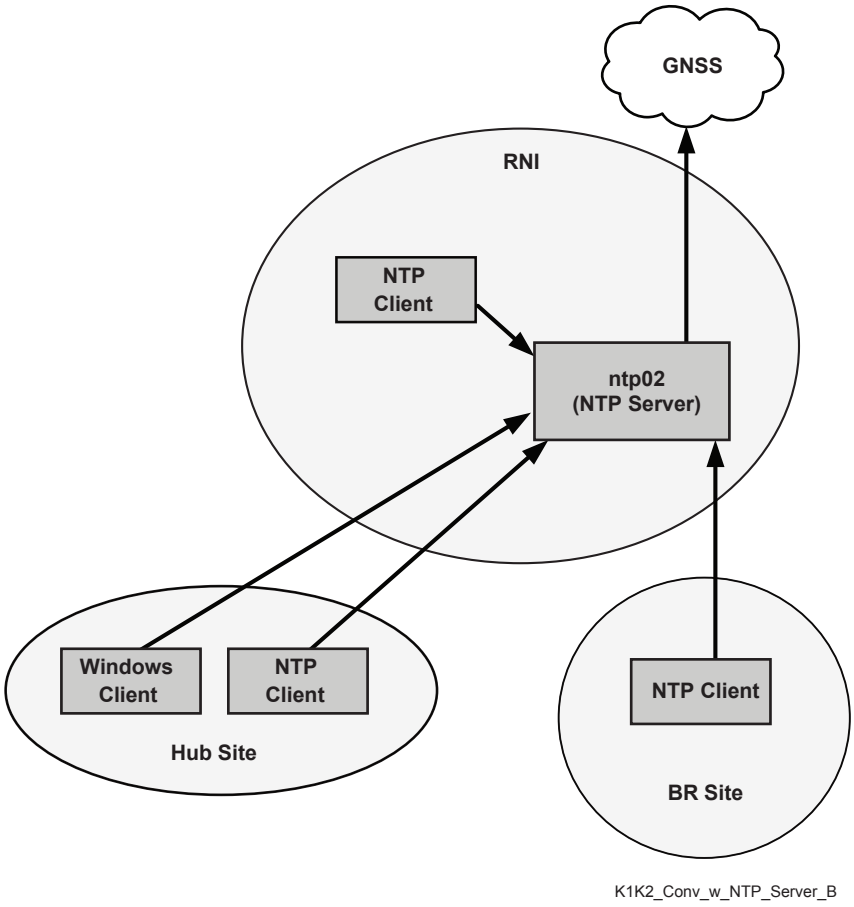
TheVMSs in the secondary core host time servers ntp05 and ntp06. In this figure, the secondary cores are referenced as Zone Z (secondary) and Zone Y (secondary). Ntp05 and ntp06 point to the collocated stratum 1 time server, ntp01.zoneZ and to the stratum 1 time server, ntp01.zoneY, at the alternate site.

The VMS NTP servers point to the VMS NTP servers collocated at the same master site in a peer configuration. VMSs that do not host time servers are not in the NTP peer configuration but are NTP clients.

A.3.8
ASTRO 25 Conventional with an NTP Server in the K Core

This figure shows an ASTRO® 25 Conventional configuration with a Network Time Protocol (NTP) server in the K core.

Figure 19: K Core ASTRO 25 Conventional with an NTP Server



The figure shows an ASTRO® 25 K core system with a third-party NTP server. Ntp02 is used as the source for elements in the Radio Network Infrastructure (RNI), Hub sites, and Base Radio sites.

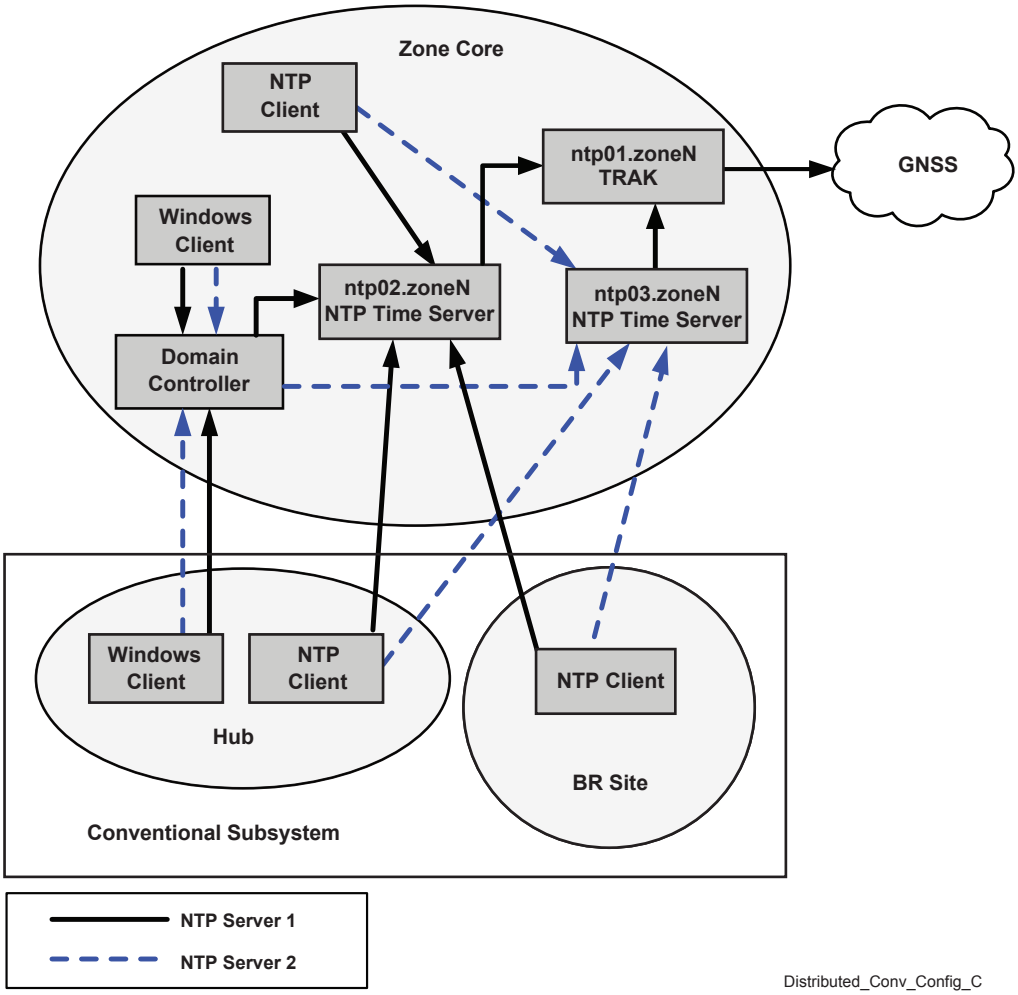
The NTP server may be a time source provided either by Motorola Solutions or by your organization. It uses the addressing information, as indicated in the System Configuration Plan for ntp02. Contact your system administrator for this plan.

A.3.9
Distributed Conventional Configuration

This figure shows the Distributed Conventional Configuration.

Figure 20: Distributed Conventional Configuration

Only one hub and one base radio site are shown in the figure. Conventional subsystems are flexible in configuration but always consist of hubs and base radio sites. A conventional subsystem may have multiple hubs and base radio sites. A system may contain multiple conventional subsystems.



In a Distributed Conventional Configuration, TRAK 9100 devices may be used to provide clocking for conventional simulcast transmitter synchronization, but when they are in the C-Sub configuration, they are not used to provide Network Time Protocol (NTP). All devices in the C-Sub are configured to use the NTP service in the zone core. Additionally, no Ethernet connection is provided by the network for the TRAK devices.

The Distributed Conventional Configuration introduces a Conventional Subsystem composed of a flexible configuration of Hubs and Base Radio Sites within limits. This figure shows only a single Conventional Subsystem, with a single Hub and a single Base Radio Site. Multiple Hubs and Base Radio Sites may be present in a Conventional Subsystem and multiple Subsystems may be present in an ASTRO® 25 system.

A conventional subsystem is connected to a zone core (see the M1, M2, and M3 diagrams for more information on NTP configuration of the master site). No time servers are in the conventional subsystem. For simplicity, an M1 zone core is shown in the diagram.

Elements at the conventional hubs are either Windows elements or non-Windows elements. Windows elements are joined to Active Directory and receive their time from the Domain Controller. Non-Windows elements receive time from NTP02 and NTP03 at the zone core respectively.

Elements at base radio sites receive their time from NTP02 and NTP03 respectively.

Distributed Conventional Architecture supports Dynamic System Resilience (DSR). See the DSR diagrams for more information on configuration. Hub sites and base radio sites are configured similarly to Network Management (NM) Dispatch sites. Also, other site types may be collocated in the same system with a Distributed Conventional Configuration. This configuration does not affect the configuration of NTP of those site types. See the corresponding diagrams for more information for configuration of those site types.

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Appendix B

TRAK Devices

This appendix lists all TRAK models and explains where the devices are used.

B.1 TRAK Device Support Overview

These tables list the configuration in which TRAK devices are supported, and provide a comparison of the TRAK models.

Table 38: TRAK Device Support Overview

	Analog Conventional (Circuit or IP)	Digital Conventional (Circuit or IP)	P25 Circuit Trunking No TDMA	P25 IP Trunking No TDMA	P25 IP Trunking With TDMA	3600 Circuit Trunking
Master Site - M1	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - M2	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - M3	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - L1	N/A	N/A	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - L2	N/A	N/A	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - K1	–	-	N/A	N/A	N/A	N/A
Master Site - K2	-	-	N/A	N/A	N/A	N/A
Prime Site Voting/Simul-	TRAK 9100-8E	TRAK 9100-8E	N/A	TRAK 9100-8E	TRAK 9100-8E	N/A

Table continued…

	Analog Conventional (Circuit or IP)	Digital Conventional (Circuit or IP)	P25 Circuit Trunking No TDMA	P25 IP Trunking No TDMA	P25 IP Trunking With TDMA	3600 Circuit Trunking
cast (GCP 8000/GCM 8000/MLC 8000)	TRAK 8835-2M/8M					
Remote Site TX/RX Voting/Simulcast (GTR 8000/GTR 8000 ESS)	TRAK 8835-2M/8M TRAK 8835-3M	TRAK 9100-9E TRAK 8835-2M/8M TRAK 8835-3M	TRAK 9100-9E	TRAK 9100-9E	TRAK 9100-9E	TRAK 9100-9E
Remote Site High Availability TX/RX Voting/Simulcast (GTR 8000 ESS)	N/A	N/A	N/A	RDM+GNSS TRAK 9100-9E TRAK 8835-3M	RDM+GNSS TRAK 9100-9E TRAK 8835-3M	N/A
Remote Site RX-only Voting/Simulcast (GPW 8000)	Internal or External Freq. Reference (5 MHz or 10 MHz)	Internal or External Freq. Reference (5 MHz or 10 MHz)	RDM (GNSS optional) TRAK 9100-9E TRAK 8835-3M	RDM (GNSS optional) TRAK 9100-9E TRAK 8835-3M	RDM (GNSS optional) TRAK 9100-9E TRAK 8835-3M	N/A
Repeater Site with Standalone GCP 8000 + GTR 8000/QUANTAR)	Internal or External Freq. Reference (5 MHz or 10 MHz)	Internal or External Freq. Reference (5 MHz or 10 MHz)	N/A	For GTR #1-6: GCP 8000 TRAK 9100-8E TRAK 8835-3M For GTR #7-28 and QUANTAR: TRAK 9100-8E TRAK 8835-3M UHSO (QUANTARs only)	For GTR #1-6: GCP 8000 TRAK 9100-8E TRAK 8835-3M For GCP 8000, GTR #7-28 and QUANTAR: TRAK 9100-8E TRAK 8835-3M UHSO (QUANTARs only)	N/A

Table 39: TRAK Model Comparison Matrix

	Redundant GNSS Receivers	Redundant Oscillators	72 hr holdover	Network Time Server	UEM Support(M & L Core Only)	GMC Manager Support (M & L Core Only)
TRAK 9100-8E (includes distribution modules)	X	X	X	X	X (through RS232 interface to SDM3000)	X (through RS232 interface to SDM3000)
TRAK 9100-9E (distribution modules available as add-on)	X		X	X	X (through RS232 interface to SDM3000)	X (through RS232 interface to SDM3000)
TRAK 8835-3M			X	X	X	
TRAK 8835-2M						
TRAK 8835-8M				Not certified	X	

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