PRR-10
Primary Reference Receiver

User Guide

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datum

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Note The contents of any amendments may effect operation and/or maintenance of the equipment.

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PRR-10 USER GUIDE

OVERVIEW

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SECTION 1 SCOPE OF USER GUIDE

This user guide provides the necessary information for installing, operating, and maintaining the Datum Model PRR-10 Primary Reference Receiver.

The user guide contains seven sections.

Section 1 Overview – Basic information applicable to the entire instrument.

Section 2 Shelves – Information applicable to each of the PRR-10 shelves.

Section 3 Modules – Individual PRR-10 Module information, specifications and configurations.

Section 4 Installation – Necessary information for installing and preparing the PRR-10 for operation.

Section 5 Operation – Detailed information on operating modes, indicators, alarms, and sample displays regarding all the PRR-10 firmware commands.

Section 6 Maintenance – Troubleshooting guidelines, information for ordering subassemblies and reshipment.

Section 7 Accessories – Provides information on the accessories that can be used with the PRR-10.

Note

This User Guide may describe options, features and functions which were not yet available in the PRR-10 at the time of publication. There may also be options, features and functions that exist in the PRR-10 that are not described in this User Guide because the information for the User Guide was not yet available at the time of publication.

1.1 PRR-10 Overview

1.1.1 Definition

The Datum PRR-10 is a complete Primary Reference Source (PRS) designed to provide highly reliable Stratum 1 synchronization signals.

1.1.2 Purpose

The PRR-10 can be used as a Stratum 1 Primary Reference Source for digital switches, cross-connect systems, SONET, and SDH transmission systems. In addition, the PRR-10 can provide Stratum 1 signals for Timing Signal Generators (TSGs) employing either Stratum 2, 3E, or 3 clocks, or any level in between. It will operate autonomously with any TSG which accepts either DS1 or E1 input signals. The PRR-10 can function as a PRS in small and medium-sized Central Offices, and can be used effectively to provide the complete timing requirements of remote sites and Controlled Environment Vaults (CEVs).

1.1.3 Description

The PRR-10 was designed around Bellcore GR-2830. It provides Stratum 1 synchronization signals for all TSGs designed to meet Bellcore GR-378-CORE and all levels between Stratum 2 and Stratum 3. It is modular in design and has various types of modules to select from so it can be configured to meet various requirements. The system can be configured to operate from

either external or internal high quality rubidium or quartz local oscillators (LO) from a TSG or cesium standard. The PRR-10 can also accommodate one high quality local oscillator in the Main Shelf and a second oscillator in an optional expansion unit. These oscillators are used for the LO input; GPS signals are used for the reference input for the Direct Digital Synthesis (DDS) techniques that are employed to enable optimum clock performance on the outputs. Micro-controllers control the DDS circuitry and store configuration information, operating status and signal data. They also record faults, changes in configuration, and changes in operating status. The operator can retrieve this information remotely through two RS-232 communications ports. The PRR-10 is shipped with factory default settings. As the operator specifies new operating limits, they are stored in non-volatile memory. These new settings remain until changed or returned to factory defaults by the operator.

Modular Design. The PRR-10 is designed to comply with the application flexibility concepts introduced in Bellcore GR-2830. Modular design is comprised of a Main Shelf and an optional Expansion Shelf. A selection of plug-in modules allows the user to easily configure, upgrade, or expand the PRR-10 to meet their application requirements. Consequently, the PRR-10 can be configured either as a Network PRS or an Office PRS, as defined in GR-2830.

Architecture. With redundant configuration architecture and careful design, the PRR-10 provides the utmost in system reliability, with fully redundant circuitry and no single point of failure. Maintenance activities such as replacing a GPS or an optional output module can be accomplished with power applied and the unit fully operational, with no perceptible transient in the output synchronization signal.

User Interfaces. User Interface connections are on the rear of the Main Shelf. There are two RS-232 communications ports individually configurable up to 19.2 KB, allowing full communication with the instrument either locally or remotely. The PRR-10 includes a simple proprietary user interface, plus various levels of password-protected access for configuration and detailed performance monitoring and diagnostics. TL1 may also be used for configuration and detailed performance monitoring.

Shelves. The PRR-10 Main Shelf and optional Expansion Shelf are described in Section 2, PRR-10 SHELVES.

Plug-in Modules. Modules are all installed from the front of the shelves. Refer to Section 3, PRR-10 MODULES, for specific information on each module that can be used in the PRR-10.

Status and Alarm Indicators. All indicators are on the front panels of the various modules. Refer to the individual modules in Section 3.1-1, Status Module Front Panels, for the description of each indicator.

1.2 General Specifications

The following table lists general specifications for the Model PRR-10 Primary Reference Receiver. Refer to Section 3, PRR-10 MODULES, for specifications on individual modules and to Section 7, PRR-10 ACCESSORIES, for accessory specifications.

Table 1.2-1: Specifications, Model PRR-10

GENERAL	
Characteristic	Specification
Long Term Accuracy	Stratum 1 PRS per ANSI T1.101-1995 & ITU-T G.811
Clock Performance	Meets requirements of Bellcore GR-1244-Core
LO Inputs	Accepts two inputs of 5 MHz or 10 MHz (user selectable), with an accuracy of 5 x 10^{-9} or better
Reference Signals	GPS signal
Event log	Stores up to 400 events with the last 10 stored in NVRam
Configuration Data	Stores all configuration information and module Identification information
Alarm Levels	Minor, Major & Critical Minor & Major Alarms can be elevated to the next higher level after a user- defined time period
Comm Ports	Dual Communications Ports, Comm 1 is the Craft Interface & Comm 2 is the Remote Interface
Communications	A simple proprietary terminal user interface or TL1 may be used to communicate with the Main Shelf
ALARM CLOSURES	
Minor	1 Amp Form C contact closure
Major	1 Amp Form C contact closure
Critical	1 Amp Form C contact closure
SHELF POWER	
DC	–42 to –72 Vdc, pos. or neg. Ground
DC Power @-48 Vdc Nominal	< 60 watts, per shelf < 85 watts with optional rubidium installed, per shelf
SHELF MECHANICAL	
Mounting	Standard 19″ rack or optional rack ears for 23″ rack
Width	17.0″ (43.2 cm)
Depth	12″ (30.5 cm)
Height	5.25″ (13.3 cm)
Weight	< 25 lbs. (11.34 kg)
SHELF ENVIRONMENTAL	
Operating Temperature	+1.7°C to +49°C @ 8.3°C maximum per hour rate change
Storage Temperature	20°C to 75°C
Relative Humidity	80% Non-condensing over specified temperature range
Altitude	200 ft. (-60 m) below sea level to 13,000 ft. (4000 m) above sea level
Vibration	Meets Bellcore TR-NWT-00063 Issue 5 Operating: Paragraphs 4.5.2 & 4.5.4 Non-Operating: Paragraph 4.4.1 (4 inch drop test)
ANTENNA ENVIRONMENTAL	
Temperature	–40°C to +75°C
Relative Humidity	100% Non-Immersed
Altitude	200 ft. (-60 m) below sea level to 13,000 ft. (4000 m) above sea level
CE (consult factory for compliant configurations)	
Safety	IEC-950/EN60950, Aug. 93
Radiated Emissions	CISPER-22/EN55022
Immunity	IEC-1000-4-1 1995-01 Level 2
ESD	IEC 1000-4-2 1995-01
Fast Transient / Burst	IEC 1000-4-4 1995-01
Conducted Emissions	1554 Conducted Emissions for DC Power & applicable sections of ANSI T1.315

SHELVES

2

SECTION 2 PRR-10 SHELVES

Overview. This section describes the capability and architecture of each of the PRR-10 Shelves. Also included are example configurations.

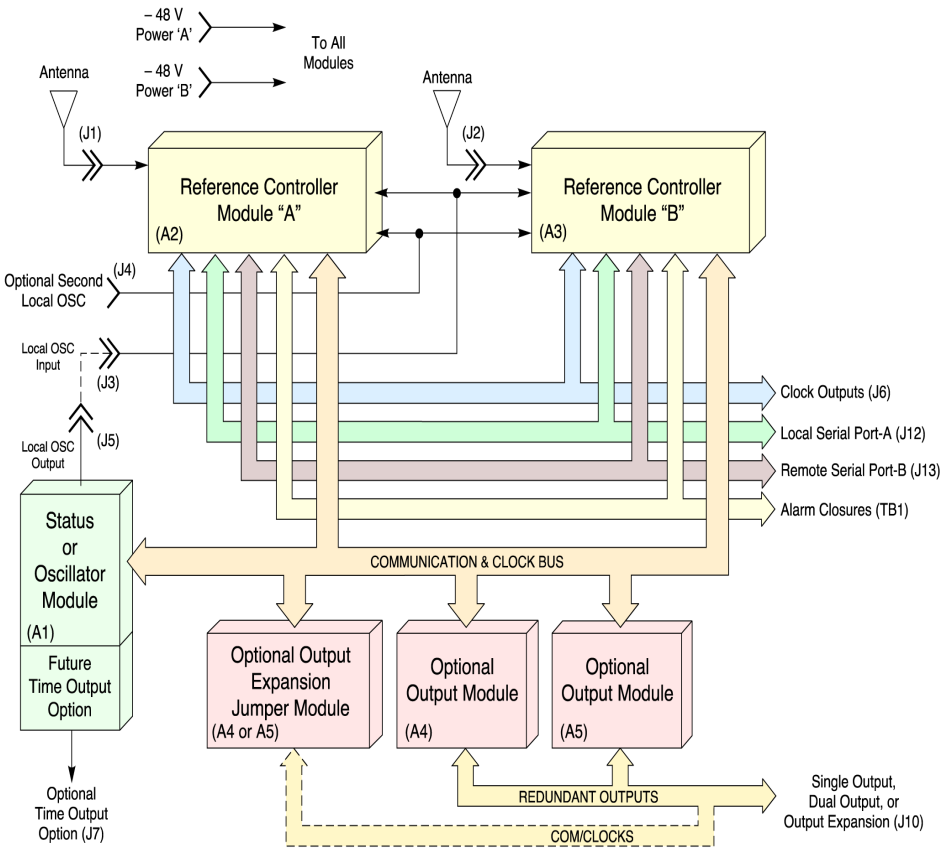
2.1 PRR-10, Main Shelf

The Main Shelf provides for two fully redundant source modules which may be any combination of Global Positioning System (GPS) Satellite Receivers which provide the radio navigation engine, receiver, frame generator, and processor functions. The Main Shelf can accommodate a pair of optional redundant output modules with up to 10 outputs, or an Output Expansion (jumper) Module. It can also accommodate an optional local oscillator (LO) Module.

2.1.1 Architecture

The Main Shelf has redundant –48 Vdc power bus for distributing A and B power to each module. Each module has its own DC to DC converters for regulating the power needed by that module. The main micro-controllers are located on the Reference Controller Modules, which communicate with each other and all other modules via a Serial Peripheral Interface (SPI) bus. Clock signals created by the reference controller(s) are distributed via a clock bus to the output modules for conditioning and distribution. Figure 2.1-1 shows the architecture of the PRR-10 Main Shelf.

Figure 2.1-1: Block Diagram, PRR-10 Main Shelf



2.1.2 Input and Output Connections

All input and output connections to the Main Shelf are on the rear of the unit. Table 2.1-1 describes each of the connections.

Table 2.1-1: PRR-10 Main Shelf Connections

NAME	TYPE	APPLICATION
A-BUS	2-Pos Terminal Block	A-Power connection
B-BUS	2-Pos Terminal Block	B- Power connection
FG	Stud	Frame Ground Connection
LG	Screw Terminal	Logic Ground Connection to Frame Ground
Alarm Closures	9-Pos Terminal Block	Minor, Major & Critical Alarm Connections
Antenna (J1)	TNC	Reference Controller “A” Antenna Connection
Antenna (J2)	TNC	Reference Controller “B” Antenna Connection
Local OSC (J3)	BNC	Local Oscillator “A” Input Connection
Local OSC (J4)	BNC	Local Oscillator “B” Input Connection
Local OSC Output (J5)	BNC	Optional Local Oscillator Output
Clock Outputs (J6)	14-Pin Ribbon Conn.	DS1 or E1 Outputs from Reference Controller
AUX Interface (J8)	25-Pin D-Type Conn.	Not Used
Output Expansion (J10)	50-Pin Ribbon Conn.	Interface Connection to Expansion Shelf or Optional Output Module Outputs
Local Serial Port (J12)	9-Pin D-Type Conn.	Local (Craft Person) Serial Port Connection
Remote Serial Port (J13)	9-Pin D-Type Conn.	Remote Location Serial Port Connection

2.1.3 Example Configurations

Figure 2.1-2 illustrates the front view of the PRR-10 Main Shelf configured with dual GPS Reference Controllers.

Figure 2.1-2: PRR-10 Main Shelf Front View

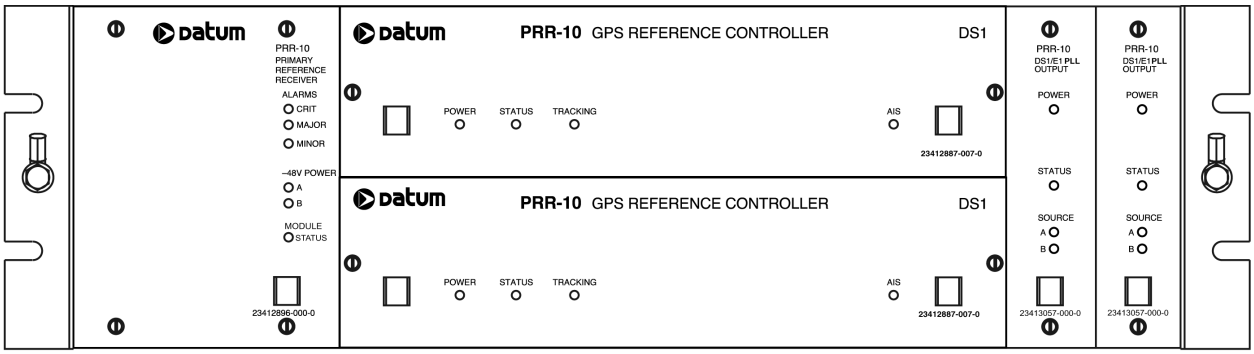
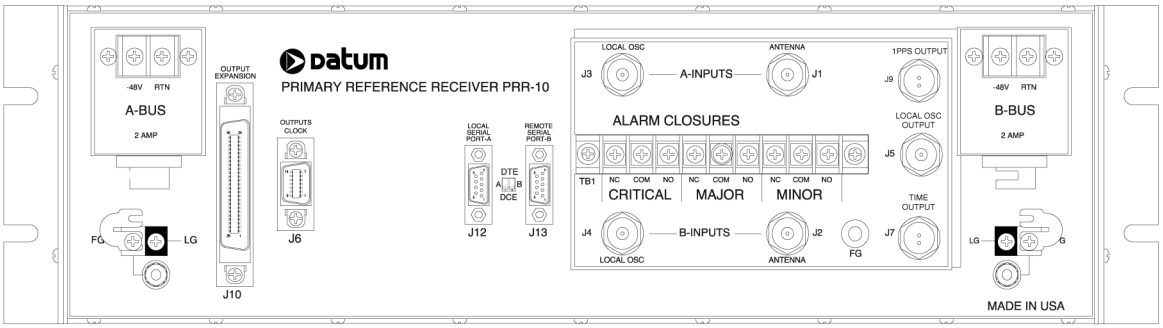


Figure 2.1-3 illustrates the rear view of the PRR-10 Main Shelf.

Note In the Dual-Controller configuration with Output Modules (main or expansion), it is Datum's recommendation not to use the two Clock Outputs on J6. In this configuration, the two controllers each produce one of the two outputs on J6. In order to maintain synchronicity on these outputs, the Sync Slave Controller is continuously "re-sychronized" to the Sync Master Controller. The Sync Slave Controller's output on J6 may move up to 60 ns.

Figure 2.1-3: PRR-10 Main Shelf Rear View



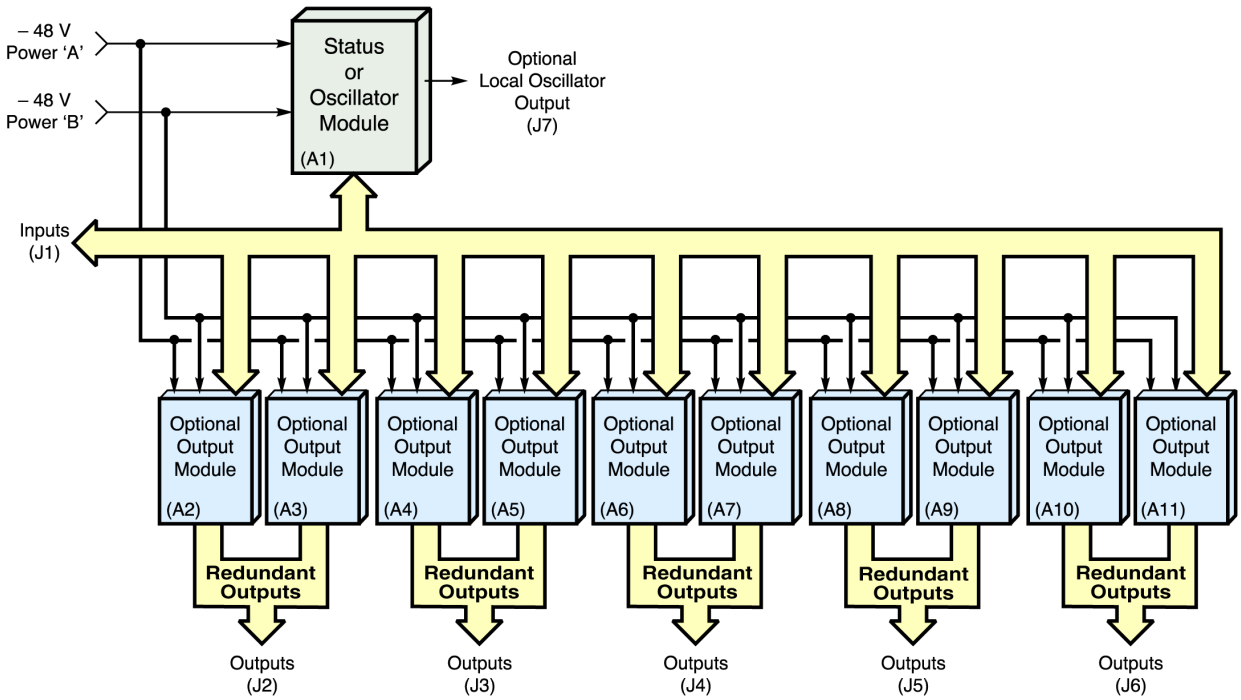
2.2 Expansion Shelf

The Expansion Shelf provides for five pairs of optional redundant output modules, with up to 10 outputs for each pair. The Expansion Shelf interfaces to the Main Shelf via an Expansion (jumper) Module and a SCSI type multiconductor cable. The clock outputs are available on 50-pin ribbon connectors. The Expansion Shelf also accommodates a Status Module or an optional LO Module.

2.2.1 Architecture

The Expansion Shelf has redundant –48 Vdc power bus for distributing A and B power to each module. Each module has its own DC to DC converters for regulating the power needed by that module. The serial bus from the Main Shelf communicates with each of the modules in the Expansion Shelf. The clock bus from the Main Shelf is fed to the Expansion Shelf where additional output modules condition and distribute additional clock signals. Figure 2.2-1 shows the architecture of the PRR-10 Expansion Shelf.

Figure 2.2-1: Block Diagram, PRR-10 Expansion Shelf



2.2.2 Expansion Shelf Connections

All input and output connections to the expansion shelf are on the rear panel. Table 2.2-1 describes each of the connections.

Table 2.2-1: PRR-10 Expansion Shelf Connections

NAME	TYPE	APPLICATION
A-BUS	2-Pos Terminal Block	A-Power Connection
B-BUS	2-Pos Terminal Block	B-Power Connection
FG	Stud	Frame Ground Connection
LG	Screw Terminal	Logic Ground Connection to Frame Ground
Local OSC Output (J5)	BNC	Optional Local Oscillator Output
Input (J1)	50-Pin Ribbon Conn.	Interface Connection from Main Shelf
Output (J2)	50-Pin Ribbon Conn.	Optional Output Module Output
Output (J3)	50-Pin Ribbon Conn.	Optional Output Module Outputs
Output (J4)	50-Pin Ribbon Conn.	Optional Output Module Outputs
Output (J5)	50-Pin Ribbon Conn.	Optional Output Module Outputs
Output (J6)	50-Pin Ribbon Conn.	Optional Output Module Outputs

2.2.3 Example Configuration

Figure 2.2-2 is a front view of the PRR-10 Expansion Shelf configured with one Status Module and ten optional Output Modules. Figure 2.2-3 shows an example of the Expansion Shelf rear panel.

Figure 2.2-2: PRR-10 Expansion Shelf Configured with Status Module and Optional Output Modules

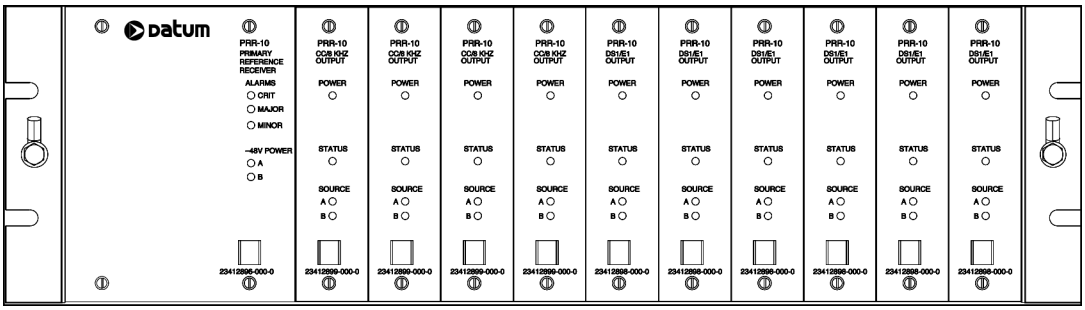
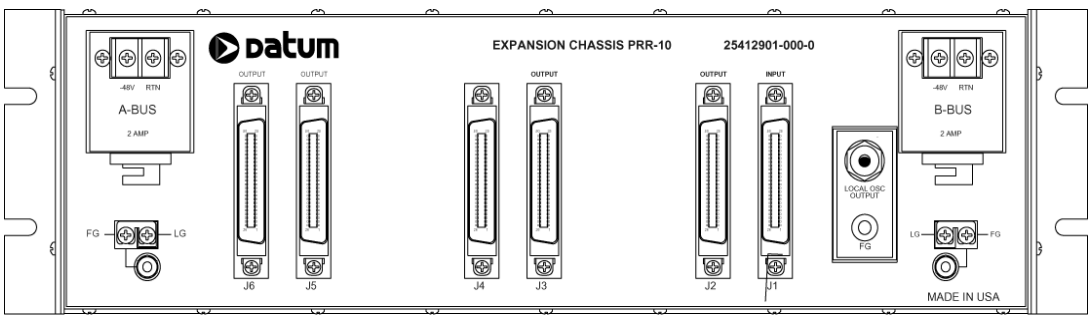
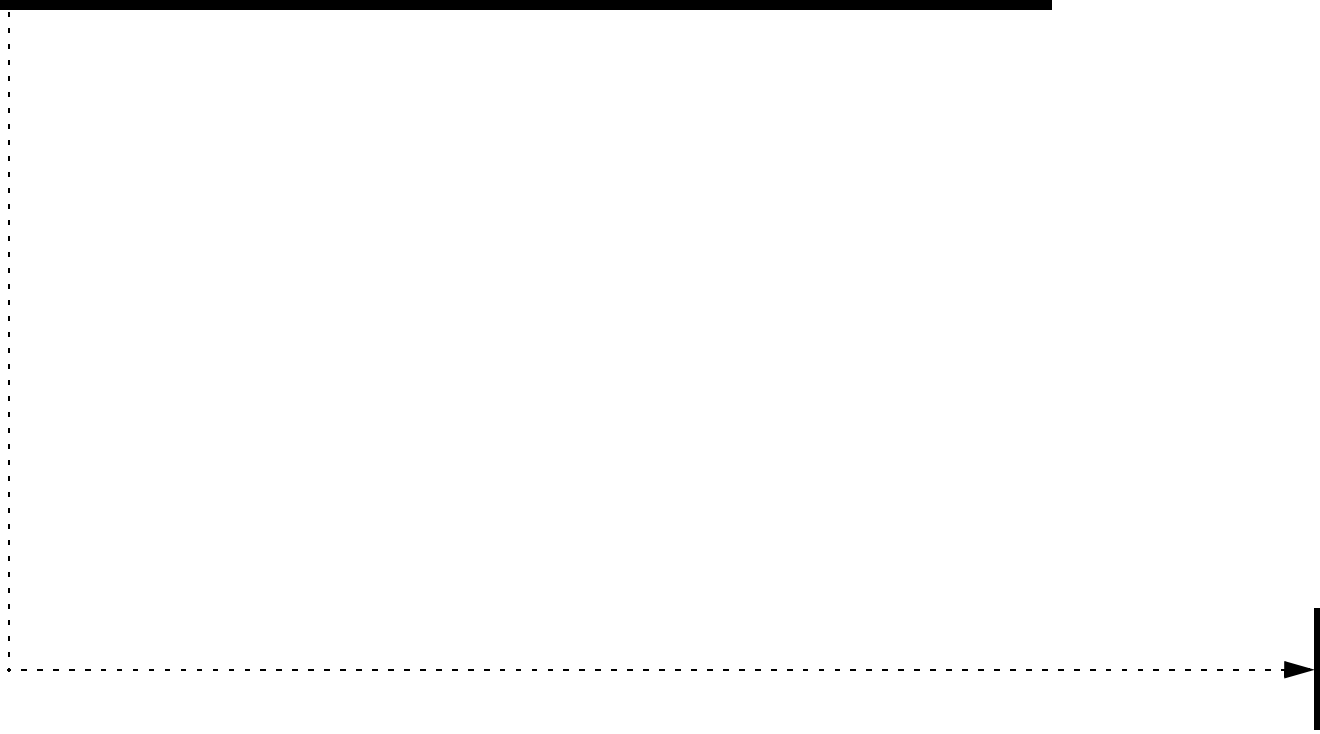


Figure 2.2-3: Rear View of PRR-10 Expansion Shelf



MODULES



SECTION 3 PRR-10 MODULES

The PRR-10 can be configured to meet the needs of a variety of applications, depending on the type of modules installed in the unit. This section describes the functions, specifications and configurations of each module that can be used in the PRR-10.

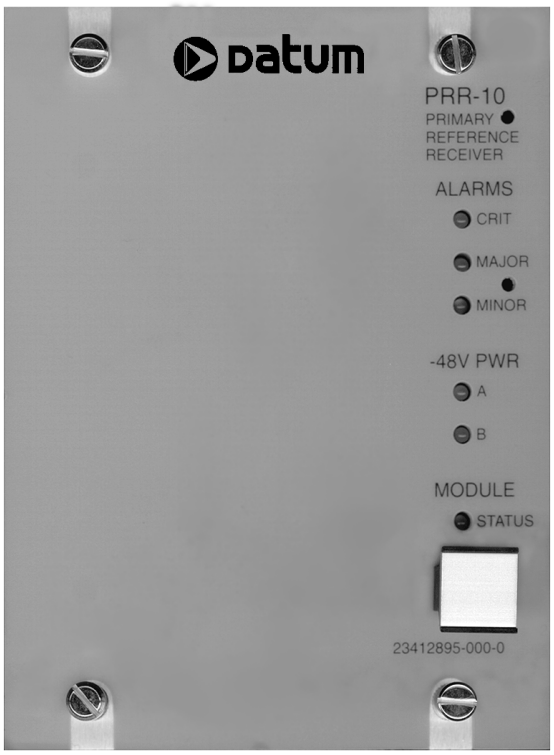
3.1 Status Module

The Status Module is an optional module which is used in the A1 slot of the shelves when there is no Local Oscillator Module used. The Status Module contains indicators for monitoring the presence of both the A and B –48 Vdc power bus to the PRR-10 shelves. It also contains the indicators for Critical, Major and Minor alarms when used in the Main Shelf. When used in an expansion chassis, the alarm indicators are disabled and covered with a snap-on legend block. The alarm indicators are driven by the Reference Controller Module(s) under normal operation. Table 3.1-1 lists the Item Number for this module and Figure 3.1-1 shows the module's front panels.

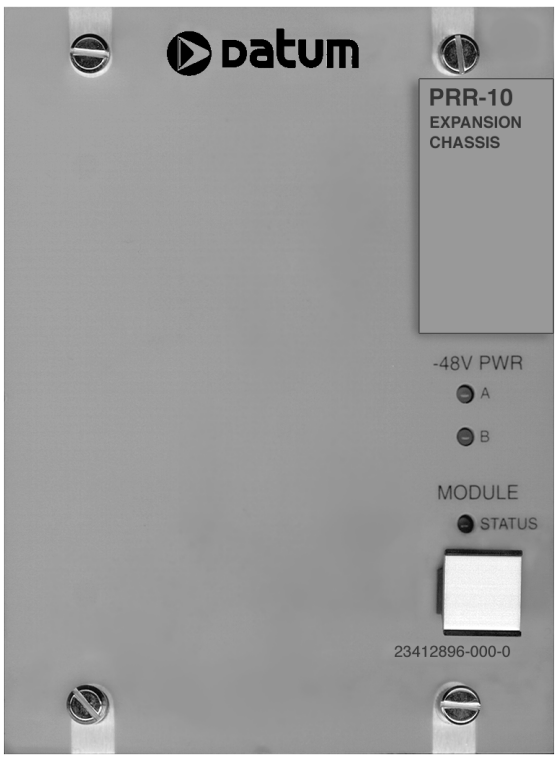
Table 3.1-1: Module Item Number

ITEM NUMBER	DESCRIPTION
23412896-000-0	Module, Status

Figure 3.1-1: Status Module Front Panels



Main Shelf



Expansion Shelf

3.1.1 Indicators

Table 3.1-2 provides a description of the indicators on the panel of the Status Module.

Table 3.1-2: Status Module

INDICATOR	COLOR	DESCRIPTION
–48 V POWER A	Green Off Red	On = –48 Vdc is present on A Bus Off = no power is present on A Bus On = power is connected reverse polarity on A Bus
–48 V POWER B	Green Off Red	On = –48 Vdc is present on B Bus Off = no power is present on B Bus On = power is connected reverse polarity on B Bus
CRITICAL ALARM	Red	On = Critical Alarm Off = No Alarm
MAJOR ALARM	Red	On = Major Alarm Off = No Alarm
MINOR ALARM	Yellow	On = Minor Alarm Off = No Alarm

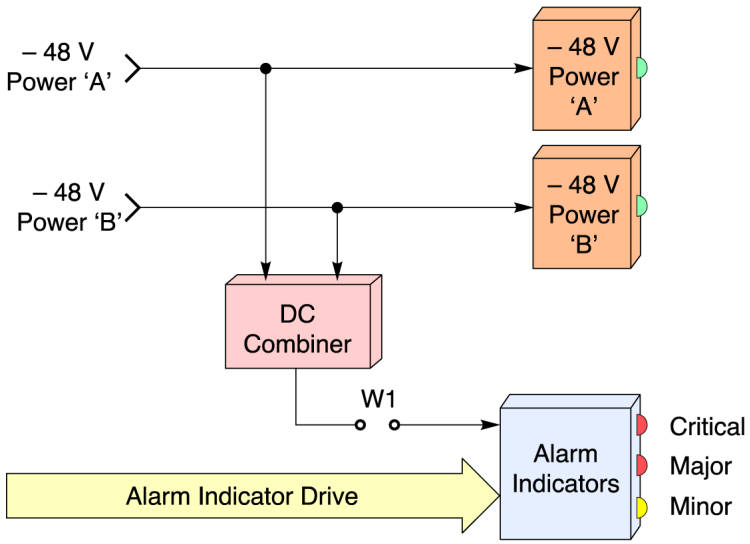
3.1.2 Functional Description

The following discussion refers to Figure 3.1-2 Block Diagram, Status Module.

The –48 V Power indicators A and B are connected directly across the associated power bus and are illuminated green when power is connected properly. If either A or B Power bus fuses on the shelf blows, or the power is disconnected the associated indicator will no longer be illuminated. If either A or B –48 V Power is connected in reverse polarity, the associated indicator will illuminate Red, indicating improper connection of power.

The A and B –48 V Power are combined to supply power to the alarm indicators when jumper W1 is installed. The alarm indicators are only used when the Status Module is installed in a Main Shelf. The alarm indicators are driven by a logic source and selected lines from the Reference Controller Module(s) installed in the Main Shelf. If no Reference Controllers are installed, all alarm indicators are illuminated.

Figure 3.1-2: Block Diagram, Status Module



3.1.3 Specifications

Table 3.1-3 lists the specifications for the Status Module.

Table 3.1-3: Specifications, Status Module

CHARACTERISTIC	SPECIFICATION
DC Voltage	–42 Vdc to –72 Vdc
Module Power	< 5 watts @ 48 Vdc
Alarm Interface	Logic source +5 Vdc ±10% Select Lines, logic zero, open collecter 10ma. sink = On

3.1.4 Installation and Operation

The module needs to be configured for the appropriate shelf it is being installed in.

1) When being installed in the Main Shelf, Jumper W1 needs to be installed so that the alarm indicators are activated.
2) When being installed in either Expansion Shelf, Jumper W1 needs to be removed to deactivate the alarm indicators and the snap-on legend block (PRR-10, Expansion Shelf), supplied with the shelf, needs to be installed in the upper left corner of the module's front panel.

3.1.4.1 Module Insertion

To install a Status Module in the PRR-10, insert it into the card guides located in the top and bottom of the shelf. Slide the module into the guides until it seats into the connector on the backplane. Tighten the captive screws located at the top and bottom of the module's panel.

Caution Be careful to completely insert the module into the slot and tighten the captive screws. A partially inserted module may be damaged or may not function properly.

3.1.4.2 Operational Check

1) After installing the module and with power applied to the instrument, verify the POWER indicators are eliminated.
2) Verify the module is receiving the input signals by observing the indicators.
3) For normal operation, the indicators should be as follows:

INDICATOR	STATE
–48 V PWR "A"	Green
–48 V PWR "B"	Green
Alarm, CRIT	Off
Alarm, MAJOR	Off
Alarm, MINOR	Off

Note Indicators may take a few seconds after module insertion to reach proper status.

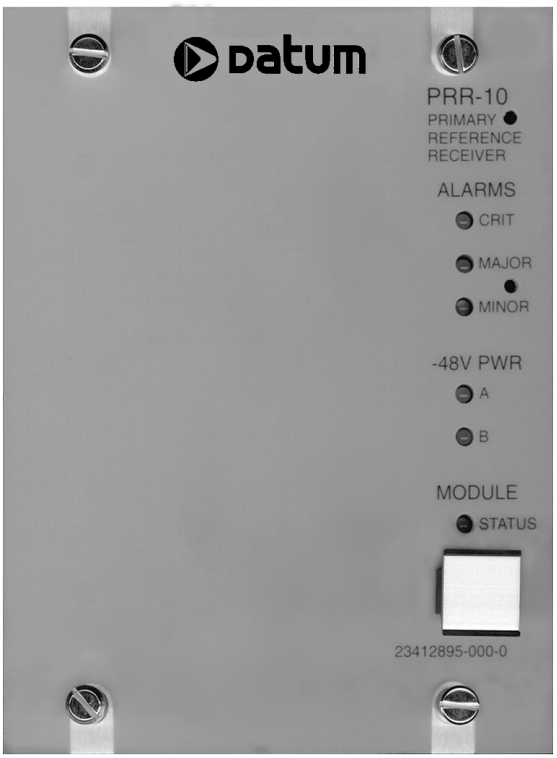
3.2 Oscillator/Status Modules

The OSC/Status Module is an optional module which is used in the A1 slot of the shelves. OSC/Status Module is available with either a medium stability quartz oscillator, or a high stability rubidium oscillator. It also contains indicators for monitoring the presence of both the A and B –48 Vdc power bus to the PRR-10 shelves and indicators for Critical, Major and Minor alarms when used in the Main Shelf. When used in an expansion chassis, the alarm indicators are disabled and covered with a snap-on legend block. The alarm indicators are driven by the Reference Controller Module(s) under normal operation. Table 3.2-1 lists the Item Numbers for the various modules while Figure 3.2-1 and Figure 3.2-2 show the module's front panels.

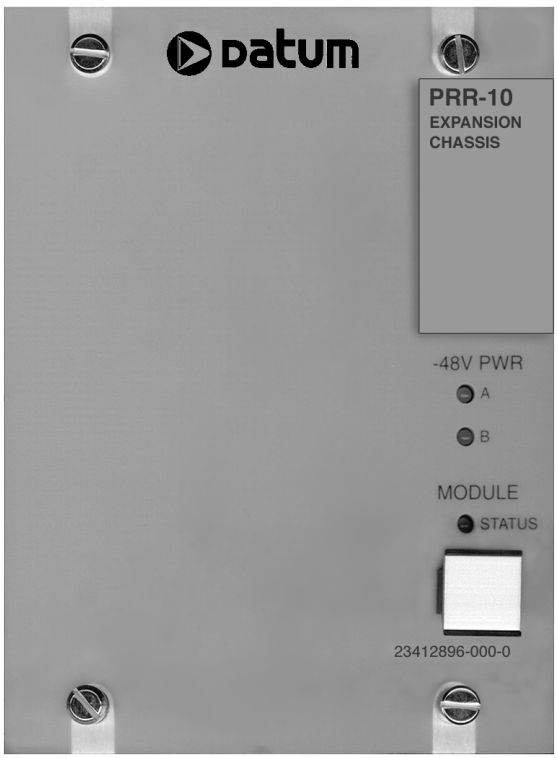
Table 3.2-1: Module Item Numbers

ITEM NUMBER	DESCRIPTION
23412895-000-0	Module, OSC/Status w/ Quartz Oscillator
23412895-001-0	Module, OSC/Status w/ Rubidium Oscillator

Figure 3.2-1: OSC/Status Module Front Panels (Quartz Oscillators)



Main Shelf



Expansion Shelf

Figure 3.2-2: OSC/Status Module Front Panels (Rubidium Oscillators)

Main Shelf **Expansion Shelf**

3.2.1 Indicators

Table 3.2-2 provides a description of the indicators on the panel of the OSC/Status Modules.

Table 3.2-2: Indicators, OSC/Status Modules

INDICATOR	COLOR	DESCRIPTION
–48 V POWER A	Green Off Red	On = –48 Vdc is present on A Bus Off = no power is present on A Bus On = power is connected reverse polarity on A Bus
–48 V POWER B	Green Off Red	On = –48 Vdc is present on B Bus Off = no power is present on B Bus On = power is connected reverse polarity on B Bus
CRITICAL ALARM	Red	On = Critical Alarm Off = No Alarm
MAJOR ALARM	Red	On = Major Alarm Off = No Alarm
MINOR ALARM	Yellow	On = Minor Alarm Off = No Alarm
MODULE STATUS (Quartz OSC Module)	Green	ON = DC to DC Converters are Okay Off = DC to DC Converter Fault
Rb OSC STATUS (Rb OSC Module)	Green	On = Rb Internal Circuits are Locked and DC Converters are Okay Off = Rb or DC to DC Converter Fault

3.2.2 Functional Description

The following discussion refers to Figure 3.2-3 Block Diagram, OSC/Status Module.

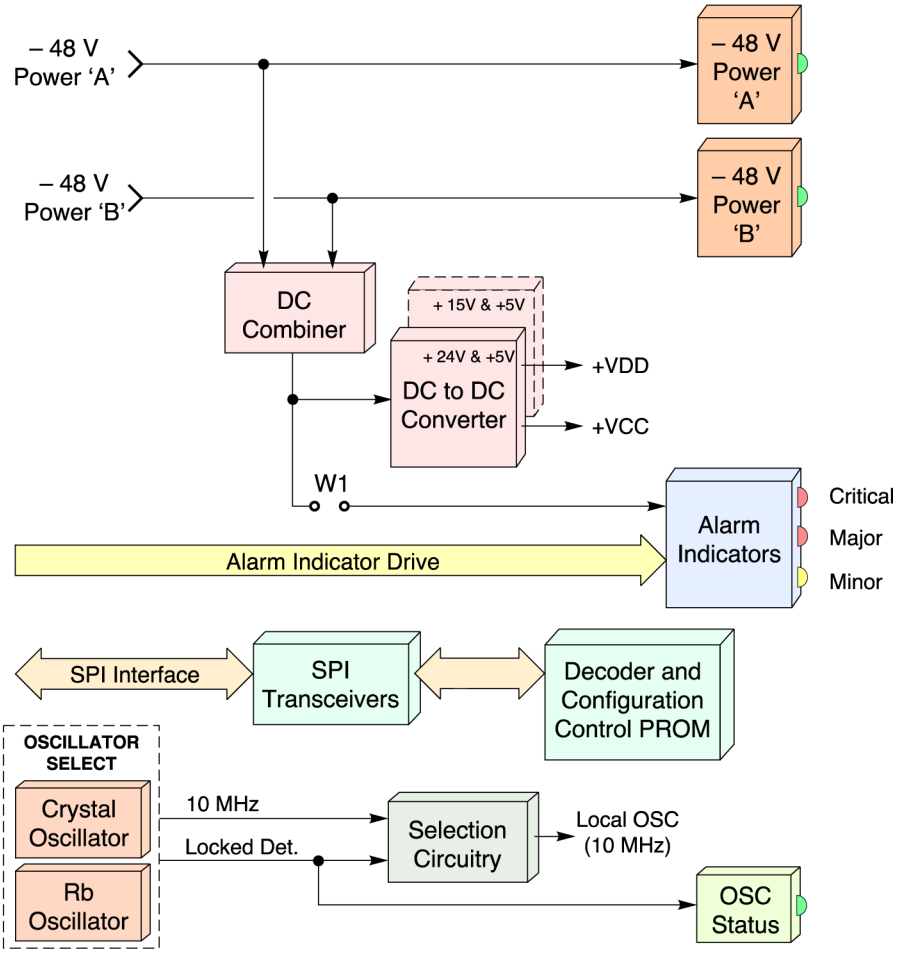
The –48 V Power indicators A and B are connected directly across the associated power bus and are illuminated green when power is connected properly. If either A or B Power bus fuses on the shelf blows, or the power is disconnected the associated indicator will no longer be illuminated. If either A or B –48 V Power is connected in reverse polarity, the associated indicator will illuminate Red, indicating improper connection of power.

The A and B –48 V Power are combined to supply power to the DC to DC converters for powering the oscillators and logic. The combined power also supplies power to the alarm indicators when jumper W1 is installed. The alarm indicators are only used when the OSC/Status Module is installed in a Main Shelf. The alarm indicators are driven by a logic source and select lines from the Reference Controller Module(s) installed in the Main Shelf. If no Reference Controllers are installed, all alarm indicators are illuminated.

The oscillator output is 10 MHz and is passed through selection circuitry as the Local OSC (LO) output. If there is a DC to DC converter fault, or in the case of an Rb oscillator internal circuits not being locked, the selection circuitry disables the LO output from the module.

Configuration control information for each module is stored at the factory in non-volatile memory on the card. This information is accessed via tristate transceivers and decoder circuitry using the Serial Peripheral Interface (SPI) bus by a Reference Controller Module. The user can request this information via one of the PRR-10 communications ports by using the commands described in the Operation Section of this user guide.

Figure 3.2-3: Block Diagram, Oscillator/Status Module



3.2.3 Specifications

Table 3.2-3 lists the specifications for the OSC/Status module.

Table 3.2-3: Specifications, OSC/Status Module

CHARACTERISTIC	SPECIFICATION
Alarm Interface	Logic source +5 Vdc ± 10% Select Lines, logic 0, open collecter 10ma. sink = On
Serial Peripheral Interface	Data and Clock are RS-485 levels Address Lines are logic levels logic 0 = .5 V logic 1 = 4.5 V
DC Voltage	–42 Vdc to –72 Vdc

Table 3.2-3: Specifications, OSC/Status Module

Quartz Oscillator	
Module Power @ 48 Vdc	< 13.5 watts, during warm-up < 9.5 watts, nominal
Output: Freq. Level Impedance	 10 MHz 1 Vrms ±10% 50 ohms
Stability: Aging Short Term Freq. vs Temp.	 < 5 X 10^{-10}, per day after 60 days continuous operation < 2 X 10^{-11}, one second measurement period < 1.5 X 10^{-8}, 0℃ to +60℃
Stabilization Time	< 1 X 10^{-8} of final freq. in one hr. @ 25℃
Rubidium Oscillator	
Module Power @ 48 Vdc	< 48 watts, during warm-up < 21 watts, nominal
Output: Freq. Level Impedance	 10 MHz 0.5 Vrms ±10% 50 ohms
Stability: Aging Short Term Freq. vs Temp.	 < 5 X 10^{-11}, per month after 30 days continuous operation < 3 X 10^{-11}, one second measurement period < 4 X 10^{-10}, –20℃ to +70℃ @ base plate
Stabilization Time	< 1 X 10^{-9} of final freq. in 10 min. @ 25℃

3.2.4 Installation and Operation

The module needs to be configured for the appropriate shelf it is being installed in.

1) When being installed in the Main Shelf, Jumper W1 needs to be installed so that the alarm indicators are activated.
2) When being installed in either Expansion Shelf, Jumper W1 needs to be removed to deactivate the alarm indicators. The snap-on legend block (PRR-10, Expansion Shelf), supplied with the shelf, needs to be installed on in the upper left corner of the module's front panel.

3.2.4.1 Module Insertion

To install a Status module in the PRR-10, insert it into the card guides located in the top and bottom of the shelf. Slide the module into the guides until it seats into the connector on the backplane. Tighten the captive screws located at the top and bottom of the module's panel.

Note Be careful to completely insert the module into the slot and tighten the captive screws. A partially inserted module may be damaged or may not function properly.

3.2.4.2 Connections

Verify that the LO Output signal is connected to the appropriate LO Input on the Main Shelf. These connectors are on the rear of the shelves. Refer to the Installations Section for detailed instructions for connecting output signals.

3.2.4.3 Operational Check

1) After installing the module and with power applied to the instrument, verify the POWER indicators are eliminated.

2) Verify the module is receiving the input signals by observing the indicators.
3) For normal operation, the indicators should be as follows:

INDICATOR	STATE
–48 V PWR “A”	Green
–48 V PWR “B”	Green
Alarm, CRIT	Off
Alarm, MAJOR	Off
Alarm, MINOR	Off
Module, STATUS (quartz osc)	Green
Rb OSC, STATUS after approximately 5 Min. @ 25℃	Green

Note Indicators may take a few seconds after module insertion to reach proper status.

3.3 Reference Controller Module

3.3.1 Module Description

The Reference Controller Module is the heart of the PRR-10. The PRR-10 requires a Reference Controller Module to be installed in module slot A2 of the Main Shelf for it to function. For redundant configuration requirements, a second Reference Controller Module is installed in module slot A3 of the Main Shelf.

This module controls and monitors the PRR-10 functions. It contains micro-controller / memory circuits, communications ports, alarm relays, DDS circuitry, and DS1 or E1 framing / output circuitry. It also supports GPS receivers. User defined settings and the last ten events are stored in NVRAM. The instrument firmware is stored in FLASH-ROM and can be updated in the field via one of the communications ports.

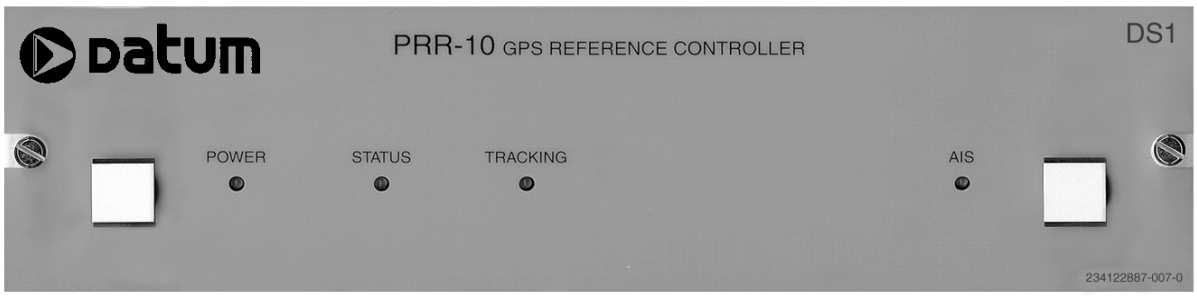
When used in a redundant configuration, the secondary Reference Controller Module communicates with the master module. So if either module fails, the other one can take over control for a seamless switch over.

There are several versions of the Reference Controller Module to select from when configuring a PRR-10 to a customer's requirements. When two Reference Controllers are used, they both need to be DS1 or E1 versions; they cannot be mixed. Table 3.3-1 lists the Item Numbers for the various modules and Figure 3.3-1 shows one of the module's front panels.

Table 3.3-1: Module Item Numbers

ITEM NUMBER	DESCRIPTION
23412887-005-0	Module, Reference controller w/DS1
23412887-006-0	Module, Reference Controller w/E1
23412887-007-0	Module, GPS Reference Controller w/DS1
23412887-008-0	Module, GPS Reference Controller w/E1

Figure 3.3-1: Reference Controller Module Front Panels



3.3.2 Indicators

Table 3.3-2 provides a description of the indicators on the panel of the Reference Controller Module.

Table 3.3-2: Indicators, Reference Controller Module

INDICATOR	COLOR	DESCRIPTION
Power	Off Green	Off = Module has no power On = Module is receiving power
Status	Off Green Yellow	Off = On start-up until module is functioning properly Off = Proper operation of module On = Fault module hardware or firmware problem
Tracking	Off Green Yellow	Off = when there is no GPS engine On = when GPS engine is tracking On = when GPS engine is not tracking
AIS	Off Yellow	Off = Output normal operation On = Output Alarm Indicator Signal condition present

3.3.3 Functional Description

The A and B –48 V Power are combined to supply power to the DC to DC converter for sub-regulating the voltages needed to power the circuits on the module.

This module contains a micro-controller that performs measurements, monitors for errors, collects data, and controls the operation of internal circuitry. The instrument firmware resides in flash ROM and has the capability to be reprogrammed in-the-field. Up to 400 events can be stored in SRAM; the last ten events, user-settable parameters and configuration control information are stored in NVRam. Refer to the Operations Section of this user guide for instructions on accessing this information, setting user-settable parameters and selecting operating modes.

There are two RS-232 communications ports (local and remote), which allow the micro-controller to communicate with the operator(s). Baud rate, and handshaking are user-selectable. They are switch-selectable for DTE or DCE type equipment. Both have tristate drivers so they can be paralleled with the communications ports on a second Reference Controller Module.

After power-up, the micro-controller performs a self-diagnostic test and properly initializes the hardware within 15 seconds. If the unit is so equipped, the micro-controller communicates back and forth to the secondary Reference Controller Module and optional input / output modules via a Serial Peripheral Interface (SPI) bus with tristate transceivers.

The Local Oscillator (LO) input can be either 5 MHz or 10 MHz (user selectable). The LO type Rubidium or Quartz needs to be selected by the operator for proper operation. Depending on the selected mode of operation, the Reference Controller will automatically switch and operate from either LO input. The selected LO input is fed to the Direct Digital Synthesizer (DDS).

If equipped with a receiver, and after the internal or external oscillator has warmed up sufficiently, a GPS signal acquisition will begin. After the receiver begins tracking the signal, phase measurements begin.

The micro-controller controls the frequency of the output signals by using phase measurement data from one of the optional receivers, optional Dual Input Reference Modules or combination thereof. It then computes a frequency correction and applies it to the DDS circuitry. The DDS circuitry output (PLL-clock) supplies the base frequency source for the outputs. The frequencies needed for DS1 or E1 and the optional receiver are synthesized by PLL circuits locked to the DDS output. The 20 MHz PLL circuit output (10 MHz) is the reference for the measurement circuitry and optional receivers when required. The DS1 or E1 PLL circuit output (T-clock) is fed to the associated framing circuits. The framing circuit outputs (T-pos and

T-neg) are fed to the line interface and selection circuits. The line interface and selection circuits convert these signals into two AMI transformer coupled outputs that can be selected by relays as the main PRR-10 outputs on the rear of the shelf. In redundant configuration, these AMI outputs are summed with the AMI outputs of a second Reference Controller Module. The clock bus is comprised of PLL-clock, T-pos, T-neg and T-clock signals which feed other option modules.

Micro-controller control of DS1 outputs include AIS, ESF, or D4, muting or squelching, and line lengths which are user-settable. The outputs can be turned off when the unit is not generating a Stratum 1 output, or the user can instruct the unit to generate an alarm indicator status (AIS ON) during this degraded time. For DS1 signals, the user can utilize the extended super frame (ESF) for Sync Status Message (SSM) indication messaging. The output will then indicate “Stratum 1” when the unit is operating within specification and “unknown traceability” otherwise. Also, the DS1 line interfaces are user-selectable to compensate for line lengths in five increments: 0-133 ft. (0-40 m), 133-266 ft. (40-80 m), 266-399 ft. (80-120 m), 399-533 ft. (120-160 m), and 533-655 ft. (160-197 m).

Micro-controller control of E1 outputs includes AIS, muting or squelching, and SSM’s. The outputs generate an E1 signal using HDB30 suppression and CAS framing. The outputs can be turned off when the unit is not generating a Stratum 1 output, or the user can instruct the unit to generate an alarm indicator status (AIS ON) during this degraded time. For E1 signals, sync status message (SSM) is used to indicate traceability. The output will then indicate “Stratum 1” when the unit is operating within specification and “unknown traceability” otherwise.

If operating in a modified PRS mode, the PRR-10 will never utilize AIS and any SSM indication will be the Stratum level of the selected oscillator during holdover. This setting is true for both DSI and E1 controllers.

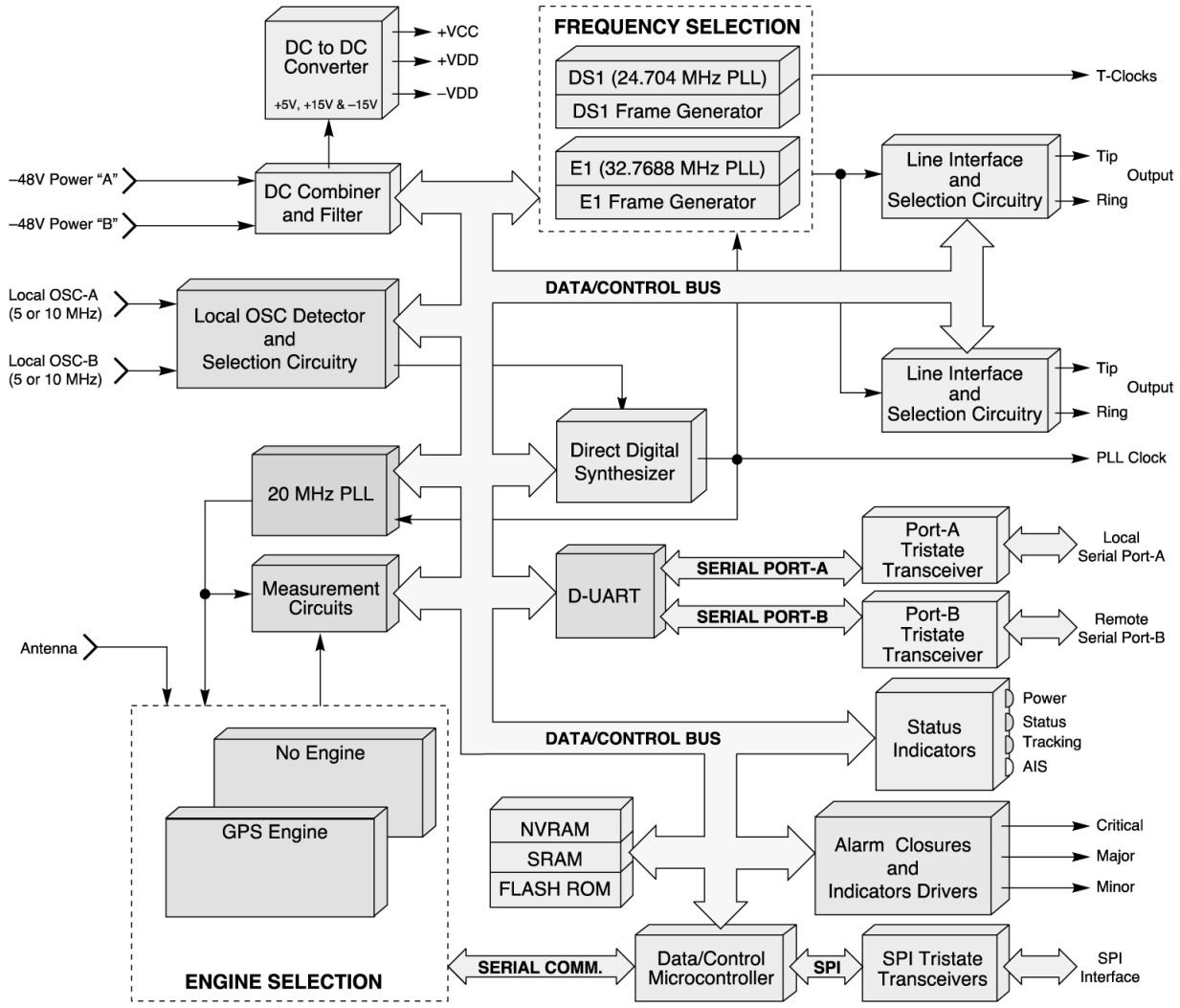
Based on default or user-settable parameters, the micro-controller monitors for errors, determines when an alarm condition exists and activates the appropriate relays and indicator drive signals. All alarms are reported over the communication ports. There are three sets of Form-C alarm closures: Critical, Major and Minor. They are also implemented in a manner so that they can be paralleled with a second Reference Controller Module. Minor and Major Alarms also have the capability of elevating to the next higher level after a user-settable time period.

GPS Receiver, Engine. The GPS engine provides a fully UTC traceable Stratum 1 output signal within minutes after initial cold start, without operator intervention. It has a 1PPS output and a serial communication port for extracting data.

The GPS Receiver has about 40 nsec measurement resolution and has an L1 (1575.42 MHz) antenna interface.

GPS satellite transmissions are calibrated to the United States Naval Observatory, which maintains UTC referenced traceability through the National Institute of Standards and Technology.

Figure 3.3-2: Block Diagram, Reference Controller Module



3.3.4 Specifications

Table 3.3-3 lists the specifications for the Reference Controller Module.

Table 3.3-3: Specifications, Reference Controller Module

CHARACTERISTIC	SPECIFICATION
DC Voltage	–42 Vdc to –72 Vdc
Module Power @ 48 Vdc	< 25 watts, nominal
Communications Ports Baud Rates Format Connections	RS-232-C 300, 1200, 2400, 4800, 9600, and 19200 (user selectable) Word 7 or 8 Bits; parity odd, even or none; 1 or 2 stop bits; (user selectable) DCE or DTE (switch selectable on rear of shelf)
Serial Peripheral Interface	Data and Clock are RS-485 levels Address Lines are logic levels logic 0 = .5 V logic 1 = 4.5 V
Clock Bus	A/B PLL-Clock, A/B T-pos, A/B T-neg and A/B T-clock, EIA RS-422 levels
Local Oscillator Input	
Frequency	5 or 10 MHz (user selectable)
Level	.5 Vrms to 2 Vrms
Waveshape	Sine or Square

Table 3.3-3: Specifications, Reference Controller Module (Continued)

Termination	50 ohms or 1 kohms (switch selectable on backplane)
Stability	Free running stability and accuracy of 5 x 10^{-9} or better
DS1 Outputs	
Signal	D4/SF or ESF (user-selectable)
Format	Framed, All Ones, Alternate Mark Inversion (AMI)
Waveshape Rise Time Pulse Width Pulse Interval Duty Cycle	Per ANSI T1.102 < 100ns < 324 ns, nominal < 648 ns, nominal 50/50
Amplitude	3 ± 0.6 Volts base to peak
Overshoot	< 10% of base to peak amplitude
Jitter	< 0.01 UI
Drive Capability	0 to 655 feet, 22AWG ABAM cable or similar
Termination Impedance	100 ohms ± 5%
E1 Outputs	
Signal	HDB3
Format	Framed, All Ones, Alternate Mark Inversion (AMI)
Waveshape Rise Time Pulse Width Pulse Interval Duty Cycle	Per ITU-T Rec. G.703/6 < 100 ns. < 244 ns, nominal 488 ns, nominal 50/50
Amplitude	3 ± 0.6 Volts base to peak
Overshoot	< 10% of base to peak amplitude Jitter < 0.01 UI
Drive Capability	Per ITU-T Rec. G703
Termination Impedance	120 ohms ± 5%
GPS Antenna Interface	
Interface Type	Active
Output voltage	5 Vdc @ 45 ma max.
Impedance	50 ohms
Signal	L1 C/A Code
Center Frequency	1,575.42 MHz
Bandwidth	30 MHz
Preamplifier gain	13.8 dB minimum @ PRR-10 input for optimum performance
Noise Figure	2.5 dB max.

Refer to Section 7, PRR-10 ACCESSORIES for information on the optional antennas, cables and transient eliminators that can be used with the GPS receivers.

3.3.5 Installation and Operation

The module automatically configures for the appropriate module slots in the Main Shelf. The user can modify operation of the module via one of the PRR-10 communications ports by using the commands as described in Section 5, PRR-10 OPERATION, in this user guide.

The factory default settings, unless otherwise specified, for a redundant configuration are listed:

For the Serial Communications Ports:

Type: DCE
Baud Rate: 9600
Word: 8 Bits
Parity: None
Stop Bits: one

For LO Inputs:

LO-“A”: 10 MHz	Rubidium	Reference Controller “A”
LO-“B”: 10 MHz	Rubidium	Reference Controller “B”

For DS1 Outputs:

Type:	D4
Format:	B8ZS
SSM:	OFF
Line Length:	0-133ft (0-40m)
Degraded Mode:	Muted Outputs

For E1 Outputs:

Type:	HDB3
Format:	CAS, CRC4 enabled, AMI
SSM:	OFF
Degraded Mode:	Muted Outputs

For Operating Mode:

Type:	PRS

For event alarm reporting parameters and modes of operation, refer to **EVENTS**, on page 5-102 in the Operations Section of this user guide.

3.3.5.1 Module Insertion

To install a Reference Controller Module in a PRR-10, insert it into the card guides located on each side of module slots A2 or A3 of a Main Shelf. Slide the module into the guides until it seats into the connectors on the backplane. Tighten the captive screws located at each side module’s panel.

Caution Be careful to completely insert the module into the slot and tighten the captive screws. A partially inserted module could be damaged or not function properly.

3.3.5.2 Connections

Verify that input signal connections to the corresponding antenna, local oscillator and communications port connectors have been done. Verify that output signal connections to the corresponding output channels have been done; this connector contains tip, ring and sleeve connections. These connectors are on the rear of the instrument. Refer to the Installations Section for detailed instructions for connecting input and output signals.

3.3.5.3 Operational Check

1) After installing the module and with power applied to the instrument, verify the POWER indicator lights.
2) Verify the module is set up properly for the input signals being applied.
3) Verify the module is receiving the input signals by observing the indicators.
4) For normal operation, the indicators should be as follows:

INDICATOR	STATE
POWER	Green
STATUS	Green
TRACKING	Green or Off
AIS	Off

Note Indicators may take a few minutes after module insertion to reach proper status.

3.4 DS1/E1 Output Module

3.4.1 Module Description

The DS1/E1 PLL Output Module is an optional output distribution module that provides ten balanced outputs for use with AMI type signals. Usually, this module is paired with a second module. In that configuration, the outputs of each module tie together forming ten redundant pairs. They can be used as a redundant pair in output slots A4 and A5 of the Main Shelf. The output can also be used as redundant pairs in output slots A2 through A11 of an expansion shelf. Table 3.4-1 lists the Item Number for this module and Figure 3.4-1 shows the module's front panel.

Table 3.4-1: Module Item Numbers

ITEM NUMBER	DESCRIPTION
23413057-000-0	Module, DS1/E1PLL Output Module

3.4.2 Indicators

Table 3.4-2 provides a description of the indicators on the panel of the DS1/E1 Output Module.

Table 3.4-2: Indicators, DS1/E1 Output Module

INDICATOR	COLOR	DESCRIPTION
Power	Green	On = Module is receiving power Off = Module is not receiving power
Status	Green / Amber	Green = Module in normal operation Amber = Module has input or output failure
Source A	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected
Source B	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected

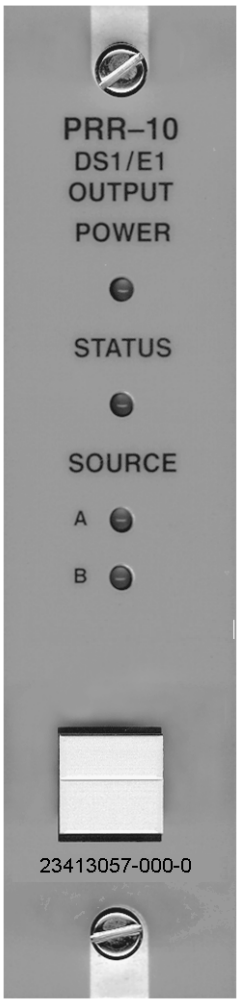


Figure 3.4-1: DS1/E1 Output Module Front Panel

3.4.3 Functional Description

The following discussion refers to Figure 3.4-2 Block Diagram, DS1/E1 Output Module.

The A and B –48 V Power are combined to supply power to the DC to DC converter that converts the input power to the required levels for powering the circuits.

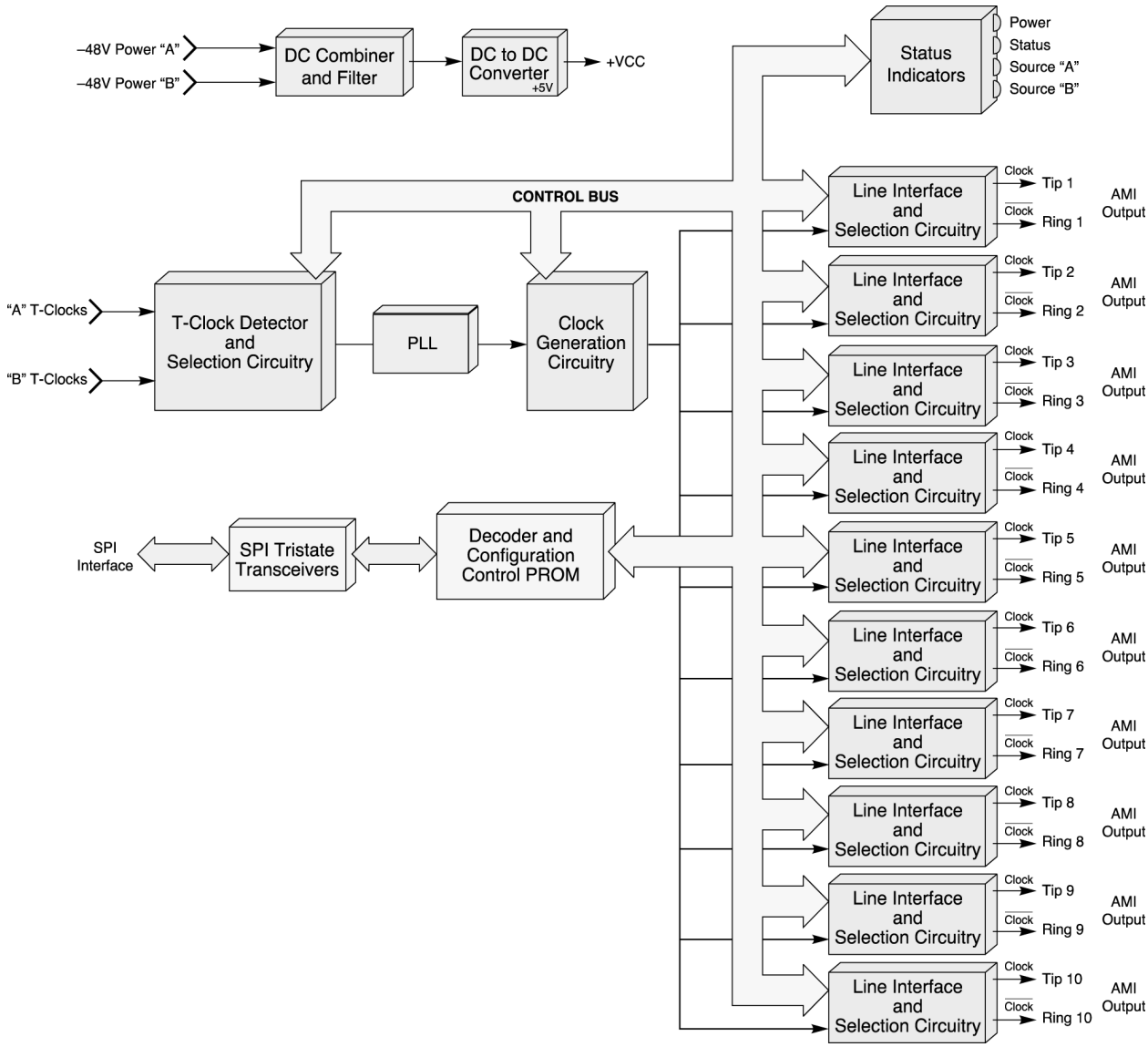
This module accepts two clock source inputs, A or B, from separate Reference Controller Modules via the PRR-10 clock bus. The Source A or B indicator will be illuminated green indicating which clock source is selected and being used. In normal operation, the Status Indicator is illuminated green.

The module selects one of the clock sources (normally clock source A), converts it to an AMI format and amplifies it. This signal couples to the output ports through line interface drivers. The DS1 line interfaces are user selectable to compensate for line lengths in five increments, 0-133 ft (0-40 m), 133-266 ft (40-80 m), 266-399 ft (80-120 m), 399-533 ft (120-160 m) and 533-655 ft (160-197 m). There is no compensation for E1 line interfaces.

If clock source A fails, the module detects its loss and switches to clock source B. Source A indicator will be illuminated yellow and Source B indicator will be illuminated green. The user may also select which clock source is to be used. The outputs are checked for signal presence. Should a clock source or output fail, the front panel status indicator will be illuminated yellow, and the failure is reported to the Reference Controller Module.

Configuration control information for each module is stored at the factory in non-volatile memory on the card. This information is accessed via tristate transceivers and decoder circuitry using the Serial Peripheral Interface (SPI) bus by a Reference Controller Module. The user can request this information via one of the PRR-10 communications ports using the commands described in the Operation Section of this user guide.

Figure 3.4-2: Block Diagram, DS1/E1 Output Module



3.4.4 Specifications

Table 3.4-3 lists the specifications for the DS1/E1 Output Module.

Table 3.4-3: Specifications, DS1/E1 Output Module

CHARACTERISTIC	SPECIFICATION
DC Voltage	42 Vdc to –72 Vdc
Module Power @ 48Vdc	< 9 watts, nominal
Serial Peripheral Interface	Data & Clock, EIA are RS-485 levels Address Lines are logic levels logic 0 = .5 V logic 1 = 4.5 V
Clock Bus	A/B T-pos, A/B T-neg & A/B T-clock, EIA RS-422 levels
DS1 Outputs	
Signal	D4/SF or ESF (user selectable)
Format	Framed, All Ones, Alternate Mark Inversion (AMI)
Waveshape Rise Time Pulse Width Pulse Interval Duty Cycle	Per ANSI T1.102 < 100ns < 324 ns, nominal < 648 ns, nominal 50/50
Amplitude	3 ± 0.6 Volts base to peak
Overshoot	< 10% of base to peak amplitude
Jitter	< 0.01 UI
Drive Capability	0 to 655 feet, 22 AWG ABAM cable or similar
Termination Impedance	100 ohms ± 5%
E1 Outputs	
Signal	HDB3
Format	Framed, All Ones, Alternate Mark Inversion (AMI)
Waveshape Rise Time Pulse Width Pulse Interval Duty Cycle	Per ITU-T Rec. G.703/6 < 100 ns. < 244 ns, nominal 488 ns, nominal 50/50
Amplitude	3 ± 0.6 Volts base to peak
Overshoot	< 10% of base to peak amplitude
Jitter	< 0.01 UI
Drive Capability	Per ITU-T Rec. G703
Termination Impedance	120 ohms ± 5%

3.4.5 Installation and Operation

The user can modify selectable perimeters of the module via one of the PRR-10 communications ports using the commands described in the Operations Section of this user guide.

The Factory Default setting, unless otherwise specified, for all outputs:

Line Length: 0-133 ft (0-40 m)

3.4.5.1 Module Insertion

To install an output module in the PRR-10, insert it into the card guides located in the top and bottom of the shelf. Slide the module into the guides until it seats into the connector on the backplane. Tighten the captive screws located at the top and bottom of the module's panel.

Caution Be careful to completely insert the module into the slot and tighten the captive screws. A partially inserted module may be damaged or may not function properly.

3.4.5.2 Connections

Verify that output signal connections to the corresponding output channel connectors have been done. These connectors contain tip, ring and sleeve connections, and are on the rear of the instrument. Refer to the Installations Section, Output Signals, for detailed instructions for connecting output signals.

3.4.5.3 Operational Check

1) After installing the module and with power applied to the instrument, verify the POWER indicator lights.
2) Verify the module is set up properly for the signals the signal outputs.
3) Verify the module is receiving the input signals by observing the indicators.
4) For normal operation, the indicators should be as follows with redundant Reference Controller Modules:

INDICATOR	STATE
POWER	Green
STATUS	Green
SOURCE "A"	Green
SOURCE "B"	Off

Note Indicators may take a few seconds after module insertion to reach proper status.

3.5 CC/8 kHz Output Module

3.5.1 Module Description

The CC/8 kHz Output Module is an optional output distribution module that provides a total of ten outputs. Eight of the outputs are balanced Composite Clocks, and two are differential 8 kHz outputs. Usually this module is paired with a second module. In that configuration, the outputs of each module tie together forming ten redundant pairs. Table 3.5-1 lists the Item Number for this module and Figure 3.5-1 shows the module's front panel.

Table 3.5-1: Module Item Numbers

ITEM NUMBER	DESCRIPTION
23412899-000-0	Module, CC/8 kHz Output

3.5.2 Indicators

Table 3.5-2 provides a description of the indicators on the panel of the CC/8kHz Output Module.

Table 3.5-2: Indicators, CC/8 kHz Output Module

INDICATOR	COLOR	DESCRIPTION
Power	Green	On = Module is receiving power Off = Module is not receiving power
Status	Green / Amber	Green = Module in normal operation Amber = Module has input or output failure
Source A	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected
Source B	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected

3.5.3 Functional Description

The following discussion refers to Figure 3.5-2 Block Diagram, CC/8 kHz Output Module.

The A and B –48 V Power are combined to supply power to the DC to DC converter that converts the input power to the required levels for powering the circuits.

This module accepts two clock source inputs, A or B, from separate Reference Controller Modules via the PRR-10 clock bus. The Source A or B indicator will be illuminated green indicating which clock source is selected and being used. In normal operation, the Status Indicator is illuminated green.

The module selects one of the clock sources (normally clock source A) and converts it to a 64 kbs AMI with a BPV every eight pulses, composite clock (CC) signal. An 8 kHz signal is also created. The CC signal couples to eight output ports through line interface drivers and transformers. Phase compensation for line lengths from 0 to 2,197 ns is user selectable in four increments: 0%, 33.3%, 66.6%, and 100%. The 8 kHz signal couples to two output ports through differential line drivers.

If clock source A fails, the module detects its loss and switches to clock source B. Source A indicator will be illuminated yellow and

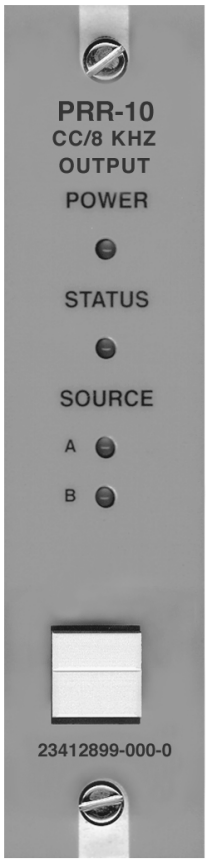
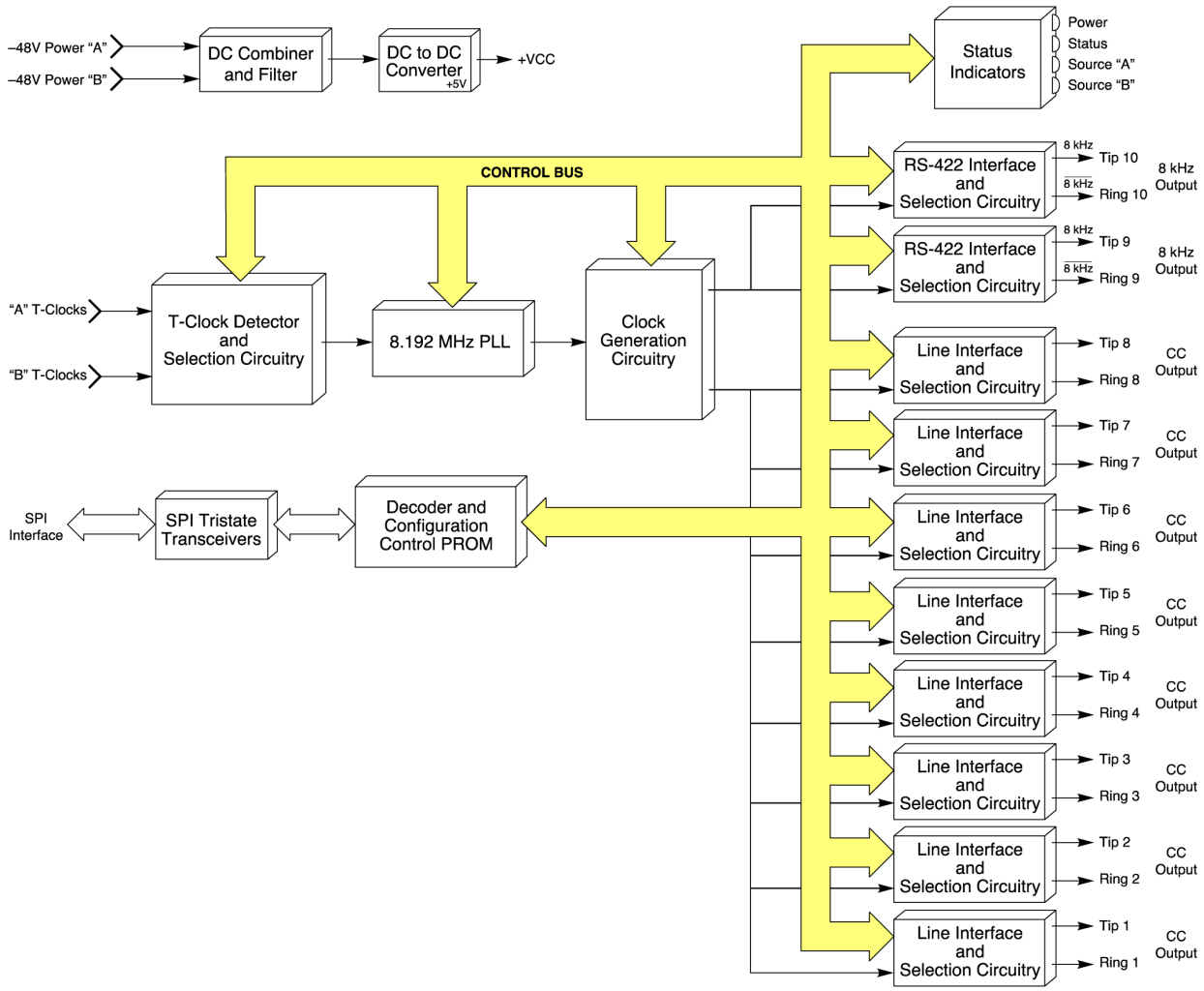


Figure 3.5-1: CC/8 kHz Output Module Front Panel

Source B indicator will be illuminated green. The user may also select which clock source is to be used. The outputs are checked for signal presence. Should a clock source or output driver fail, the front panel Status Indicator will be illuminated yellow and the failure is reported to the Reference Controller Module.

Configuration control information for each module is stored at the factory in non-volatile memory on the card. This information is accessed via tristate transceivers and decoder circuitry using the Serial Peripheral Interface (SPI) bus by a Reference Controller Module. The user can request this information via one of the PRR-10 communications ports using the commands described in the Operation Section of this user guide.

Figure 3.5-2: Block Diagram, CC/8 kHz Output Module



3.5.4 Specifications

Table 3.5-3 lists the specifications for the CC/8 kHz Output Module.

Table 3.5-3: Specifications, CC/8 kHz Output Module

CHARACTERISTIC	SPECIFICATION
DC Voltage	42 Vdc to –72 Vdc
Module Power @ 48 Vdc	< 9 watts, nominal
Serial Peripheral Interface	Data & Clock, EIA are RS-485 levels Address Lines are logic levels logic 0 = .5 V logic 1 = 4.5 V
Clock Bus	A/B T-pos, A/B T-neg & A/B T-clock, EIA RS-422 levels
Composite Clock (64 kb/s)	
Waveshape Rise Time Pulse Width Pulse Interval Duty Cycle	Rectangular (5/8 or 50/50 duty cycle), software selectable < 500 ns < 500 ns 9.8 µs ± 5% 9.8 µs ± 5% 15.6 µs ± 5% 7.8 µs ± 5% 62.5% 50.0%
Amplitude	2.7 to 5.5 V peak (3.5 V peak Nominal)
Phase Compensation	1/8 th UI, in 4 steps, approximately 0 to 2 µs
Drive Capability	0 to 1500 ft, 22 AWG ABAM cable
Termination Impedance	133 ohms ± 5%
8 kHz Output	
Format	Per EIA RS-422
Waveshape Rise Time Fall Time Duty Cycle	Squarewave < 50 ns < 50 ns 50/50 ± 10%
Amplitude	1.0 to 2.9 V peak, Differential
Termination Impedance	100 ohms ± 5%

3.5.5 Installation and Operation

The user can modify selectable parameters of the module via one of the PRR-10 communications ports using the commands described in the Operations Section of this user guide.

The Factory Default setting, unless otherwise specified, for all outputs:

Phase Comp 0% (0 ns)

3.5.5.1 Module Insertion

To install an output module in the PRR-10, insert it into the card guides located in the top and bottom of the shelf. Slide the module into the guides until it seats into the connector on the backplane. Tighten the captive screws located at the top and bottom of the module's panel.

Caution Be careful to completely insert the module into the slot and tighten the captive screws. A partially inserted module may be damaged or may not function properly.

3.5.5.2 Connections

Verify that output signal connections to the corresponding output channel connectors have been done. These connectors contain tip, ring and sleeve connections, and are on the rear of the instrument. Refer to the Installations Section, Output Signals, for detailed instructions for connecting output signals.

3.5.5.3 Operational Check

1) After installing the module and with power applied to the instrument, verify the POWER indicator lights.
2) Verify the module is set up properly for the signals the signal outputs.
3) Verify the module is receiving the input signals by observing the indicators.
4) For normal operation, the indicators should be as follows with redundant Reference Controller Modules:.

INDICATOR	STATE
POWER	Green
STATUS	Green
SOURCE “A”	Green
SOURCE “B”	Off

Note Indicators may take a few seconds after module insertion to reach proper status.

3.6 G.703/10 Output Module

3.6.1 Module Description

The G.703/10 Output Module is an optional output distribution module that provides ten balanced 2048 kHz (E1 Reference Controller required) outputs. Usually, this module is paired with a second module. In that configuration, the outputs of each module tie together forming ten redundant pairs. It can be used as a redundant pair in output slots A4 and A5 of the Main Shelf. It can also be used as redundant pairs in output slots A2 through A11 of an Expansion Shelf. Table 3.6-1 lists the Item Number for this module and Figure 3.6-1 shows the module's front panel.:

Table 3.6-1: Module Item Numbers

ITEM NUMBER	DESCRIPTION
23412989-000-0	Module, G.703/10 Output

3.6.2 Indicators

Table 3.6-2 provides a description of the indicators on the panel of the G.703/10 Output Module.

Table 3.6-2: Indicators, G.703/10 Output Module

INDICATOR	COLOR	DESCRIPTION
Power	Green	On = Module is receiving power Off = Module is not receiving power
Status	Green / Amber	Green = Module in normal operation Amber = Module has input or output failure
Source A	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected
Source B	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected

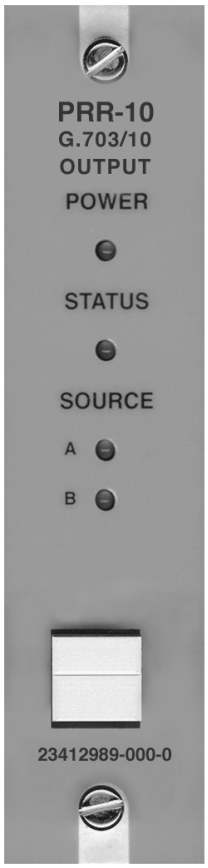


Figure 3.6-1: G.703/10 Output Module Front Panel

3.6.3 Functional Description

The following discussion refers to Figure 3.6-2 Block Diagram, G.703/10 Output Module.

The A and B –48 V Power are combined to supply power to the DC to DC converter that converts the input power to the required levels for powering the circuits.

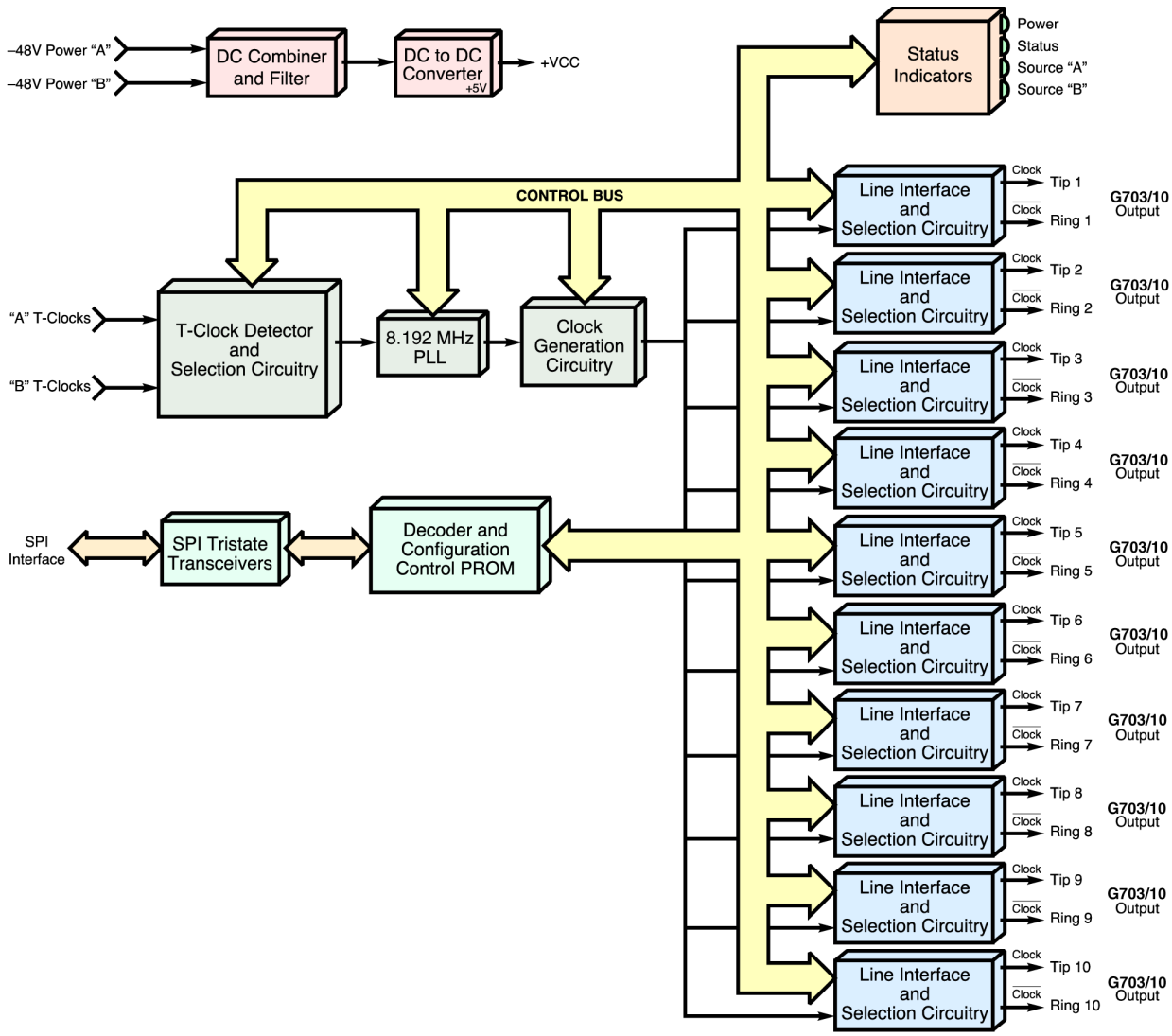
This module accepts two clock source inputs, A or B, from separate Reference Controller Modules via the PRR-10 clock bus. The Source A or B indicator will be illuminated green, indicating which clock source is selected and being used. In normal operation, the Status Indicator is illuminated green.

The module selects one of the clock sources (normally clock source A) and amplifies it. This signal couples to the output ports through balanced transformers. If clock source A fails, the module detects its loss and switches to clock source B. Source A indicator will be illuminated yellow, and Source B indicator will be illuminated green. The user may also select which clock source is to be used. The outputs are checked for signal presence. Should a clock source or output

fail, the front panel Status Indicator will be illuminated yellow and the failure is reported to the Reference Controller Module.

Configuration control information for each module is stored at the factory in non-volatile memory on the card. This information is accessed via tristate transceivers and decoder circuitry using the Serial Peripheral Interface (SPI) bus by a Reference Controller Module. The user can request this information via one of the PRR-10 communications ports using the commands described in the Operation Section of this user guide.

Figure 3.6-2: Block Diagram, G.703/10 Output Module



3.6.4 Specifications

Table 3.6-3 lists the specifications for the G.703/10 Output Module.

Table 3.6-3: Specifications, G.703/10 Output Module

CHARACTERISTIC	SPECIFICATION
DC Voltage	42 Vdc to –72 Vdc
Module Power @ 48 Vdc	< 9 watts, nominal
Serial Peripheral Interface	Data & Clock, EIA are RS-485 levels Address Lines are logic levels logic 0 = .5V logic 1 = 4.5V
Clock Bus	A/B T-pos, A/B T-neg & A/B T-clock, EIA RS-422 levels
2048 kHz Outputs	
Frequency	2048 kHz
Format	Per ITU-T Rec. G.703/10
Waveshape Rise Time Fall Time Duty Cycle	Squarewave < 50 ns < 50 ns 50/50 ± 10%
Amplitude	1.5 to 1.9 V peak
Jitter	< 0.01 UI
Termination Impedance	120 ohms ± 5%

3.6.5 Installation and Operation

3.6.5.1 Module Insertion

To install an output module in the PRR-10, insert it into the card guides located in the top and bottom of the shelf. Slide the module into the guides until it seats into the connector on the backplane. Tighten the captive screws located at the top and bottom of the module's panel.

Caution Be careful to completely insert the module into the slot and tighten the captive screws. A partially inserted module may be damaged or may not function properly.

3.6.5.2 Connections

Verify that output signal connections to the corresponding output channel connectors have been done. These connectors contain tip, ring and sleeve connections, and are on the rear of the instrument. Refer to the Installations Section, Output Signals, for detailed instructions for connecting output signals.

3.6.5.3 Operational Check

1) After installing the module and with power applied to the instrument, verify the POWER indicator lights.
2) Verify the module is set up properly for the signals the signal outputs.
3) Verify the module is receiving the input signals by observing the indicators.
4) For normal operation, the indicators should be as follows with redundant Reference Controller Modules:

INDICATOR	STATE
POWER	Green
STATUS	Green
SOURCE “A”	Green
SOURCE “B”	Off

Note Indicators may take a few seconds after module insertion to reach proper status

3.7 Analog Output Module

3.7.1 Module Description

The Analog Output Module is an optional output distribution module that provides four sine-wave outputs. This module cannot be paired with a second module. Therefore, when using this module, it cannot be configured in redundant pairs. Normally it is installed in output slot A4 of a Main Shelf, or in output slots A2, A4, A6, A8, or A10 of an Expansion Shelf. Table 3.7-1 lists the Item Number for this module and Figure 3.7-1 shows the module's front panel.

Table 3.7-1: Module Item Numbers

ITEM NUMBER	DESCRIPTION
23412988-000-0	Module, Analog Output

3.7.2 Indicators

Table 3.7-2 provides a description of the indicators on the panel of the Analog Output Module.

Table 3.7-2: Indicators, Analog Output Module

INDICATOR	COLOR	DESCRIPTION
Power	Green	On = Module is receiving power Off = Module is not receiving power
Status	Green / Amber	Green = Module in normal operation Amber = Module has input or output failure
Source A	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected
Source B	Green / Amber	Green = Input to module is present and selected Amber = Input to module is faulted Off = Input to module is not present, or not selected

3.7.3 Functional Description

The following discussion refers to Figure 3.7-2 Block Diagram, Analog Output Module.

The A and B -48 V Power are combined to supply power to the DC to DC converter that converts the input power to the required levels for powering the circuits.

This module accepts two clock source inputs, A or B, from separate Reference Controller Modules via the PRR-10 clock bus. The Source A or B indicator will be illuminated green, indicating which clock source is selected and being used. In normal operation, the Status Indicator is illuminated green.

The module selects one of the clock sources, (normally clock source A) and applies it to a 20 MHz PLL circuit. The PLL circuit has 1, 5, and 10 MHz outputs which feed sine filter circuits for each frequency. The buffered sine filter outputs are user selectable as to which frequency is fed to each output buffer circuit. Each output is transformer-coupled.

If clock source A fails, the module detects its loss and switches to clock source B. Source A indicator will be illuminated yellow and Source B indicator will be illuminated green. The user may also select

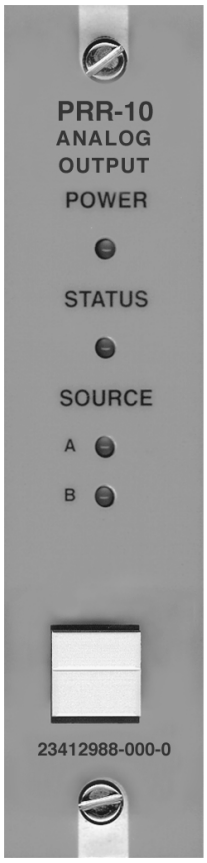
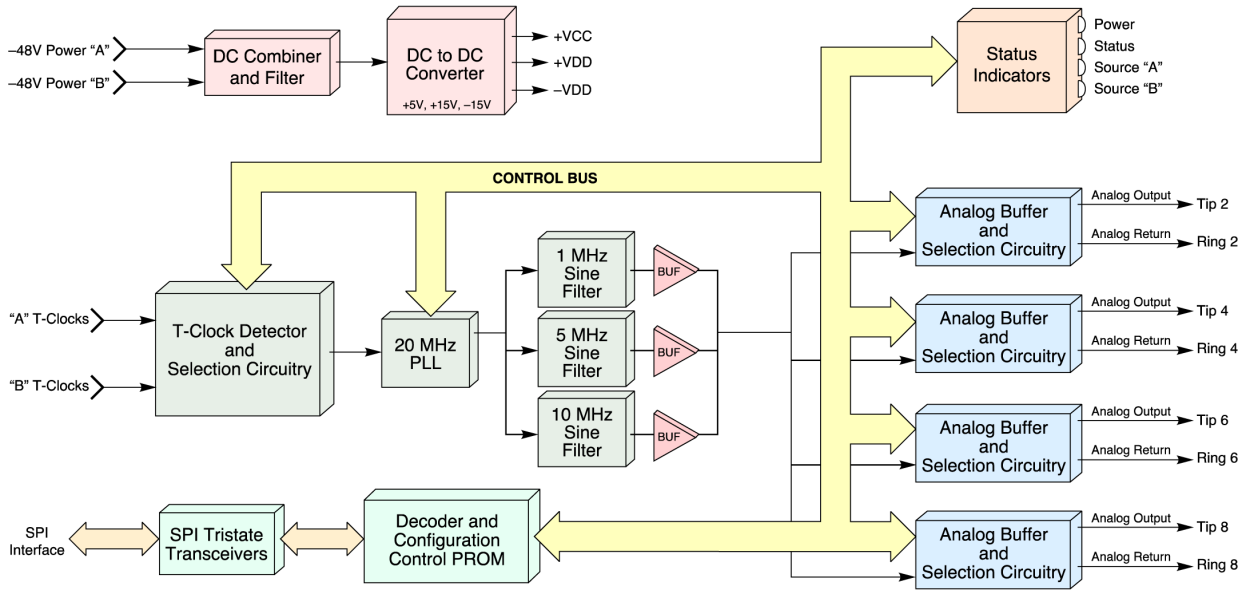


Figure 3.7-1: Analog Output Module Front Panel

which clock source is to be used. The outputs are checked for signal presence. Should a clock source fail, the PLL circuit become unlocked, or an output fail, the front panel Status Indicator will be illuminated yellow and the failure is reported to the Reference Controller Module.

Configuration control information for each module is stored at the factory in non-volatile memory on the card. This information is accessed via tristate transceivers and decoder circuitry using the Serial Peripheral Interface (SPI) bus by a Reference Controller Module. The user can request this information via one of the PRR-10 communications ports using the commands described in the Operation Section of this user guide.

Figure 3.7-2: Block Diagram, Analog Output Module



3.7.4 Specifications

Table 3.7-3 lists the specifications for the Analog Output Module.

Table 3.7-3: Specifications, Analog Output Module

CHARACTERISTIC	SPECIFICATION
DC Voltage	42 Vdc to –72 Vdc
Module Power @ 48 Vdc	< 9 watts, nominal
Serial Peripheral Interface	Data & Clock, EIA are RS-485 levels Address Lines are logic levels logic 0 =.5 V logic 1= 4.5 V
Clock Bus	PLL-Clock, A/B T-pos, A/B T-neg & A/B T-clock, EIA RS-422 levels
Analog Outputs	
Frequency	1, 5, or 10 MHz (user selectable)
Waveshape	Sinewave
Amplitude	1 Vrms ± 10%
Impedance	50 ohms ± 5%

3.7.5 Installation and Operation

The user can modify the output frequency selection on each output via one of the PRR-10 communications ports using the commands described in the Operation Section of this user guide.

The Factory Default setting, unless otherwise specified, for all outputs:

J1	10 MHz
J2	10 MHz
J3	5 MHz
J4	5 MHz

An optional output panel, P/N 10912988-000-0, can be installed to allow type BNC output connections. The panel is 1.75” x 19” and has four BNC outputs. An interface cable is included as part of the output panel. The connector of the output panel cable connects to J10 of the main chassis or J2, J3, J4, J5, or J6 of the output expansion chassis, depending on where the output module is installed.

3.7.5.1 Module Insertion

To install an output module in the PRR-10, insert it into the card guides located in the top and bottom of the shelf. Slide the module into the guides until it seats into the connector on the backplane. Tighten the captive screws located at the top and bottom of the module’s panel.

Caution Be careful to completely insert the module into the slot and tighten the captive screws. A partially inserted module may be damaged or may not function properly.

3.7.5.2 Connections

Verify that output signal connections to the corresponding output channel connectors have been done. These connectors contain tip, ring and sleeve connections, ring and sleeve connections need to be tied together for analog outputs, and are on the rear of the instrument. Refer to the Installations Section, Output Signals, for detailed instructions for connecting output signals.

3.7.5.3 Operational Check

1) After installing the module and with power applied to the instrument, verify the POWER indicator lights.
2) Verify the module is set up properly for the signals the signal outputs.
3) Verify the module is receiving the input signals by observing the indicators.

4) For normal operation, the indicators should be as follows with redundant Reference Controller Modules:

INDICATOR	STATE
POWER	Green
STATUS	Green
SOURCE “A”	Green
SOURCE “B”	Off

Note Indicators may take a few seconds after module insertion to reach proper status.

INSTALLATION

4

SECTION 4 PRR-10 INSTALLATION

Overview. Detailed descriptions for installation and checkout are contained in this section. The PRR-10 Shelves are a plug-in and play package. Installation, setup, and checkout are summarized below:

1) Unpack and inspect shipping cartons/units for content and damage.
2) Install Antenna(s).
3) Install PRR-10 Shelves.
4) Connect power and grounds.
5) Connect signal, and alarm cables.
6) Apply power.
7) Observe status indicators (after a two-minute warm-up).

Note Customer setups require a terminal connected to the local communications port.

4.1 Unpacking and Inspection

The PRR-10 Shelves contains piece parts which are sensitive to electrostatic discharge (ESD). No special precautions are needed when dealing with the shelf as a unit. However, ESD handling practices should be implemented when handling plug-in modules.

The PRR-10 Shelf is shipped in a foam-padded container to protect against normal shock, vibration, and handling damage. The GPS Antenna may be shipped in their own container, or they may also be packaged with the antenna cable using a larger container. These containers protect the antennas against normal shock, vibration, and handling damage.

Inspect the container(s) for signs of damage.

1) If the container(s) shows damage, inspect the contents immediately. If the contents appear damaged, notify both the carrier and the Datum, Inc. distributor.
2) Retain the shipping container and packing material for the carriers inspection.
3) Inspect for, and remove, any paperwork and small parts (e.g., transient eliminators) which may have been packed in the same container.
4) Remove the PRR-10 Shelf(s), Antenna(s) and accessories from the container(s).
5) Remove the anti-static bag(s).
6) Verify the model and serial number(s) shown on the shipping list agrees with the information on the equipment. If the serial number does not match, contact your distributor immediately.
7) Check the module complement against the shipping list. If it does not match, contact your distributor immediately.
8) Locate the antenna cable and accessories. Verify the cable length and accessories match with what was ordered. If it does not match, contact your distributor immediately.

4.2 Antenna Installation

Detailed descriptions for installation of GPS Antennas are contained in the following paragraphs. Refer to the Accessories Section of this user guide for antenna, coaxial cable and transient eliminator specifications and compatible combinations.

4.2.1 Antenna Kits

The following antenna kits contain 1 GPS antenna, 1 transient eliminator, 2 coaxial cables, 1 right angle N type to TNC adapter, and a roll of 3M weatherproof tape. The short cable is to be installed between the antenna and the transient eliminator, and the longer cable is to be installed between the transient eliminator and the GPS receiver antenna connector. The longer cable is not part of the antenna kit and must be ordered separately.

Antenna Kit P/N	Description	Minimum Cable Length
13813091-000-0	10-200ft/LMR400/26dB antenna/90V eliminator	10 ft.
13813073-000-0	100-400ft/LMR400/40dB antenna/90V eliminator	100 ft.
13813074-000-0	250-600ft/LMR400/48dB antenna/90V eliminator	250 ft.
13813075-000-0	650-1000ft/LMR400/48dB antenna/20dB amp/90V eliminator	650 ft

Note Antenna kit #13813091-000-0 is designed for short cable applications and includes a 10-ft. antenna-to-transient-eliminator cable. All other kits have a 30-ft. cable.

Note Antenna kit #13813075-000-0 includes a plate assembly which is composed of a transient eliminator, adapter connector, and an in-line 20 dB amplifier.

WARNING: ***Datum does not recommend cutting the antenna cables provided in these kits. If the cables must be cut, please ensure that the following requirements are met.***

Cable Requirements **-** The total length of the cable run between the receiver and antenna must not be shorter than the minimum cable lengths indicated in the kits listed above.

Connector Requirements **-** The cables provided with these kits have factory installed crimped connectors. Cutting these cables will require a new connector. Datum, Inc. recommends only crimp style connectors to be used for this application. Listed below is the crimper kit with connectors available through Datum.

Crimper Kit P/N	Description
12813080-000-0	LMR400 crimper/10 connectors (N-type), LMR400 prep tool, 3M weatherproof tape

4.2.2 Antenna Installation Considerations

GPS signals cannot penetrate buildings, foliage, mountains or obstructions. The following criteria should be used in selecting an antenna location.

Warning: This is a general guideline for an antenna installation. Please follow all local building electrical condes in your area.

ocation Considerations:

- Antenna must have the best view of the open sky. A 360 degree view of the horizon is not generally possible but would be ideal.
- This antenna should not be the highest point of the building, this is to reduce the possibility of a direct lightning strike.
- The GPS antenna should not be located within 12 feet of any large metal objects.
- At least 10 ft. separation between antennas if more than one is installed.
- If possible, position the antenna within 30 ft. of where the antenna cable enters the building.
- Elevate antenna above any possible snow drifts.
- The transient eliminator should be installed in a protected area if possible to avoid standing water, etc.
- For applications requiring an in-line amplifier, mount the amp/plate assembly where the transient eliminator would normally be mounted.

Note: The in-line amplifier receives +5 Vdc power from the GPS engine that is supplied on the center conductor of the LMR-400 coax cable.

Caution The following items should be observed and considered when installing the Antenna!

- High-power radar signals, beamed directly at the unit, may damage the preamplifier in a GPS Antenna.
- Use extreme caution when installing antennas near, under or around high voltage lines. Avoid contact with these lines to prevent bodily injury or equipment damage.

4.2.3 Antenna System Grounding and Coaxial Cable Lead-in Protection

In addition to location and mounting considerations, a grounding scheme to provide some protection against voltage surges and static discharge should be considered. If transient eliminators are used they also need to be connected to the perimeter ground system or bulk-

head entrance panel that is connected to the perimeter ground system. If the transient eliminator is mounted inside a metal box enclosure, ensure there are no painted surfaces insulating the transient eliminator or grounding clamps. The ground conductors should be bonded to the metal box and not enter through an access hole.

Note:

1) There should be no sharp bends in the ground conductors.
2) Soldered connections are not recommended for grounding purposes. All grounding connections should be secured with mechanical clamp style connectors. All bonding surfaces should be free of paint. Follow local building codes when selecting a ground scheme, wire sizing and installation.
3) The recommended ground wire size is #6 AWG copper grounding wire or 1.5" halfhard copper strap.
4) The larger the ground conductors are, the better the chance for eliminating transients.
5) Connecting the outside transient eliminator ground to the inside equipment rack ground is not recommended and can defeat the protection of the transient eliminator.

The antenna system should never be connected to the same earth ground conductor as heating/cooling systems, elevator motors, pump motors, etc. because they will induce noise into the antenna system.

Datum, Inc. makes no recommendations as to whether to install transient eliminators. Figure 4.2-1 provides details on how they might be installed if local practice requires their use. Suitable transient eliminators are available from Datum, Inc. Refer to the Accessories Section of this user guide for specifications.

4.2.4 Installation Tools and Materials

Standard hand tools are required for antenna installation. A cable puller may be required for installation of the antenna coaxial cable. The following consumables may also be needed:

1) 4 ea. 1/4″ or 6 mm fasteners for installing the antenna floor flange.
2) Extra cable ties or acceptable cable clamps.
3) #6 AWG (minimum) copper grounding wire or 1.5" halfhard copper strap
4) 8 ft. (2.44 m) ground electrode.
5) Custom mounting plates/U-bolts/masonry bolts, etc., as needed for mounting to a tower, roof or wall of a building.

4.2.5 Antenna Mounting

Datum, Inc. antennas are supplied with floor flanges which allow them to be easily fastened to any stable flat surface. The type of fasteners, screws, bolts, etc., is dependent on the mounting surface and local building codes. Datum, Inc. has available an optional right angle mounting bracket which allows the antenna to be mounted on the side of a building or tower (Item Number 12010210-000-0).

4.2.6 Antenna Cabling and Connecting

1) After the antenna is securely mounted, route the antenna coaxial cable from the antenna to where the PRR-10 is going to be installed, avoiding bundling it with other cables and possible noise sources where

practical. Also, when pulling the coaxial cable through conduit or a weather head, use appropriate cable pulling devices. Do not attach to the connectors to pull the coaxial cable. To connect the coaxial cable to the GPS antenna, loosen the four screws holding the top of the antenna to gain access to the antenna connector.

Run one end of the short coaxial cable through the lower half of the antenna base and connect it to the antenna connector.

Note: Do not over-tighten connector as this could damage internal solder connections.

Using the four screws, reassemble the antenna with cable connected. Run the short coaxial cable out the slot of the floor flange.

2) If using transient eliminators, install them in accordance with your antenna system grounding scheme. Mount the transient eliminator within 30 ft. of the antenna and protected from the weather if possible.

Note: A second transient eliminator may be mounted near the equipment if required.

Note: It is recommended to wrap all exposed connections with weatherproof tape.

Connect the opposite end of the short coaxial cable to the transient eliminator.

3) Connect one end of the longer coaxial cable assembly to the transient eliminator.
4) Use a cable tie or appropriate cable clamps to secure the coaxial cable to the mast.
5) Route the long cable through the building to the location where the Primary Reference Receiver will be installed.
6) Datum recommends coiling any excess cable to avoid any gain mismatch problems between the antenna and receiver. Coiling the excess cable also allows use of the factory installed crimped connector and provides the user the flexibility to relocate the equipment in the future if necessary.

WARNING: ***Datum does not recommend cutting the antenna cables provided in these kits. If the cables must be cut, please ensure that the following requirements are met.***

7) Connect the antenna cable to the antenna input connector on the unit using the N type to TNC right angle adapter.

Installation Checklist

1) Verify that all ground wires are installed correctly and securely.
2) Check that all N type connectors are secure, tight, and weatherproofed.
3) Before connecting the antenna coaxial cable to the receiver, test the DC resistance between the center conductor and the shield using an ohmmeter.

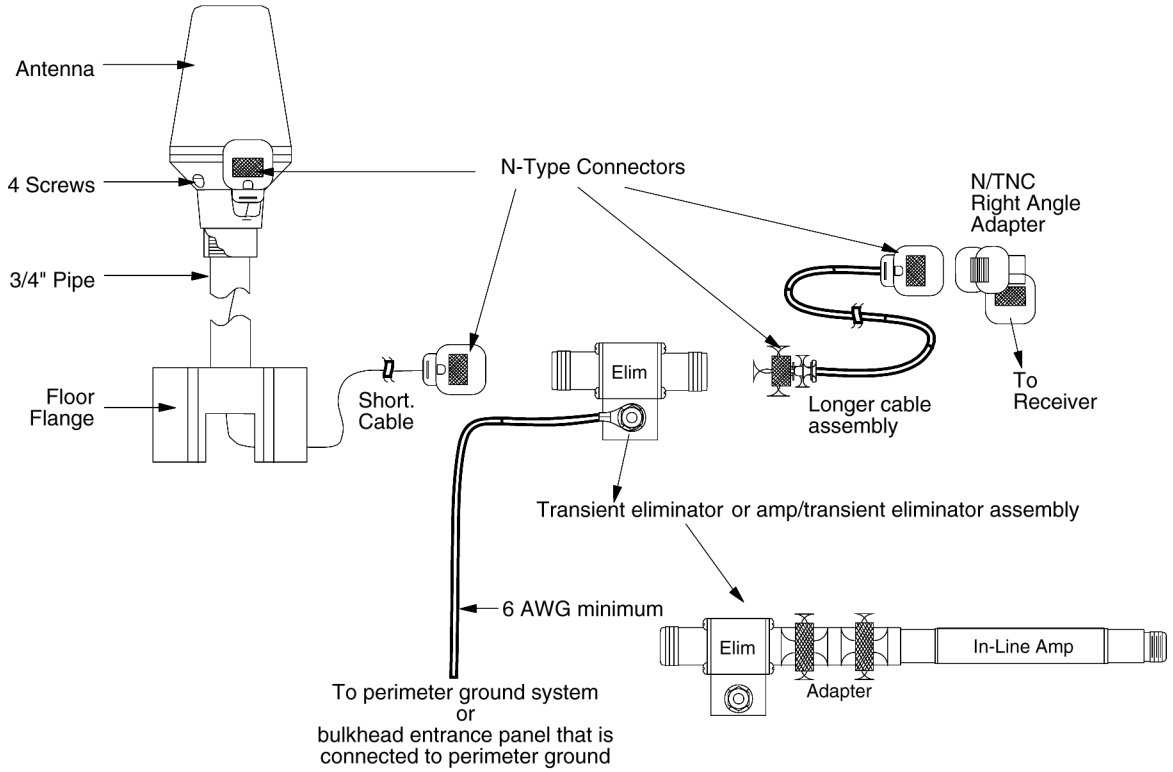
Note: The reading should be over a thousand ohms, but less than forty megohms, for an active GPS antenna. Different meters may give various readings due to the individual meter's open-circuit voltage.

4.2.7 GPS Antenna / LNA, 26, 40 or 50

The 26, 40, or 50 GPS Antenna/LNA receives the GPS signal from each satellite, and amplifies the 1,575.42 MHz (L1) signal and feeds it to the PRR-10. The amplified L1 signal and 5 Vdc power are carried over the coaxial antenna cable connecting the units. The antenna is housed in a weatherproof package suitable for permanent installation in an exposed location. The antenna-to-receiver cable should be kept to the shortest reasonable length. Figure 4.2-1

illustrates a typical GPS Antenna/LNA installation. If it is felt that additional transient eliminator protection is needed, a 250B-90 Gas Tube transient eliminator can be installed in series with the antenna coaxial cable.

Figure 4.2-1: Typical GPS Antenna/LNA Installation



The gain required at 1575.42 MHz for a GPS receiver input is the manufacturer's specification for the receiver to acquire satellites, with some level of signal degradation allowed. L1 Antenna gains are usually specified as the minimum effective gain. Depending on their reception pattern, they can have 4.5-10 dB more signal strength at various satellite azimuths and elevations.

One common problem when installing a GPS receiver system is under or over driving the receiver antenna input. That is why it's very important to select the proper gain antenna and coaxial cable to account for the Insertion Loss between the antenna and receiver. The GPS engine used in the Model PRR-10 requires a net gain on the received signal at the antenna connector input of the chassis to be between 13.8 dB and 36.8 dB. This tolerance allows for the signal loss of the internal coaxial cable and connectors. The optional signal level at the receiver input is 25.3 dB. To select the proper gain antenna and type of coaxial cable to use, the distance between the antenna and receiver needs to be known. Then, if you know the gain required at receiver input, the Insertion Loss of coaxial cable, the Insertion Loss of transient eliminators, and the antenna gain, one can calculate and select the proper items for a specific installation. Refer to the Modules and Accessories Section of this user guide for receiver, antenna, transient eliminator and coaxial cable specifications.

Datum provides antenna kits that allow for antenna cable lengths up to 1000 ft. These kits use low loss LMR-400, or equivalent, flexible cable providing excellent RF shielding. This cable provides excellent protection from interference. All Kits include the GPS L1 antenna, mount-

ing pipe, floor flange, transient eliminator, pre-assembled coaxial cable (for antenna to transient eliminator), roll of 3m 2150 weatherproof tape, and a right angle TNC/N adapter. All antenna, transient eliminator, and in-line amplifiers have N type connectors. The TNC/N adapter allows for connection to the TNC type connector on the PRR-10 chassis. The coaxial cable that connects from the transient eliminator or in-line amplifier to the PPR-10 unit can be supplied in 10 foot increments. The dash number of the cable part number is the length in feet.

Example: P/N 12013076-100-0 is 100 feet in length.

All antenna kits utilize LMR-400, or equivalent, low-loss coaxial cable. Other types of coaxial cable may be used for GPS antenna applications, but it is most important that the specific loss of the cable be calculated to ensure that the net gain is between 13.8 dB and 36.8 dB at the antenna connector input of the Model PRR-10 (See Table 4.2-1 Signal Level Input below).The L1 signal loss of LMR-400 is .051dB/foot. The L1 signal loss of a 90v transient eliminator is typically.25dB.

Table 4.2-1: Signal Level Input

Net Gain Required at PRR-10 Antenna Connector	
Minimum **13.8 dB**	**Maximum** **36.8 dB**

Example:

1) Antenna Gain = 40 dB
2) Transient Eliminator Loss = .25 dB
3) 200 foot LM4-400 (200 x .051) = 10.2 dB Loss

Total Loss: (.25 dB transient eliminator + 10.2 dB (cable loss)) = 10.45 dB

40 dB (antenna gain) - 10.45 dB (total loss) = 29.55 dB (net gain at receiver input)

4.2.8 Rack Mounting Considerations

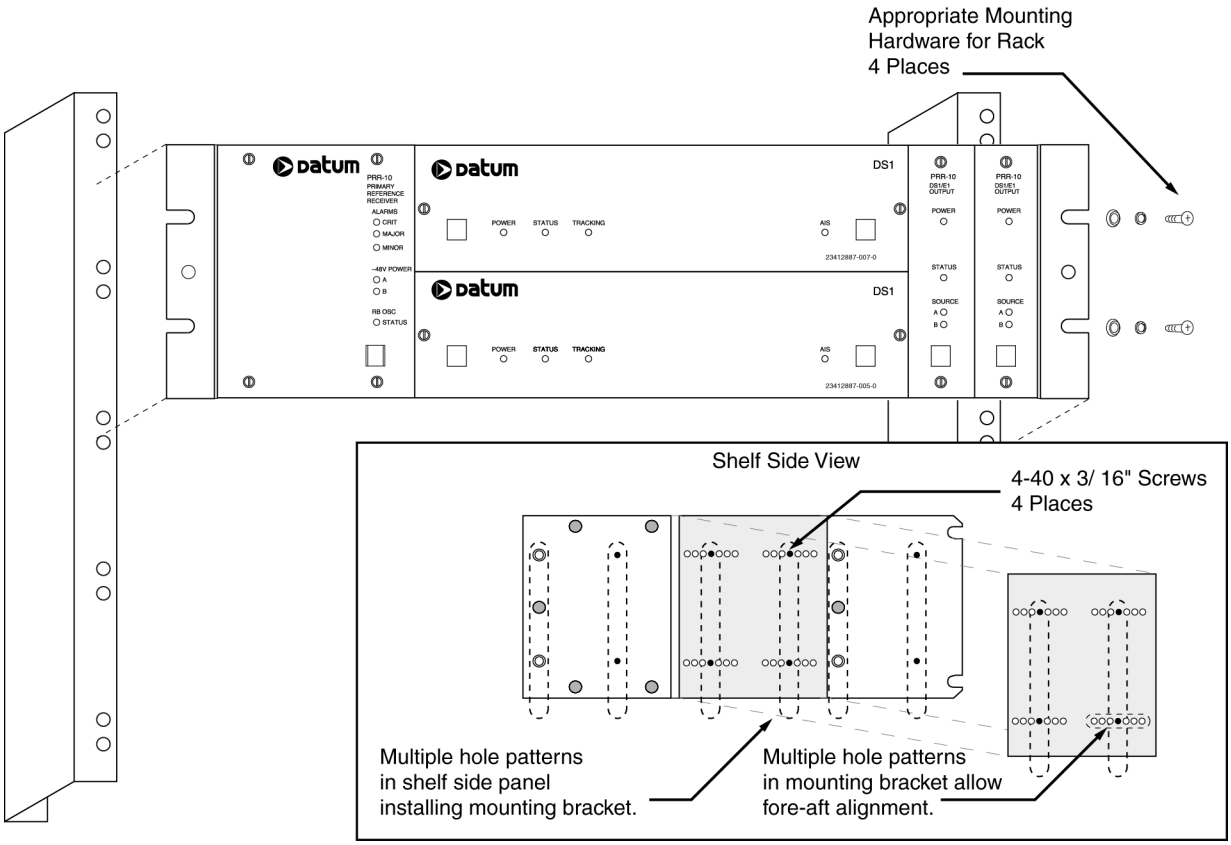
The PRR-10 Main Shelf and optional Expansion Shelves are supplied with brackets for mounting directly in a 19″ (48.26 cm) rack. If your rack is 23″ (58.42 cm) it will be necessary to remove the mounting brackets and attach a set of optional brackets for 23″ (58.42 cm) mounting. The fore-aft position of the brackets is adjustable to accommodate a variety of rack depths. Each Shelf occupies 5.25″ (13.3 cm) of vertical rack space and has a depth of 12″ (30.5 cm).

The PRR-10 shelves are convection-cooled. A 1U space above and below the chassis is recommended for optimum temperature control.

4.2.9 Rack Mounting Instructions

1) The shelves are shipped with the 19″ rack ears, which are adjusted fore-aft positions for mounting in a telecom frame. If the installation requires 23″ rack ears, change the rack ears to the optional 23″ (00412900-001 2 ea. required). Adjust the fore-aft position of the rack ears to the appropriate position needed for your specific installation. Ensure that both brackets are attached at equal distances from the front of the shelf. Refer to illustration Figure 4.2-2
2) Mount the shelf to the front of the rack rails with four screws and associated hardware, as shown in Figure 4.2-2. Make sure the use the correct screws to the rack you are installing.

Figure 4.2-2: Shelf Rack Mounting Diagram



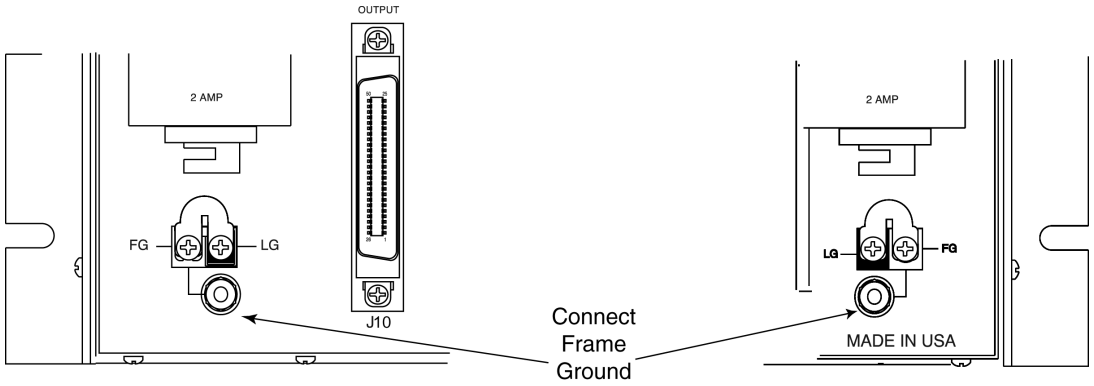
4.2.10 Electrical Interface

All PRR-10 connectors are located on the rear of the shelves. Refer to the tables in the Shelves Section of this user guide. Table 4.2-2 through Table 4.2-6 list the multiconductor connector pin-outs.

4.2.10.1 Grounding and Power connection to each shelf

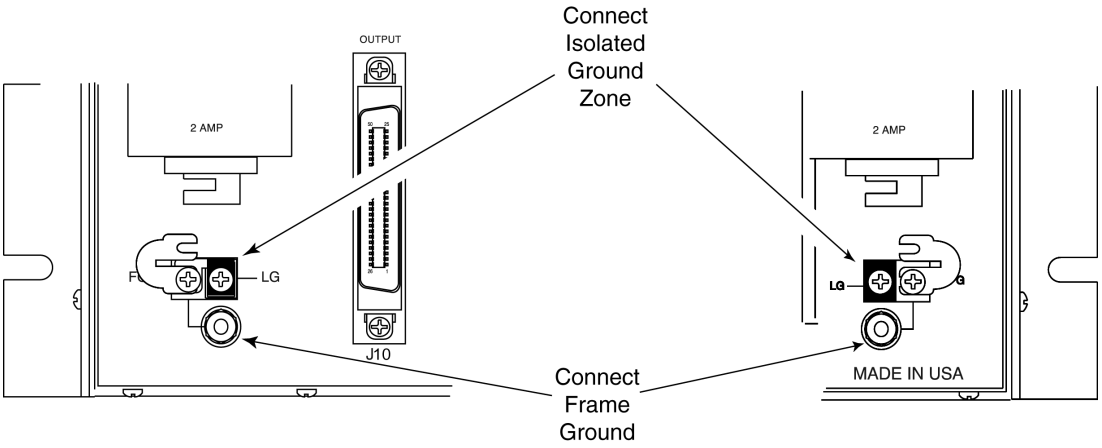
1) Connect Frame Ground(s) to the Frame Ground terminals. The ground conductor used should be of a sufficient gage to provide < .010 ohms between the equipment and the ground system (examples: two 12 x 19/25 AWG wires for distances up to 10.68' (3.25m); two 10 x 37/26 AWG wires for distances up to 16.4' (5m)). Connect the Frame Ground conductor with #10 ring or spade terminals. Refer to Figure 4.2-3.

Figure 4.2-3: Frame Ground Terminals, Integrated Ground Zones



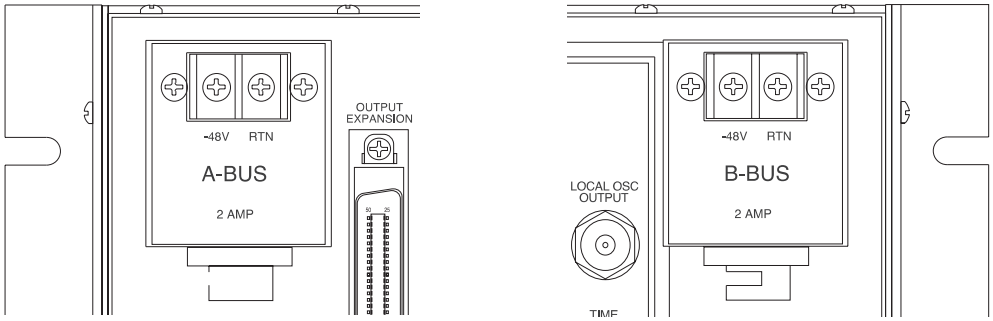
2) Each PRR-10 Shelf is equipped with a shorting strap that can be removed for isolating Logic Ground from Frame Ground for installation in isolated ground zones. When this is required, connect the logic ground terminals to the isolated ground zone. The ground conductor used should be of a sufficient gage to provide < .010 ohms between the equipment and the isolated ground zone. Connect the Logic Ground conductor with # 6 ring or spade terminals. Refer to Figure 4.2-4.

Figure 4.2-4: Logic and Frame Ground Terminals, Isolated Ground Zones



3) Connect –48 V Power and –48 V Return to A-Bus terminals. If redundant power supplies are used, connect the second –48 V source to B-Bus terminals. Ensure that proper polarity is observed. The power conductors used should be of a sufficient gage to handle twice the current rating of the unit, between connections. Connect the –48 V Power with # 6 ring or spade terminals. Refer to Figure 4.2-5.

Figure 4.2-5: Power Terminals A-Bus and B-Bus

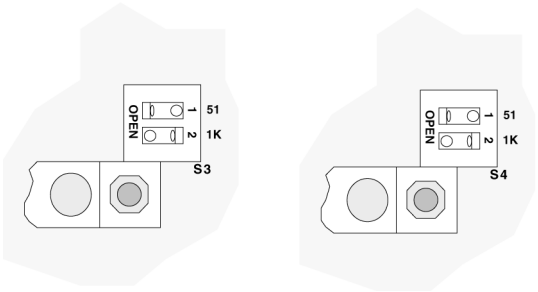


Caution Don't apply power to the shelves until installation is completed and everything is ready for initial check-out.

4.2.10.2 PRR-10 Main Shelf I/O Connections

1) If the PRR-10 was purchased with an internal oscillator, verify that the 10 MHz Local OSC Output on BNC connector (J5) is connected to Local OSC input BNC connector J3 with the coaxial cable supplied.
2) If an Expansion Shelf was purchased with an internal oscillator, verify that the 10 MHz Local OSC Output of the Expansion Shelf is connected to Local OSC input BNC connector J4 with the coaxial cable supplied.
3) If the PRR-10 was purchased without internal oscillators, connect a high quality 5 or 10 MHz reference to Local OSC input BNC connector J3. If redundant oscillators are used, connect the second reference to LO input BNC connector J4. The PRR-10 is shipped with the terminations for these inputs set to 50 ohms. If either local oscillator source will not drive a 50-ohm termination, the termination can be changed to 1 kohms via two dual position dip switches on the backplane located adjacent to each input connector. They are accessible with the Reference Controller Modules removed from the shelf. These references could be from a Cesium or Rubidium standard, and they could also be Local oscillator outputs from an existing TSG. Refer to Figure 4.2-6 for a view of a Local OSC Input Termination Selection Switch.

Figure 4.2-6: Local OSC Input Termination Selection Switches



4) Connect the GPS Antenna to coaxial cable to antenna input TNC connector (J1). Depending on the type of coaxial cable, it may be required that a right angle adapter supplied with the antenna coaxial cable be used.

5) If the PRR-10 was purchased with redundant GPS Reference Controllers, connect the redundant antenna to antenna input TNC connector (J2).

6) Connect Alarm Closures on terminal block (TB1) to the external monitoring equipment per your alarm monitoring scheme. Figure 4.2-7 is an illustration of the terminal block. Connect the Alarm Closure conductors with # 6 ring or spade terminals. NOTE: Outputs J7 and J9 are reserved for future options.

7) Connections for the two DS1 or E1 Clock outputs are on the Clock Output 14Ds ribbon connector (J6). Refer to Table 4.2-2 for TIP, RING and SLEEVE connections. In order to preserve EMC compliance, it is recommended that these connections be made with a low capacitance shield multiconductor computer grade cable. Refer to the Section Note on page 2-23 for more information.

Figure 4.2-7: Alarm Closure Terminal Block

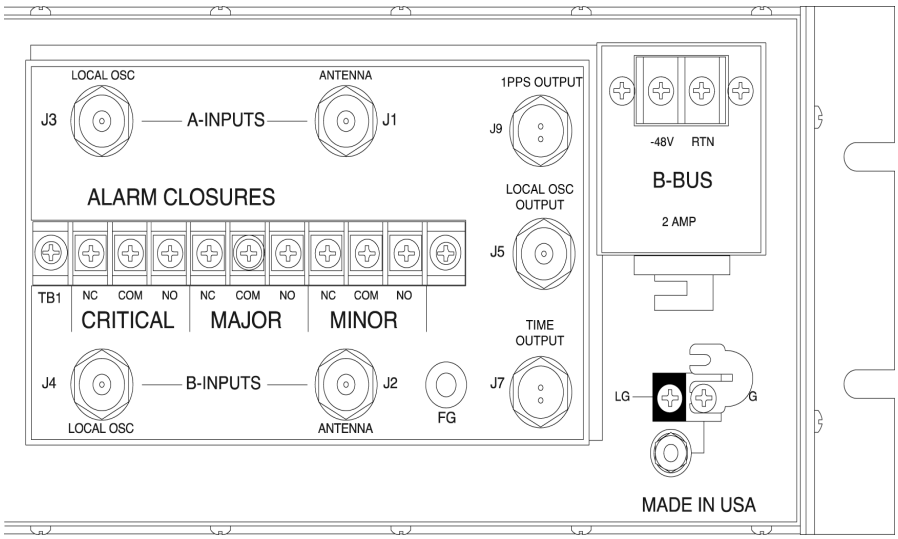
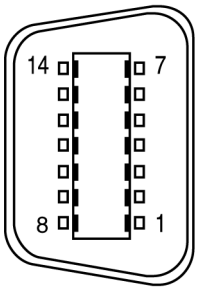


Table 4.2-2: Clock Outputs J6 Pinout

SIGNAL	PIN	PIN	SIGNAL
FG	14	7	FG
RING-B	13	6	TIP-B
No Conn.	12	5	No Conn.
FG	11	4	FG
No Conn.	10	3	No Conn.
RING-A	9	2	TIP-A
FG	8	1	FG

Connector Orientation
14Ds Ribbon Connector



8) Connect the Local Serial Port - A on DB9 connector (J12) to the crafts person terminal for local control and monitoring of the instrument. Verify that S1-A on the rear panel is set to the appropriate equipment type DTE or DCE. The factory default settings for the local serial port are Type: DCE, Baud Rate: 9600, Word: 8 Bits, Parity: None and Stop Bits: 1. The 5 ft. (1.5 m) DB9P to DB9S cable supplied with the PRR-10 may be used. If the cable supplied is not used, be aware, that in order to preserve EMC compliance, it is recommended that these connections be made with a low capacitance shield multiconductor computer grade cable. This connection is usually not a permanent connection, and is used only for initial checkout and troubleshooting. Table 4.2-3 gives the pinout of this connector, and Figure 4.2-8 is a view of S1.

Table 4.2-3: Local and Remote Serial Ports J12 and J13 Pinout

SIGNAL	PIN	PIN	SIGNAL
FG	Shield	5	Logic Return
RI	9	4	DSR
CTS	8	3	TXD
RTS	7	2	RXD
DTR	6	1	DCD

Connector Orientation
DB9S

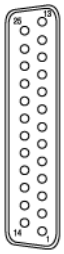
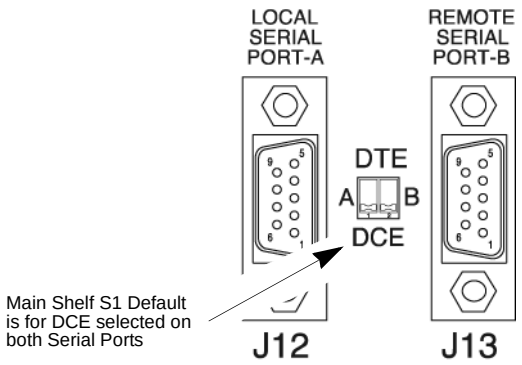


Figure 4.2-8: View of Switch S1



9) Connect the Remote Serial Port - B on DB9 connector (J13) to the Network Synchronization Management System for remote control and monitoring of the instrument. Verify that S1-B on the rear panel is set to the appropriate equipment type DTE or DCE. The factory default settings for the remote serial port are Type: DCE, Baud Rate: 9600, Word: 8 Bits, Parity: None and Stop Bits: 1. In order to preserve EMC compliance, it is recommended that these connections be made with a low capacitance shield multiconductor computer grade cable. Table 4.2-3 gives the pinout of this connector, and Figure 4.2-8 is a view of S1.

10) If the PRR-10 was purchased with optional output module(s), the connections for these outputs are made on an Output Expansion 50Ds ribbon connector (J10). Refer to Table 4.2-4 for TIP, RING and SLEEVE connections. In order to preserve EMC compliance, it is recommended that these connections be made with a low capacitance shield multiconductor computer grade cable.

Table 4.2-4: Outputs J10 Pinout

SIGNAL	PIN	PIN	SIGNAL
FG	50	25	FG
Don't connect	49	24	Don't connect
Don't connect	48	23	Don't connect
FG	47	22	FG
Don't connect	46	21	Don't connect
Don't connect	45	20	Don't connect
FG	44	19	FG
Don't connect	43	18	Don't connect
Don't connect	42	17	Don't connect
FG	41	16	FG
RING-1	40	15	TIP-1
RING-2	39	14	TIP-2
FG	38	13	FG
RING-3	37	12	TIP-3
RING-4	36	11	TIP-4
FG	35	10	FG
RING-5	34	9	TIP-5
RING-6	33	8	TIP-6
FG	32	7	FG
RING-7	31	6	TIP-7
RING-8	30	5	TIP-8
FG	29	4	FG
RING-9	28	3	TIP-9
RING-10	27	2	TIP-10
FG	26	1	FG

Connector Orientation
50Ds Ribbon Conn.

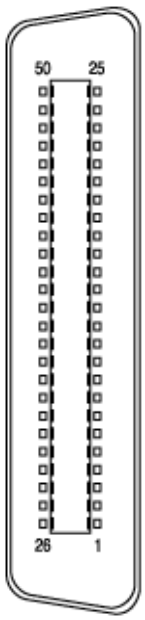


Figure 4.2-9: Views of Switch S2

4.2.10.3 PRR-10 Expansion Shelf I/O Connections

1) If the output Expansion Shelf was purchased with an internal oscillator, connect the 10 MHz Local OSC Output of the Expansion Shelf to the Local OSC Input BNC connector J4 on the Main shelf with the coaxial cable supplied.
2) Verify that an Output Expansion (jumper) module (23412968-000-0), which is supplied with the Expansion Shelf, is installed in the Main Shelf module slot A4. Any optional Output Module(s) that may be in the Main Shelf have to be moved to the Expansion Shelf.
3) Connect the Input 50Ds connector (J1) to the Main Shelf Output Expansion 50Ds Connector (J10) using the 50Dp 3.3 ft. (1 m) cable supplied with the Expansion Shelf. Table 4.2-5 gives the pinout of this connector, and Figure 4.2-10 shows Expansion Shelf to Main Shelf connection.

Figure 4.2-10: Expansion Shelf to Main Shelf Connections

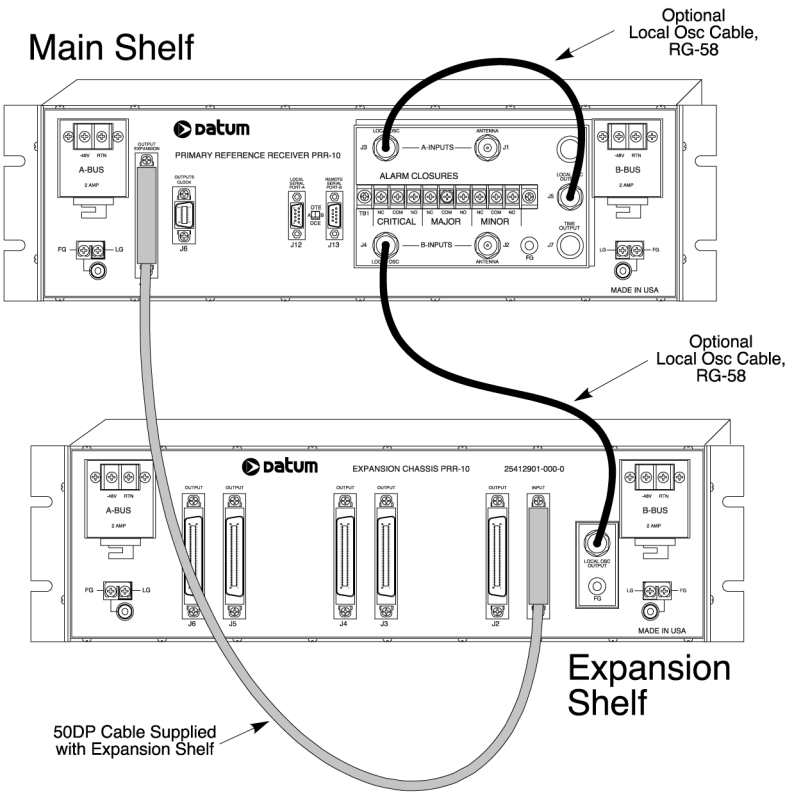
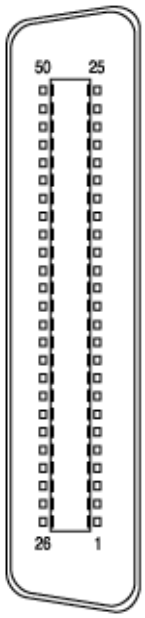


Table 4.2-5: Expansion Interface, Input J1 Pinout

SIGNAL	PIN	PIN	SIGNAL
FG	50	25	FG
SCLK-	49	24	SCLK+
MISO-	48	23	MISO+
FG	47	22	FG
MOSI-	46	21	MOSI+
PCS4	45	20	PCS2
FG	44	19	FG
PCS3	43	18	PCS1
No Conn.	42	17	Logic Return
FG	41	16	FG
XSYNC-	40	15	XSYNC+
ATCLK-	39	14	ATCLK+
FG	38	13	FG
ATPOS-	37	12	ATPOS+
ATNEG-	36	11	ATNEG+
FG	35	10	FG
ADDS-	34	9	ADDS+
SPARE14	33	8	SPARE13
FG	32	7	FG
BTPOS-	31	6	BTPOS+
BDDS-	30	5	BDDS+
FG	29	4	FG
BTNEG-	28	3	BTNEG+
BTCLK-	27	2	BTCLK+
FG	26	1	FG

Connector Orientation
50Ds Ribbon Conn.

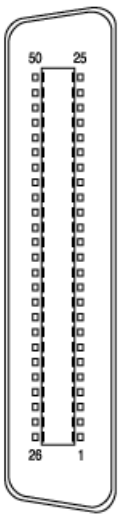


4) If the PRR-10 was purchased with optional output module(s), the connections for these outputs are made on Output 50Ds ribbon connectors (J2, J3, J4, J5 and/or J6) depending on how many output modules are installed. Refer to Table 4.2-6 for TIP, RING and SLEEVE connections. In order to preserve EMC compliance, it is recommended that these connections be made with a low capacitance shield multiconductor computer grade cable.

Table 4.2-6: Optional Outputs J2, J3, J4, J5 and J6 Pinout

SIGNAL	PIN	PIN	SIGNAL
FG	50	25	FG
No Conn.	49	24	No Conn.
No Conn.	48	23	No Conn.
FG	47	22	FG
No Conn.	46	21	No Conn.
No Conn.	45	20	No Conn.
FG	44	19	FG
No Conn.	43	18	No Conn.
No Conn.	42	17	No Conn.
FG	41	16	FG
RING-1	40	15	TIP-1
RING-2	39	14	TIP-2
FG	38	13	FG
RING-3	37	12	TIP-3
RING-4	36	11	TIP-4
FG	35	10	FG
RING-5	34	9	TIP-5
RING-6	33	8	TIP-6
FG	32	7	FG
RING-7	31	6	TIP-7
RING-8	30	5	TIP-8
FG	29	4	FG
RING-9	28	3	TIP-9
RING-10	27	2	TIP-10
FG	26	1	FG

Connector Orientation
50Ds Ribbon Conn.



4.3 Installation Acceptance Testing

Note No special tools are required for checking out a basic PRR-10 installation other than a terminal connected to the local serial port to change the default operating limits, if required, for proper operation.

4.3.1 Static Acceptance Inspection Steps

1) If GPS is being used, inspect the GPS Antenna installation to verify that the antenna was installed and grounded properly.
2) Inspect the PRR-10 Shelf installation and verify that –48 V Power and grounds and outputs have been connected properly.
3) Inspect and verify that all inputs and outputs have been connected properly for the configuration of PRR-10 that has been installed.

4.3.2 Initial power-up observation and operation

1) Apply –48 V Power.
2) Observe the PRR-10 front panel for the following indications:

Note Initial warm-up is approximately two minutes.

Status Module indicators.

- –48 V PWR A and B illuminates green with power present.
- MINOR Alarm illuminates amber during warm-up, changing to Off when warm-up is complete.
- CRITICAL illuminates red until 5 or 10 MHz LO are detected present, and changes to Off when LO is detected. (The default setting is 10 MHz. Refer to the Operation Section of this user guide for changing to a 5 MHz LO.)
- MAJOR Alarm illuminates red during warm-up, changing to Off when warm-up is complete.

Optional OSC/Status Module indicators (if supplied).

- –48 V PWR A and B illuminates green with power present.
- MINOR Alarm illuminates amber during warm-up, changing to Off when warm-up is complete.
- CRITICAL illuminates red until the 10 MHz LO is detected present, and changes to Off when LO is detected.
- MAJOR Alarm illuminates red during warm-up, changing to Off when warm-up is complete.

- MODULE STATUS illuminates green with power present.

Optional Rb OSC/Status Module indicators (if supplied).

- –48 V PWR A and B illuminates green with power present.
- MINOR Alarm illuminates amber during warm-up, changing to Off when warm-up is complete.
- CRITICAL illuminates red until the 10 MHz LO is detected present, and changes to Off when LO is detected.
- MAJOR Alarm illuminates red during warm-up, changing to Off when warm-up is complete.
- Rb OSC STATUS illuminates green when 10 MHz output is valid. Critical Alarm is on during rubidium oscillator warm-up (less than 15 minutes).

Reference Controller Module indicators.

- POWER illuminates green when Power is present
- STATUS illuminates amber during warm-up, changing to Green when warm-up is complete.
- TRACKING illuminates amber on power-up, changing to green when lock is acquired.
- AIS illuminates amber during warm-up, changing to Off when warm-up is complete.

The following test procedures apply to units with a GPS radio receiver installed. When the automatic gain control (AGC) signal strength for a channel is greater than 025, the signal is tracking and an OK message appears in a report returned to the screen. Otherwise, one of the following messages appears in the report:

- EPH—obtaining Ephemeris data
- MSG—message sync from satellite
- SRC—searching for code from satellite
- TIM—setting time from satellite

The report columns from let to right include the GPS channel numbers, satellite identification numbers, automatic gain control (AGC) signal strength, and the response message. This report updates on the screen approximately every five seconds. To generate the report and verify that the signal is tracking:

1) Type ENGINE TDATA and press **Enter.** This command is a toggle function. A report appears on the screen:

1	**17**	**029**	**OK**
2	**21**	**052**	**OK**
3	**06**	**059**	**OK**
4	**23**	**041**	**OK**
5	**09**	**051**	**OK**
6	**26**	**078**	**OK**
7	**29**	**066**	**OK**
8	**03**	**083**	**OK**

Optional Output Module indicators (If supplied).

- POWER illuminates green when Power is present.
- STATUS illuminates green when On and selected.

- SOURCE A illuminates green when Channel A is providing the clock source.
- SOURCE B illuminates green when Channel B is providing the clock source.

4.4 Module Insertion

4.4.1 Handling

The following should be considered when handling any of the modules:

1) Discharge yourself from static charge, before touching the circuit board. This can be done by touching a grounded surface on the equipment rack or workbench before touching the module.
2) Avoid touching component leads and DIN connectors.
3) Avoid laying the module on an ungrounded surface.
4) Avoid touching the module to insulated surfaces.
5) Use ground wrist straps! A ground lug is provided on the front of each mounting bracket, and one banana jack is provided on the rear of each shelf for connecting these straps to frame ground.

4.4.2 Module Slot Locations

Locate the slot or slots allocated for the type of module being inserted. Modules of different types are of different sizes, and have different DIN connector orientations to prevent them from being inserted into the wrong locations. Module slots in each shelf are numbered left to right, top to bottom from the front of the shelves. Refer to the following tables.

Table 4.4-1: Module Location Main Shelf

<table>
<tr><td rowspan="2">A1

Status Module
or
Optional Oscillator
Module</td><td>A2

Reference Controller Module
(primary)</td><td rowspan="2">A4

Module
(Primary)
Optional
Output</td><td rowspan="2">A5

Module
Optional
Output</td></tr>
<tr><td>A3

Optional Reference Controller Module</td></tr>
</table>

Table 4.4-2: Module Location Expansion Shelf

<table>
<tr><td rowspan="2">A1

Status Module
or
Optional Oscillator
Module</td><td>A2

Optional
Output
Module
(Primary)</td><td>A3

Optional
Output
Module</td><td>A4

Optional
Output
Module
(Primary)</td><td>A5

Optional
Output
Module</td><td>A6

Optional
Output
Module
(Primary)</td><td>A7

Optional
Output
Module</td><td>A8

Optional
Output
Module
(Primary)</td><td>A9

Optional
Output
Module</td><td>A10

Optional
Output
Module
(Primary)</td><td>A11

Optional
Output
Module</td></tr>
<tr><td colspan="2">Redundant Pairs</td><td colspan="2">Redundant Pairs</td><td colspan="2">Redundant Pairs</td><td colspan="2">Redundant Pairs</td><td colspan="2">Redundant Pairs</td></tr>
</table>

4.4.3 Module Insertion Procedure

This procedure is common for all modules. Some modules require the installer to set or verify jumper or switch settings, as described previously in this section. Also, refer to each module in the Modules Section of this user guide for any pre-insertion instructions before proceeding.

All modules are inserted as follows:

1) Align the module card edges with the card guides of the appropriate module slot.
2) Slide the module into the shelf until it is fully seated into the backplane.
3) Tighten the captive screws, located on the module front panel.

Caution Ensure that the module is completely inserted into the slot. The module may not function properly or extensive damage may result if the module is left partially inserted.

OPERATION

5

SECTION 5 PRR-10 OPERATION

Overview. This section provides additional information about the operation and configuration of the PRR-10.

5.1 Design

The PRR-10 is designed to perform a frequency lock of an externally applied Local Oscillator (LO) to a received radio signal. The radio receiver, called 'engine' in this document, is a GPS receiver. Steering of the LO input frequency is performed through Direct Digital Synthesis (DDS) with an absolute resolution of 1.4e-12. Greater frequency accuracy is obtained by dithering the DDS value over time. The main cards within the unit, referred to as a 'reference controller', form the heart of the PRR-10 system. These cards contain all control, alarm, and user interface functionality. The unit achieves full redundancy by inserting a second reference controller.

5.2 Single/Dual Reference Controller Operation

Operation of the PRR-10 is altered when there is more than a single reference controller present in the system. With a single reference controller, that controller is always in control of all signals within the system. These include the RS232 communication, backplane communication and frame generation. When dual reference controllers are present, some of the functionality has to be controlled by one reference controller, the master, and the other controller becomes a slave to the signals provided by the master. There are three types of masters possible on the system:

RS232 master - this is the reference controller that currently has control of the output data from the instrument. Both reference controllers always have access to the input data on the ports. The RS232 master is dynamic and can be changed by the user. Refer to the User Interface section for how control is changed.

Backplane master - this is the reference controller that is in control of the communication lines on the backplane of the chassis. This is fixed when the units are installed or powered up. By default, the top reference controller, A, is the master. If A is removed, the mastership passes to B until B is removed.

Sync master - this is the reference controller that is providing the sync signals for the frame generation circuitry. This is under software control and is dynamically assigned to maintain output sync. Output from the output modules is always from the Sync master.

By default the backplane master is referred to merely as the master. Sync mastership is always changing, is not under user control and is not generally referred to. RS232 mastership, being dynamic, only refers to which reference controller is generating the actual user output.

When the unit is powered up, the master assumes the RS232 mastership and provides all event reporting, etc. The master also assumes the RS232 mastership when a user is logged off of the system.

In a dual reference controller configuration, the two reference controllers are always sharing enough information over the backplane for the slave controller to be able to take over mastership in the event that the master is lost. This includes, but is not limited to, alarm conditions and frequency control information. In the event that the master is removed, the slave takes over ALL mastership. If the removed card is then reinserted, mastership does not revert.

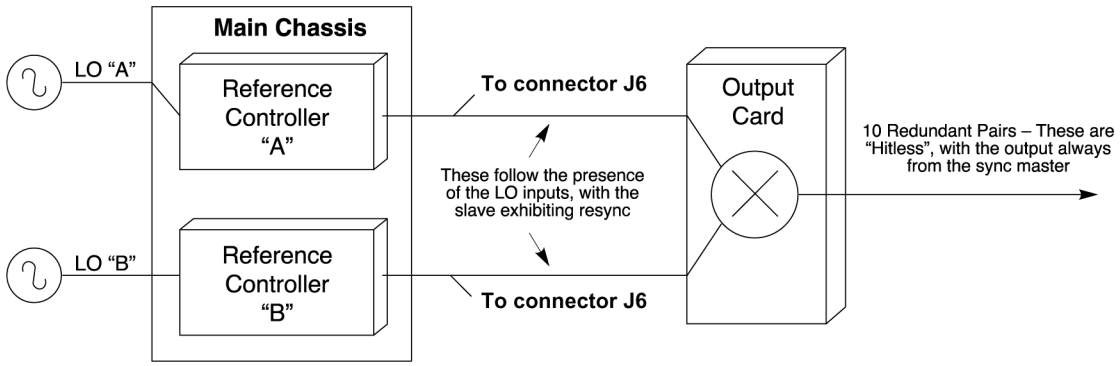
5.2.1 Dual Reference Controller Alarms

When there are multiple reference controllers present in the system, each controller handles its own alarm indications. The master controller has all control for the alarm relay and LED indications. The status command reflects the total of all of the alarms present in the system.

5.2.2 Dual Local Oscillator Operation

With the addition of a second reference controller in the system, the user may also desire that, for maximum redundancy, one controller utilize LO input A and the other utilize LO input B. This is the default mode of operation, controller A utilizes LO A and controller B utilizes LO B. In this mode of operation, the user wants to minimize the phase changes on the output when a LO fails. This would be the case if, for instance, the unit is using the LO outputs from a TSG and one of the oscillators fails. If the main oscillator is a Rb and the other a Stratum 3E, the unit could go into a Holdover mode with 3E stability as the PRR-10 attempts to learn the new LO input. This mode of operation is diagramed in Table 5.2-1.

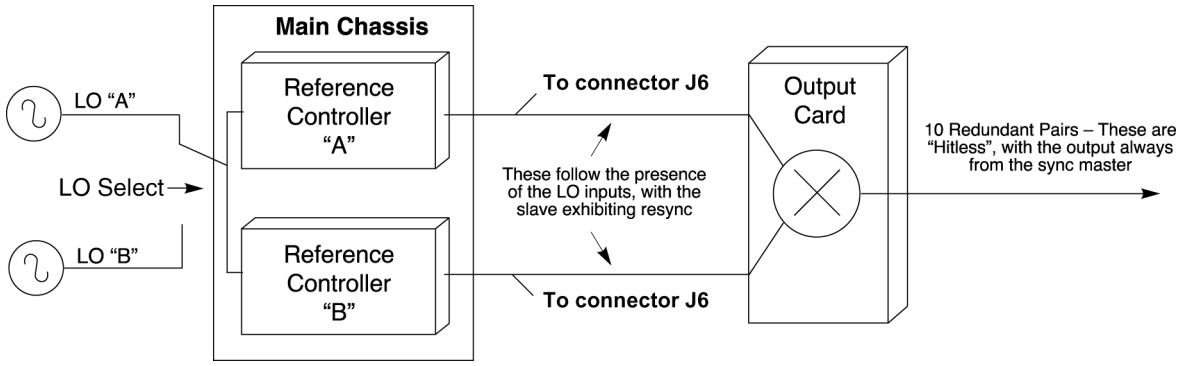
Figure 5.2-1: Dual Local Oscillator Operation



With this mode of operation, each reference controller 'follows' the presence of the individual LO input. In the event that the LO input fails, the controller would mute its output and, if autoswitching is enabled, switch to the other LO and re-acquire. Once re-acquisition is successful, the controller then resyncs its output and turns it back on. This re-establishes the redundant reference controllers with no phase hits on the output from the output cards. Note that, if frequency alarms are ignored, the output from the main chassis is continuous, with the Sync master changing between controllers. In the event that the failed LO returns, the controller can change back to the LO, if autoreturn is enabled, following the same procedure. This restores the full redundancy of the system.

The other choice is that both controllers utilize the same LO input at all times, as diagramed in Figure 5.2-2.

Figure 5.2-2: Alternative Dual Local Oscillator Operation



In both modes of operation, the last reference controller to enable outputs syncs those outputs to the other reference controller before actually enabling them. This is to guarantee the outputs are synchronous on initialization. This functionality is handled with both hardware and software. The slave then continuously resyncs its outputs to the master.

Note If the frequency degraded alarm is set to ignore, the PRR-10 outputs will not mute on a LO change, but after a change, the output from the unit cannot be guaranteed to meet the Stratum 1 MTIE mask until the controlling software has established a lock to the new LO input.

5.3 LO Switching

There are several different types of LO switching available on the PRR-10. All of these can be enabled/disabled by the user. The LO inputs are identified as 'A' or 'B'. If a LO input is not present, switching should not be attempted to the missing input.

Switch Description.

Autoswitch – In the event of a loss of the LO signal, the unit will automatically switch to the other LO input. If this is disabled and the LO signal faults, the outputs are squelched as there is no LO input for the hardware and the output from the unit will be off frequency.

Autoreturn – In the event that the LO signal returns that which was previously switched from the unit will automatically return to utilizing the original LO signal. If this function is disabled and the unit selected LO fails, the outputs are squelched. Refer to the Autoswitch function for the reasoning.

User – The user can select which input to utilize.

In addition to the switching capabilities, the user can select which input is to be the primary input. This is the input the unit attempts to utilize at all times, with the switching restraints above. In the event the primary LO is absent, the unit will switch to the primary if autoreturn is enabled and the LO input is returned.

5.4 Event Logging

Each reference controller in the PRR-10 maintains a list of the last 400 events that have occurred within the unit. The latest 10 events are stored in non-volatile memory. Users are able to query events from the list, utilizing the latest event, the last N events, only alarms, only reports, or which reference controller reported the event.

5.4.1 Alarms

Alarms represent a subset of the event reporting. Alarms are used by the system to indicate something that may require user intervention, or has degraded the operation of the unit. The unit attempts to avoid nuisance alarms by not reporting routine degradation of signals due to selective availability on the GPS signal. All alarm indications are sent over the communication ports and contain the pertinent details of the alarm condition in a single message, including the time of the alarm state change.

Valid alarm levels:

Disabled alarms are invisible to the user. This is part of the self configuration of the unit. For example, if an engine does not have the feature to detect if the antenna is shorted, this alarm is disabled so that it does not appear to the user. In this way, nuisance alarms are avoided for features that are not available with a given configuration.

Ignored alarms have been set by the user to be ignored by the unit. This alarm condition has no effect on the actual state of the alarm, it merely indicates that the user has no need to know about it. Note that if the type of alarm is utilized by the software to be able to detect degradation of the operation of the unit, it will still be utilized internally. For example, if the Frequency Degraded alarm is set to be ignored, and the LO input to the unit fails, the outputs from the unit are still squelched to avoid causing problems within the network.

Minor alarm conditions are those alarms that are at an informational level and may, eventually, degrade the performance of the unit.

Major alarms are those alarms indicating a failure within the unit that may require user intervention.

Critical alarms are those alarm conditions that represent a failure within the unit that require user intervention.

A user can set the level of any alarm to customize his installation. In addition to the alarm levels, the user is able to set alarm delay times for alarms that are generated by software conditions. Delay times are the length of time, in seconds, before an alarm is actually generated and reported. If the alarm condition clears before the time has expired, no alarm condition is generated or reported. Any hardware failure alarms do not allow the user to change the delay time; they are always immediately reported. Whenever an alarm is listed as being set, it is implied that what is actually happening is the alarm delay time (if any) is being actuated and the alarm does not actually go active until the delay time is over. If there are any exceptions to this they are noted when the alarm setting is discussed. Alarms available from the PRR-10 include:

Tracking – Indication of whether the receiver is currently tracking or not.

Antenna Fault – Antenna is currently disconnected. This alarm is only available if the receiver utilized supports this feature.

Antenna Shorted – Antenna is currently shorted. This alarm is only available if the receiver utilized supports this feature.

Position Bad – Current receiver position has not been verified by the receiver installed. When a GPS engine is used, this alarm must be cleared before the unit can begin utilizing information from a receiver to control the clock outputs.

Lost LO 1 input – LO input #1 has faulted.

Lost LO 2 input – LO input #2 has faulted.

Lost all LO input – All LO inputs have faulted. This causes all the clock outputs from the unit to be muted.

Engine Hardware Failed – The receiver is indicating a failure of its hardware.

Engine System Failed – The engine is reporting a system failure. This means that the receiver is currently unable to report any information necessary for the control of the clock outputs. This may be due to other failures within the system.

Output Degraded – The clock outputs from the unit are not guaranteed to meet the Stratum 1 mask. See Section 5.5, Output Control for more information. Activation of this alarm controls the output control status from the unit.

Ref. Cont. Removed – The redundant reference controller has been removed from the system. This alarm is only available if a redundant reference controller was previously detected in the system.

Ref. Cont. Failed – The redundant reference controller has failed. This means that it is no longer responding to the backplane transfers within the unit. This is usually an indication of a hardware failure on the redundant unit. This alarm is only available if a redundant reference controller was previously detected in the system.

Power A Faulted – Power input A has faulted.

Power B Faulted – Power input B has faulted.

System PLL unlocked – The system PLL has not achieved a lock to the incoming LO. This PLL is used to generate reference frequencies for the receivers and, therefore, may also generate receiver alarms. This can be a hardware failure, but usually is an indication that the incoming LO frequency has not been set properly.

Frame Gen PLL unlocked – The frame generation PLL has not achieved a lock to the incoming LO. The clock outputs should be disabled. This can be a hardware failure, but usually is an indication that the incoming LO frequency has not been set properly.

Bad Hardware Config – The system is configured with hardware that cannot be utilized in a redundant fashion.

Clock Out Failure – One or more outputs on an output module are indicated at a faulted state. This indicates a short or heavy load on the output signal, or a hardware failure of the drivers on the module.

Clock In Failure – One or more inputs are not present for an output module. This is usually caused by outputs not being yet enabled from any of the reference controllers, or a failure to install the Clock Output Expansion module in the Main Chassis.

Frequency Control Range - The control for the frequency control has reached 90% of its full scale value.

Output Module PLL Unlocked - The phase locked loop on one or more of the output modules is not locked to the clock input signal.

Unit Holdover - The unit is currently in the holdover mode. This means there are no valid measurements being used and the output of the unit is at the stability of the LO input type.

Redundant Failure - A redundant output module is failed. This is usually caused by a mismatch of redundant cards in the system.

Non-Redundant Failure - A non-redundant output module failed. This is caused by a bad card being inserted into the system.

5.4.2 Reports

Reports represent another subset of events. Reports are status indications that are less severe than a minor alarm, and exist only for user information. Reports can be utilized to trace why a failure occurred. When reports are utilized, they include the time and nature of the event. They are reported on both communicating ports from the unit. Some reports within the unit have the ability to be disabled; others are enabled all of the time. Reports that can be disabled are utilized only in the interactive mode of operation. Reports available from the PRR-10 include are outlined in Table 5.4-1.

Table 5.4-1: Reports from PRR-10

REPORT	SETTABLE?	LOGGED?	DESCRIPTION
LO Switch	No	Yes	Unit has switched LO inputs. This is due to a fault of the LO input, or return of a LO input that had faulted.
User LO Switch	No	Yes	User has forced a LO switch.
Log In	No	Yes	User has logged in.
Log Out	No	Yes	User has logged out.
Restart	No	Yes	Reference controller restarted.
Board removed	No	Yes	Board has been removed. Only reported if board was previously installed.
Board Inserted	No	Yes	Board installed.
Events cleared	No	Yes	All events stored in event log have been cleared by a user. This is the only event stored in the event log after the clear has been executed.
User Image Set	No	Yes	User has transferred the setting from non-volatile memory to Flash memory.
Phase Sample	Yes	No	Phase sample measurements from the software PLL control.
Freq Control	Yes	No	Frequency control measurements from the PLL control. This is only sent to the port that enabled the report.
Keep Alive	Yes	No	Generates an output to the port every five minutes. This is utilized to keep a communication line active. This is only sent to the port that enabled the report.
Position updates Settable	Yes	No	Generates an output to the port every time there is a position calculation update. Included in the log is the current position and average count. This is only sent to the port that enabled the report.

Note Settable reports are not available in TL1.

5.5 Output Control

The hardware chips installed on the reference controller determine the output type from the unit. Software determines the type of framing chip installed and updates appropriately. The types of outputs allowed are DS1 and E1. In the event that the user installs mixed output types (dual reference controllers), the unit generates a bad hardware config alarm and refuses to enable the outputs. The output from the unit has the ability to operate in several different modes, depending on whether the unit is meeting the Stratum 1 mask or not.

Output Type Description.

Off – Clock outputs are turned off from the unit. This is user-settable as an alarm indication when the unit is not generating a Stratum 1 output. When the alarm is cleared, the output returns to the previous set type.

Framed – Normal output generates the framed signal. This is user-settable as an output when the unit is generating a Stratum 1 output.

AIS – Alarm Indication Status. This is user-settable as an alarm indication whenever the clock outputs are not guaranteed to meet the Stratum 1 mask. When the alarm is cleared, the output returns to the previous set type.

SSM/ESF – This is the Sync Status Messaging from the unit. For DS1 signaling, the output is ESF (Extended Super Frame). This can be utilized for both alarm and no alarm conditions. In the event that the unit is outputting a Stratum 1 level, the message should indicate this. If operating mode is set to PRS, the unit is outputting Stratum unknown.This is because there is no knowledge of the stability of the input that is feeding the LO. If operating mode is set to Modified PRS (mod-PRS), the Stratum level changes to Stratum level LO. If the AIS is also enabled, it takes precedence over this alarm indication for non-Stratum 1 levels.

All output indications are triggered off of the Frequency Degraded Alarm. This alarm usually goes through the normal alarm delay times, unless the reason for the alarm warrants an immediate setting of the alarm. Examples of this would be: loss of all LO input to the unit, frequency error correction from the software PLL of greater than 2e-10 in any one step, a phase difference from all inputs of greater than 1 microsecond. All of these are indications that the output from the unit has the potential of greatly exceeding even the degraded mask for PRS operation and, therefore, constitute an immediate error indication. If this alarm is set to 'ignore', the unit will always indicate a Stratum 1 level except as previously discussed. The exception is in a hardware failure where the outputs are truly unusable. In this case, the outputs are squelched.

5.6 Interactive Commands and Operations

This section outlines the operation of the interactive mode of operation for the PRR-10 unit. Presented here is a description of the general command parsing, RS232 operations, the commands for the PRR-10 and their operation.

5.6.1 General Interactive Operation

The interactive parser (a parser is just a fancy term for a computer program that translates commands entered by a user into information the computer uses to perform the desired command) is the default parser in the PRR-10. When any other parsing mode is terminated, this is the mode returned to. Interactive mode is used as the interface to a human user. TL1 is currently the only other parser available. Refer to Section 5.7, TL1 Commands and Operations for more information.

There are five levels of password protection that are only functional if the user has entered passwords. The five levels, their numbering scheme, and description of operation are listed in Table 5.6-2.

Table 5.6-2: Password Levels

LEVEL NAME	ID	DESCRIPTION
Idle	0	Only able to query the user type and login to the instrument.

Table 5.6-2: Password Levels

User	1	Ability to view the current status and settings of the unit. The user is also able to change settings for anything that deals with being able to communicate to the instrument - namely line termination and echo control. Changes are only in affect until the user is logged out.
Craft Person	2	The craft person has all of the abilities of the user, but they are also able to identify different reference controllers within the unit and set anything that is pertinent to an installation. This would include line lengths for outputs, oscillator input frequencies, etc. Changes are stored into nonvolatile RAM.
Supervisor	3	The Supervisor level has all ability of the Craft Person with the addition of being able to configure anything within the unit - except for creation of users.
Administrator	4	The Administrator level has all ability of the Supervisor with the addition of being able to create users for the system.

Parsing is started by the user entering data on the terminal. All lowercase input is converted to uppercase, unless enclosed in double quotes (‘”’) (refer to the data section that follows). Any data entry can be canceled with the escape character (hex $1B). Character echo may be enabled or disabled. If enabled, the backspace character is echoed destructively. There will be no echo if the unit is currently sending a response or information.

In the interactive mode event time stamps are of the form:

DDMONYYYY HH:MM:SS

Interactive mode of operation allows for both hardware and software handshaking, both of which can be enabled or disabled by the user on a port basis.

The command parser has the following format:

Command [<Data Separator><data>...][<Command Separator>]

where:

Command	any valid command consisting only of uppercase letters or numbers, excluding the <Data Separator> and <Command Separator> codes
<Data Separator>	is any of the following:
‘ ’ (hex 20)	space character. Multiple spaces are converted into a single space character
‘ , ’	Comma. Multiple commas denote empty data fields
‘ : ’	Colon. Multiple colons denote empty data fields.
‘ / ’	Slash. Multiple slashes denote empty data fields
<data>	The data input for the command. This can be any combination of printable ASCII codes and is specified in the command description section. Note that double quotes (“”) imply literal input and all data is accepted as a single data entry. This allows the user to enter complex input strings. When user input is enclosed within double quotes, no conversion is made to upper-case.
<Command Separator>	is the ‘ ; ’ (semicolon)

The parser learns the input line terminator. Possible inputs are CR, LF, or CRLF. To change the terminator the user is required to send the new terminator twice in succession. After learning a new line terminator that terminator stays in effect until the user sets a new one.

Upon line entry from the user the line is ‘cleaned up’. All leading spaces before a command are removed. All multiple spaces are converted to a single space, including those entries within double quotes. All double quotes are removed from the individual <data> entries. Parsing then continues per the above specification.

5.6.2 Prompts

The interactive parser prompts are defined in Table 5.6-3.

Table 5.6-3: Interactive Parser Prompts

PROMPT	LEVEL	DEFINED MEANING
+>	0,1	Communication is only through the backplane master reference controller.
c:+>	>1	User is logged onto the backplane master reference controller. c is the actual reference controller in use. This will be either 'A' or 'B' for the top and bottom reference controllers, respectively.
c:->	>1	User is logged onto the backplane slave reference controller. c is the actual reference controller in use.

5.6.3 RS232 Mastership

RS232 mastership can be changed only from Level 2 or above. This is indicated to the user by a prompt change. To communicate with the other reference controller, the user enters the reference controller's ID, either A or B, followed by a colon (:). To completely change to the other controller, this is entered on a single line. Commands on a single line may be mixed between the controllers.

5.6.4 Interactive Commands

All command descriptions follow this format:

Sys Name: *Shows the command name as it should be entered by the user. Only enough characters need to be entered to make a unique name for the access level.*

Command: *Brief description of the functionality of the command.*

Operation:

Level 0: *Gives the options & operations for level 0. These are to be preceded by the command.*

Level 1: *Gives the options & operations for level 1. These are to be preceded by the command*

Level 2: *Gives the options & operations for level 2. These are to be preceded by the command.*

Level 3: *Gives the options & operations for level 3. These are to be preceded by the command.*

Level 4: *Gives the options & operations for level 4. These are to be preceded by the command.*

Remarks: *Includes comments on the operation of the command.*

Related: *Shows any commands that are related to this command. This command may affect other commands, or be affected by other commands.*

Restrictions: *If there are any special restrictions on the use or operation of this command, they are presented here.*

Sys Name: **ALARM**

Command: Provides current alarm status and access to the alarm settings.

Operation:

Level 0: N/A

Level 1: N/A

Level 2: [{ALL} | #]

Allows the user to query the current status of the alarms on the current controller. Only active alarm indications are given unless an option is passed. Valid options are:

ALL	Show the current status of all valid alarm types for this system
#	Show the alarm status for the given alarm number

Output from the command includes the alarm # (internal number used for alarm identification), a text description of the alarm, the current alarm status, the current alarm level (elevated alarms should be indicated with an '*'), and the current delay time for the alarm. If no alarms are active, the command reports: 'No Alarms active'.

Level 3: Same as Level 2 operation, with the following additions:

[{DELAY} time | {IG}|{MI}|{MA}|{CR}]

Allows the supervisor to set up the expected operation for a given alarm number. Only 1 alarm number can be passed if additional information is to be entered. The additional parameters available are:

DELAY	Allows the supervisor to enter the amount of time that an alarm condition must be active before an actual alarm condition is generated. If an alarm is indicated to be of the format 'Immediate', then no delay time may be entered. Delay times are in seconds. Valid delays are from 0 (immediate) to 86400 seconds (1 day).
IG	Set the alarm status level to Ignore. This means that no action will be taken for an alarm condition.
MI	Set the alarm status level to Minor.
MA	Set the alarm status level to Major.
CR	Set the alarm status level to Critical.

Level 4: Same as Level 3 operation.

Remarks: Use of this command by the user implies that they are querying the unit about the current status of the unit and, therefore, the information presented is as concise as possible and presented in a table format.

Related: ELEVTIME, STATUS

Restrictions: None

Sys Name:	**BYE**
Command:	Log a user off of the system.
Operation:	
Level 0:	NA
Level 1:	Logs the user off of the system. There is an event logged as to the user that has logged off and a report is generated reflecting this.
Level 2:	Same as Level 1 operation
Level 3:	Same as Level 1 operation
Level 4:	Same as Level 1 operation
Remarks:	None
Related:	LOGIN
Restrictions:	This command is only available if there are currently users entered into the unit.

Sys Name:	**CLK**
Command:	This is an alias for the FRAMEGEN command.
Operation:	
Level 0:	see FRAMEGEN
Level 1:	see FRAMEGEN
Level 2:	see FRAMEGEN
Level 3:	see FRAMEGEN
Level 4:	see FRAMEGEN
Remarks:	see FRAMEGEN
Related:	FRAMEGEN
Restrictions:	see FRAMEGEN

Sys Name:	**CLS**
Command:	Provides a method of clearing the terminal screen for ANSI control.
Operation:	
Level 0:	NA
Level 1:	Sends out the ANSI escape sequence to clear the terminal screen.
Level 2:	Same as Level 1 operation
Level 3:	Same as Level 1 operation
Level 4:	Same as Level 1 operation
Remarks:	This command is only for aesthetic purposes for the user and serves no real function on the instrument.
Related:	COMM
Restrictions:	This command only available if the comm port is setup for ANSI control.

Sys Name: **COMM**

Command: Read/Set the information for the operation of a comm port on the unit.

Operation:

Level 0: NA

Level 1: [ANSI [{ON} | {OFF}] [ECHO [{ON} | {OFF}]] [EOL [{CR} | {LF} | {CRLF}]]
Returns the current settings for the comm port the user is communicating over. All comm settings are returned including baud rate, current settings for hardware and software handshaking, character echo, current output line termination, and whether the port is ANSI capable. This command also allows the user to set up information that affects how the output looks on their terminal, for their current session. When the user logs out, the setup is returned to the non-volatile RAM setting. Allowable options are:

ANSI [{ON} | {OFF}]

Allows setting of the port to respond to the ANSI command set.

ECHO [{ON} | {OFF}]

Enable or disable character echo on the terminal. This is usually used when a user is connected to a terminal that automatically echoes information so double characters do not appear.

EOL [{CR} | {LF} | {CRLF}]

Allows the user to set the current End-Of-Line termination for output lines. Acceptable inputs are:

CR	Lines are terminated with a Carriage Return (hex 0D).
LF	Lines are terminated with a Line Feed (hex 0A).
CRLF	Lines are terminated with a Carriage Return followed by a Line Feed.

Level 2: Same as Level 1 operation with the following additions:
The craft person is able to setup more information for the comm port to allow for installation configuration. Additional parameters are:

HAND [{ON} | {OFF} | HARD [{ON} | {OFF}] | SOFT [{ON} | {OFF}]]

Setup the current handshaking options for the comm port. The ports support both hardware and software handshaking. Software handshaking is through the characters Control-S to stop the output, Control-Q to restart output. Hardware handshaking occurs on the RTS/CTS lines. DTR is turned on when the unit starts up and left on while the unit is functioning. DSR is ignored. Handshaking options are:

ON/OFF	Enable or disable all handshaking on this port.
HARD ON/OFF	Enable or disable hardware handshaking on this port
SOFT ON/OFF	Enable or disable software handshaking on this port

BAUD [300 | 1200 | 2400 | 4800 | 9600 | 19200]

Set the current baud rate for this port. Only the baud rates shown are valid.

MODE [{ASCII} | {TL1}]

Set the current communication mode to either ASCII (interactive) or TL1. To return to the interactive mode of operation, the user enters 3 consecutive ESC characters. ANSI mode, echo, and software handshaking are ignored in TL1. The unit name is used as the TID when in TL1 mode.

Level 3: Same as Level 2 operation

Level 4: Same as Level 2 operation

Remarks: The only ANSI escape sequences used by the unit are the clear-screen, locate cursor to beginning of line and clear to end of line. All settings are done when the command is entered and, if the user level is above 1, are saved into non-volatile RAM. To change operating modes of the ports requires that it is either the current port, or the target port is in the idle state. Utilize the USERS command to log users off of ports to change the port mode.

Related: CLS, NAME, SETUP, USERS

Restrictions: None

Sys Name: **CONFIG**

Command: Query the current hardware configuration for a unit.

Operation:

Level 0: NA

Level 1: NA

Level 2: [loc [{REMOVE} | {DISABLE}]

Read the current hardware configuration information for the unit. If no input is given, brief information for all modules is included. If a slot location is passed, this command returns more in-depth information for the given module. Output is of this format:

DDMONYYYY HH:MM:SS ID: PRR-10, Name: [current name for unit]

Loc#	Name	Item #	HW Date	Serial #
xAyy	[stored module name]	[item number]	rr DDMONYY	[module serial number]

where:

x	is the chassis number. 1 is the Main Chassis, 2 is the Input Expansion, 3 is the Output Expansion.
yy	is the slot number within the chassis. This matches the slot number shown on the silkscreen of the chassis.

All of the information is entered for a module at Datum, Inc. test time and if it is not valid for a given module, the unit reports that. The command also accepts chassis-only locations. In addition, the modules in the main chassis can be specified by **Ayy**.

The REMOVE option is valid only for modules which indicate that they are missing. If the REMOVE option is used, all alarms associated with the module are set to the same state as if the module was never inserted. This may mean that the alarm is disabled; it definitely means that it is cleared.

The DISABLE option is only for output modules. This option is used when an active output module is to be physically removed. All outputs from the module are disabled and it is now safe to remove the module. In order for the module to become active again, it must be physically removed and then reinserted, or utilize the REMOVE option.

Level 3: Same as Level 2 operation

Level 4: Same as Level 2 operation

Remarks: If a module is bad, this command indicates that. Possible bad indications occur when a module shows as being installed, but the unit is unable to communicate with it. When a module is removed, this table indicates that also. Missing modules are only indicated if the module was previously installed.

Related: NAME

Restrictions: This command is available only on the Master Reference Controller.

Sys Name: **DATE**

Command: Read/Set the current date within the unit.

Operation:

Level 0: NA

Level 1: Allows the user to query the current date within the unit. The date format returned is:

MM/DD/YYYY

Level 2: Same as Level 1 operation

Level 3: Same as Level 1 operation with the addition of the ability to set the date.
Input format is:

MM/DD/YY[YY]

If the user gives a year that is < 100, then translation is to be made as:

00-79 add 2000
80-99 add 1900

If the year < 1980, this is an error condition.

Level 4: Same as Level 3 operation

Remarks: This command has limited usefulness when the unit is equipped with a GPS Receiver. See 'restrictions' for more information about the operation of the command when the unit is equipped with a GPS Receiver.

Related: USERS

Restrictions: Restrictions: If the unit has acquired the date from a GPS Receiver, the user is unable to change the date setting of the unit.

Sys Name: **DOY**

Command: Read the current day of year from the unit.

Operation:

Level 0: Hidden command, returns the day of year and the current year.

Level 1: Same as Level 0 operation

Level 2: Same as Level 0 operation

Level 3: Same as Level 0 operation

Level 4: Same as Level 0 operation

Remarks: This command is only utilized to find out the current day of year and year in the unit for the generation of backdoor passwords. For this reason, it is always a hidden command.

Related: DATE, USERS, LOGIN

Restrictions: This command is always hidden, meaning it does not show up in the help screens.

Sys Name: **ELEVTIME**

Command: Read/Set the current timeouts for alarm elevation.

Operation:

Level 0: NA

Level 1: NA

Level 2: NA

Level 3: [{MINOR} time] | [{MAJOR} time]
This command provides the supervisor the ability to read and set the current time-out length for alarm elevation. The unit is required to elevate Minor and Major Alarms to the next level after a user-settable time period. Time is in seconds and can be from 60 seconds (1 minute) to 172800 seconds (2 days).

Level 4: Same as Level 3 operation

Remarks: Default values for the elevation times are to be 86400 seconds (24 hours).

Related: ALARM, SETUP

Restrictions: None

Sys Name: **ENGINE**

Command: Allow setting of reporting and queries about information specific to an engine.

Operation:

Level 0: NA

Level 1: NA

Level 2: [{TDATA} | {TIME}]
Allows the craft person to begin querying for information about the operation of the engine. Included are the TrackDATA information from the unit, and the current TIME from the engine. TrackDATA information is dependent on the type of engine, but like engines have similar outputs. Time output is of the format:

MM/DD/YY HH:MM:SSa

where:

a	is the current time status
'*'	means time is not valid
' '	means time is valid

Level 3: Same as Level 2 operation

Level 4: Same as Level 2 operation

Remarks: Engine reports are asynchronous outputs. That means they can occur at any time, not necessarily at the time the command is issued.

Related: REPORT

Restrictions: This command is only valid for the reference controller which is currently being communicated with and no information is kept in the event log. If no engine is installed, this command is not available.

Sys Name: **EVENTS**

Command: Read and control the current event log information.

Operation:

Level 0: NA

Level 1: [{ALL} | #] [{A} | {B}] [{ALARM} | {REPORT}]
Read the current event log information. If no options are given, only the last event is printed. Other options are:

ALL	Show all stored events for all controllers
#	Show the last # events for all controllers
A | B	Show only the events from controller A or B. A is the top slot, B is the bottom slot. This option also disables showing of events that are caused by the other reference controller.
ALARM	Show alarm events only
REPORT	Show report events only

Level 2: Same as Level 1 operation.

Level 3: Same as Level 1 operation with the added ability to clear the event log:

[{CLR}]

If the event log is cleared, all events are cleared on all reference controllers, except for a new event. The actual clearing of the event log is done by this supervisor.

Level 4: Same as Level 3 operation

Level 4: The event log is 150 events, with the last 10 events stored in non-volatile RAM. There are no provisions made for only querying or clearing certain types of events other than that listed under the Operation Section.

Related: ALARM, SETUP

Restrictions: None

Sys Name: **FG**

Command: An alias for FRAMEGEN.

Operation:

Level 0: see FRAMEGEN.

Level 1: see FRAMEGEN.

Level 2: see FRAMEGEN.

Level 3: see FRAMEGEN.

Level 4: see FRAMEGEN.

Related: FRAMEGEN

Restrictions: see FRAMEGEN.

Sys Name: **FRAMEGEN**

Command: Read/Set the current frame generator output alarm status.

Operation:

Level 0: NA

Level 1: Provides the user with the current type of base clock output from the unit and the settings for the alarm status indications for frequency degraded alarm indication on all clock outputs. Possible status indications are:

Output is muted when in alarm
Output is in the AIS condition when in alarm
Output utilizes SSM on the output to indicate current status

Level 2: [AIS {ON} | {OFF}][SSM {ON} | {OFF}]
Allows the craft person to set up an installation for the appropriate action on the clock outputs when an alarm condition occurs. Setting of the frame generator output is as follows:

AIS	If set to ON, the frame generator outputs go into the AIS mode when the unit is generating a degraded output signal. This takes priority over any other setting.
SSM	If set to ON, the unit utilizes Sync Status Messaging and shall indicate 'Stratum 1' output when the unit is operating per spec, and 'unknown traceability' otherwise. Note that the AIS setting takes precedence over the setting of this control when in alarm. For E1 output, the unit places the message in all messaging channels for the output.

Level 3: Same as Level 2 operation

Level 4: Same as Level 2 operation

Remarks: The settings for the frame generator outputs are stored in non-volatile RAM.

Related: ALARM, SETUP

Restrictions: None

Sys Name: **FREQ**

Command: Read the current software PLL control information.

Operation:

Level 0: NA

Level 1: Information includes:
Current loop status, possible states are:

Acquire	Loop is in the acquisition mode. In this mode the time constant of the loop is relatively fast and the output does not have to meet the Stratum 1 spec.
Locking	Unit is following the inputs. This is the normal mode of operation.
Halt	Unit has halted updates. This may be due to loss of, or noisy input signals.
User Halt	User has halted the updates to the control loop.

Current measured phase difference of the output to the input signals.

Current measurement noise

Current frequency offset

Current change in frequency offset. This is necessary because the frequency offset may be large enough that no meaningful information will be able to be printed without a lot of significant figures.

Level 2: Same as Level 1 operation

Level 3: Same as Level 1 operation

Level 4: Same as Level 1 operation

Remarks: This command is the user's primary look at how the system is doing from a numerical standpoint. See the <<PLL>> section of this document for more about the information reported and the operation of the PLL.

Related: LOOP, STAT

Restrictions: If the PLL has never been updated (right after startup, for instance) this command reports that and nothing else.

Sys Name: **HELP**

Command: Provides information about the operation of specific commands.

Operation:

Level 0: Only shows current active level 0 commands

Level 1: Only shows current active level 1 commands

Level 2: Only shows current active level 2 commands

Level 3: Only shows current active level 3 commands

Level 4: Only shows current active level 4 commands

Remarks: This command is always available as it is meant to act as an 'on-line' manual for the user. As much information about a command that is necessary for proper operation and understanding of the command is given.

Related: All commands.

Restrictions: Only gives information for current active commands for a user level. Disabled or hidden commands are not accessible through the HELP system.

Sys Name: **ID**

Command: Shows the fixed unit ID for the system.

Operation:

Level 0: Returns 'PRR10'

Level 1: Same as Level 0 operation

Level 2: Same as Level 0 operation

Level 3: Same as Level 0 operation

Level 4: Same as Level 0 operation

Remarks: This command is utilized by test systems to tell the type of instrument connected. This differs from the NAME command in that the NAME information is settable by the user. The unit ID is also returned on any status type commands.

Related: NAME, SETUP, STAT

Restrictions: NONE

Sys Name: **INFO**

Command: Read information about the instrument and Datum, Inc.

Operation:

Level 0: NA

Level 1: Return the unit ID, software revisions, copyright information, the Datum Inc. address and phone numbers.

Level 2: Same as Level 1 operation

Level 3: Same as Level 1 operation

Level 4: Same as Level 1 operation

Remarks: This command provides a method for the user to have available all of the information that may be necessary should service be necessary for a unit.

Related: D, VER

Restrictions: None

Sys Name: **IVAR**

Command: Read the current variance calculation information for the input signals.

Operation:

Level 0: NA

Level 1: NA

Level 2: IVAR [{A}|{B}]
Return the current variance calculations for the given input source:

A	Reference controller in the top slot
B	Reference controller in the bottom slot

The variance information includes the time interval for the measurement, the measurement noise at the interval, and the current frequency offset for the time interval.

Level 3: Same as Level 2 operation

Level 4: Same as Level 2 operation

Remarks: This command presents information that is the heart of the dynamic PLL operation. The variance calculations are based on the Modified Allan Variance and provide information to the control loop of how well the control is operating. When the PLL is in the lock state, the software keeps a running variance measurement on the LO. This is accomplished by keeping variance 'bins'. These bins are actually measurements of the noise of the reference versus the LO for varying time constants. Each bin represents a different time constant. It is from these time constants that the loop determines the maximum TAU to utilize in the loop.

Related: FREQ

Restrictions: If no valid input is available for a given source, no information is shown. If no references have input, this command reports that.

Sys Name: **LINELEN**

Command: Read/Set current information for the line length parameters for the output from the reference controller.

Operation:

Level 0: NA

Level 1: [{A} | {B}]

Allows the user to read the current settings for the line lengths connected to the output of the reference controllers and output buffer cards. 'A' and 'B' refer to the outputs from the reference controllers. The text output from the command reflects, in plain language, the output line lengths and the type of output. In addition, this command shows the information in the internal program representation. For instance:

```
DS1 output A : 3, 0 dB buildout, 0-133 feet
DS1 output B : 3, 0 dB buildout, 0-133 feet
```

Note that in the above case '3' represents the internal numbering scheme. See Level 2 for the possible numbers and their meanings.

Using this format gives the user feedback as to the actual information, but also allows an easy entry method.

Level 2: Same as Level 1 operation with the following additions:

[{A} | {B} [value]]

where value is the decimal number equivalent to the various possible line configurations:

Value	Meaning
0	Undefined
1	-7.5 dB buildout
2	-15 dB buildout
3	0 dB buildout, 0-133 feet
4	133-266 feet
5	266-399 feet
6	399-533 feet
7	533-655 feet

The default setting for a line is 3, 0 dB buildout, 0-133 feet. If no output selection information is given, all outputs are set to the new value.

Level 3: Same as Level 2 operation

Level 4: Same as Level 2 operation

Remarks: This command works across pairs of outputs. Any redundant cards are configured to be the same as the first card that was available. It is important that the outputs for redundant pairs always match! The master controller passes the information for the setting to the slave controller. This is necessary to make sure the two controllers utilize the same driver parameters for the connections. The settings are stored in non-volatile RAM.

Related: CONFIG, SETUP

Restrictions: This command is only available for DS1 style output controllers. The command only affects the options that are installed in the system at the time the command is issued. In other words, setting all outputs to 4 does not affect cards that are not yet plugged into the system, unless the addition forms a redundant pair.

Sys Name: **LOGIN**

Command: Allows a user to log into the system.

Operation:

Level 0: [username]
If no username is passed, the system prompts for one. Once a user name is entered, the system then prompts for a password. The password entry is echoed as '*' characters. If the username and password match an entry in the user table, then the user is logged in at the assigned access level. After 5 minutes of inactivity on the port, the user is automatically logged out.

Level 1: Same as Level 0 operation.

Level 2: Same as Level 0 operation.

Level 3: Same as Level 0 operation.

Level 4: Same as Level 0 operation.

Remarks: This command provides access to the various levels of the system. This is the only way to change access levels for a port. This command also allows for a 'backdoor' entry. This entry is based from a random number generation based from the current day of year information from the unit. Datum, Inc. can provide the 'password of the day'. This is to guard against lost/forgotten passwords for the users. The password generation for each day is unique, so that if a password is given out for a given day it will change the next day for security measures. The backdoor name is 'ADMIN'. There is also a 'guest' entry, with a null password, that is always present to gain access at level 1.

Related: BYE, DATE, USERS

Restrictions: If no user passwords have been entered, this command is not available.

Sys Name: **LOOP**

Command: Read/Set the current PLL operation parameters.

Operation:

Level 0: NA

Level 1: NA

Level 2: NA

Level 3: [{ACQ} | {HALT} | {LOCK}]
This command enables the supervisor to control the current status of the control loop for the unit. The options available are:

ACQ	Force reacquisition of the loop. This allows the user to restart the loop. This would generally be used for testing purposes. In acquisition, the unit sets the frequency alarm and mutes the outputs as the loop control is very coarse. If the unit is already in acquisition mode, this option still forces a reacquisition. The loop will automatically go into LOCK after acquisition.
HALT	Set the loop to user halt. This freezes the frequency control updates. This mode would be used for testing the hold-over mode of the unit
LOCK	Put the loop into the lock state. This is only valid if the unit is in user halt mode. Attempting to go to the lock mode, from any mode other than halt, has no effect. This is the normal mode of operation for the control loop.

Level 4: Same as Level 3 operation.

Remarks: This command may be used to speed reacquisition to a new reference by forcing the unit into the acquire mode. In addition, it is useful for testing the hold-over abilities of the unit by halting the PLL updates.

Related: FREQ, STAT

Restrictions: If the PLL is currently in acquire, the user cannot force a locked condition. In addition, if the PLL is in acquisition mode and the user chooses to do a reacquisition, the software merely clears the acquisition information and restarts the acquisition phase.

Sys Name: **NAME**

Command: Read/Set the current unit name.

Operation:

Level 0: NA

Level 1: Read the current unit name. The name is returned without any character delimiters.

Level 2: Same as Level 2 operation.

Level 3: [name]

Same as Level 2 operation, with the addition of being able to set the name. The name can be any printable ASCII character, space (hex $20), through tilde (hex $7F).

Level 4: Same as Level 3 operation.

Remarks: This command allows the reading or setting of the Unit Name. This differs from the ID as the ID name is fixed. Up to 20 characters may be entered. If more than 20 characters are entered, the input is terminated at 20 characters. The unit name is stored in all reference controllers in the unit. Care should be taken in the assignment of the unit

name if the unit is to utilize TL1. The unit name is the TL1 TID, converted to all uppercase used by the system.

Related: COMM, ID

Restrictions: None

Sys Name: **OSC**

Command: Read/Set the current Local Oscillator (LO) input frequencies and switching operation for the individual reference controllers.

Operation:

Level 0: NA

Level 1: Allows the user to read the current oscillator configuration information for each LO input on the Master Reference Controller. The output reports the settings for the input frequency, which reference is currently selected, which input is the primary, if autoswitching is enabled, if autoreturn is enabled, and the type of oscillator.

Level 2: [FREQ [{A| B}] [{10| 5}]] [TYPE [{A| B}] {XTAL | RB}] [SEL {A | B}]
[PRI {A | B}] [SWI {ON | OFF}] [RET {ON | OFF}]

Allows the craft person access to the parameters for the LO inputs on the reference controller(s). This is necessary at this level so that the unit can be properly set up at installation. Options are:

FREQ	Allow setting of the LO input frequency. The only acceptable frequencies are 5 or 10 MHz. If no LO input ID is passed both inputs are set the same. An event is stored and a report generated when the frequency is changed. Note that selection of the wrong frequency may cause the internal PLL circuitry to loose lock. If this happens the clock outputs from the unit will be muted.
TYPE	Allow selection of the quality of the input LO. See Remarks section for description of allowable oscillator types.
SEL	Allow selection of the current input. This selection occurs immediately and the PLL should go into acquisition mode. This is because the controller does not know what the current frequency offset of the input is. An event is logged and a report generated when the input selection is changed.
PRI	Allow identification of the primary reference. This is the reference that the controller attempts to use, unless the user forces a switch, whenever it is available.
SWI	Allow setting of whether the controller is to autoswitch or not. Autoswitch means that the controller will automatically switch LO inputs if the current LO signal is lost. Setting this to off requires manual intervention by the user to select another reference.
RET	Allow setting of the autoreturn function. Setting of this allows the controller to return to the primary (or the user selected) signal in the event of an autoswitch occurring and the signal returns.

Level 3: Same as Level 2 operation.

Level 4: Same as Level 2 operation.

Remarks: This command allows for the configuration of how each controller is to utilize the LO inputs. Anytime the user changes a LO setting, there is an event logged and a report generated. Likewise, if the controller automatically changes any LO settings based on the user settings that constitutes an event. This command also allows the user to give

the controller an indication of the stability of the incoming LO through the TYPE parameter. If the LO has the stability of a rubidium (or better), then the 'RB' type should be selected. If the stability of the LO is less than rubidium quality, the 'XTAL' type should be selected. This gives the unit the ability to minimize the phase movements on the output. If the wrong LO type is selected, then the performance of the unit will be degraded! Refer to the PLL section for the description of the various oscillator types. This command can be used to affect any reference controllers in the system. How the LO inputs are utilized determines the mode of operation for the unit. The unit operates in the separate output mode to allow for automatic output module switching.

Related: SETUP

Restrictions: No attempt is made to verify the input frequency settings, so an improper setting may cause the System or FrameGen PLL's to loose lock. Also, if the wrong type of LO is selected, the performance will be degraded.

Sys Name: **OUTMOD**

Command: Read/Set the current selections and faults for the individual output modules.

Operation:

Level 0: NA

Level 1: [loc]

Allows the user to read the current output configuration information for each output module. If no input is given, brief information for all modules is output in the form of a table. The text output from the command when location information is given reflects, in plain language, the output line compensation, which source is currently selected and which lines are faulted, if any. 'loc' is defined as:

xJk-cc OR xOcc

where:

x	is the chassis number
k	is the J connector ID on the chassis
cc	is the output pair. This is 1-10 for the J style and 1-10 for the main chassis, or 1-50 for the output chassis, utilizing the O style.

Level 2: [loc] [{COMP} n | FREQ m}]]

FREQ allows setting of the frequency output for the analog module, where *m* is the output frequency in MHz. Valid outputs are 1, 5, or 10.

Allows the craft person access to the parameters for the output modules. This is necessary at this level so that the unit can be properly set up at installation. Options are:

COMP	Allow setting of the line compensation for the output modules. For some modules this is the line length compensation (driving level); for others it is a phase shift value. Here are possible values:

Value	DS1 output	CC output
0	Undefined	000 ns, 62.5% duty cycle
1	-7.5 dB buildout	700 ns, “
2	-15 dB buildout	1400 ns, “
3	0-133 feet	2100 ns, “
4	133-266 feet	000 ns, 50% duty cycle
5	266-399 feet	700 ns, “
6	399-533 feet	1400 ns, “
7	533-655 feet	2100 ns, “

SOURCE Allows setting of the source for the output module. Selections are either ‘A’ or ‘B’. Selection takes place within 5 seconds and is indicated on the module hardware LEDs.

Level 3: Same as Level 2 operation.

Level 4: Same as Level 2 operation.

Remarks: This command allows setup information and also pinpointing any line faults on the output modules. All output from the command should follow the xOcc format given in the Level 1 operation description.

Related: SETUP

Restrictions: This command only operates on modules that are present in the system.

Sys Name: **POS**

Command: Read/Set the current position of the antenna. In addition, the user is able to set the maximum number of averages to perform on the position calculations.

Operation:

Level 0: NA

Level 1: Returns the current antenna position as calculated by the receiver. In addition, this command returns whether this is a 2D or 3D position. If the position is 3D, the calculated PDOP is also returned.

Level 2: [lat lon ht] [{AVG} n]

AVG n number, n, of averages for the calculated position fixes.

Range is 10 <= n <= 1000. If the unit has completed a position fix, this forces the unit to recalculate its position with the current average setting.

Same as level 1 operation, with the addition of being able to set the current position and/or the number of averages to utilize when calculating a position. The options available are:

lat	antenna latitude, the decimal point determines the input format, i.e., If the user enters: 30:27:49.8 seconds the result is the same if they enter 30:27.830 or 30.4638333, ‘-’ indicates South, and must be entered on the degrees portion.
lon	antenna longitude, see latitude for the input format, in degrees/minutes, ‘–’ indicates west, and must be entered on the degrees portion.
height	antenna height
AVG n	number, n, of averages for the calculated position fixes. Range is $10 \leq n \leq 1000$

Level 3: Same as Level 2 operation

Level 4: Same as Level 2 operation

Remarks: The user should only set the position if it is known accurately. The software automatically verifies the position on restart. The unit averages 10 position fixes and compares the result to the entered position. If the position is within 300m RMS, no position update is performed. If the position error is > 300m RMS, an event is logged and a report generated stating that the user position is being recalculated and updated in the non-volatile RAM.

Related: SETUP

Restrictions: No position may be entered if the unit has already verified the position. The average count is used the next time the unit calculates the position (next power-up).

Sys Name: **REPORTS**

Command: Set up autonomous reports from the unit.

Operation:

Level 0: NA

Level 1: NA

Level 2: NA

Level 3: *Type:* REPORTS [#]

Valid report numbers are reported by the software. Read/Set the current report outputs for the unit. Reports are system information that is below an event, but may be useful or interesting. Report enabling is a toggle function. The first time it is entered , reporting is enabled. The next time, it is disabled.

Valid Report #'s are:

0	Phase Samples Show the individual samples and the results from the ensembling of those samples
1	Frequency Control Show updates made to the DDS circuitry on the reference controller.
2	Periodic Output Generate an output from the unit every 5 minutes to keep the communication ports active.
3	Position Updates Show position updates as they are calculated.

Level 4: Same as Level 3 operation

Remarks: This command is used to enable/disable autonomous reports. Reports are deemed information that may be useful but are at a lower priority than event information. These include, but are not limited to:

Phase measurements	Information regarding the individual phase measurement from all sources.
PLL updates	Software PLL updates as they occur. This includes frequency offset as well as last applied delta frequency information.

Periodic outputs	This is used only to keep communication ports active. Unit sends a line of information every 5 minutes.

Reports are enabled/disabled on all reference controllers within the unit.

Related: ENGINE, FREQ

Restrictions: Report settings are not stored in non-volatile RAM. When a comm port command parser is changed, all reports are disabled.

Sys Name: **SETUP**

Command: Read a summary of the current non-volatile RAM settings and allow transfer of these setting to/from FLASH memory.

Operation:

Level 0: NA

Level 1: NA

Level 2: This command provides a summary of all information stored within the non-volatile RAM.

Level 3: [{FACTORY} | USER | PRS | MOD}]

PRS - Set the unit mode of operation to PRS. With this configuration, the outputs are assumed to be connected to a TSG. With this mode of operation, the outputs are able to be muted.

MOD - Set the unit mode of operation to modified PRS. With this configuration, the outputs are assumed to be directly connected to network elements, and therefore, may not be muted. This allows the down stream network elements to make the decision to use this signal via SSM. In the MOD PRS mode, the PRR-10 will generate a PRS/PRC SSM when locked to GPS. If the PRR-10 enters holdover then the PRR-10's SSM will change to the Stratum Level of the local oscillator. The local oscillator in the PRR-10 can be either Stratum 2 (rubidium) or Stratum 3 (crystal).

Same as Level 2 operation with the added ability to transfer the current settings stored in FLASH from either the FACTORY defaults or the stored USER settings to non-volatile RAM. An event is logged and a report generated to show that the non-volatile RAM settings have been updated.

Level 4: [{FACTORY} | {USER} | {SAVE}]

Same as Level 3 operation with the added ability to transfer the current settings in non-volatile into FLASH as the stored user settings. An event is logged and a report generated to show that the current FLASH settings have changed.

Remarks: This command provides a way for the unit to save default settings that the user prefers for operation. The unit will restore user defaults in the event that the current non-volatile RAM information is lost. If the user information is not present, or unusable, the unit will restore the current factory settings. If those are also unusable the software will initialize non-volatile RAM with the current program defaults and transfer those settings into FLASH as the new factory settings.

Related: ALARM, CLK, COMM, ELEVTIME, LINELEN, OSC, POS

Restrictions: If there are no stored user settings in FLASH, this command returns a message stating that if an attempt is made to use the USER information.

Sys Name: **STATUS**

Command: Read the current status summary for the unit.

Operation:

Level 0: NA

Level 1: Returns the current status summary for the unit. The status summary includes:

- Count of Minor, Major, and Critical Alarms active, or 'No Alarms active' if appropriate
- Current PLL loop status
- Last PLL updates, and which LO reference is being used

Level 2: Same as Level 1 operation

Level 3: Same as Level 1 operation

Level 3: Same as Level 1 operation

Remarks: This command gives a quick summary of how the unit is working. If there are any alarms, they will need to be queried with the ALARM command to find the exact nature. More information about the status of the PLL may be obtained through the FREQ command.

Related: ALARM, FREQ, SETUP

Restrictions: None

Sys Name: **SYSTIME**

Command: Read the length of time that power has been applied to the unit.

Operation:

Level 0: NA

Level 1: Read the length of time that power has been applied to the unit, or since restart of the unit. Output format is:

c days HH:MM:SS

where:

c is the ID for the reference controller that the user is communicating with. 'A' is the top slot, 'B' is the bottom slot.

days is the number of days since a restart

Level 2: Same as Level 1 operation

Level 3: Same as Level 1 operation

Level 4: Same as Level 1 operation

Remarks: This command is used to be able to see if a unit has been restarted. This can give indications of power failure, etc.

Related: None

Restrictions: None

Sys Name: **TIME**

Command: Read/Set the current time within the unit.

Operation:

Level 0: NA

Level 1: Allows the user to query the current time within the unit. The time format returned is:

HH:MM:SS

Level 2: Same as Level 1 operation

Level 3: Same as Level 1 operation with the addition of the ability to set the time. Input format is:

HH:MM:SS

Level 4: Same as Level 3 operation

Remarks: This command has limited usefulness when the unit is equipped with a GPS Receiver. See 'restrictions' for more information about the operation of the command when the unit is equipped with a GPS Receiver.

Related: None

Restrictions: If the unit has acquired the time from a GPS Receiver, the user is unable to change the time setting of the unit.

Sys Name: **USERS**

Command: Read/Set current users known to the system.

Operation:

Level 0: NA

Level 1: Returns the names of all users stored that have Level 1 clearance.

Level 2: Same as Level 1 operation with added users that have Level 2 clearance.

Level 3: Same as Level 2 operation with added users that have Level 3 clearance.

Level 4: [{ADD} | {DELETE} | {MODIFY} [user id]] | [{INITUSERTABLE} | {LOGOFF}]

Same as Level 3 operation with added users that have Level 4 clearance. In addition, this command provides the current passwords stored for all users and an entry/update ability for the current users for the system. The 'user id' may be any combination of upper or lower case letters, numbers or spaces. To enter lowercase letters requires enclosing the input in '"'. Leading spaces are truncated, multiple spaces are changed to 1 space. If no user id is entered, this command prompts for one (except if the INITUSERTABLE or LOGOFF options are used). INITUSERTABLE is an option by itself and clears the whole user table. This option requires the whole entry 'INITUSERTABLE' be entered to verify that the user really wants to clear the table. The LOGOFF option gives the administrator the ability to free the other comm port so that

it may be reconfigured. The user on the other port is immediately logged off, terminating any data they may have been entering. The other options correspond to:

ADD	Add the user to the system. If the user exists in the system this option exits with an error. After the user id is entered, this command prompts for a password. Password entries are echoed as '*'. A blank password cancels the command. Valid password characters include numbers, upper and lowercase letters and the set {:;<=>?@}. Lowercase letters must be surrounded by '"', and passwords are, by default, not case sensitive. After the password is entered, this command prompts for the user level. Refer to the General Interactive Operation Section for level descriptions.
DELETE	Delete the user from the system. If the user id is not in the system, this command exits with an error.
MODIFY	Modify the password and/or the access level for the given user. If the user id is not in the system, this command exits with an error. Once the user id is entered, this option performs identically to the 'ADD' option.

Remarks: This command is useful for an administrator to be able to check the access currently allowed to the unit and alter that access. There are always 2 levels and users present for backdoor entry. These are 'ADMIN' - with an access level of 4, and 'GUEST' with an access level of 1. 'ADMIN' is accessible only through the backdoor entry. 'GUEST' never has a password assigned. Note that it is acceptable for the administrator to enter users with the same names. The backdoor entry takes precedence over the entered names. If the entered password matches the backdoor, then they are logged in at the appropriate level.

Related: BYE, COMM, LOGIN

Restrictions: If there are no users currently entered into the system, this command reports that.

Sys Name: **VER**

Command: Read the current software version information.

Operation:

Level 0: NA

Level 1: Returns the current software versions for the reference controller and engine (if any).

Level 2: Same as Level 1 operation

Level 3: Same as Level 1 operation

Level 4: Same as Level 1 operation

Remarks: This command is useful for checking for adherence to the functional specifications.

Related: None

Restrictions: None

Sys Name: **WHOAMI**

Command: Provide information about the current user and port connection.

Operation:

Level 1: NA

Level 1:	This command is for information only, and returns the current user name and which port the command was issued from.
Level 2:	Same as Level 1 operation
Level 3:	Same as Level 1 operation, with the addition of showing anyone logged onto the other port.
Level 4:	Same as Level 3 operation
Remarks:	This command serves no real purpose other than allowing a user to query about themselves and the name of the port they are connected to.
Related:	COMM
Restrictions:	If there are no users entered into the user table then this command is not available.

5.7 TL1 Commands and Operations

This section lists the TL1 commands implemented in the PRR-10 and is followed by descriptions of the commands and the associated response messages generated. All commands require the **tid** and **ctag** fields. The **aid** is either required, optional or null depending on the command. Any parameters following the **ctag** must be preceded with the **::** to indicate the unused general block field. Each response message follows the header and complied lines in the TL1 responses, and each response is terminated with a semicolon after the last message line. All command characters are to be upper case (or converted to upper case on input). The lower case characters below indicate parameters to be supplied as defined in the descriptions following.

5.7.1 Connecting to the TL1 Port

To set up a PRR-10 port for TL1 communications the operator must first be logged into the port with a supervisor or administrator level name and password and then set the comm port to TL1 mode. This requires that it is either the current port, or no one is logged into the other port. The port remains in TL1 mode operation until the EXIT command is issued. Comm port B (remote) stores the setting for the mode in NVRAM while Comm A (local) always resets to the Interactive ASCII mode on startup.

COMM^MODE^TL1<eol>Enter TL1 Communications Mode

5.7.2 Disconnecting the TL1 Port

To discontinue use of the port for TL1 communications, use the EXIT command. After sending the comply response, the TL1 user is logged out and the port is reset to ASCII communications mode.

EXIT:tid::ctag;<cr lf>Exit TL1 Communications Mode

Valid aid code: none.

The same results can be obtained by sending the ESC character 3 times in succession.

5.7.3 Equipment Removal

To facilitate reconfiguration of the equipment there are two commands available, **RMV** and **DISC**. Use the **DISC** command to disable an output module. This disconnects the module's

outputs from the output port on the back of the unit. The output module can then safely be physically removed from the unit without affecting the integrity of the output of a redundant pair. If any module has been physically removed from the equipment use the **RMV** command to clear any alarms associated with that module.

DISC-MODULE:tid::ctag::loc;

Valid aid code: none.

The Disconnect Module command is used to disable an output module for removal from the system. No **aid** is valid as this command is based on the location parameter:

locThe hardware location of the module. These are of the format x-yy where x is the chassis number, yy is the slot within the chassis.

The command responds with either the complied or **DENY** response, depending on whether loc indicates a valid, installed module, or not.

RMV-MODULE:tid::ctag::loc;

Valid aid code: none.

The Remove Module command attempts to flag a module as being physically removed from the unit. No **aid** is valid as this command is based on the location parameter:

locThe hardware location of the module. These are of the format x-yy where x is the chassis number, yy is the slot within the chassis.

The command responds with either the complied or **DENY** response, depending on whether loc indicates a valid, installed module, or not.

5.7.4 Command Parameters

When entering a command, use upper case for all command characters. In the command syntax, all lower case characters indicate parameters that the user must supply. All TL1 commands use the following format:

cmd:tid:aid:ctag:gb:parameters

tid = Target Identifier - This is the name assigned to the PRR-10, which may be null or up to 20 characters long, beginning with a character.

sid = Source Identifier - This is the returned ID, which is the same as the tid unless the null matching is utilized and then it is the name.

aid = Access Identifier - This identifies the module or port within the PRR-10 the command is addressed to or the response applies to. It may be specific or ALL (null indicates ALL or not used). The following are used for PRR-10 modules and ports:

OTP Output Module or port. Valid module/ports are 1-14. 1 is the uppermost reference controller output (present only in the main chassis). 2 is the lower reference controller (present only in the main chassis). 3-14 refer to the output cards. 3 and 4 represent the possible redundant pair in the main chassis. 5-14 represent the modules in the output expansion chassis. For

the output modules there may also be outputs numbered 1-10. For the reference controllers there are only 2 outputs, numbered 1 and 2.

ALL All modules or ports applicable to the command. This overrides any other aid contained within the command.

PWR Power Input A or B, or both

CTL Reference Controller A or B, or both

OSC Local Oscillator Input A or B, or both

Within the aid the hyphen (-) is used to separate entities. For example OTP-1 refers to card number 1 for the output modules. OTP-1-1 refers to output number 1 on card number 1 for the output modules. For all aid entries the ampersand and double-ampersand seperators are valid. The ampersand (&) is used to signify multiple aid's, for example OTP-1&2 refers to output cards 1 and 2. The double ampersand (&&) is used to signify ranges, for example OTP-3-5&&8 refers to outputs numbered from 5 to 8 on output card number 3. The increment function is not supported.

ctag = Correlation Tag - Up to 6 alpha-numeric characters, received with the command and returned with the response for correlation within the OS.

almcde = Alarm Code sent with the autonomous reports - one of the following two character codes:

*C for critical alarms

** for major alarms

*^ for minor alarms

A^ for a non-alarm events

ntfcncde = Notification Code for alarms or events - one of the following:

CR for critical alarms

MJ for major alarms

MN for minor alarms

CL for a cleared alarm

IG for ignored alarms

NA for not alarmed (events only)

condtype = Condition Type for alarms or events - one of the following:

ADDED, REMOVED, RESTORED	Module operations
ALARM, PWR	Controller alarm operation
REF	LO reference updates
MSG	Message information
OPER	Operator responses
INTIFCFAIL	Equipment faults

condscr = Condition Description for alarms or events - text string.

srveff = Service Affecting or Not Service Affecting - SA or NSA.

ocrdat = Occurance Date - YY-MM-DD (date of occurance)

ocrtim = Occurance Time - HH-MM-SS (time of occurance)

start or **stop** = MM-DD,HH-MM (start or stop date/time for data)

This specifies month and day, hour and minute. If the date is null but followed by a time it defaults to the current date. If the start or stop time is null, but preceded by a date, it defaults to current time. If the start date and time is null it defaults to the start of the data. If the stop date and time is null it defaults to the end of the data. The comma must be present to indicate a null start.

alrm = Alarm number, valid alarm number for given aid.

Error Codes for Deny Responses messages

ICNV Command Not Valid
SDNR Data Not Ready
IIAC Invalid AID Code
IICT Invalid CTAG
IPEX Extra Parameter
IPMS Parameter Missing
IPNV Parameter Not Valid
IITA Invalid Target Identifier
SROF Requested Operation Failed
SRAC Requested Access Configuration is Invalid

5.7.5 Autonomous Reports

Autonomous reports are sent when the PRR-10 detects an alarm condition or status change. The report has the following format:

<cr>< lf>< lf>

^^^sid^date^time<cr><lf>

almcde^atag^REPT^mod1<cr><lf>

^^^"response message"<cr><lf>

;

The **almcde** reports the level of alarm or event and **atag** is a six digit correlation tag that is incremented each time a message is sent. The modifier, **mod1**, is **ALRM** or **EVNT**. The response message line has the following format:

^^^"[aid]:ntfcncde,condtype,srveff,ocrdat,ocrtm[:condscr]"<cr><lf>

The optional description **condscr** will be added to further describe the alarm or event when needed. Refer to Section 5.7.8, Autonomous Messages, for the **condscr** description for the Autonomous reports.

5.7.6 RETRIEVE Commands and Responses

For each Retrieve command, the unit responds with the complied message and a response message containing the requested data. Listed below are the command parameters and the response message formats and parameter definitions. There may be multiple lines each ending with <cr><lf> and a terminating semicolon at the end of the output.

RTRV-ALRMS:tid:[aid]:ctag;

Valid aid code: CTL, PWR, OSC, ALL, null.

The Retrieve Alarms command reports all active alarms with an aid indicating which module or port. There may be none or multiple lines in the report, one for each active alarm. There will be no report message for modules or inputs that have no alarm condition. The format for the response message line(s) is:

^^^"aid:ntfcncde,condtype,srveff[:condscr]"<cr><lf>

Refer to Section 5.7.8, Autonomous Messages, for the **condscr** responses for alarms.

RTRV-COND-ALM:tid:[aid]:ctag;

Valid aid code: CTL, PWR, OSC, ALL, null.

The Retrieve Condition of the Alarms command reports the current status of all alarms with the aid indicating the module or port. There will be multiple lines in the report, one for each alarm. The format for the response message line(s) is:

^^^"aid:ntfcncde,condtype,srveff[:condscr]"<cr><lf>

Refer to Section 5.7.8, Autonomous Messages, for the condscr responses for alarms.

RTRV-COND-OTP:tid:[aid]:ctag;

Valid aid code: OTP, ALL, null.

The Retrieve Condition of Outputs command returns the current type and status of the output modules within the unit. Only modules 3-14 of the aid are valid. There may be multiple lines present in the report, one for each module source requested. The response message is of the form:

^^^"aid:type,inA,inB,source,outstat"<cr><lf>

Where:

typeModule type, {DS1 | E1 | CC | ANLG | G703 | RS422}.

inAState of input A, {PRESENT | ABSENT}.

inBState of input B, {PRESENT | ABSENT}.

sourceCurrently selected source input, {A | B | ?}. If the desired controller output is faulted this may be different from the selected one.

outstatComma delimited list of status of each output. 'F' for faulted, 'O' for Ok.

RTRV-CONF:tid::ctag[::loc];

Valid aid code: none.

The Retrieve Configuration command returns the current hardware configuration of the equipment. No aid is valid as this command is based on the location parameter:

locThe hardware location of the module. These are of the format x-yy where x is the chassis number, yy is the slot within the chassis. No additional modifiers may be used for the loc option.

Different types of outputs are generated depending on the presence of the loc parameter.

The format of the response message if no location is given:

^^^"loc,stat[,desc,item,hwrev,serial]"<cr><lf>

Where:

loc The hardware location of the module. These are of the format x-yy where x is the chassis number, yy is the slot within the chassis.

statCurrent installation status of the module. This is OK, DISABLED, REMOVED, BAD, or EMPTY. . If stat is OK then the rest of the fields are present. Utilize the RMV-MODULE command to clear any bad status modules.

desc The description string for the module.

item Datum Item number for the module.

hwrev Hardware revision level for the module.

serial Serial number for the module.

If a location is passed then the above response has additional information following if the stat is OK:

^^^"loc,stat[,desc,item,hwrev,serial]"<cr><lf>

[^^^"loc,svcdat,svctim,mandat,\"userdat\""<cr><lf>

^^^"loc,cnt,\"revstr"\"<cr><lf>]

Where the descriptors in the first line are as documented above and the other descriptors are:

svcdatIn service date for this module. This, with the svctim, is when the module was detected by the system. This has the format YY-MM-DD.

svctimIn service time for this module. It is of the format HH-MM-SS.

mandateManufacture date as reported by the module. It has the format of YY-MM-DD.

userdatAdditional user data that was entered for the module. This is a free flow string.

cntSoftware version count, from 0 to 3. If there is no additional software registered on the module then no software revision lines will be present.

revstrRevision string as returned by the module. These vary by module but have the general format of X.yy[YY-MM-DD] where X is the major revision number, yy is the minor revision number and YY-MM-DD is the date the version was created. The date is not present for all revision strings.

The revision string line will be repeated up to 4 times, depending on how many revisions are present within the module. If there are no revisions registered within the module this line will not be present.

RTRV-EVNT-ALL:tid:[aid]:ctag[::start[:stop]];

RTRV-EVNT-EQPT:tid:[aid]:ctag[::start[:stop]];

RTRV-EVNT-MSG:tid:[aid]:ctag[::start[:stop]];

Valid aid code: CTL, PWR, OSC, ALL, null.

The Retrieve Event commands return data from the Event Log. **EQPT** specifies alarm messages, **MSG** specifies non-alarm messages only and **ALL** specifies everything in the event log, including alarms. The PWR and OSC aids are valid only for EQPT messages. Start and stop specify an optional time interval for events to be retrieved and are of the format MM-DD, HH-MM for date in month and day and time in hours and minutes. One line will be returned

for each event in the log containing the time stamp and event message. The response will be the same style response message as for autonomous reports.

RTRV-HDR:tid::ctag;

Valid aid code: none.

Retrieve Header is used to verify system connectivity. The only action taken is to respond with the complied message. This can also be used to query the current time from the unit as the complied message contains the current date and time.

RTRV-NETYPE:tid::ctag;

Valid aid code: none.

Retrieve Network Element Type responds with a complied message followed by:

^^^"AUSTRON PRR"<cr><lf>

RTRV-PM-LOOP:tid:[aid]:ctag;

Valid aid code: CTL, ALL, null.

The Retrieve Performance Monitor Loop command returns the current software phase lock loop settings for the equipment. The format of the response message is:

^^^"aid:lstat[,(delt),sig,(looff),(delf),tau]"<cr><lf>

Where:

lstatThe status of the control loop, one of:

INIThe loop is in the initialization stage. If in this stage, no other information is presented.

ACQThe loop is in acquisition

LOCKThe loop is in the Locked state

HALTThe loop updates are halted due to no, or invalid, phase measurements

UHLTThe loop has been halted by a user

deltThe delta T measurement of the loop. This is the difference between the phase measurements and the current output from the loop, scaled by 1E-9. Per TR-TSY-000831, Section 2.2.6 this will be enclosed within ().

sigCurrent measurement noise of the inputs, scaled by 1E-9.

looffLocal Oscillator offset, scaled by 1E-12. Per TR-TSY-000831, Section 2.2.6 this will be enclosed within ().

delfLast applied frequency update to the local oscillator offset, scaled by 1E-12. Per TR-TSY-000831, Section 2.2.6 this will be enclosed within ().

tauCurrent loop time constant, in seconds.

RTRV-PRMTR-ALM:tid:[aid]:ctag[::alrm];

Valid aid code: CTL, PWR, OSC, ALL, null.

The Retrieve Parameter Alarm command retrieves the current alarm settings for the unit. If the PWR or OSC **aid** is utilized the **alrm** parameter is ignored. Valid **alrm** parameters for CTL can be found in Section 5.7.8, Autonomous Messages.

Multiple alarms may be indicated by utilizing the ampersand and double-ampersand input format. The ampersand (&) is used to signify multiple alarms, for example 0&2&3. The double-ampersand is used to signify ranges of alarms, for example 0&&5 for alarms 0 through 5. If an alarm is not valid due to the equipment not being available no report for that alarm is generated for the multi-alarm case. If no alarms are valid in the parameter list the response is a DENY report with an IPNV status. The format of the response message is:

^^^"aid:alrm,astate,dly"<cr><lf>

Where:

alrmThe alarm number.

astateThe alarm state. These are the same as ntfcncde, with the addition of IG for ignored.

dlyThe alarm delay time, in seconds. If the alarm delay does not apply this field is null.

RTRV-PRMTR-COMP:tid:[aid]:ctag;

Valid aid code: OTP, ALL, null.

The Retrieve Parameter Compensation command retrieves the current settings for the line compensation of the outputs from the unit. There may be multiple lines present in the report, one for each line compensation requested. The format of the response message is:

^^^"aid:comp"<cr><lf>

Where:

compThe line compensation setting for the aid output port, a number from 0 to 7, corresponding to the following:

Module Type	Max Outputs	Comp #	Meaning
DS1	10	0	Undefined
		1	Undefined
		2	Undefined
		3	0-133 feet
		4	133-266 feet
		5	266-399 feet
		6	399-533 feet
		7	533-655 feet
E1	10	--	No Compensation available. Will not be returned/accepted
CC		0	0 ns, 62.5% duty cycle
		1	700 ns, 62.5% duty cycle
		2	1400 ns, 62.5% duty cycle
		3	2100 ns, 62.5% duty cycle
		4	0 ns, 50% duty cycle
		5	700 ns, 50% duty cycle
		6	1400 ns, 50% duty cycle
		7	2100 ns, 50% duty cycle
ANLG	4	0	Frequency output is disabled.
		1-4	Undefined
		5	1 MHz output.
		6	5 MHz output.
		7	10 MHz output.
G.703	10	--	No compensation available. Will not be returned/accepted.
RS422	10	--	No compensation available. Will not be returned/accepted.

RTRV-PRMTR-ELTIME:tid::ctag;

Valid aid code: none.

The Retrieve Parameter Elevation Times command retrieves the current settings for the elevation times of the alarm messages. The format of the response message is:

^^^"min,maj"<cr><lf>

Where:

minThe time, in seconds, before a minor alarm is elevated to a major.

majThe time, in seconds, before a major alarm is elevated to a critical.

RTRV-PRMTR-FG:tid::ctag;

Valid aid code: none.

The Retrieve Parameter Frame Generation command retrieves the current settings for the Frame Generation within the unit. The format of the response message is:

^^^"type,ais,ssm"<cr><lf>

Where:

typeFrame generator type, {DS1 | E1}

ais{ON | OFF}, depending on the state of the AIS generation.

ssm{ON | OFF}, depending on the state of SSM generation.

RTRV-PRMTR-LOOP:tid:[aid]:ctag;

Valid aid code: CTL, ALL, null.

The Retrieve Parameter Loop command returns the current operating mode of the software Phase Locked Loop. The format of the response message is:

^^^"aid:lstat"<cr><lf>

Where lstat is one of:

INIThe loop is in the initialization stage

ACQThe loop is in acquisition

LOCKThe loop is in the Locked state

HALTThe loop updates are halted due to no, or invalid, phase measurements

UHLTThe loop has been halted by a user

RTRV-PRMTR-OSC:tid:[aid]:ctag;

Valid aid code: CTL, ALL, null.

The Retrieve Parameter Oscillator command returns the current settings for the oscillator inputs. There may be multiple lines present in the report, one for each LO parameter setting requested. The format of the response message is:

^^^"aid:as,ar,pri,sel,fa,ta,fb,tb"<cr><lf>

Where:

asCurrent setting of the AutoSwitch function, {ON | OFF}.

arCurrent setting of the AutoReturn function, {ON | OFF}.

priLO input to utilize as the primary input.

selCurrent LO input. If the input is faulted this may differ from the primary input.

faInput frequency for the LO A, in MHz, either 5 or 10.

taLO A input type, {RB | XTAL}.

fbInput frequency for the LO B, in MHz, either 5 or 10

tbLO B input type, {RB ½ XTAL}

RTRV-PRMTR-POS:tid:[aid]:ctag;

Valid aid code: CTL, ALL, null.

The Retrieve Parameter Position command returns the current positioning information from the unit. There may be multiple lines present in the report, one for each position requested. The format of the response message is:

^^^"aid:lat,lon,(ht),avg,pstat"<cr><lf>

Where:

latCurrent unit latitude, presented as (DD)-MM-SS.SS. The degrees are positive for north, negative for south.

lonCurrent unit longitude, presented as (DDD)-MM-SS.SS. The degrees are positive for east, negative for west.

htCurrent unit height, in meters.

avgNumber of position averages that will be used - as set by the user.

pstatPosition status, either GOOD, meaning the unit has completed a position verification, or BAD meaning the unit is in the process of verifying or correcting the position.

RTRV-SETUP:tid::ctag;

Valid aid code: none.

The Retrieve Setup command returns the current operating mode of the unit and always has a null aid. The format of the response message is:

^^^"mode"<cr><lf>

Where mode is the current operating mode of the unit and is either:

PRSUnit is operating in the PRS mode. This means that the clock outputs from the unit operate according to the PRS specification. The PRS specification allows for the outputs of the unit to be in what would be interpretted as invalid states to indicate that the output is not guaranteed to meet Stratum 1 requirements.

MODUnit is operating in the MODified PRS mode. This means that the clock outputs from the unit are always present with the only error indications available on the clock output is the indication of the current Stratum level of the clock, with Stratum 1 when locked to GPS, Stratum 2 for Rubidium holdover, and Stratum 3 for Crystal holdover. If SSM is disabled the output from the unit is valid at all times.

RTRV-STAT:tid:[aid]:ctag;

Valid aid code: CTL, ALL, null.

The Retrieve Status command returns status information of the equipment. There may be multiple lines present in the report, one for each status requested. The format of the response is:

^^^"aid:mincnt,majcnt,cricnt,sel,lstat[,(lofreq),(delf)]"<cr><lf>

Where:

mincntCount of active minor alarms.

majcntCount of active major alarms.

cricntCount of active critical alarms.

selWhich LO input is currently selected.

lstatThe loop status control. See RTRV-PM-LOOP for a description of lstat. If in INI, no other information is present.

lofreqCurrent LO frequency offset.

delfLast applied delta frequency control.

RTRV-STAT-POS:tid:[aid]:ctag;

Valid aid code: CTL, ALL, null.

The Retrieve Status Position command returns the current positioning information from the unit. There may be multiple lines present in the report, one for each position requested. The format of the response message is:

^^^"aid:lat,lon,(ht),avg,pstat"<cr><lf>

Where:

latCurrent unit latitude, presented as (DD)-MM-SS.SS. The degrees are positive for north, negative for south.

lonCurrent unit longitude, presented as (DDD)-MM-SS.SS. The degrees are positive for east, negative for west.

htCurrent unit height, in meters.

avgNumber of position averages utilized for this position.

pstatPosition status, either GOOD, meaning the unit has completed a position verification, or BAD meaning the unit is in the process of verifying or correcting the position.

5.7.7 SET Commands and Responses

SET-DAT:tid::ctag::date^time;

Valid aid code: none.

The Set Date and Time command always has a null aid and the <other> field contains the date and time. The format of the date and time is YY-MM-DD^HH-MM-SS where the ^ may be either a space character or a comma separating the date and time. The PRR-10 system clock will be set to the received date and time and a complied message will be returned, with the new date/time in the header. It is possible for this command to return the DENY message with an error code of SDNR if the unit has already acquired time from the GPS system.

SET-NAME:tid::ctag::name;

Valid aid code: none.

The Set Name command assigns a new name to the unit. The name may be null or up to 20 characters beginning with a letter. The tid and the returned sid match the original name. The new name is used as the tid and sid for all commands following.

SET-PRMTR-ALM:tid:[aid]:ctag::alrm,astate,del;

Valid aid code: CTL, PWR, OSC, ALL, null.

The Set Parameter Alarm command allows for setting the alarm parameters. If the PWR or OSC aid is utilized the alrm parameter is ignored. See Section 5.7.8, Autonomous Messages, for a description of valid alarm numbers. Multiple alarms may be indicated by utilizing the ampersand and double-ampersand input format. The ampersand (&) is used to signify multiple alarms, for example 0&2&3. The double-ampersand is used to signify ranges of alarms, for example 0&&5 for alarms 0 through 5. If an alarm is not valid due to the equipment not being available no report for that alarm is generated for the multi-alarm case. If no alarms are valid in the parameter list the response is a DENY report with an IPNV status. Only single alarm states and delay times are possible. The parameters are:

alrmThe alarm number. If this does not apply (as is the case for OSC and PWR alarms) this parameter is ignored.

astateThe alarm state. These are the same as ntfcncde, with the addition of IG for ignored.

dlyThe alarm delay time, in seconds. If the alarm delay does not apply this field is ignored. Valid alarm delay times are from 0 (immediate) to 86400 (1 day).

SET-PRMTR-COMP:tid:[aid]:ctag::comp;

Valid aid code: OTP, ALL, null.

The Set Parameter Compensation command allows for setting of the line compensation parameters for the outputs from the unit. comp is the desired setting for the line compensation parameter. Only numbers 0 through 7 are valid for the compensation number. Refer to the RTRV-PRMTR-COMP command for valid settings for the various output modules. No error will be returned if any of the modules in the range can be set to the given compensation.

SET-PRMTR-ELTIME:tid::ctag::min,maj;

Valid aid code: none.

The Set Parameter Elevation Times command allows updating of the alarm elevation times. The parameters are:

minDelay time, in seconds, for a minor to be elevated to a major. Valid ranges are from 60 (1 minute) to 86400 (1 day).

majDelay time, in seconds, for a major to be elevated to a critical. Valid ranges are from 60 to 86400.

SET-PRMTR-FG:tid::ctag::ais,ssm;

Valid aid code: none.

The Set Parameter Frame Generation command allows for the setting of the Frame Generation parameters. The parameters are:

aisEnable or disable the AIS generation in the event of a degraded output. Valid input is {ON | OFF}.

ssmEnable or disable output of Sync Status Messages in the event of a degraded output. Valid input is {ON | OFF}.

SET-PRMTR-LOOP:tid:[aid]:ctag::lstat;

Valid aid code: CTL, ALL, null.

The Set Parameter Loop command allows changing of the current software Phase Locked Loop operating mode. 'lstat' is one of:

ACQPut the loop into acquisition mode. If the unit is in INI this has no affect.

LOCKPut the loop into the Locked state. If the unit is in INI this has no affect.

UHLTPut the loop into the user halt mode.

SET-PRMTR-OSC:tid:[aid]:ctag::as,ar,pri,sel,fa,ta,fb,tb;

Valid aid code: CTL, ALL, null.

The Set Parameter Oscillator command allows setting of the LO input controls. The parameters are:

asAutoswitch enable, {ON | OFF}.

arAutoreturn enable, {ON | OFF}.

priLO input to utilize as the primary input, {A | B}.

selLO input to select for input, {A | B}. If the input is faulted no switch will take place. If different than the primary input the unit may switch back to the primary, depending on the status of Autoreturn.

faLO input A frequency, in MHz. Valid input is either 5 or 10.

taLO input A type, {RB | XTAL}.

fbLO input B frequency, in MHz. Valid input is either 5 or 10

tbLO input B type, {RB | XTAL}

SET-PRMTR-POS:tid:[aid]:ctag::lat,lon,ht,avg;

Valid aid code: CTL, ALL, null.

The Set Parameter Position command allows setting of the position information within the controller. This command also allows for forcing the unit to recalculate a position. The parameters are:

latCurrent latitude, or null. Format is (DD)-MM-SS.SS for the latitude in degrees, minutes, and seconds. Positive degrees indicate north, negative south.

lonCurrent longitude, or null. Format is (DDD)-MM-SS.SS for the longitude in degrees, minutes and seconds. Positive degrees indicate east, negative west.

htCurrent height above the geoid, in meters, or null. Input must be surrounded by parenthesis for negative numbers.

avgNumber of averages to apply before the unit considers the position to be valid. Valid range is from 10 to 1000. Setting this forces the unit to recalculate the position with the new averaging time.

It is possible for this command to return the DENY message with an error code of SDNR if the unit has already acquired a position from the GPS system, unless the average count is also set which forces the unit to check the position entered. If the position is incorrect the unit will recalculate a position using the new averaging time. The control loops are put into holdover while positioning is taking place.

SET-SETUP:tid::ctag::stype;

Valid aid code: none.

The Set Setup command allows setting of the default NVRAM parameters. 'stype' is one of:

FACTORYTransfer the factory settings to NVRAM.

USERTransfer the stored user settings to NVRAM. This will generate a deny if no user settings have previously been saved.

SAVETransfer the current settings from NVRAM into Flash memory. These settings can later be recalled with the USER option.

PRSSetup the unit for PRS operation. This changes some of the alarm settings and handling of the clock outputs.

MODSet the unit for MODified PRS operation. This changes some of hte alarm settings and the handling of the clock outputs.

5.7.8 Autonomous Messages

The following is a list of the **condscr** for autonomous messages generated from the PRR-10.

The **condscr** messages are of the general format:

<n,\"p1,p2,p3,p4,...,pn\">

where 'n' is the event number and p1,..pn are the values associated with this event. Events less than 31 are alarm events and they have p1 predefined to be the delay time for the alarm, in seconds.

Within the description the following notes apply:

[] means optional output

{} means one of the enclosed occur, the valid (no alarm) state first, the invalid (alarm) state second.

| OR separator

Valid Alarm numbers and descriptions for Alarm condscr follows:

NOTE: p1, for alarms, is predefined to be the delay time for the alarm, in seconds.

0.**Tracking status of the Receiver**

p2..pn :

TRACKING,{YES|NO}

Meaning:

Current tracking status of the receiver. Available only when an engine is present on the reference controller.

1.**Connection status of the receiver antenna**

p2..pn:

ANTENNA,{CONNECTED|NOT CONNECTED}

Meaning:

Current connection status of the receiver antenna. Not valid for all receiver types. Available only when an engine is present on the reference controller.

2.**Load indication of the receiver antenna**

p2..pn:

ANTENNA,{NOT SHORTED,SHORTED}

Meaning:

Load indication for the current receiver antenna. Not valid on all receiver types. Available only when an engine is present on the reference controller.

3.**Receiver positioning status**

p2..pn:

POSITION,{GOOD|UNKNOWN}

Meaning:

Reports current receiver positioning status. Clears once the receiver has either verified the user entered position or calculated an accurate position. Available only when an engine is present on the reference controller.

4.**Local Oscillator, A, present**

p2..pn:

{PRESENT|NOT PRESENT}

Meaning:

Reports current status of the presence detection for oscillator input A.

5.**Local Oscillator, B, present**

p2..pn:

{PRESENT|NOT PRESENT}

Meaning:

Reports current status of the presence detection for oscillator input B.

6.**Local Oscillator, ALL, present**

p2..pn:

L.O. REF ALL,{PRESENT|NOT PRESENT}

Meaning:

Activates when both LOs are absent. This forces outputs of the unit off.

7.**Engine hardware status**

p2..pn:

ENGINE HDWR,{GOOD|BAD}

Meaning:

When the engine detects a hardware problem, or the reference is unable to communicate to the engine this is set. Available only when an engine is present on the reference controller.

8.**Engine system status**

p2..pn:

ENGINE SYSTEM,{GOOD|BAD}

Meaning:

Set when the receiver is not providing any phase measurement to the system. Available only when an engine is present on the reference controller.

9.**Output frequency quality**

p2..pn:

OUTPUT FREQ,{OK|DEGRADED}

Meaning:

Set when the output frequency from the unit is not able to meet a Stratum 1 mask.

10.**Redundant controller presence detection**

p2..pn:

REDUN CONTR,{PRESENT|NOT PRESENT}

Meaning:

The redundant reference controller has been removed from the chassis. Available only after a redundant controller has been detected.

11.**Redundant controller status**

p2..pn:

REDUN CONTR,{GOOD|BAD}

Meaning:

Current communication status to the redundant controller. Set if communication has been lost. Available only when a redundant controller is present.

12.**Power input A present**

p2..pn:

{PRESENT|NOT PRESENT}

Meaning:

Power input A is not detected.

13.**Power input B present**

p2..pn:

{PRESENT|NOT PRESENT}

Meaning:

Power input B is not detected.

14.**System hardware PLL lock status**

p2..pn:

SYSTEM PLL,{LOCKED|NOT LOCKED}

Meaning:

System hardware PLL has unlocked. This provides the reference to the receiver. This automatically squelches output from the unit.

15.**Frame generator hardware PLL lock status**

p2..pn:

FRAMEGEN PLL,{LOCKED|NOT LOCKED}

Meaning:

The hardware PLL for the frame generator has unlocked. This automatically squelches output from the unit.

16.**Frequency control range status**

p2..pn:

FREQ CONTROL,{OK|OUT OF RANGE}

Meaning:

The DDS control is within 10% of its full range of control utilizing the selected LO input. This means that the LO input is out of range for use by the unit. The range is +/- 2E-5.

17.**Unit hardware configuration status**

p2..pn:

H/W CONFIG,{OK|INVALID}

Meaning:

Redundant modules are incompatible for redundancy. The offending cards are disabled. If the reference controller is the offender then there are no outputs from the unit. Available only when redundant equipment is installed in the unit.

18.**Clock module output status**

p2..pn:

CLK OUTPUT,{OK|FAULTED}

Meaning:

One (or more) of the outputs from the output cards is shorted. Query the output modules to find where the fault it. Available only when output modules have been present in the unit.

19.**Clock module input status**

p2..pn:

CLK INPUT,{PRESENT|NOT PRESENT}

Meaning:

One (or more) of the output modules does not have the input signal present for the circuitry. Query the output modules to find where the fault is. Available only when output modules have been present in the unit.

20.**Clock module hardware PLL lock status**

p2..pn:

OUTMOD PLL,{LOCKED|NOT LOCKED}

Meaning:

One (or more) of the output modules has failed to lock its hardware PLL to its input signal. Available only when output modules have been present in the unit.

The following are event messages, these numbers are not valid for alarm number input:

33.**Unit forced LO switch**

p1..pn:

UNIT LO SEL,LO x

Meaning:

The unit has switched LO inputs to the reference controller, where 'x' is the new LO selected.

34.**User forced LO switch**

p1..pn:

USER LO SEL,username,LO x

Meaning:

A user, username, has switched LO inputs to the reference controller. 'x' is the new LO selection.

35.**User logged in**

p1..pn:

LOG IN,username,PORT x,LEVEL y

Meaning:

A user, username, has logged in at port 'x' with an access level of 'y'.

36.**User logged out**

p1..pn:

LOG OUT,username,PORT x,LEVEL y

Meaning:

A user, username, has been logged out from port 'x' with an access level of 'y'.

37.**Unit power restored**

p1..pn:

Meaning:

Power to the unit was restored. This is always the first event after a power-on.

38.**Board disabled**

p1..pn:

x-yy,name

Meaning:

An output module, name, has been disabled. 'x' is the chassis ID, 'yy' is the slot within the chassis.

39.**Board removed**

p1..pn:

x-yy,name

Meaning:

A module, name, has been removed from the unit. 'x' is the chassis ID, 'yy' is the slot within the chassis.

40.**Board inserted**

p1..pn:

x-yy,name

Meaning:

A module, name, has been inserted into the unit. 'x' is the chassis ID, 'yy' is the slot within the chassis.

41.**User cleared event log**

p1..pn:

CLR EVENT LOG,username,PORT x

Meaning:

A user, username, has cleared the event log from comm port 'x'.

42.**Software PLL change of operating modes**

p1..pn:

LOOP CNTL,{BEGIN|END} HO,{HALT|USER HALT|LOCKING}

Meaning:

The software PLL has changed operating modes. Holdover (HO) is caused by the unit not having valid inputs for the PLL. The descriptive text indicates the current loop status, Halted, User Halted, or Locking.

43.**User update of Flash user settings**

p1..pn:

SET FSRAM,username,{USER|FACTORY|PRS|MODPRS} SETTINGS

Meaning:

The stored parameters in NVRam have been cleared by a user, username, to the indicated defaults.

44.**User set default settings**

p1..pn:

SET USER DEF,username

Meaning:

A user, username, has forced the parameters stored in Flash memory (USER settings) to be updated with those currently in NVRam.

45.**Override of current position**

p1..pn:

OVERRIDE POS,AVERAGE avg

Meaning:

The position that was stored in NVRam has been overridden and the unit is recalculating a position with an averaging time of 'avg' updates.

46.**Sync change**

p1..pn:

SYNC CHANGE,{MASTER|SLAVE}

Meaning:

The sync mastership within the unit has changed. This gives an indication of which reference controller is currently driving the output modules and providing the sync status message.

47.**Engine Detected**

p1..pn:

ENGINE DET,revstr

Meaning:

An engine (receiver) has been detected by the reference controller. 'revstr' is the revision string as returned by the engine. Refer to the RTRV-CONF command for a description.

MAINTENANCE

6

SECTION 6 PRR-10 MAINTENANCE

Overview. This section provides information for ordering subassemblies, accessories, reshipment of the product, troubleshooting guidelines.

6.1 Re-ordering Information

To re-order any subassembly or accessory, contact the Datum, Inc. sales office. A current list of subassemblies/accessories and the Datum, Inc. Item Number maybe obtained from our sales office. When you know what items need to be ordered, supply subassembly or accessory name and its Datum, Inc. Item Number along with a purchase order number to our sales office.

6.2 Reshipment

Products being returned for repair require no special preparation other than standard packing procedures to protect the equipment during shipment. Connectors should be protected with connector covers or the equipment should be wrapped in plastic before packaging. Custom foam packing is preferred because it conforms to the shape of the equipment. Take special care to protect the front and rear panels.

Product Return Procedure

To return equipment to the factory for repair:

1) Obtain a return authorization from Datum, Inc. prior to returning a product for service. Call Datum, Inc. customer Service @ 1-512-721-4032 for return authorization.
2) Provide a description of the problem, Product Item Number, Serial Number, and warranty expiration date.
3) Provide return shipping information (customer field contact, address, phone number, etc.)
4) Ship the product to Datum, Inc. transportation prepaid and insured, with the Return Material Authorization (RMA) number and serial numbers attached to the product and clearly marked on the outside of the container to:

ATTN: SERVICE DEPARTMENT
Datum, Inc.
15811 VISION DRIVE
PFLUGERVILLE, TX 78660

6.3 Troubleshooting Guidelines

Note Datum offers a 24-hour technical support line and a 2-hour response time for each trouble call. For Customer Service, call (512) 721-4032 during our normal business hours (8 a.m. to 5 p.m. CST), or (512) 721-4000 after hours and on weekends.

Guidelines for determining and correcting alarm conditions are contained in the following paragraphs and tables. Visible signs of problems are the status indicators and serial communication port event messages. The user's main tool for diagnosing problems with the PRR-10 will be the ALARM command. Issuing this command will display the current alarm conditions. Table 6.3-1 lists all possible alarms. This table displays (from left to right) the alarm number, alarm name, alarm status, the present level of the alarm, and the default amount of time (in seconds) before the alarm becomes active. Note that alarms are only present if applicable to the current unit configuration.

Below is a definition of each field in the alarm table.

1) **Alarm Number Field** – The Alarm Number is used when using the ALARM command to setup an alarm, e.g. ALARM 09 Delay 300 would cause a Minor Alarm after 300 seconds because the Output Frequency is degraded.
2) **Alarm Field** – The Alarm is the name of the alarm.
3) **Status Field** – The Status is the current status of the alarm. This field's contents will depend on the alarm that it is associated with.
4) **Level Field** – The Level field shows the current level of the alarm. This initial alarm level is user definable. The user definable levels include Ignored, Minor, Major, and Critical. The alarm level will not be active until the delay period has been exceeded. If the alarm continues for longer than the user defined elevation time, the alarm will then elevate to the next level of alarm, e.g., a Minor will elevate to a Major. The elevation time can be set by the user and will be between 0 and 169200 seconds (48 hours). The default elevation time is 84600 seconds (24 hours).
5) **Delay Field** – The Delay field defines how long the system will wait before the alarm becomes active.

Table 6.3-1: PRR-10 Alarms

ALARM NUMBER	ALARM	STATUS	LEVEL (DEFAULT)	DELAY (DEFAULT)
(00)	Tracking	Yes or No	Minor	300 sec
(01)	Antenna	Connected or Not Connected	Major	Immed
(02)	Antenna	Not Shorted or Shorted	Major	Immed
(03)	Position	Good or Unknown	Minor	O sec
(04)	LORef A	Present or Not Present	Major	Immede
(05)	LORef B	Present or Not Present	Major	Immed
(06)	LORef All	Present or Not Present	Critical	Immed
(07)	Engine Hdwr	Good or Bad	Major	Immed
(08)	Engine System	Good or Bad	Minor	300 sec
(09)	Output Freq	OK or Degraded	Minor	600 sec
(10)	Redun Contr	Present or Not Present	Major	Immed
(11)	Redun Contr	Good or Bad	Major	Immed
(12)	Power A	Present or Not Present	Major	Immed
(13)	Power B	Present or Not Present	Major	Immed
(14)	System PLL	Locked or Not Locked	Major	Immed
(15)	FrameGen PLL	Locked or Not Locked	Critical	Immed
(16)	Freq Control	OK or Out of Range	Major	300 sec
(17)	H/W Config	OK or Invalid	Critical	Immed
(18)	Clk Output	OK or Faulted	Major	Immed
(19)	Clk Input	Present or Not Present	Major	Immed
(20)	Output PLL	Locked or Not Locked	Major	Immed
(21)	Holdover	No Holdover or Holdover	Ignore	0 sec
(22)	Redundant Failure	OK or Faulted	Minor	Immed
(23)	Non-Redundant Failure	OK or Faulted	Major	Immed

Note For proper analysis of alarms in the PRR-10, the alarms must be set up properly. See the Alarm Setup in the Operation Section of this user guide for a complete explanation.

Test equipment and tools required to perform maintenance and diagnostics are listed in Table 6.3-2. The frequency reference is only required when checking input frequency accuracy.

Table 6.3-2: Test Equipment and Tools

ITEM	CHARACTERISTICS	PURPOSE
Oscilloscope	Dual Trace, 150 MHz (equivalent to Tektronix 2465)	Signal amplitude measurements; Frequency comparisons
Terminal	Capable of 9600 Baud	Receiving event messages and entering commands
Frequency reference	Same frequency and Meeting or exceeding the accuracy of signal to be measured	Reference for frequency comparisons

Most status indicators indicate a that a possible problem exists (e.g., loss of LO, loss of output) Computed errors, such as MTIE, can illuminate alarm indicators. Refer to the Modules section of this user guide for an explanation of each modules indicators.

Event messages are automatically sent via the serial communications ports. Each message is dated, time stamped and lists the cause of the event. However, not all messages are alarms or faults. Changes in operating parameters are also reported.

Table 6.3-3 is a troubleshooting aid which lists alarms and possible solutions to clear the Troubleshooting Alarms:

Table 6.3-3: Troubleshooting Alarms

ALARM	SOLUTION
(00) Tracking: This alarm indicates whether or not the receiver is currently tracking. Status Message: Yes or No	1. Verify that the antenna and the antenna cable are properly connected. 2. Verify that the antennas location allows for Line of Sight reception of the signal (if it is GPS). The antenna cannot be inside and should not have its location blocked by tall buildings. 3. Verify that there are no large transmitters in the area that could cause interference. 4. Verify the antenna cable on the reference controller is connected to the GPS engine. This will require the reference controller to be removed from the chassis. Look at the cable that runs from the Euro connector to the GPS engine on the reference controller, also verify that the cable has not disengaged from the Euro connector. 5. Check to see what other alarms are active by issuing the Alarm command. A. Make sure the receiver Engine Hardware alarm is Good; if not Good, call factory.
(01) Antenna This alarm indicates whether the antenna is currently connected or coaxial lead-in cable is open. Status Message: Connected or Not Connected	1. Verify that the antenna coaxial lead-in is connected to the proper antenna TNC connector on the rear of the unit. 2. Verify that the antenna coaxial cable is connected to the antenna. 3. Verify that the antenna coaxial cable is not open, connectors properly installed. 4. Verify the antenna cable on the reference controller is connected to the GPS engine. This will require the reference controller to be removed from the chassis. Look at the cable that runs from the Euro Connector to the GPS engine on the reference controller, also verify that the cable has not disengaged from the Euro Connector.
(02) Antenna This alarm indicates whether the antenna coaxial lead-in cable is shorted or the antenna has failed. Status Message: Not Shorted or Shorted	1. Verify that the antenna coaxial cable is not shorted, connectors properly installed. 2. Verify that the antenna is not drawing excessive current, failed.
(03) Position: The current position has not been verified by the receiver. The receiver will not control the clock outputs until this alarm is cleared. Status Message: Good or Unknown	1. This process can take as long as the averaging time for new installations. 2. Verify that the receiver is tracking. 3. Verify that position updates are occurring and PDOP is below 5.0 4. If PDOP >5.0, verify unit is tracking satellites that are in view.
(04) LO Ref A: The Local Oscillator A (or LO1) has faulted. Status Message: Present or Not Present	1. Verify the cable connection from the source to the PRR-10 by checking for a signal at the end that plugs into the PRR-10. The signal coming in should be 5 or 10 MHz and 1 Vp-p (in to a 50 ohm load). 2. Verify that S4 on the backplane behind the reference controller in the top slot is set to the proper type of termination. The default setting for this switch is 50 ohms. The only time this switch should not be set to 50 ohms is if the PRR-10 is not the terminating device for the LO reference signal, or a larger impedance is needed for termination.
(05) LO Ref B: The Local Oscillator B (or LO2) has faulted. Status Message: Present or Not Present	1. Verify the cable connecting from the source to the PRR-10 by checking for a signal at the end that plugs into the PRR-10. The signal coming in should be 5 or 10 MHz and 1 Vpp (into a 50 ohm load). 2. Verify that S3 on the backplane behind the reference controller in the bottom slot is set to the proper type of termination. The default setting for this switch is 50 ohms. The only times this switch should not be set to 50 ohms is if the PRR-10 is not the terminating device for the LO reference signal, or a larger impedance is needed for termination.
(06) LO Ref All: The receiver has lost all LO inputs, all clock outputs from the receiver to be disabled. Status Message: Present or Not Present	1. Verify the inputs to both LO inputs; this includes checking the cables, connectors, and the output from the LO(s). 2. Verify that S4 and S3 are set for proper termination. To view these switch settings the reference controller(s) will have to be removed from the chassis. By default these are set to 50 ohms. If the PRR-10 has two reference controllers installed and the LO inputs are both being fed from the same source, e.g., the PRR-10 oscillator module, then one of the two switches should be set to 1000 ohm termination. Typically, set S3 to1000 ohm and leave S4 at 50 ohm, then feed the input to LOB and tee the signal over to LOA. This will provide proper termination.
(07) Engine Hdwr: The reference controller is indicating the failure of the receiver engine hardware. Status Message: Good or Bad	1. Remove the reference controller and verify the engine daughter board is firmly seated on the interface connector on the reference controller. 2. If the engine requires a reference input, verify cable is connected to engine. 3. If the engine requires a ribbon cable, verify that it is seated properly. 4. Call Datum, Inc. Technical Support for a replacement controller.

Table 6.3-3: Troubleshooting Alarms (Continued)

(08) Engine System The engine is reporting a system failure. The receiver is currently unable to report information necessary for the control of the clock outputs. System Message: Good or Bad	1. Check the Alarm Status for the PRR-10 (issue the ALARM command) for System PLL and/or Frame Gen PLL alarm conditions. 2. If either PLL is in alarm condition, issue the OSC command and verify that the proper LO input frequency has been selected (either 5 or 10 MHz). If the selected frequency is not the frequency of the LO input, issue the OSC Freq [A|B] [5|10] command to set it up properly. 3. Verify that the engine is tracking.
(09) Output Freq The clock outputs are not guaranteed to meet Stratum 1 mask. System Message: OK or Degraded	1. Verify the status of other possible alarm conditions including Position, LO All, Engine System, or Frame Gen PLL. If any of these alarms are active then the clocks output maybe degraded or disabled. 2. Verify that the engine is tracking.
(10) Redun Contr The redundant reference controller has been removed from the system. The alarm is only available if a redundant reference controller was previously detected in the system. System Message: Present or Not Present	1. If a redundant controller was removed from the system and there is no intention of replacing the redundant controller, this alarm can be disabled by issuing the command to remove equipment. Refer to the Operations section, CONFIG Command. 2. Reseat the redundant controller to ensure it is firmly installed. 3. Replacing the redundant controller will remove this alarm condition.
(11) Redun Contr The redundant reference controller has failed. Specifically, the reference controller is no longer responding to communications to and from the backplane transfers within the unit. This alarm is only available if a redundant reference controller was previously detected in the system. System Message: Good or Bad	1. Reseat the redundant reference controller, making sure it is properly seated. 2. Call Datum, Inc. Technical Support for a replacement controller.
(12) Power A Power A input has faulted. System Message: Present or Not Present	1. Verify that the Power Bus A is providing -48 Vdc to the PRR-10. 2. Verify that the fuse for Power A is properly installed and is not open. 3. If no power is connected to the Power A input and there is no plan to connect power, then issue the command AL 12 IG.
(13) Power B Power B input has failed. System Message: Present or Not Present	1. Verify that the Power Bus B is providing -48 Vdc to the PRR-10. 2. Verify that the fuse for Power B is properly installed is not open. 3. If no power is connected to the Power B input and there is no plan to connect power then issue command, AL 13 IG.
(14) System PLL The system PLL has not achieved lock to the LO input. The PLL is used to generate reference frequencies for the receivers and, therefore, may also generate receiver alarms. System Message: Locked or Not Locked	1. Verify that the proper LO frequency has been set by issuing the OSC command, which will display how the LO has been set up. If the wrong oscillator frequency has been set up, it will need to be changed. To modify the oscillator type, issue the command, OSC Type [A|B] [XTAL|RB], select RB for LO of rubidium or better stability. To modify the oscillator frequency, issue the command, OSC Freq [A|B] [5|10]. 2. Verify other alarm conditions for an indication that the LO is not present.
(15) FrameGen PLL The Frame Generation PLL has not achieved a lock to the incoming LO. The clock outputs should be disabled. System Message: Locked or Not Locked	1. Verify that the proper LO frequency has been set by issuing the OSC command, which will display how the LO has been set up. If the wrong Oscillator frequency has been set up, they will need to be changed. To modify the oscillator type, issue the command, OSC Type [A|B] [XTAL|RB], select RB for LO of rubidium or better stability. To modify the oscillator frequency, issue the command, OSC Freq [A|B] [5|10]. 2. Verify other alarm conditions for an indication that the LO is not present.
(16) Freq Control Indicates the maximum control range of the DDS is being approached; it is within 10% of its maximum control range.	1. The LO needs to be put back on frequency. This may require a mechanical adjustment or replacement of the oscillator.
(17) H/W Config The system is configured with hardware that cannot be utilized together, e.g., an E1 reference controller and a DS1 reference controller. System Message: OK or Invalid	1. Verify the controller configuration by issuing the Configure command. 2. Remove any non-matching modules.
(18) CLK Output A clock output has faulted. System Message: OK or Faulted	1. Verify that the unit has gone thru normal start-up and outputs are enabled. 2. Issue the output command to see which output is faulted and verify that the output is not shorted. 3. If the output is not shorted, call Datum, Inc. Technical Support for a replacement module. Replace module

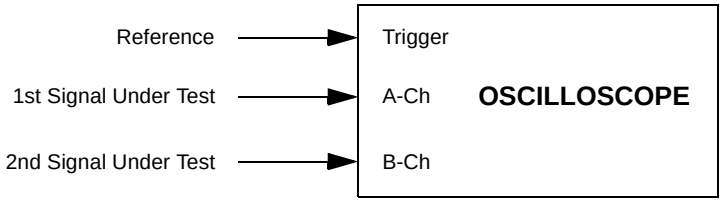
Table 6.3-3: Troubleshooting Alarms (Continued)

(19) CLK Output The clock input to the output modules is not present. System Message: Present or Not Present	1. Verify that the unit has gone thru normal start-up and the outputs are enabled. 2. If there is an expansion chassis present, verify that the expansion card is inserted into the main chassis and the expansion cable is properly connected. 3. Call Datum, Inc. Technical Support for assistance.
(20) Output PLL The PLL is not locked on the output module. System Message: Locked or Not Locked	1. Verify that the unit has gone thru normal start-up and the outputs are enabled. 2. If there is an expansion chassis present, verify that the expansion card is inserted into the main chassis and the expansion cable is properly connected. 3. Call Datum, Inc. Technical Support for assistance.
(21) Holdover The unit is currently in holdover mode. System Message: No Holdover or Holdover	1. Verify that the engine system alarm is clear 2. Verify that positioning has been completed. 3. Verify that there is good coverage for the unit. If the antenna is blocked, periods of no valid information is possible. Lengthen the alarm activation time period to account for known periods of holdover.
(22) Redundant Failure A redundant output card has failed. System Message: OK or Faulted	1. Verify the controller configuration by issuing the CONFIG command. 2. Remove the failed card. 3. Issue the CONFIG REMOVE command to clear the alarm condition. 4. If the card is not of the same type as its redundant pair, then place the card into an empty pair location or match it with the appropriate redundant module. 5. If the card was matched with a valid redundant module, then call Datum, Inc. Technical Support for a replacement module.
(23) Non-Redundant Failure A non-redundant output card is failed System Message: OK or Faulted	1. Remove the failed card and call Datum, Inc. Technical Support for a replacement module.

Note Another useful PRR-10 command for determining the proper operation of the receiver is the Configuration command. Issuing the Config command will display information about each module installed in the receiver and any expansion chassis connected to the receiver. The information displayed by the Config command will be Module Location, Type of Module, Datum, Inc. Item Number, hardware revision, date of hardware test, and Module Serial Number. If any of the installed modules do not report this information or the information it reports is wrong, try reseating the module. If the problem persists, call Datum, Inc. Technical Support.

To check the frequency stability or synchronization of a suspected bad input or output signal, compare that signal to an independent signal reference. Using a oscilloscope to compare signals, connect the suspected signal(s) to the channel A or B inputs and the independent reference of the same frequency to the external trigger input (see Figure 6.3-1). If the signals under test are not stationary or drifting at a rate equal to or less than the signal's specified tolerance, it is defective and should not be used.

Figure 6.3-1: Frequency Comparison



ACCESSORIES

SECTION 7 PRR-10 ACCESSORIES

Overview. This section provides additional information about optional antennas, antenna accessories, mounting and connectivity accessories for the PRR-10. Refer to the Installation section of this user guide for proper installation of these accessories.

7.1 GPS Antenna with Internal LNA

The series of GPS Antennas with internal LNA's are compatible with almost all commercially available GPS Receivers on the market to day. These antennas receive, amplify and filter the L1 (1575.42 MHz) signal from GPS NAVSTAR Satellites. The amount of amplification depends on the version of antenna selected. The conditioned, received signal is fed to the receiver. Datum offers three versions of this antenna: 26, 40 and 50. By choosing the appropriate gain antenna, in-line amplifier, and mating it with various types of coaxial cable, the antenna may be located from 10 ft. to 1000 ft. from the receiver when installed with the appropriate coaxial cable. Table 7.1-1 lists the Item Number and Figure 7.1-1 is an illustration of the GPS Antenna with internal LNA.

Table 7.1-1: Antenna Item Number

ITEM NUMBER	DESCRIPTION
32012937-012-0	26, L1 GPS Antenna, 26.5 dB Gain, N-type connector
32012937-010-0	40, L1 GPS Antenna, 40 dB Gain, N-type connector
32012937-001-0	50, L1 GPS Antenna, 48 dB Gain, N-type connector

Figure 7.1-1: L1 GPS Antenna with LNA

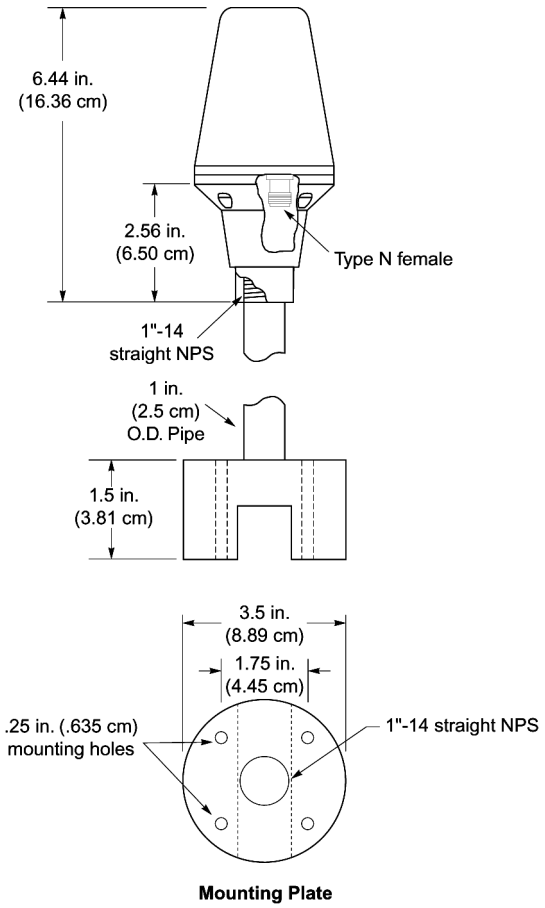


Table 7.1-2 lists the specifications for GPS Antennas with LNA.

Table 7.1-2: Specifications, GPS Antennas with LNA

Characteristic	Specification
Mechanical	
Mounting	4 Holes, 13/4″ X 13/4″ centers, .25“ mounting holes
Diameter	3.5″ (8.89 cm)
Height	12.94″ (32.87 cm)
Weight	< 3 lbs. (1.4 kg)
Environmental	
Temperature	–40°C to +75°C
Relative Humidity	100% Non-Immersed
Altitude	200 ft. below sea level to 13,000 ft. above sea level
Electrical	
Power	4.7 to 28 Vdc (5 Vdc Nominal)
Element	Right Hand Circular
Carrier	L1, 1545.42 MHz
Bandwidth	10 MHz

Table 7.1-2: Specifications, GPS Antennas with LNA (Continued)

Noise Figure	< 2.5 dB
Output Impedance	50 ohms
Gain 26 40 50	 26.5 dB ± 3 dB 40 dB minimum 48 dB minimum

Table 7.1-3, Table 7.1-4 and Table 7.1-5 list the optional accessories that can be used with each GPS Antenna. Refer to Section 4.2.1 - Antenna Kits, for specifics.

Table 7.1-3: Accessories for GPS L1 Antenna, 26.5 dB Gain (32012937-012-0), 10 ft to 200 ft

ITEM NUMBER	DESCRIPTION
12013076-xxx-0	Cable, LMR-400, 10 ft to max. of 190 ft. (xxx is length in feet)
773000-008	TRANS ELIM, 90 Volts, 1.5 GHz, Type-N
12013076-010-0	Cable, LMR-400, 10 ft, Type-N
551100-6010	Adapter, Right Angle TNC Male to Type-N Female
12010210-000-0	Bracket Assy, Antenna Mount Right Angle
400302-0500	Roll, 3M 2150 weatherproof tape
12813080-000-0	Crimper Kit, LMR-400 (crimp tool, 2150 tape, LMR prep tool, 10 ea N crimp connectors)

Table 7.1-4: Accessories for GPS L1 Antenna, 40 dB Gain (32012937-010-0), 100 ft to 400 ft

ITEM NUMBER	DESCRIPTION
12013076-xxx-0	Cable, LMR-400, 70 ft to max. of 370 ft (xxx is length in feet)
773000-008	Transient Elm, 90 Volts, 1.5 GHz, Type-N
12013076-030-0	Cable, LMR-400, 30 ft, Type-N
551100-6010	Adapter, Right Angle TNC Male to Type-N Female
12010210-000-0	Bracket Assy, Antenna Mount Right Angle
400302-0500	Roll, 3M 2150 weatherproof tape
12813080-000-0	Crimper Kit, LMR-400 (crimp tool, 2150 tape, LMR prep tool, 10 ea N crimp connectors)

Table 7.1-5: Accessories for GPS L1 Antenna, 48 dB Gain (32012937-001-0), 250 ft to 1000 ft

ITEM NUMBER	DESCRIPTION
12013076-030-0	Cable, LMR-400, 30 ft, Type-N
12013076-xxx-0	Cable, LMR-400, 220 ft to max. of 970 ft (xxx is length in feet)
773000-008	TRANS ELIM, 90 Volts, 1.5 GHz, Type-N
551100-6010	Adapter, Right Angle TNC Male to Type-N Female
12010210-000-0	Bracket Assy, Antenna Mount Right Angle
570704-0001	GPS L1 In-Line Amp, Type-N, Required for total length over 650 ft
11013077-000-0	GPS L1 Amplifier Assy (amp, transient eliminator, adapter, mounting plate)
400302-0500	Roll, 3M 2150 weatherproof tape
12813080-000-0	Crimper Kit, LMR-400 (crimp tool, 2150 tape, LMR prep tool, 10 ea N crimp connectors)

7.2 Transient Eliminators

If an installation requires antenna coaxial lead-in protection to assist in protecting equipment and the facility, Datum, Inc. offers a transient eliminator. The FCC-250B-90-1.5NFNF is designed to pass DC power and frequencies in the 1.5 GHz range. It is normally mounted where the antenna lead-in comes into the building. Table 7.2-1 lists the optional transient eliminator item number. Figure 7.2-1 is a illustration of this transient eliminator and Table 7.2-2 lists its specifications.

Table 7.2-1: Optional Transient Eliminator Item Number

ITEM NUMBER	DESCRIPTION
773000-0008	FCC-250B-90-1.5NFNF Transient Eliminator, L1 90Vdc (N-type connector)

Figure 7.2-1: Model FCC-250B-90-1.5-NFNF Transient Eliminator

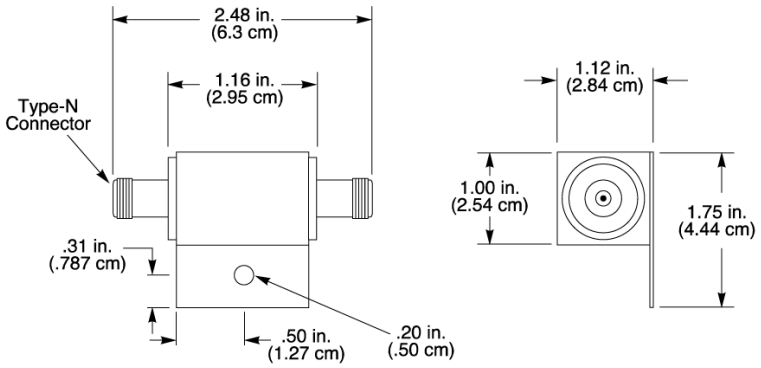


Table 7.2-2: Specifications, FCC-250B-90-1.5-NFNF

Type	Gas
Response Time	< 2 nanosecond
Impedance	50 ohms
Insertion Loss	< 0.25dB @1,575 MHz
VSWR	< 1.6:1 @ 1,575 MHz
DC Breakdown Voltage	90 Volts
Dissipation Capacity	10,000 Amperes, Impulse 8/20 usec
Connector Type	Type-N
Temperature	–55℃ to +70℃
Relative Humidity	100% Non-Immersed Altitude 200 ft. below sea level to 13,000 ft. above sea level

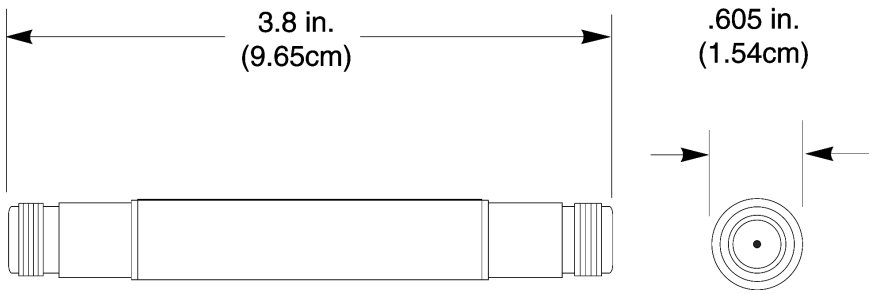
7.3 GPS L1 Amplifier

The GPS L1 Inline Amplifier (item number 570704-0002) option used to boost the signal from the antenna for installation. The amplifier uses LMR-400 cables longer than 650 feet and receives power from the GPS radio receiver through the antenna coaxial cable connections. Table 7.3-1 provides environmental, mechanical, and electrical specifications for the amplifier. Figure 7.3-1 illustrates the GPS L1 Amplifier.

Table 7.3-1: GPS L1 Inline Amplifier Specifications

Characteristic	Specification
Environmental	
Temperature	-40° C to +80° C
Mechanical	
Connectors, (In/Out)	N-Type
Gain	> 20 dB
Dimensions, includes connectors	Diameter .605" (1.54 cm) Length 3.8" (9.65 cm)
Electrical	
Power	+4.0 vDC to +28 vDC
Current	10 mA, typical at 4vDC
Input/Output Impedance (bandwidth at 3dB points)	50 ohms

Figure 7.3-1: GPS L1 Amplifier



7.4 Antenna Coaxial Cables

Datum, Inc. provides a low-loss LMR-400, or equivalent, coaxial cable with Type-N connectors on both ends.

Table 7.4-1 lists the optional antenna coaxial cables.

Table 7.4-2 lists the optional antenna coaxial cable crimper kit.

Table 7.4-3 provides antenna cable specifications.

Table 7.4-1: Optional Antenna Coaxial Cables

Item Number	Description
12012995-xxx-0*	Cable, UHF/VHF (B-9913), with Type-N Connectors
12012994-xxx-0*	Cable, UHF/VHF (B-89913), with Type-N Connectors
12012992-xxx-0*	Cable, RG213/U, with TNC/Type-N Connectors
12013076-xxx-0	Cable, LMR-400 or equivalent, with Type-N Connectors

Note Contact factory sales office for available cable lengths and specific cable item dash number.

Table 7.4-2: Optional Antenna Coaxial Cable Crimper Kits

Item Number	Description
12813059-000-0	Crimp Kit for RG213 (10 ea. N connectors, Crimp tool, weatherproof tape)
12813060-000-0	Crimp Kit for 9913 (10 ea. N connectors, Crimp tool, weatherproof tape)
12813080-000-0	Crimp Kit for LMR-400 or equivalent (10 ea. N connectors, Crimp tool, weatherproof tape)

Table 7.4-3: Antenna Cable Specifications

Cable Type	Measured Loss (@1.575 GHz dB per foot)	DC Resistance (ohms per foot)	Type Center Conductor	Flammability
RG213/U (Beldon 8267)	0.093 dB	0.0030ohms	Stranded 13 AWG	U/L CSA
UHF/VHF (Beldon 9913)	0.058 dB	0.0027 ohms	Solid 10 AWG	
UHF/VHF (Beldon 89913)	0.089 dB	0.0027 ohms	Solid 10 AWG	Plenum U/L CSA
LMR-400	0.051 dB	Shield - .00165 ohms Center - .00139 ohms	.109 inch Solid	

7.5 Accessories

Table 7.5-1 lists installation accessories, such as optional rack mounting ears and filler panels, for non-used module slots.

Table 7.5-1: PRR-10 Accessories, Installation

ITEM NUMBER	DESCRIPTION
00412900-001-1	Bracket, rack ear 23″ (2 ea required)
10912888-000-0	Panel Assy, 6U X 13HP Filler
10912888-001-0	Panel Assy, 3U X 6.5HP Filler

Table 7.5-2 lists cable assemblies for connecting the expansion shelves to the Main Shelf and serial communications port cable for crafts person.

Table 7.5-2: Accessories, PRR-10 Cables/Analog Output Panel

ITEM NUMBER	DESCRIPTION
551026-0030	Cable, 25 pair shielded, 50DP, 3.3 ft. (1 m)
551026-0034	Cable, 25 conductor shielded DB25P to DB25P, 2.5 ft. (0.67 m)
551026-0038	Cable, RS-232 shielded DB9P to DB9S, 5 ft. (1.5 m)
10912988-000-0	Analog output panel (1.75" and 19") 4 BNC outputs

Table 7.5-3 lists input and output connectivity accessories that may aid in installation of the PRR-10. However, these accessories are not recommended for installations that need to be EMC-compliant.

Table 7.5-3: Non-EMC Complient Connectivity Accessories

ITEM NUMBER	DESCRIPTION
799PE3020011 (see below)	Panel, WW Cross Connect, Dual 50 Terminals (Puleo)
12812911-000-0	Option, 14-Pin WW Adapter Kit
12812911-001-0	Option, 50-Pin WW Adapter Kit

Note Requires one 25 pair shielded cable, 50DP to 50DP for each 50 WW terminals; can be used for 20 PRR-10 outputs.

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