

PNT-62xx Series

Assured Position, Navigation, and Timing Reference

Users Guide

R000



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About this User Guide

This prefix explains how to use this User Guide and includes the following topics:

- “Purpose and scope” on page iv
- “Assumptions” on page iv
- “Related Information” on page iv
- “Conventions” on page iv
- “Safety and compliance information” on page vi
- “Technical assistance” on page vii

Purpose and scope

This manual is intended to help you use the capabilities of the PNT-62xx Assured Position, Navigation, and Timing Reference.

This manual includes task-based instructions that describe how to configure, use, and troubleshoot the test capabilities available on your instrument assuming it is configured and optioned to support the capabilities.

Assumptions

This manual is intended for novice, intermediate, and experienced users who want to use their instrument effectively and efficiently. We are assuming that you have basic computer experience and are familiar with basic telecommunication concepts, terminology, and safety.

Related Information

This manual is application-oriented and contains information about using these instruments to test service carried on each of the listed networks. It includes an overview of testing features, instructions for using the instruments to generate and transmit traffic over a circuit, and detailed test result descriptions. This manual also provides contact information for VIAVI's Technical Assistance Center (TAC).

Conventions

This manual uses conventions and symbols, as described in the following tables.

Table 1 Text formatting and other typographical conventions

Item(s)	Example(s)
Buttons, keys, or switches that you press or flip on a physical device.	Press the On button. – Press the Enter key. – Flip the Power switch to the on position.
Buttons, links, menus, menu options, tabs, or fields on a PC-based or Web-based user interface that you click, select, or type information into.	Click Start – Click File > Properties . – Click the Properties tab. – Type the name of the probe in the Probe Name field.
Directory names, file names, and code and output messages that appear in a command line interface or in some graphical user interfaces (GUIs).	<code>\$NANGT_DATA_DIR/results</code> (directory) – <code>test_products/users/defaultUser.xml</code> (file name) – <code>All results okay.</code> (output message)

Table 1 Text formatting and other typographical conventions (Continued)

Item(s)	Example(s)
Text you must type exactly as shown into a command line interface, text file, or a GUI text field.	<ul style="list-style-type: none"> Restart the applications on the server using the following command: <code>\$BASEDIR/startup/npio_init restart</code> Type: <code>a:\set.exe</code> in the dialog box.
References to guides, books, and other publications appear in <i>this typeface</i> .	Refer to <i>Newton's Telecom Dictionary</i> .
Command line option separators.	<code>platform [a b e]</code>
Optional arguments (text variables in code).	<code>login [platform name]</code>
Required arguments (text variables in code).	<code><password></code>

Table 2 Symbol conventions









	This symbol indicates a note that includes important supplemental information or tips related to the main text.
	This symbol represents a general hazard. It may be associated with either a DANGER, WARNING, CAUTION, or ALERT message. See Table 3 for more information.
	This symbol represents an alert. It indicates that there is an action that must be performed in order to protect equipment and data or to avoid software damage and service interruption.
	This symbol represents hazardous voltages. It may be associated with either a DANGER, WARNING, CAUTION, or ALERT message. See Table 3 for more information.
	This symbol represents a risk of explosion. It may be associated with either a DANGER, WARNING, CAUTION or ALERT message. See Table 3 for more information.
	This symbol represents a risk of a hot surface. It may be associated with either a DANGER, WARNING, CAUTION, or ALERT message. See Table 3 for more information.
	This symbol represents a risk associated with fiber optic lasers. It may be associated with either a DANGER, WARNING, CAUTION or ALERT message. See Table 3 for more information.
	This symbol, located on the equipment, battery, or the packaging indicates that the equipment or battery must not be disposed of in a land-fill site or as municipal waste, and should be disposed of according to your national regulations.

Table 3 Safety definitions

Term	Definition
DANGER	Indicates a potentially hazardous situation that, if not avoided, <i>will</i> result in death or serious injury. It may be associated with either a general hazard, high voltage, or other symbol. See Table 2 for more information.
WARNING	Indicates a potentially hazardous situation that, if not avoided, <i>could</i> result in death or serious injury. It may be associated with either a general hazard, high voltage, or other symbol. See Table 2 for more information.
CAUTION	<p>Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury and/or damage to equipment.</p> <p>It may be associated with either a general hazard, high voltage, or risk of explosion symbol. See Table 2 for more information.</p> <p>When applied to software actions, indicates a situation that, if not avoided, could result in loss of data or a disruption of software operation.</p>
ALERT	Indicates that there is an action that must be performed in order to protect equipment and data or to avoid software damage and service interruption.

Safety and compliance information

The following sections describe the safety and compliance information for the PNT-62xx.

California Proposition 65

California Proposition 65, officially known as the Safe Drinking Water and Toxic Enforcement Act of 1986, was enacted in November 1986 with the aim of protecting individuals in the state of California and the state's drinking water and environment from excessive exposure to chemicals known to the state to cause cancer, birth defects or other reproductive harm.

For the VIAVI position statement on the use of Proposition 65 chemicals in VIAVI products, see the Hazardous Substance Control section of the VIAVI Policies & Standards web page.

Federal Communications Commission (FCC)

The equipment was tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

The authority to operate this equipment is conditioned by the requirements that no modifications be made to the equipment unless the changes or modifications are expressly approved by VIAVI.

Product Environmental Compliance

VIAVI is committed to compliance with all applicable laws and regulations controlling the use of hazardous substances in its products, as well as the disposal of equipment (including batteries) and waste packaging. For details, see the VIAVI Policies & Standards web page or contact the VIAVI WEEE Program Management team at Global.WEEE@ViaviSolutions.com.

EU REACH

Article 33 of EU REACH regulation (EC) No 1907/2006 requires product suppliers to provide information when a substance included in the list of Substances of Very High Concern (SVHC) is present in an product above a certain threshold.

For information about the presence of REACH SVHC in VIAVI products, see the Hazardous Substance Control section of the VIAVI Policies & Standards web page.

Additional standards compliance

The equipment meets the following standards and requirements:

- Installation Category (Over Voltage Category) II under IEC 60664-1
- Pollution Degree 2 Category under IEC 62368-1 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

Technical assistance

If you require technical assistance, call 1-844-GO-VIAVI. For the latest TAC information, go to <https://support.viavisolutions.com>.



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Introduction

This chapter discusses the following topics:

- [“About the PNT-62xx” on page 2](#)
- [“Applications” on page 2](#)
- [“Equipment included with the PNT-62xx Series” on page 2](#)

About the PNT-62xx

The PNT-62xx Series combines concurrent L1, L2, L3, and L5 GNSS reception with a secure STL (LEO-based) timing receiver, terrestrial receivers, and full PTP/IEEE-1588 Edge-Grandmaster (EGM) and PTP/IEEE-1588-slave capability.

Figure 1 shows the PNT-62xx.

Figure 1 PNT-62xx Series Assured Position, Navigation, and Timing Reference



Applications

- Critical Infrastructure applications in response to the directives of the recent Presidential Executive Order 13905
- Timing reference for 5G equipment
- Enhanced Primary Reference Time Clock (ePRTC) referencing
- High-performance disciplined referencing, supporting PTP/IEEE-1588, LEO-based Satellite Time and Location (STL), RF distribution, and multi-frequency GNSS capability

Variants

Table 1 describes the PNT-62xx Series variants.

Table 1 PNT-62xx Series variants

Part Number	Model	Description
200288	PNT-6230	PNT-6230S DOCXO STL MOS GNSS Transcoder

Equipment included with the PNT-62xx Series

The PNT-62xx includes the following:

- Mini-USB cable
- 12V Power Supply
 - The unit supports a second power supply, sold separately
- SMA-to-SMA adapter

Optional accessories

The following optional accessories are available for the PNT-62xx:

- 55-80861 – PNT-62xx 1U Rackmount Kit
- 22168426 – PNT-62xx Antenna Kit

Customer-provided equipment

The following equipment is needed to install the PNT-62xx:

- Windows PC (required to support firmware upgrades and monitoring/control)
- Frequency/time measurement equipment as required for evaluation
- Cat-5 Ethernet cable(s) for access to console and/or PTP interface
- 50-ohm BNC interface cables for time/frequency signals (if measuring time/frequency outputs, or supplying time/frequency reference inputs)
- Backup power Uninterruptible Power Supply (UPS) for 120VAC modules

Powering the unit

Power is supplied to the instrument by the 12V power supply. Use of power adapters other than those supplied with your PNT-62xx is not recommended. [Figure 2](#) shows the power supply label.

Figure 2 12V power supply



Specifications

Table 2 describes the specifications.

Table 2 Technical specifications

Parameter	Specification
Module	
1 PPS Stability	< 5ns rms GPS locked, <65ns rms STL LEO locked
Holdover Performance over 24 hours (at 25°C, no airflow, no motion)	After 7 days with GNSS reference: <250ns (Rubidium), <2us DOCXO
RF Distribution (GPS Transcoder) GPS L1 RF output option	Generates GPS L1 C/A RF output signal to retrofit GPS equipment
NMEA Messages	USB and RS-232 connectors, GGA, RMC, ZDA, GSV, PASHR, GSA
GNSS Receiver	Multi-Frequency: L1, L2, L3, L5 GPS/ Glonass/Galileo/BeiDou/QZSS/SBAS
STL LEO Receiver	Custom-designed Low Earth Orbit STL receiver

Table 2 Technical specifications

Parameter	Specification
GPS Sensitivity	Acquisition –148 dBm, Tracking -167 dBm
GNSS TTFF	Cold Start - <29 sec, Warm Start – <2 sec, Hot Start - <2 sec
STL Sensitivity	-100dBm tracking
Supply Voltage (Vdd)	Single or Dual Redundant +12V DC inputs
Power Consumption	<10W (DOCXO variant)
Operating Temperature	-25°C to +75°C, forced air environment
Storage Temperature	-45°C to +95°C
External Reference input options (e.g. 5071A Cesium Beam Clock)	10MHz Sine Wave (0dBm to +15dBm), 1PPS CMOS options
Auto Switchover between external UTC references	GNSS (four frequencies), STL/LEO, PTP/IEEE1588, 10MHz, 1PPS
10MHz output	2x +13dBm 10MHz Sine Wave, Low Phase Noise and ADEV
1PPS Outputs	2x CMOS 3.3V 1PPS (5V option), 50 Ohms coax (>1K Ohms termination)
Oscillator	
Frequency Output	10MHz from TCXO, DOCXO, CSAC, or Rubidium oscillator options
10MHz Accuracy	<±0.2E-010 after 20 minutes with GNSS
Frequency Stability of Oscillator over Temperature (in Holdover)	-10°C to +75°C: ±0.2E-09 DOCXO option, ±5E-011 Rubidium option
Output spurs	<-110dBc/Hz
Connections	
RF Antenna (one for STL, one for GNSS)	SMA
10MHz in/out, 1PPS in/out, TTL status	SMA
PTP/IEEE1588 Grandmaster/Slave option	32x to 256x PTP clients, RJ-45 for PTP and configuration console
In situ firmware updates	Fully field upgradeable through USB or RS-232 serial ports

PNT-62xx Series connections and indicators

Table 3 describes the PNT-62xx connections.

Table 3 Connections

Connector	Description
GNSS	SMA from a GNSS antenna, supplies 3.3VDC bias
ALT	SMA from an antenna supporting STL frequency, supplies 3.0VDC bias
1PPS IN	SMA from a 1PPS reference source
10 MHz IN	SMA from a 10MHz reference source
LOCK OK	SMA
1PPS	SMA timing output (x2)
10 MHz	SMA frequency output (x2)
RF OUT	SMA provides transcoder output, i.e. simulated GPS derived from STL input
RS-232	9-pin DSUB console interface
USB	Mini USB console interface
RJ-45	Ethernet console interface
PTP	RJ-45
A/12VDC	Power input A
B/12VDC	Power input B

Table 4 describes the LED indicators.

Table 4 LED indicators

LED	Description
POWER	<ul style="list-style-type: none">Green (solid): Power supplies connected and within specificationsGreen (slow blinking): Only one power supply is providing power to the PNT-62xx Series
1PPS OK	PNT-62xx Series has received a 1PPS pulse from the selected UTC reference.
SYNC	PNT-62xx Series is locked to the UTC reference and no events are flagged.
ALARM	<ul style="list-style-type: none">Red (solid): Event or alarm condition presentRed (fast blinking): Event or alarm condition present for 20 minutes or longer
PTP/1588 RJ-45	Standard connection and activity.

Installation

The following topics are discussed in this chapter:

- [“Overview” on page 8](#)
- [“Pre-installation” on page 8](#)
- [“Installation” on page 8](#)

Overview

The following sections describe how to install the PNT-62xx.

Pre-installation

Perform the following steps before installing the receiver.

- 1 Determine STL antenna location.



NOTE

For indoor installations, locate the antenna near, or as close as possible, or within sight of a window, skylight, or outside wall.

- 2 Determine the STL receiver location and whether the rack mount kit is needed.
- 3 Install the RF antenna cable from the antenna location to the receiver location: 50 Ohm cable with less than 10 dB loss at 1626 MHz, SMA-M connectors both ends.
The typical cable loss for 100 ft @ 1626 MHz:
 - LMR 400 6.0 dB (preferred)
 - LMR 240 11.4 dB (preferred)
 - RG214 .7 dB (preferred)
 - LMR 200 15 dB (short cables only)



NOTE

LMR 400 and similar “stiff” cables usually require a flexible RF tail extension to not over stress the SMA connection.

- 4 Have the client GNSS receiver available at the site (Nokia FYGM, Ericsson GPS 01/03, etc.)
- 5 Have an Uninterrupted Power Supply (UPS) available for the STL receiver.
- 6 Have a laptop ready for the integration verification (optional, but recommended.)

Installation

The following procedures describe how to install the PNT-62xx.

Mounting the receiver

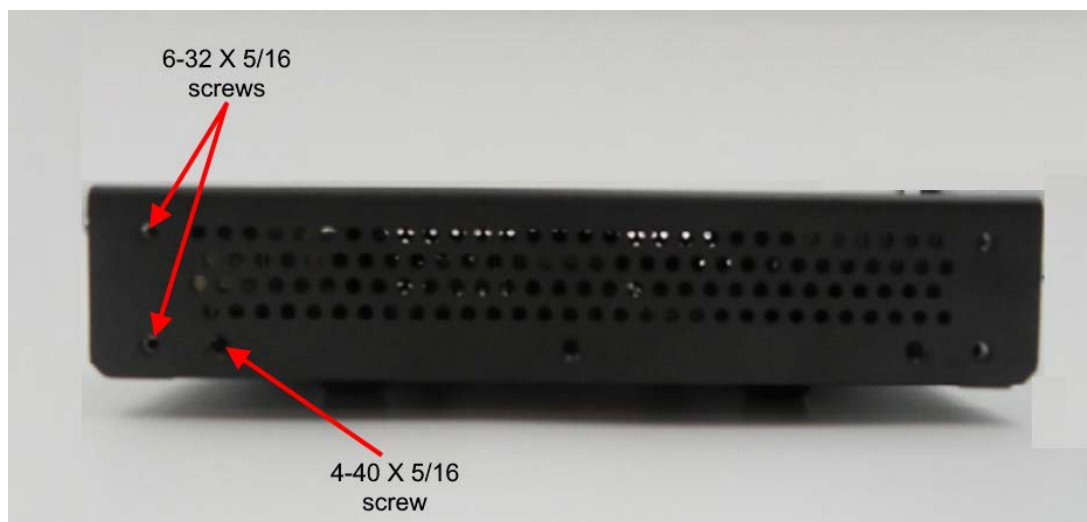
- 1 Ensure the receiver is not connected to a power source.
- 2 Using the screws and washers included, attach the two 1427B handles on the JL-PNT 622X-1U-LB and JL-PNT 622X-1U-RB brackets. Ensure that the handles are placed on the connector side of the PNT-62xx, as shown in [Figure 3](#).

Figure 3 Handle placement



- 3 Attach the brackets using the included 6-32 X 5/16 and 4-40 X 5/16 screws, as shown in [Figure 4](#).

Figure 4 Bracket screw locations



- 4 Mount the receiver in the desired location.

Connecting the receiver

- 1 Connect the antenna cable to the STL receiver **ALT** connector using the 47 meter SMA cable.
- 2 Connect **RF OUT** to the GNSS receiver input.
- 3 Connect DC Power by connecting provided 12VDC AC/DC power supplies to the UPS (not provided.)
- 4 Verify the receiver powers up. The POWER LED illuminates. After about 10 minutes, the receiver is warmed up and the red ALARM LED illuminates and stays lit until the receiver is locked and ready to use.

- 5 Verify STL signal reception. The 1 PPS OK LED blinks every second while the STL signal is locked. After about 10 to 20 minutes, the SYNC LED and transcoder output turn on. Use the GPSCon utility to verify good burst reception (BPMP AVG of at least 10.)



NOTE

For some deep indoor locations, the receiver may take an hour or more to achieve initial lock, and the SYNC and ALARM LEDs may go off/on periodically during the first 25 hours while the OCXP performance is optimized.

- 6 Power cycle the GNSS receiver. The GNSS receiver should quickly lock to the transcoder signal (<3 minutes), but may require an additional 12.5 minutes to load the almanac before all alarms clear.
- 7 Verify the system alarms clear.

GPSCon Utility

The following topics are discussed in this chapter:

- [“Description” on page 12](#)
- [“Installation” on page 12](#)
- [“Using GPSCon” on page 12](#)
- [“Interpreting the Data” on page 18](#)

Description

GPSCon – Jackson Labs Edition is a free program for the monitoring and control of Jackson Labs Technologies, Inc, GPSDO, Simulator, and Receiver products. It communicates with the receiver using the SCPI command set. This free version of the GPSCon utility is only compatible with Jackson Labs products, and is available for download from the support section of the Jackson Labs website:

<http://www.jackson-labs.com/index.php/support>

Installation

Extract the contents of the ZIP file downloaded from the Jackson Labs website and execute the MSI installer. Follow the on-screen instructions to complete the installation of GPSCon.

Using GPSCon

The GPSCon utility has a help file that should be consulted in order to get the full functionality of this utility. Only a few of the features and commands are mentioned in this appendix for convenience.

Setting options


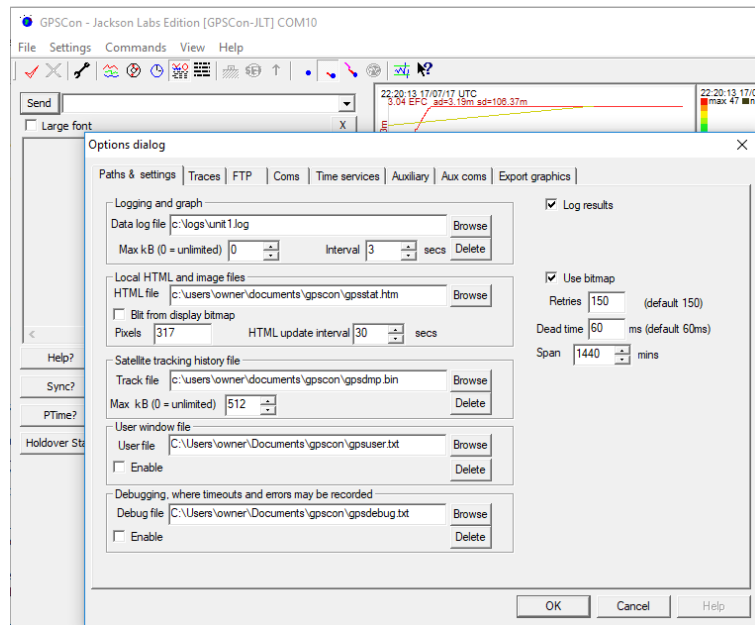
To set up the options for your GPSCon session, press the wrench icon  under the menu bar, or select Settings / Options on the menu. The window shown in [Figure 5](#) will appear. You can select from the tabs which options you wish to set.

Figure 5 Options window



Communication parameters


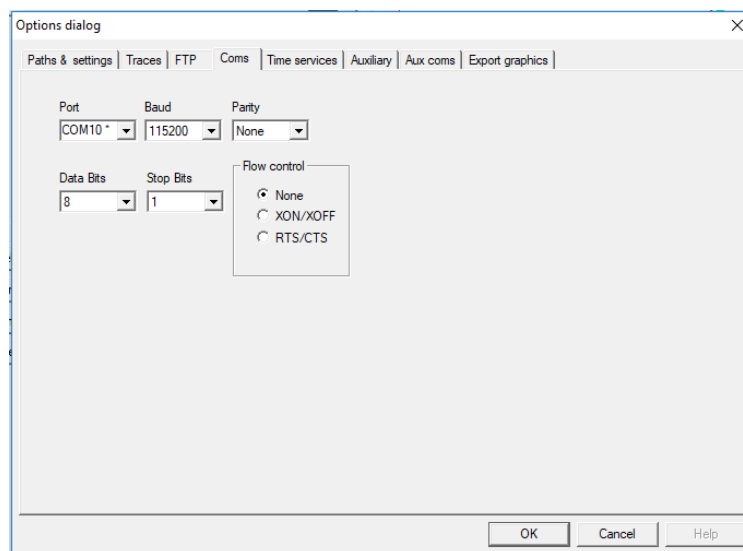
Before you can use GPSCon, you must set the communication parameters for your system. Open the dialog box by pressing the wrench icon , then select the **Coms** tab. The Options window opens on the Coms tab, as shown in [Figure 6](#).

Figure 6 Coms parameters tab



Available COM ports for your particular computer are indicated with a “*” symbol next to the COM port number in the drop-down menu. You can only select COM ports with this adjacent symbol. Select the correct COM port for your computer’s serial port connection and set the baud rate to 115200, parity to None, Data Bits to 8 and Stop Bits to 1. Set Flow Control to “None”. Once you have configured the communication parameters, press the “OK” button to close the window.

Auxiliary parameters


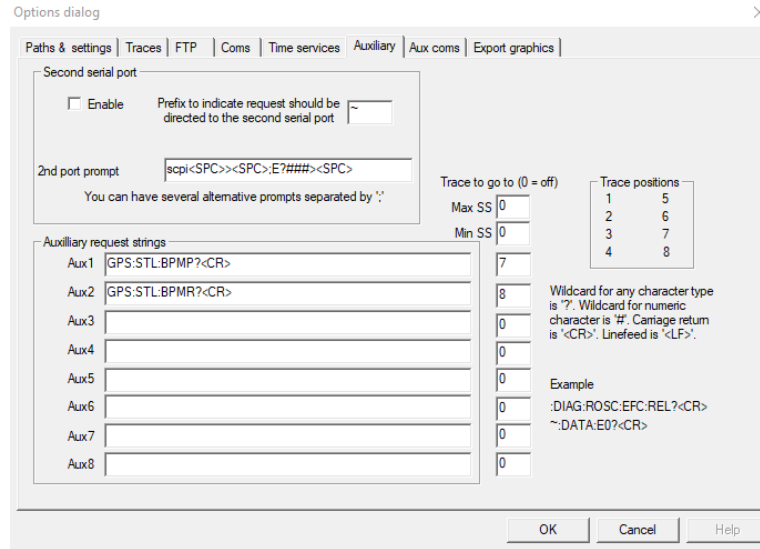
After pressing the wrench icon , you can select the **Auxiliary** tab to configure auxiliary measurements. [Figure 7](#) shows an example of an auxiliary measurement.

Figure 7 Auxiliary parameters tab



In the above example, the **Aux1** request string has been set to `GPS:STL:BPMP?<CR>` and the **Aux2** request string has been set to `GPS:STL:BPMP?<CR>`. The **Trace to go to** is set to trace positions 7 and 8 respectively. See the **Trace Position** diagram for the arrangement of the trace positions in the trace window. In this example, the bursts process and received obtained from the `GPS:STL:BPMP?` and `GPS:STL:BPMP?` queries will be plotted in trace position 7 and 8.

Traces parameters


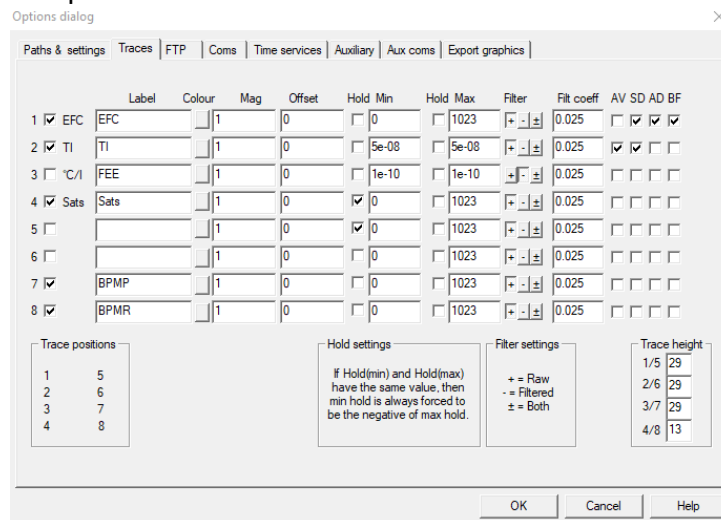
After pressing the wrench icon , you can select the **Traces** tab and configure the trace labels and vertical plot ranges. [Figure 8](#) shows an example of the trace parameter tab.

Figure 8 Traces parameters tab

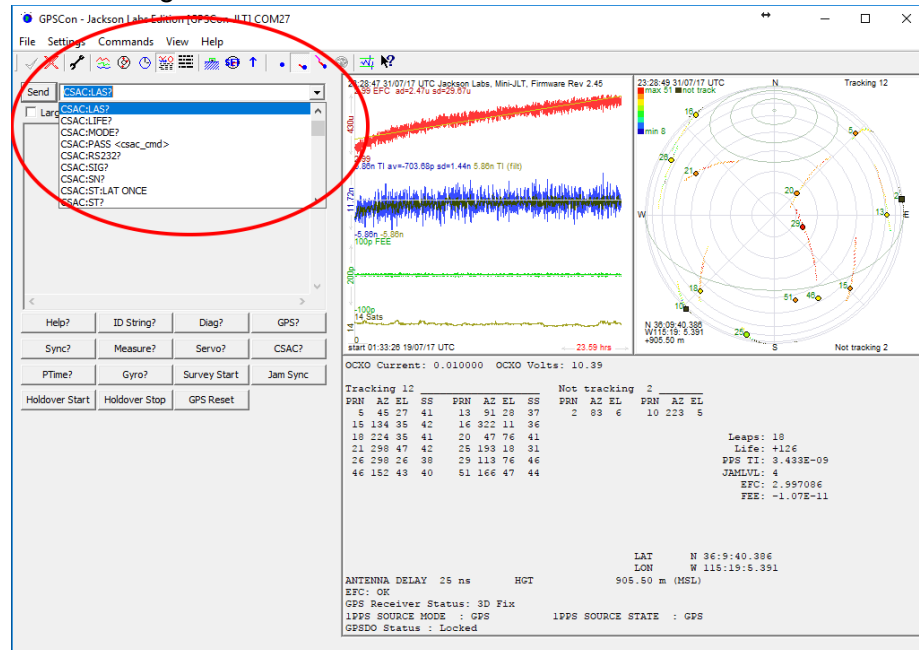


The labels and parameters are completed by default for traces 1 through 5. Any of the eight traces can be replaced by auxiliary traces as described in “Auxiliary parameters” on page 14. Press the **Help** button for a full description of each option in the Traces tab.

Sending manual commands to the receiver

You can send SCPI commands manually by using the drop-down box in the upper left of the main window, as shown in Figure 9.

Figure 9 Sending manual commands



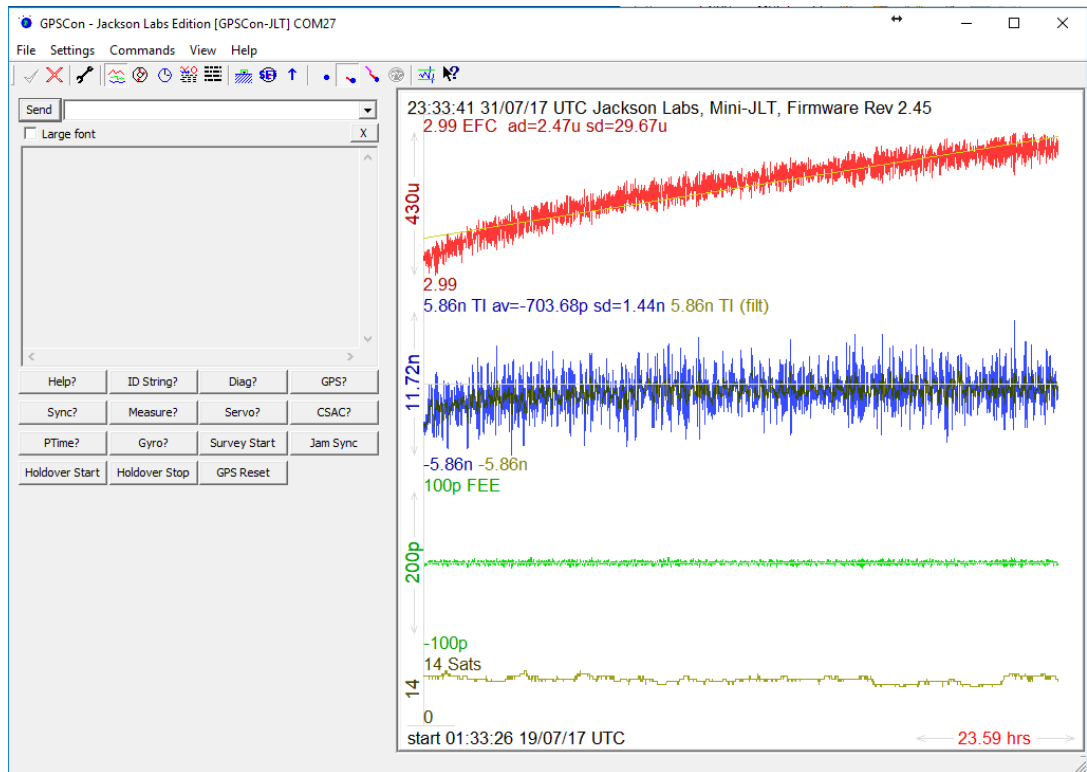
Once a command is selected, press **Send** to send it to the PNT-62xx. You can also send common commands by clicking on the buttons below the message window. Hover over the buttons to see the exact command that is sent.

NOTE
Ensure the selected command is supported by the PNT-62xx.

Using the mouse in the Graph display

Figure 10 shows the Graph display. The default view in GPSCon is **All**, which you can select with the **View/All** menu option. To see a larger view of the graph, select the **View/Graph** menu option.

Figure 10 Graph display



You can set the horizontal range of the graph using the mouse. Perform the following steps to set the horizontal range.

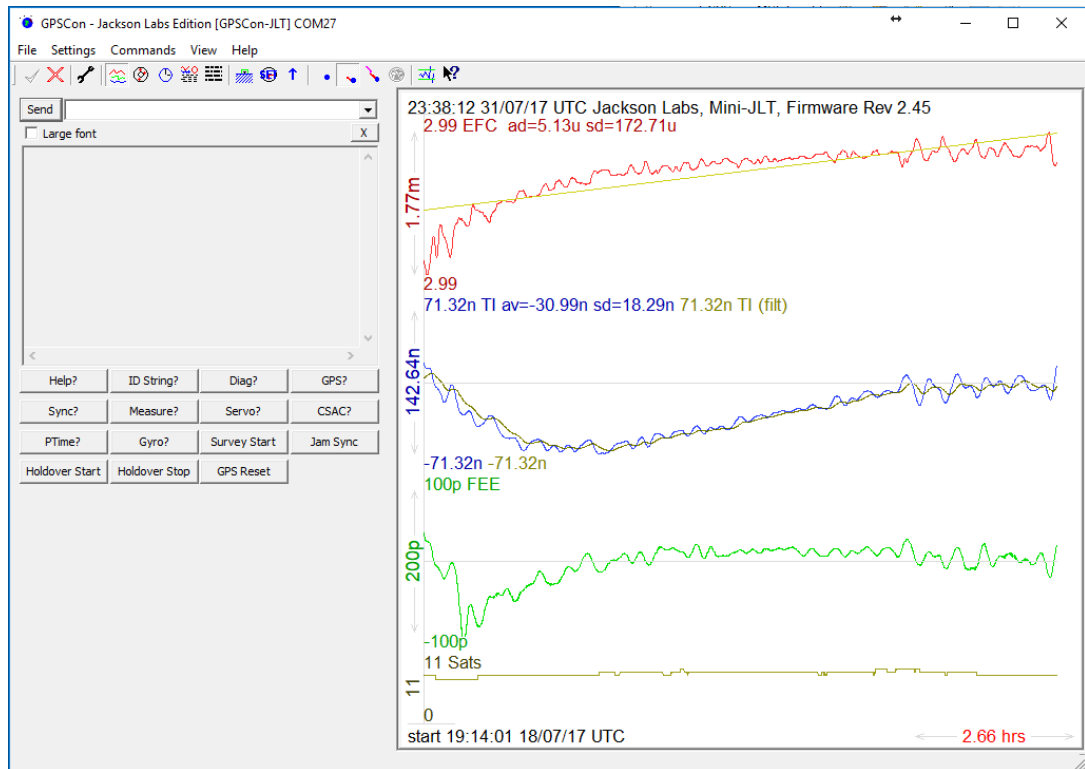
- 1 Set the start time by clicking on the point that marks the left side of the curve to be magnified.
- 2 Set the stop time by right-clicking on the point that marks the right most portion of the magnified curve.

NOTE
The Set and Stop times can be removed by double-clicking anywhere on the graph.

- 3 Return to the "Fit to window" view by double left-clicking on the curve.

Figure 11 shows the extended graph display.

Figure 11 Expanded graph display



When you have locked the start and stop time using the mouse, you can scroll left or right through the data:

- To scroll to a later time, use Shift + Left click
- To scroll to an earlier time, use Shift + Right click

Exporting graphics

The settings which control the export function are contained in the “Export graphics” tab in the Options dialog.

Export allows you to create an image file of the graph and/or the satellite trails map. You can select which you want by specifying a file for the Graph path and/or Map path. If you export the graph, you have the option to export only that which is currently visible, or to export the graph which is a plot of the entire logfile contents. Use the checkbox “Export all graph data” to make this choice.

You may select a size of the exported images in X and Y. The file format may be .BMP, .JPG, .GIF, or .PNG. Your settings will be stored and will be the default next time you open this dialog.

If you choose to export the graph, you can override the TI max setting in force on the screen display by entering a non-zero value into the 'Override TI' control. A value of zero causes the export to take the same setting if any as the screen display.

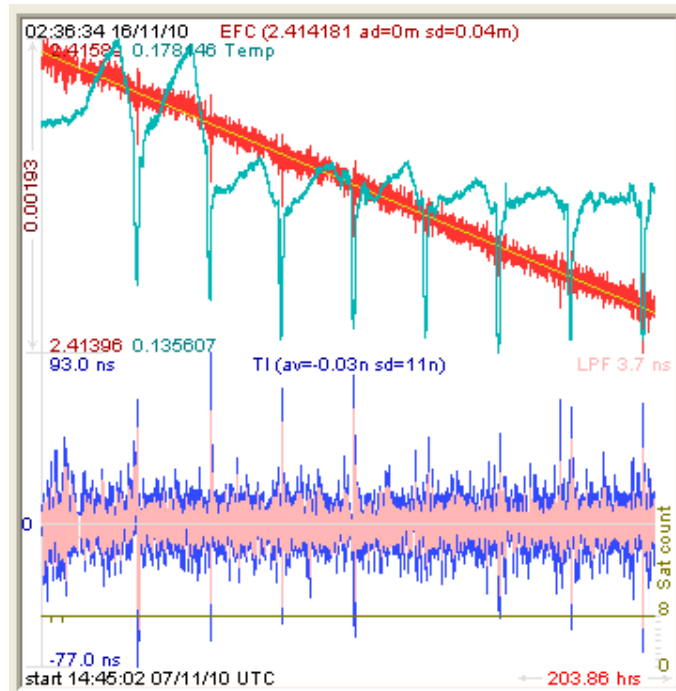
- To export automatically on a timed basis, enter a non-zero value in seconds to choose an export time interval.

- To manually export in accordance with the settings, press the 'Export' button.

Interpreting the Data

Figure shows an example of data acquired by a GPSDO unit over a period of time of more than 200 hours.

Figure 12 Captured data example



The red trace is EFC (crystal frequency control voltage). The crystal is aging (becoming faster in frequency over time). This requires the control voltage to be lowered to maintain precisely 10.0 MHz. A drift of ~2 mV is visible over 200 hours. On the left side of the screen, the EFC range over this 200 hour plot is displayed vertically as 0.00193 V. This means the drift of the EFC voltage due to aging is ~88 mV per year. The EFC sensitivity of the crystal is about 8 Hz per volt, so the crystal ages at:

$$8\text{Hz/V} * 0.088\text{V/Year} = 0.704\text{Hz/Year drift.}$$

At 10 MHz:

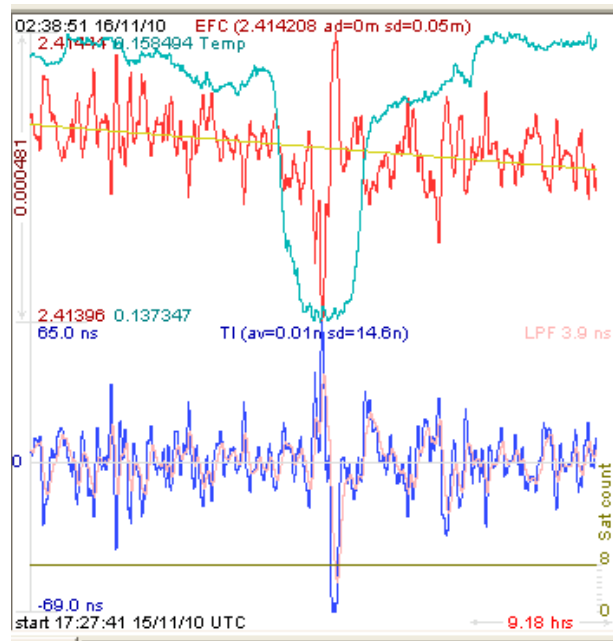
$$0.704\text{Hz} / 10\text{MHz} = 7.04\text{E-}08 \text{ aging rate per year}$$

This is the same as 0.2ppb drift due to aging per day. This crystal aging is fully compensated by the firmware with and without GPS reception of course.

The board temperature is shown in tortoise. We can see it ranges from 0.135607A to 0.178146A. The OCXO current jumps lower every 24 hours because the unit is sitting next to a window, and the sun shines onto the OCXO in the evenings, heating it up, and thus making the unit use lower power during that event.

Figure 13 shows a zoom of the captured data.

Figure 13 Zoomed captured data example



The image shows a phase offset error of the internal OCXO to the UTC GPS reference. The maximum drift is -77 ns to +93 ns. The average is ($TI_{av} = -0.03$ ns). The standard deviation over the 200 hour plot is $sd = 11$ ns. This means the average error of the 10 MHz phase of this unit over 200 hours is only +/- -11 ns. Or, in other words, the average jitter (wander) over 200 hours is:

$$11\text{ns} / 200\text{Hrs} = 1.528\text{E-}014$$

The unit performs as well as a high quality Cesium Atomic reference clock over long periods of time. The unit disciplines its internal 10MHz reference to within less than +/- 80ns peak to peak of UTC at all times, which is less than one complete clock cycle at 10MHz.

SCPI Commands

The following topics are discussed in this chapter:

- “Introduction” on page 22
- “General SCPI commands” on page 22
- “GPS Subsystem” on page 23
- “PTP SUBSYSTEM” on page 53
- “PTIME Subsystem” on page 59
- “SYNChronization Subsystem” on page 62
- “DIAGnostic Subsystem” on page 70
- “CSAC Subsystem” on page 71
- “RFOUTput Subsystem” on page 77
- “MEASURE Subsystem” on page 79
- “System subsystem” on page 80
- “SYSTEM:COMMunicate:SERial:ECHO <ON|OFF>” on page 81
- “SERVO Subsystem” on page 87

Introduction

The Standard Commands for Programmable Instrumentation (SCPI) subsystem is accessed using a mini-USB or RS-232 serial cable and a terminal program. By default, the terminal settings are 115200, 8N1, no flow-control.

A number of commands that can be used are listed below. To get a listing of the available commands, send the `HELP?` query. This will return a list of all the available commands for the PNT-62xx. Additional information regarding the SCPI protocol syntax can be found here:

<http://www.ivifoundation.org/scpi/>

A basic familiarity with the SCPI protocol is recommended when reading this chapter.



NOTE

The symbols '<', '>', '[', ']', '|', and ',' in the parameter field listed in some commands in this chapter are used for ranging or separating ONLY. Do not include these symbols when sending the SCPI commands to avoid Command Error response.



NOTE

All lower-case letters in SCPI commands throughout this manual are optional. The abbreviated version of the SCPI commands such as `SYST:STAT?` and `SYNC?` will also work.

General SCPI commands

The following sections describe the general SCPI commands.

Quick Start commands

For a quick start, try the following SCPI serial port commands:

- `HELP?`
- `SYSTEM:STATUS?`
- `GPS?`
- `SYNChronization?`
- `MEASure?`
- `DIAGnostic?`

*IDN?

Outputs an identifying string. The response shows the following information:

`<company name>, <model number>, <firmware revision>`

For example:

```
Jackson Labs, PNT-6220, Firmware Rev 0.71
```

HELP?

Returns a list of available commands.

GPS Subsystem



NOTE

The PNT-62xx displays antenna height in MSL Meters rather than in GPS Meters on all commands that return antenna height (unless otherwise specified). The NMEA position fixes are in the WGS84 coordinate system, while the X, Y, and Z positions and velocity vectors are given in the ECEF coordinate system.

The GPS subsystem regroups all the commands related to the control and status of the GNSS or STL receiver. The following commands are supported:

- GPS?
- GPS:RESET ONCE
- GPS:REfERENCE:ADELay <float> <s | ns > [-32767ns,32767ns]
- GPS:REfERENCE:PULse:SAWtooth?
- GPS:TMODe <ON|OFF|RSTSURV>
- GPS:SURVey ONCE
- GPS:SURVEY:STATUS?
- GPS:SURVey:DURation <sec>
- GPS:SURVey:VARIANCE <mm^2>
- GPS:HOLD:POSition <cm, cm, cm>
- GPS:DYNAMic:MODE <int> [0,8]
- GPS:DYNAMic:MODE?
- GPS:DYNAMic:MODE 8 (Automatic Dynamic Mode)
- GPS:DYNAMic:STATe?
- GPS:GPRMC <int> [0,255]
- GPS:GPGGA <int> [0,255]
- GPS:GGASat <int> [0,255]
- GPS:GPGLL <int> [0,255]
- GPS:PJLTS <int> [0,255]
- GPS:PJLTV <int> [0,255]
- GPS:XYZSPeed <int> [0,255]
- GPS:GPZDA <int> [0,255]

- GPS:PASHR <int> [0,255]
- GPS:GPGSA <int> [0,255]
- GPS:GPGSV <int> [0,255]
- GPS:SATellite:TRAcking:COUNT?
- GPS:SATellite:VISible:COUNT?
- GPS:JAMlevel?
- GPS:FWver?
- GPS:INITial:DATE <yyyy,mm,dd>
- GPS:INITial:TIME <hour,min,sec>
- GPS:SYSTem:SElect [GPS | SBAS | QZSS | GAL | BD ^ GLO]
- GPS:SYSTem:LBAND [L1 | L2 | L3 | L5 | ALL]
- GPS:SYSTem:BANDTRAck [L1 | L2 | L3 | L5 | ALL]
- GPS:SYSTem:TIMESOURce <GPS|GAL|BD|AUTO>
- GPS:SYSTem:TIMESOURce:STATE?
- GPS:HEALth:IGNOre <ON|OFF>
- GPS:RTC:DATE <yyyy,mm,dd>
- GPS:RTC:TIME <hour,min,sec>
- GPS:HEIGHT?
- GPS:HEIGHT:MSL?
- GPS:HEIGHT:GPS?
- GPS:POLarity <LOW|HIGH>
- GPS:POSition?
- GPS:POSition:ECEF?
- GPS:CNOthres <int> [1,40]
- GPS:FOV <int> [3,85]
- GPS:STATus?
- GPS:STATus:STRing?
- GPS:PASSthru <GNSS|RSRSCPI|STL|TOD|CSAC|RSRGPS|MCE|RSRDEBUG>
- GPS:PASSthru:TIMEout <ON|OFF>
- GPS:PASSthru:COUNT <int> <s> [1,86400]
- GPS:TYPE?
- GPS:TYPE:MODE <AUTO|UBLOX|SEPTentrio|STL>
- GPS:SOURce:SElect <AUTO|STL|GNSS>
- GPS:FILTer:SElect <STL|UBX>
- GPS:FILTer:NMEA <int> [0,255]
- GPS:GNSS:MODE <ON|OFF>
- GPS:GNSS:RESET ONCE
- GPS:GNSS:POWer <ON|OFF>
- GPS:GNSS:FWver?
- GPS:GNSS:TYPE?

- GPS:STL:RESET <ONCE | WARMUP|HOLD|OFF>
- GPS:STL:RESET:AUTO <int> [0,604800]
- GPS:STL:SCPI <ASCII> <command>
- GPS:STL:ISP ON
- GPS:STL:BPMProcessed?
- GPS:STL:BPMPReceived?
- GPS:STL:PFOM?
- GPS:STL:TFOM?
- GPS:STL:EXTCLOCK <ON|OFF>
- GPS:STL:AGC <int> [500,2700]
- GPS:STL:CNO?
- GPS:STL:CNO:MINTHReshold <float> [1.0,100.0]
- GPS:STL:DOPpler:MINimum <double> [-36000.000000,0.0]
- GPS:STL:DOPpler:MAXimum <double> [0.0,36000.000000]
- GPS:STL:CLOCKmodel <double> [1E-20,1.0]
- GPS:STL:CLOCKmodel:FAST <double> [1E-20,1.0]
- GPS:STL:CLOCKmodel:MEDIUM <double> [1E-20,1.0]
- GPS:STL:SUBSCRIPTION?
- GPS:STL:SUBSCRIPTION:AUTHKEY <string>
- GPS:STL:SERVO:LOOP <ON|OFF>

GPS:SATellite

This group of commands describe the satellite constellation.

GPS:SATellite:TRACKING:COUNT?

This query returns the number of satellites being tracked for GNSS receiver only.

GPS:SATellite:VISIBLE:COUNT?

This query returns the number of satellites (PRN) that the almanac predicts should be visible, given date, time, and position for GNSS receiver only.

NMEA Support

The following NMEA commands allow the PNT-62xx GNSDO to be used as an industry standard navigation GNSS receiver. The GGA, GLL, RMC, GSA, GSV, ZDA and PASHR NMEA commands comprise all necessary information about the antenna position, height, velocity, direction, satellite info, fix info, time, date and other

information that can be used by standard navigation applications via the PNT-62xx serial interface. Not all standard NMEA messages such as GSA and GSV will be supported in STL receiver mode (`GPS:TYPE:MODE STL`).

The instrument will send out the enabled NMEA information on the serial transmit pins automatically every N seconds. The PNT-62xx will not send out NMEA messages if the 1PPS output is not yet enabled. See [“SYNChronization:OUTput:1PPS:RESET <ON|OFF>” on page 67](#) for descriptions of 1PPS generation and instructions to enable 1PPS output upon power on. All incoming serial commands are still recognized by PNT-62xx since the serial interface transmit and receive lines are completely independent and orthogonal of one another.


The GSV and GSA messages include the satellites being tracked or included in the GNSS solution and both messages use a modified satellite numbering scheme as detailed in [Table 5](#) that makes all satellite numbers unique. Also, to indicate the GNSS systems enabled and used to generate the NMEA data, the PNT-62xx GNSDO’s NMEA output includes a two character talker ID before the GGA, GLL, RMC, GSA, GSV, and ZDA sentence headers. [Table 5](#) shows the talker IDs for the supported GNSS systems.

If more than one GNSS system is enabled and GNSS receiver mode is selected, the talker ID of NMEA output is GN except for GSV sentence which outputs multiple sets of sentences for each main talker ID. The talker ID of NMEA output in STL receiver mode is GP. Refer to [“GPS:GPGSV <int> \[0,255\]” on page 29](#) for example GSV output format. Also, the GSV output uses a modified satellite numbering scheme as detailed in [Table 5](#) to allow all satellites in different GNSS systems to be differentiated.

Table 5 PRN numbering scheme for GNSS systems

GNSS Type	SV Range	GPGSV PRN vehicle numbering	Talker ID
GPS	G1-G32	1-32	GP
SBAS	S120-S158	33-64, 152-159	GP
Galileo	E1-E36	301-336	GA
BeiDou	B1-B37	401-437	GB
IMES	I1-I10	173-182	GP
QZSS	Q1-Q5	139-137	GP
GLOSNASS	R1-R32, R?	65-96, 0	GL

In addition to standard NMEA sentences, the PNT-62xx GNSDO also supports PJLTS and PJLTV Jackson Labs proprietary NMEA sentences, PASHR and a proprietary version of the GGA sentence (GGASTat) described in [“GPS:GGASTat <int> \[0,255\]” on page 27](#).

 **NOTE**
The position, direction, and speed data is delayed by one second from when the GNSS receiver internally reported these to the PNT-62xx microprocessor, so the position is valid for the 1PPS signal previous to the last 1PPS signal at the time the data is sent (one second delay.)

The time and date are properly output with correct UTC synchronization to the 1PPS signal immediately prior to the data being sent.

Once set, the following command settings will be stored in NV memory, and generate selected NMEA sentence output information even after power to the unit has been cycled.

GPS:GPGGA <int> [0,255]

This command instructs the PNT-62xx to send the NMEA standard GGA message every N seconds, with N in the interval [0,255]. The command is disabled until the GNSS receiver achieves a first fix.

This command has the following format:

```
GPS:GPGGA <int> [0,255]
```

This command will query the state of this command:

```
GPS:GPGGA?
```

The GPGGA string has the following data format:

```
$GPGGA,hhmmss.00,1111.1111,S/N,yyyyy.yyyy,W/  
E,f,ss,hh.h,aa.a,M,gg.g,M,,*[checksum]
```

The GGA output message header includes the talker ID for the currently enabled GNSS system(s) or STL receiver mode as described in [“NMEA Support” on page 25](#). The GGA message shows height in MSL Meters for GNSS receiver mode (GPS Meters for STL receiver mode), this is different from the STL receiver mode or traditional GPS receivers that display height in GPS Meters. The difference between MSL and GPS height can be significant, 35m or more are common.

GPS:GGASTat <int> [0,255]

This command instructs the PNT-62xx to send a modified version of the NMEA standard GGA message every N seconds, with N in the interval [0,255]. The command is disabled until the GNSS receiver achieves a first fix.

This command has the following format:

```
GPS:GGASTat <int> [0,255]
```

This command will query the state of this command:

```
GPS:GGASTat?
```

The GGASTat string has the following data format:

```
$GPGGA,hhmmss.00,1111.1111,S/N,yyyyy.yyyy,W/  
E,l,ss,hh.h,aa.a,M,gg.g,M,,*[checksum]
```

This command replaces the regular NMEA GGA validity flag with a decimal number indicating the lock-state of the unit. See “[SERVo:TRACe <int> \[0,255\]](#)” on page 94 for a detailed description of the lock state variable. The command allows capture of the position and other information available in the GGA command, as well as tracking the lock state and health of the unit’s OXO performance simultaneously.

The GGASat output message header includes the talker ID for the currently enabled GNSS system(s) or STL receiver mode as described in “[GPS:GGASat <int> \[0,255\]](#)” on page 27. GGASat output shows height in MSL Meters for GNSS receiver mode (GPS Meters for STL receiver mode), this is different from the STL receiver mode or traditional GPS receivers that display height in GPS Meters. The difference between MSL and GPS height can be significant, 35m or more are common.

GPS:GPGLL <int> [0,255]

This command instructs the PNT-62xx to send the NMEA standard GLL message every N seconds, with N in the interval [0,255]. The command is disabled until the GNSS receiver achieves a first fix.

This command has the following format:

```
GPS:GPGLL <int> [0,255]
```

This command will query the state of this command:

```
GPS:GPGLL?
```

The GPGLL string has the following data format:

```
$GPGLL,1111.1111,S/N,yyyyy.yyyy,W/  
E,hhmmss.00,s,m*[checksum]
```

The GLL output message header includes the talker ID for the currently enabled GNSS system(s) or STL receiver mode as described in “[NMEA Support](#)” on page 25.

GPS:GPRMC <int> [0,255]

This command instructs the PNT-62xx to send the NMEA standard RMC message every N seconds, with N in the interval [0,255]. The command is disabled until the GNSS receiver achieves a first fix.

This command has the following format:

```
GPS:GPRMC <int> [0,255]
```

This command will query the state of this command:

```
GPS:GPRMC?
```

The GPRMC string has the following data format:

```
$GPRMC,hhmmss.00,s,1111.1111,S/N,yyyyy.yyyy,W/  
E,k.k,d.d,ddmmyy,,m*[checksum]
```


With multiple GNSS systems enabled, a typical sky view may generate up to six GSV messages per second per talker ID.

GPS:XYZSPeed <int> [0,255]

This command is a 3D velocity vector output command. Enabling this command will output a 3 dimensional velocity vector indicating the unit's speed in centimeters per second in the ECEF coordinate system.

X, Y, and Z speed are individually given, and are independent of each other. An accuracy estimate in centimeters per second is also given. The velocity data is time-stamped using the time-of-week with a resolution of milliseconds.

Additionally, the number of accrued Leapseconds and GPS time of week is indicated in this message, which allows proper calculation of GPS time from UTC time as indicated by other messages, as well as proper handling of Leapsecond events.

Use the following format to generate the velocity vector every N seconds, with N in the interval [0,255]:

```
GPS:XYZSPeed <int> [0,255]
```

This command will query the state of this command:

```
GPS:XYZSPeed?
```

The XYZSP string has the following data format:

```
$XYZSP VX VY VZ ... Leapseconds: aaaaa bbbbb ccccc ddd  
eeeeeeee ff
```

where

- aaaaa is the velocity in the x direction (cm/s)
- bbbbb is the velocity in the y direction (cm/s)
- ccccc is the velocity in the z direction (cm/s)
- ddd is the speed accuracy estimate (cm/s)
- eeeeeeee is the GPS TOW in seconds
- ff is the current UTC leap second offset in seconds

GPS:GPZDA <int> [0,255]

This command instructs the PNT-62xx to send the NMEA standard ZDA message every N seconds, with N in the interval [0,255]. The command is disabled until the GNSS receiver achieves a first fix.

This command has the following format:

```
GPS:GPZDA <int> [0,255]
```

This command will query the state of this command:

GPS:GPZDA?

The GPZDA string has the following data format:

```
$GPZDA, hhmmss.00, dd, mm, yyyy, +00, 00* [checksum]
```

The ZDA output message header includes the talker ID for the currently enabled GNSS system or systems as described in [“NMEA Support” on page 25](#).

GPS:PASHR <int> [0,255]

The NMEA string \$PASHR,POS has been added for compatibility to legacy GPS hardware. The PASHR command alongside the GPZDA command will give all relevant parameters such as time, date, position, velocity, direction, altitude, quality of fix, and more. As an example, the String has the following data format:

```
$PASHR, POS, 0, 12, 191512.00, 3610.11157, N, 11518.89941, W, 00887.70, ?????, 000.00, 000.0 1, -00.00, 00.0, 00.8, 00.0, 00.0, 0.46*21
```



NOTE

The length of the string is fixed at 115 characters, plus the two binary 0x0d, 0x0a termination characters.

```
$PASHR, POS, 0, aa, bbbbbb.00, cccc.ccccc, d, eeeee.eeeee, f, ggggg.gg, hhhh, iii.ii, jjj.jj, kkkk.kk, ll.l, mm.m, nn.n, 00.0, p.pp* [checksum]
```

Where:

- aa: Number of Sats
- bbbbbb.00: Time of Day UTC
- cccc.ccccc, d: Latitude, S/N
- eeee.eeeee, f: Longitude, W/E
- ggggg.gg: Antenna Height in meters
- hhhh: Four fixed '?' symbols
- iii.ii: Course Over Ground
- jjj.jj: Speed in Knots
- kkkk.k: Vertical Velocity in meters/s
- ll.l: PDOP
- mm.m: HDOP
- nn.n: VDOP
- 00.0: Static number
- p.pp: Firmware Version

This command instructs the PNT-62xx to send the NMEA standard string \$PASHR every N seconds, with N in the interval [0,255]. The command is disabled until the GNSS receiver achieves a first fix.

This command has the following format:

```
GPS:PASHR <int> [0,255]
```

This command will query the state of this command:

```
GPS:PASHR?
```

GPS:PJLTS <int> [0,255]

This command instructs the PNT-62xx to send the proprietary NMEA string \$PJLTS every N seconds, with N in the interval [0,255]. This proprietary command includes information on the GNSDO lock, oscillator status, and other telemetry status. The following is an example of the PJLTS sentence:

```
$PJLTS,3.39,3.62,21341,6,2.4627123,82.0904,1.3E-12,0,12,0x0*52
```

This command has the following format:

```
GPS:PJLTS <int> [0,255]
```

This command will query the state of this command:

```
GPS:PJLTS?
```

The format of the \$PJLTS command is:

```
$PJLTS,aaa.aa,bbb.bb,ccc,d,e.eeeeeee,ff.ffff,g.gEhh,iii,jj,kkkk*[checksum]0x0d 0x0a
```

where

- `aaa.aa`: the filtered UTC offset in ns,
- `bbb.bb`: the raw UTC offset in ns from the time interval counter,
- `ccc`: the number of captured input 1PPS signals
- `d` is the lock status
- `e.eeeeeee` is the EFC voltage,
- `ff.ffff` is the EFC percentage (0% to 100%),
- `g.gEhh` is the estimated frequency accuracy (similar to 100s ADEV) in scientific notation,
- `iii` is the seconds in holdover,
- `jj` is the number of satellites tracked, and
- `kkkk` is the health status explained in the SYNC:HEALTH? query shown in [“SYNChronization:HEALTH?” on page 68](#).

GPS:DYNAMIC:MODE <int> [0,8]

This command allows the user to select the dynamic motion model being applied to the Kalman filters in the GNSS receiver ONLY. This allows for larger amounts of filtering for

lower velocity applications, effectively reducing noise and multipath interference. Applications with high acceleration can now be used with fast filter settings to allow for the most accurate GPS coordinates to be provided in high-dynamic applications such as Jet aircraft. Doppler tracking is enabled in all airborne modes, as Carrier Phase tracking is very difficult to achieve in high velocity applications. The GNSS receiver will perform Carrier Phase tracking for non-airborne modes.

The command has the following syntax:

```
GPS:DYNAMIC:MODE <int> [0,8]
```

Sending the following command to the PNT-62xx will select a stationary GNSS dynamic model, for example:

```
GPS:DYNAM:MODE 1
```

[Table 6](#) lists all available dynamic modes.

Table 6 Supported Dynamic GNSS operating modes

Value	Model	Application
0	Portable	Recommended as a default setting
1	Stationary	Used in stationary applications
2	Pedestrian	Used in man-pack, pedestrian settings
3	Automotive	Vehicular velocity applications
4	Sea	Used on ships, where altitude is expected to be constant
5	Airborne <1g	Airborne applications with less than 1g acceleration
6	Airborne <2g	Airborne applications with less than 2g acceleration
7	Airborne <4g	Airborne applications with less than 4g acceleration
8	Automatic Mode	Selects one of the above states (0-7) based on the actual velocity of the vehicle

The current dynamic state being applied to the GNSS receiver can be queried with the command `GPS:DYNAMIC:STATE?`.



NOTE

This command syntax has changed from previous products such as the FireFly-IIA GPSDO units, which did not support Position Hold Auto Survey modes.

GPS:DYNAMIC:MODE 8 (Automatic Dynamic Mode)

Automatic Dynamic Mode allows the PNT-62xx GNSDO firmware to automatically configure the GNSS receiver Kalman filter parameters based on actual mission velocities and motion profiles. The unit will try to set the GNSS receiver to the optimal setting for any given velocity. The unit is able to set 7 different modes, as shown in “GPS:DYNAMIC:MODE <int> [0,8]” on page 32.

Table 7 shows the Dynamic mode the unit will program into the GNSS receiver when Automatic Mode is selected (Dynamic Mode 8).

Table 7 Auto Dynamic Mode switching rules

Velocity Threshold	Selected Dynamic Model	Fallback to lower setting
0-2 knots	Stationary	none
>2 knots	Pedestrian	<1 knots
>10 knots	Automotive	<8 knots
>60 knots and >400 Feet/min climb/descent	Airborne 1g	<50 knots
>150 knots	Airborne 2g	<130 knots
>240 knots	Airborne 4g	<210 knots

In this Automatic mode, the unit will configure the GNSS receiver based on the actual vehicle-velocity.



NOTE

In order to switch from the Automotive mode into the first Airborne (1g) mode, both a vehicle velocity greater than 60 knots as well as a climb/descent rate greater than 400 feet per minute are required. Alternatively, a vehicle velocity of greater than 100 Knots will also initiate a switch into airborne-1g mode.

Without an appropriate climb/descent, the unit will remain in Automotive mode unless 100 knots of velocity are exceeded.

The following command returns the setting of the GNSS dynamic model:

```
GPS:DYNAMIC:MODE?
```

The actual state chosen by the firmware for the GNSS receiver based on vehicle velocity can be obtained with the command:

```
GPS:DYNAMIC:STATE?
```

A value between 0 and 7 is then returned depending on vehicle dynamics. Settings will be applied immediately to the GNSS receiver, and are stored in Non-Volatile memory.

GPS:DYNAMIC:STATE?

This query returns the actual state of the dynamic model, chosen by the firmware to be applied to the GNSS receiver depending on vehicle velocity. It returns a value between 0 and 7, which correspond to one of the dynamic models defined in [Table 6 on page 33](#).

This state can be different from the user-selected Dynamic model mode for two reasons:

- If the dynamic mode is set to 8 (Automatic mode), the state will reflect the dynamic model being applied to the GNSS receiver depending on actual vehicle dynamics
- If the GPS Timing Mode is set to ON or to RSTSURV, the dynamic state will always be set to 1 (Stationary)

GPS:REFerence:ADELay <float> <s | ns > [-32767ns,32767ns]

The ADELay command allows bi-directional shifting of the 1PPS output in relation to the UTC (USNO) 1PPS reference in one nanosecond steps for GNSS receiver ONLY. This allows antenna cable delay compensation, as well as retarding or advancing the 1PPS signal arbitrarily. Typical antenna delays for a 30 foot antenna cable with 1.5ns per foot propagation delay would be compensated with the following command:

```
GPS:REF:ADEL 45ns
```

This command can be used to fine-tune different units to have co-incident 1PPS signal outputs.



NOTE

During normal operation, the 1PPS signal may wander around the UTC 1PPS signal while the unit is tracking the GNSS signals. This present offset between the 1PPS output and the UTC 1PPS signal can be queried with the command `SYNC:TINT?`. This offset should be taken into account when calibrating the two units' 1PPS outputs to each other, as the lock algorithms will try to steer the OCXO for a 0.0ns offset to the UTC 1PPS time-pulse.

Change in this command will be effective after the next power cycle or after the `GPS:RESET ONCE` command is sent.

This command has the following format:

```
GPS:REFerence:ADELay [-32767,32767]
```

This command will query the state of this command:

```
GPS:REFerence:ADELay?
```

GPS:REFerence:PULse:SAWtooth?

This command returns the momentary sawtooth correction factor that the GNSS receiver indicated.

GPS:RESET ONCE

This command issues a reset to the internal GNSS receiver. This can be helpful when changing the antenna for example, since the GNSS receiver measures the antenna system's C/No right after reset, and adjusts its internal antenna amplifier gains accordingly. It takes approximately 1 minute for locking to commence after a GNSS receiver reset, as indicated by the red blinking LED.

GPS:TMODe <ON|OFF|RSTSURV>

This command selects the Timing Mode of the SEPTENTRIO receiver when SEPTENTRIO type is selected in `GPS:TYPE?` settings. The Timing Mode is not currently supported for other receivers in PNT-62xx.

If the Timing Mode is OFF, the receiver will act as a regular GNSS receiver in 3D mobile mode. This mode has to be chosen if the unit is used with a moving antenna.

If the Timing Mode in ON, the timing features of the GNSS receiver are enabled. At power-up, the Hold position stored in NVRAM will be sent to the GNSS receiver and will be used as the reference. In order to use this mode, the receiver position must be known as exactly as possible. Errors in the Hold position will translate into time errors depending on the satellite constellation.

The Hold position can be set manually by the user or can be the result of a position Auto Survey executed by the GNSS receiver.

If the Timing Mode is set to RSTSURV, the GNSS receiver will start an Auto Survey every time the unit is powered-on and following the Survey sequence, the GNSS receiver will run with the timing features enabled. Once in Position Hold mode, the antenna location should be held completely stationary.

This command has the following format:

```
GPS:TMODe <ON|OFF|RSTSURV>
```

The following command will query the settings of this command:

```
GPS:TMODe?
```

GPS:SURVey ONCE

The Timing Mode is not currently supported in PNT-62xx. This command starts a Survey. At the end of the Survey, the calculated Hold position will be stored in NVRAM.

The Survey parameters can be set with the `GPS:SURVey:DURation <sec>` and `GPS:SURVey:VARIANCE <mm^2>` commands.

The GNSS receiver will stop the Survey when the minimal duration has been reached and the variance of the average position is under the specified minimum variance.

GPS:SURVey:DURation <sec>

This command sets the Survey minimal duration. This minimum value is used as a threshold under which the GNSS receiver can stop the Survey.

The GNSS receiver will stop the Survey when the minimal duration has been reached and the variance of the average position is under the specified minimum variance.

This command has the following format:

```
GPS:SURVey:DURation < int in sec >
```

This command will query the state of this command:

```
GPS:SURVey:DURation?
```

GPS:SURVey:VARIANCE <mm^2>

This command specifies the minimum variance of the average position computed during the Survey. This minimum value is used as a threshold under which the GNSS receiver can stop the Survey.

The GNSS receiver will stop the Survey when the minimal duration has been reached and the variance of the average position is under the specified minimum variance.

This command has the following format:

```
GPS:SURVey:VARiance <int>
```

This command will query the state of this command:

```
GPS:SURVey:VARiance?
```

GPS:HOLD:POSition <cm, cm, cm>

This command allows the user to specify manually the exact position of the unit. This command will overwrite the Hold position in NVRAM. Subsequent Survey also will overwrite the Hold position. The Hold position is stored in ECEF coordinates.

This command has the following format:

```
GPS:HOLD:POSition <int,int,int>
```

This command will query the state of this command:

```
GPS:HOLD:POSition?
```

GPS:SURVEY:STATUS?

This query displays the current status of the survey. The status of the survey is in one of the 3 states:

- **ACTIVE:** a survey is in progress
- **VALID:** a survey has been achieved successfully and the GNSS receiver is now using this Hold position as reference.
- **INVALID:** no survey are in progress or have been achieved since the last power cycle

When in ACTIVE or VALID state, this query will also display the duration, the Hold position in ECEF coordinates and the position variance.

GPS:INITial:DATE <yyyy,mm,dd>

This command allows setting the internal RTC DATE manually when operating the unit in GNSS denied environments. This command is compatible to the `PTIME:OUTput ON` command available in JLT CSAC based products to allow automatic time and date synchronization of two units to each other. The internal RTC is driven by the highly stable ovenized oscillator 10MHz signal, and thus has very high time accuracy.

If the internal RTC DATE has set itself to 1/1/2010 and the internal RTC TIME has set itself to 00:00:00 upon power-up, this indicates the clock is outdated and the user must wait for valid UTC data from the receiver or modify the time to a valid one.

This command has the following format:

```
GPS:INITial:DATE <yyyy,mm,dd>
```

This command will query the state of this command:

```
GPS:INITial:DATE?
```

GPS:INITial:TIME <hour,min,sec>

This command allows setting the internal RTC TIME manually when operating the unit in GPS denied environments. This command is compatible to the `PTIME:OUTput ON` command available in JLT CSAC based products to allow automatic time and date synchronization of two units to each other. The internal RTC is driven by the highly stable ovenized oscillator 10MHz signal, and thus has very high time accuracy.

If the internal RTC DATE has set itself to 1/1/2010 and the internal RTC TIME has set itself to 00:00:00 upon power-up, this indicates the clock is outdated and the user must wait for valid UTC data from the receiver or modify the time to a valid one.

This command has the following format:

```
GPS:INITial:TIME <hour,min,sec>
```

This command will query the state of this command:


```
GPS:INITial:TIME?
```

GPS:RTC:DATE <yyyy,mm,dd>

This command allows setting the hardware RTC DATE manually when operating the unit in GNSS denied environments. The on-board super-capacitor C63 will keep the hardware RTC clock running for additional 1+ days after removing the PNT-62xx main power supply. The PNT-62xx will verify the hardware RTC date and time and assign initial internal RTC DATE if valid.

This command has the following format:

```
GPS:RTC:DATE <yyyy,mm,dd>
```

This command will query the state of this command:

```
GPS:RTC:DATE?
```

GPS:RTC:TIME <hour,min,sec>

This command allows setting the hardware RTC TIME manually when operating the unit in GNSS denied environments. The on-board super-capacitor C63 will keep the hardware RTC clock running for additional 1+ days after removing the PNT-62xx main power supply. The PNT-62xx will verify the hardware RTC date and time and assign initial internal RTC DATE if valid.

This command has the following format:

```
GPS:RTC:TIME <hour,min,sec>
```

This command will query the state of this command:

```
GPS:RTC:TIME?
```

GPS:SYSTem:SElect [GPS | SBAS | QZSS | GAL | BD ^ GLO]

This command selects the GNSS systems that are enabled in the GNSS receiver and are used to generate the timing and positioning information for the NMEA data, and to generate the 1PPS reference for the GNSDO. The command is followed by a list of the shortened names of the GNSS systems to enable. The shortened names of supported GNSS system include GPS, SBAS, QZSS, BD (BeiDou), GAL (Galileo) and GLO (GLONASS). Invalid combinations of GNSS systems will result in a Command Error response and no change to the configuration.

The following example command will enable GPS, SBAS, Galileo and GLONASS all concurrently:

```
GPS:SYST:SEL GPS SBAS GAL GLO
```

The following command will query the currently enabled GNSS systems:

```
GPS:SYST:SEL?
```

The PNT-62xx will respond to the query with the list of enabled GNSS systems such as:

```
GPS SBAS GAL GLO
```

GPS:SYSTem:LBAND [L1 | L2 | L3 | L5 | ALL]

This command configures the L band signal usage in PVT solution of SEPTENTRIO receiver when SEPTENTRIO type is selected in `GPS:TYPE?` settings. Configurable L band signals include L1, L2, and L5 for GPS, L1 and L5 for Galileo, BeiDou, SBAS, and QZSS constellations, L1, L2, and L3 for GLONASS.

The SEPTENTRIO receiver will generate PVT solution with PVT data from enabled L band signals for current enabled constellations in “[GPS:SYSTem:SElect \[GPS | SBAS | QZSS | GAL | BD ^ GLO\]](#)” on page 39. Invalid combinations of L band configuration and `GPS:SYSTem:SElect [GPS | SBAS | QZSS | GAL | BD ^ GLO]` settings will result in a Warning response and no change to the configuration.

The following example command will enable all available L band signals for PVT solution:

```
GPS:SYST:LBAND ALL
```

The following example command will enable signals from L1 and L5 bands for PVT solution:

```
GPS:SYST:LBAND L1 L5
```

The following command will query the currently enabled L band signals for PVT solution:

```
GPS:SYST:LBAND?
```

GPS:SYSTem:BANDTRACK [L1 | L2 | L3 | L5 | ALL]

This command configures the L band signals to be tracked by the SEPTENTRIO receiver when SEPTENTRIO type is selected in `GPS:TYPE?` settings. Configurable L band signals include L1, L2, and L5 for GPS, L1 and L5 for Galileo, BeiDou, SBAS, and QZSS constellations, L1, L2, and L3 for GLONASS.

The SEPTENTRIO receiver will track enabled L band signals for satellites from current enabled constellations in “[GPS:SYSTem:SElect \[GPS | SBAS | QZSS | GAL | BD ^ GLO\]](#)” on page 39. Invalid combinations of L band configuration and `GPS:SYSTem:SElect [GPS | SBAS | QZSS | GAL | BD ^ GLO]` settings will result in a Warning response and no change to the configuration.



NOTE

Tracking of GLONASS L3 band requires enabling of GLONASS L1 band as well.

The following example command will enable all available L band signals for satellite tracking:

```
GPS:SYST:BANDTRAC ALL
```

The following example command will enable satellite tracking of L5 band signals only if current enabled constellations in “GPS:SYSTEM:SElect [GPS | SBAS | QZSS | GAL | BD ^ GLO]” on page 39 support L5 band:

```
GPS:SYST:BANDTRAC L5
```

The following command will query the currently enabled L band signals for satellite tracking:

```
GPS:SYST:BANDTRAC?
```

GPS:SYSTEM:TIMESOURce <GPS|GAL|BD|AUTO>

This command selects the timing source for computation of receiver clock bias comparing to SEPTENTRIO receiver time when SEPTENTRIO type is selected in `GPS:TYPE?` settings. This command also determines the primary GNSS constellation in PVT solution.



NOTE

No PVT solution will be computed if insufficient satellites of selected timing resources are visible and tracked by the receiver.

The default timing source is GPS. Under GPS-denied challenged environment, changing to GAL for Galileo system time or BD for Beidou system time is recommended for potential alternative PVT solution.

The `GPS:SYST:TIMESOUR AUTO` settings will switch the timing source automatically based on the best available source.

The following example command will enable Galileo system time for primary system in PVT solution:

```
GPS:SYST:TIMESOUR GAL
```

The following command will query the currently selected timing source in PVT solution:

```
GPS:SYST:TIMESOUR?
```

GPS:SYSTEM:TIMESOURce:STATE?

This command queries the current GNSS time source. The response will indicate the GNSS time source currently selected. The response will match the `GPS:SYSTEM:TIMESOURce` setting except when configured in AUTO time source.

GPS:HEIGHT?

This command returns the output from the following queries:

```
GPS:HEIGHT:MSL?  
GPS:HEIGHT:GPS?
```

GPS:HEIGHT:MSL?

This query returns the Mean Sea Level height in meters which differs from the GPS ellipsoid height by up to +/-100 meters. This feature is not supported for STL receiver mode. This difference varies depending upon the actual antenna location. The MSL to GPS height differences are calculated by the GNSS receiver.

GPS:HEIGHT:GPS?

This query returns the height above the GPS ellipsoid in meters reported by the GNSS or STL receiver.

GPS:POLarity <LOW|HIGH>

This command will set the Septentrio GNSS receiver's starting polarity level for GNSS 1PPS output. This command is not supported for the uBlox GNSS receiver option or the STL receiver mode.

The default setting is LOW where the GNSS 1PPS output will trigger from low to high level to UTC time. A low to high polarity indicates a rising edge, and a high to low polarity indicates a falling edge. The selected rising or falling edge/polarity will be aligned to UTC time.

This command has the following format:

```
GPS:POLarity <LOW|HIGH>
```

This command will query the state of this command:

```
GPS:POLarity?
```

GPS:POSition?

This query will return the `GPS:GPRMC` latitude, longitude, the speed over ground in knots, and the course made good check. The course made good check indicates the direction a vehicle is traveling independent of the direction the vehicle is pointing. This query will also return the `GPS:GPGGA` antenna height in MSL Meters and the antenna height in GPS Meters for GNSS receiver mode. This query will return the GPS Meters ONLY for STL receiver mode.

GPS:POSition:ECEF?

This query will return the earth-centered, earth-fixed X,Y, and Z coordinates as well as the position accuracy of the GNSS receiver. This query is not currently supported for STL receiver mode.

GPS:CNOthres <int> [1,40]

This command allows the user to set a carrier to noise threshold for GNSS receiver ONLY. This sets up a navigation solution that will only be attempted if there exists the given number of SVs with signals that are, at minimum, as strong as the given threshold.

This command has the following format:

```
GPS:CNOthres [1,40]
```

This command will query the state of this command:

```
GPS:CNOthres?
```

GPS:FOV <int> [3,85]

This command allows the user to set the minimum elevation limit of a satellite above the horizon in order to be used in the GNSS navigation solution ONLY. Low elevation satellites may provide degraded accuracy, due to the long signal path through the atmosphere.

This command has the following format:

```
GPS:FOV [3,85]
```

This command will query the state of this command:

```
GPS:FOV?
```

GPS:STATus?

This query returns the status of the GNSS or STL receiver. For GNSS receiver mode, a status of 1 means a fix is not available. A status of 2 indicates a 2D fix has been achieved and a status of 3 indicates a 3D fix has been achieved. For STL receiver mode, a status of 1 or higher indicates a 3D fix.

GPS:STATus:STRing?

This query returns the status of the GNSS and STL receiver as a string. The receiver may have a status of “No Fix”, “2D Fix”, or “3D Fix”.

GPS:PASSthru

<GNSS|RSRSCPI|STL|TOD|CSAC|RSRGPS|MCE|RSRDEB UG>

This command allows the user to select a source for pass-through mode for debugging ONLY. Pass-through mode will allow one of these sources to pass data through their respective COM ports. The GNSS pass-through command will allow either uBlox or Septentrio data to pass through depending on the GNSS receiver connected.

This command has the following format:

```
GPS:PASSthru <GNSS|RSRSCPI|STL|TOD|CSAC|RSRGPS|MCE|RSRDEB UG>
```

This command will query the state of this command:

```
GPS:PASSthru?
```

GPS:PASSthru:TIMEout <ON|OFF>

This command will enable or disable the time-out feature of the pass-through mode. Setting this command to “ON” will cause the pass-through mode to time-out after the period specified in [“GPS:PASSthru:COUNT <int> <s> \[1,86400\]” on page 44](#). Setting this command to “OFF” will cause the pass-through mode to disable the time-out feature.

The default settings is ON which enables the time-out feature. See [“GPS:SATellite:VISible:COUNT?” on page 25](#) for the command to configure the length of time-out mode.

This command has the following format:

```
GPS:PASSthru:TIMEout <ON|OFF>
```

This command will query the state of this command:

```
GPS:PASSthru:TIMEout?
```

GPS:PASSthru:COUNT <int> <s> [1,86400]

This command will set length of time the device remains in pass-through time-out mode described in [“GPS:PASSthru:TIMEout <ON|OFF>” on page 44](#). The time entered should be in seconds and the default period is 60 seconds.

This command has the following format:

```
GPS:PASSthru:COUNT [1,86400]
```

This command will query the state of this command:

```
GPS:PASSthru:COUNT?
```

GPS:TYPE?

This query will return the current detected or selected receiver source. The possible receiver types are:

- AUTO DETECTING
- UBLOX
- SEPTENTRIO
- STL

GPS:TYPE:MODE <AUTO|UBLOX|SEPTentrio|STL>

This command will override the current receiver mode settings to the user selected mode. The default receiver mode is STL for order option with mounted Jackson-Labs STL-2600™ board.

The query command GPS? will display the current receiver mode and status for the current receiver mode. Some NMEA outputs and SCPI query commands will also reflect on the current receiver mode selected.

This command has the following format:

```
GPS:TYPE:MODE <AUTO|UBLOX|SEPTentrio|STL>
```

This command will query the state of this command:

```
GPS:TYPE:MODE?
```

GPS:SOURce:SElect <AUTO|STL|GNSS>

This command is not currently supported in PNT-62xx.

GPS:FILTer:SElect <STL|UBX>

This command is not currently supported in PNT-62xx.

GPS:FILTer:NMEA <int> [0,255]

This command is not currently supported in PNT-62xx.

GPS:GNSS:MODE <ON|OFF>

This command is not currently supported in PNT-62xx.

GPS:GNSS:RESET ONCE

This command will issue a restart sequence for the uBlox/Mosaic GNSS receiver. The uBlox/Mosaic GNSS receiver will be initialized to its default settings after the reset.

GPS:GNSS:POWer <ON|OFF>

This command will power on/power down the uBlox/Mosaic GNSS receiver. When the uBlox/Mosaic is powered on from off settings, it will conduct a cold start and initialize the uBlox/Mosaic. Use OFF settings to power down the GNSS receiver.



NOTE

When the Mosaic receiver is powered on there is a chance the receiver will enter its software upgrade mode and will wait for the user to upload its firmware. Alternatively, the Mosaic receiver will exit this upgrade mode after 200 seconds if there is no valid response from the user. The user may expect a 200 second delay before the receiver status in GPS? changes from Reserved to No fix/3D Fix.

This command has the following format:

```
GPS:GNSS:POWer <ON|OFF>
```

This command will query the state of this command:

```
GPS:GNSS:POWer?
```

GPS:GNSS:FWver?

This query prints the firmware version of the GNSS receiver.

GPS:GNSS:TYPE?

This command is not supported on the PNT-62xx.

GPS:STL:RESET <ONCE | WARMUP|HOLD|OFF>

This command will configure the reset state of STL-2600™ board if mounted.

The ONCE settings will issue a reset sequence for the STL-2600™ board once. The HOLD settings will keep and hold the STL-2600™ board on reset.

The following command will query the state of this command:

```
GPS:STL:RESET?
```


GPS:STL:RESET:AUTO <int> [0,604800]

This command will configure the reset state of STL-2600™ board if mounted.

This command adjusts the length of time during which the FASTLOCK feature is active, please see “SERVo:FASTlock <int> [1,20]” on page 88.

The length can be set from 100 seconds to 20000 seconds. The Dynamic FASTLOCK gain is slowly reduced until it reaches a gain of 1.0 after the FALength period of seconds. During this time the PLL loop gain is increased by the amount specified in the SERVo:FASTlock parameter, which will result in a faster initial phase lock to UTC after power-on, while giving the lowest possible noise floor (best short term stability) during normal operation.

This command has the following format:

```
GPS:STL:RESET:AUTO <int> [0,604800]
```

This command will query the state of this command:

```
GPS:STL:RESET?
```

GPS:STL:SCPI <ASCII> <command>

This command will allow the user to send any ASCII command to the integrated STL-2600™ module, if present on the PNT-62xx. Note that the PNT-62xx may overwrite the settings on next connection for settings changed with this command.

This command has the following format:

```
GPS:STL:SCPI <ASCII> <command>
```

GPS:STL:ISP ON

This command will send the STL-2600™ board into ISP mode for reprogramming. Refer to Chapter 4 of the STL-2600™ User Manual for programming instructions.

GPS:STL:BPMProcessed?

This query will return the number of processed STL bursts in last 60 seconds on the STL-2600™ board if mounted. Typical values range from 0 to 400 depending on the quality of STL signal reception at the time of query.

GPS:STL:BPMReceived?

This query will return the number of received STL bursts in last 60 seconds on the STL-2600™ board if mounted. Typical values range from 0 to 400 depending on the quality of STL signal reception at the time of query.

GPS:STL:PFOM?

This query will return the current Position Figure of Merit (PFOM) value in range of 1 to 9 for STL-2600™ solution.

GPS:STL:TFOM?

This query will return the current Time Figure of Merit (TFOM) value in range of 1 to 9 for STL-2600™ solution.

GPS:STL:EXTCLOCK <ON|OFF>

This command will toggle the state of CSAC_LOCK pin (8 on the STL-2600™ 20-pin connector) and enable/disable the use of the external clock (10 MHz) input to the STL-2600™ board if mounted. The state (on/off) of LED D18 on the STL-2600™ board indicates if the external clock is enabled/disabled, respectively.

For testing purpose, this command can be configured to OFF to disable the external clock reference into the STL-2600™ board. The settings in `GPS:STL:SERVO:LOOP <ON|OFF>` command can also be ON to enable the internal servo loop on the STL-2600™ board for disciplining.

This command has the following format:

```
GPS:STL:EXTCLOCK <ON|OFF>
```

The following command will query the settings of this command:

```
GPS:STL:EXTCLOCK?
```

GPS:STL:AGC <int> [500,2700]

This command will configure the manual RF Analog Gain Control (AGC) for the STL receiver.

Sending minimum value of 500 mV in this command results in maximum analog gain. The maximum value of 2700 mV results in minimum analog gain, with a nearly linear change of gain for intermediate values. Use this command to compensate for excessive cable losses or indoor reception with low signal levels, or non-amplified antennae.

Observe the number of processed bursts per minute (BPM) with

`GPS:STL:BPMProcessed?` command after changing the analog gain, and slowly adjust the value to achieve maximum number of processed BPM. A typical value when using the Tallysman 2346A amplified antenna with short antenna cabling is 1350 mV.

This command has the following format:

```
GPS:STL:AGC <int> [500,2700]
```

The following command will query the settings of this command:

GPS:STL:AGC?

GPS:STL:CNO?

This query command responds with the maximum STL CNO value observed since power on.

GPS:STL:CNO:MINTHReshold <float> [1.0,100.0]

This command allows the user to configure the minimum carrier to noise (C/No) threshold for any burst to be further processed in the STL solution. The default minimum C/No threshold value is 40.0 dB.

All bursts used in STL solution will need to have C/No value above the value configured in this command.

This command has the following format:

```
RECEiver:STL:CNO:MINTHReshold <float> [1.0,100.0]
```

The following command will query the settings of this command:

```
RECEiver:STL:CNO:MINTHReshold?
```

GPS:STL:DOPpler:MINimum <double> [-36000.000000,0.0]

This command allows the user to configure the minimum doppler value for any burst to be further processed in the STL solution. The value must be between -36,000.000000 Hz and 0.0 Hz.

All bursts used in STL solution will need to have doppler value inside the range of minimumthreshold configured in this command and maximum threshold configured in GPS:STL:DOPpler:MAXimum <double> [0.0,36000.000000] command.

This command has the following format:

```
RECEiver:STL:DOPpler:MINimum <double> [-36000.000000,0.0]
```

The following command will query the settings of this command:

```
RECEiver:STL:DOPpler:MINimum?
```

GPS:STL:DOPpler:MAXimum <double> [0.0,36000.000000]

This command allows the user to configure the maximum Doppler value for any burst to be further processed in the STL solution. The value must be between 0.0 Hz and 36,000.000000 Hz.

All bursts used in STL solution will need to have Doppler value inside the range of minimum threshold configured in `GPS:STL:DOPpler:MINimum <double> [-36000.000000,0.0]` command and maximum threshold configured in this command.

This command has the following format:

```
RECEiver:STL:DOPpler:MAXimum <double> [0.0,36000.000000]
```

The following command will query the settings of this command:

```
RECEiver:STL:DOPpler:MAXimum?
```

GPS:STL:CLOCKmodel <double> [1E-20,1.0]

This command allows the user to choose a clock model for the integrated STL-2600™ module. A smaller numeric value would instruct the STL receiver to expect higher stability in reference clock.



NOTE

The consequence to stability of configuring a somewhat optimistic, i.e. thinking the reference clock can maintain higher stability than its actual specification, clock model is significantly worse than if configuring the clock model somewhat pessimistic.

This command has the following format:

```
GPS:STL:CLOCKmodel <double> [1E-20,1.0]
```

The following command will query the settings of this command:

```
GPS:STL:CLOCKmodel?
```

GPS:STL:CLOCKmodel:FAST <double> [1E-20,1.0]

This command allows the user to choose a clock model for the integrated STL-2600™ module. A smaller numeric value would instruct the STL receiver to expect higher stability in reference clock.



NOTE

The consequence to stability of configuring a somewhat optimistic, i.e. thinking the reference clock can maintain higher stability than its actual specification, clock model is significantly worse than if configuring the clock model somewhat pessimistic.

This command has the following format:

```
GPS:STL:CLOCKmodel:FAST <double> [1E-20,1.0]
```

The following command will query the settings of this command:

```
GPS:STL:CLOCKmodel:FAST?
```

GPS:STL:CLOCKmodel:MEDium <double> [1E-20,1.0]

This command allows the user to choose a clock model for the integrated STL-2600™ module. A smaller numeric value would instruct the STL receiver to expect higher stability in reference clock.



NOTE

The consequence to stability of configuring a somewhat optimistic, i.e. thinking the reference clock can maintain higher stability than its actual specification, clock model is significantly worse than if configuring the clock model somewhat pessimistic.

This command has the following format:

```
GPS:STL:CLOCKmodel:MEDium <double> [1E-20,1.0]
```

The following command will query the settings of this command:

```
GPS:STL:CLOCKmodel:MEDium?
```

GPS:STL:SUBScription?

This query returns the subscription information for the integrated STL-2600™ module.

GPS:STL:SUBScription:AUTHKEY <string>

This command allows the user to configure an authentication key for the integrated STL-2600™ module. The string entered should be 28 characters long unless otherwise specified.

Use the `GPS:STL:SUBScription?` command to query the key status and the STL subscription status. If the subscription/key is invalid or inactive (expired), please contact your STL subscription/authentication key provider.



ALERT

This command will overwrite the existing key. System reset is required for new key activation.



NOTE

The over-the-air (OTA) subscription update may be available without having to send this command. Contact your STL subscription/authentication key provider for more details.



ALERT

If the new OTA key is received, the existing key will be overwritten. Subscription state may have changed and affected receiver operation. This is expected behavior in response to an OTA update.

This command has the following format:

```
GPS:STL:SUBscription:AUTHKEY <string>
```

The following command will query the state of the key:

```
GPS:STL:SUBscription:AUTHKEY?
```

GPS:STL:SERVo:LOOP <ON|OFF>

This command will enable or disable the internal servo loop on the integrated STL-2600™ module.

The default settings is OFF to disable the internal servo loop to avoid confusion on the STL-2600™ board.

For testing purpose, this command can be configured to ON to enable the internal servo loop on the STL-2600™ board for disciplining. The settings in `GPS:STL:EXTCLOCK <ON|OFF>` command should also be OFF to disable the external clock reference into the STL-2600™ board.

This command has the following format:

```
GPS:STL:SERVo:LOOP <ON|OFF>
```

This command will query the state of this command:

```
GPS:STL:SERVo:LOOP?
```

GPS:FWver?

This command queries and returns the Firmware version for the current selected receiver mode.

GPS?

This query displays the configuration, position, speed, height and other relevant data of the GNSS or STL receiver in one convenient location.

PTP SUBSYSTEM

The PNT-62xx includes a High Precision IEEE1588 PTP phase and frequency synchronization engine that module supports PTP Master, slave, boundary, and gateway clock operation. Among the features of the device include PPS in and out functionality with a stability of +25ns to UTC. The unit interfaces standard NMEA GPS interface that can be enabled via software and provides timing distribution across Ethernet to up to 32 Slave devices.

The PTP subsystem regroups all the commands related to the PTP engine. The list of the commands supported is the following:

- PTP:StAtE?
- PTP:LED <ON|OFF>
- PTP:HMI <COMMAND>
- PTP:MODE <MASTER|SLAVE|PTPPRI|REFPRI|AUTO|OFF>
- PTP:MODE:NUMber <int> [0,5]
- PTP:PULSE <ON|OFF>
- PTP:IP?
- PTP:IP:StAtic <XXX.XXX.XXX.XXX>
- PTP:DHCP <ON|OFF>
- PTP:IP:CONSOLE <XXX.XXX.XXX.XXX>
- PTP:CONfig
- PTP:RESEt
- PTP:MCEVersion?
- PTP:CLKQuality <CLASS,ACCURACY,VARIANCE> [<int>[0,255],<int>[0,255],<short>[0,65535]]
- PTP:TIMESour <ATOMIC | GPS | RADIO | PTP | NTP | HANDSET | INTOSC>
- PTP:TIMEScale <PTP | ARB >
- PTP:Profile <DEFAULT | G8265 | G8275.1 | G8275.2 | POWER>
- PTP:PORTData?
- PTP:PORTData:ANNounce <int> [-4, 5]
- PTP:PORTData:SYNC <int> [-8, 2]
- PTP:PORTData:DELAyreq <int> [-7, 7]
- PTP?

PTP:StAtE?

This query returns the state of the PTP engine.

PTP:LED <ON|OFF>

This command will turn the PTP LED light on or off.

This command has the following format:

```
PTP:LED <ON|OFF>
```

This command will query the state of this command:

```
PTP:LED?
```

PTP:HMI <COMMAND>

This command allows the user to write HMI commands to the M88. See the M88 HMI command list in the M88 user manual for more information on the M88.

This command has the following format:

```
PTP:HMI <command>
```

This command will query the state of this command:

```
PTP:HMI?
```

PTP:MODE <MASTER|SLAVE|PTPPRI|REFPRI|AUTO|OFF>

The PTP has three modes: master, slave, or off. Use this command to set the PTP to one of these three modes.

This command has the following format:

```
PTP:MODE <MASTER|SLAVE|PTPPRI|REFPRI|AUTO|OFF>
```

This command will query the state of this command:

```
PTP:MODE?
```


PTP:MODE:NUMBER <int> [0,5]

This command returns or sets the mode number that corresponds to the PTP:MODE settings. [Table 8](#) describes the number settings.

Table 8 PTP:MODE:NUMBER settings

Number	PTP:MODE Setting	Description
0	AUTO	In Auto mode, the device switches between master and slave on the network, depending on the availability of synchronization sources and other grand masters on the network.
1	MASTER	The device is the grand master on the network. All slave devices sync to the master. It requires a 1PPS source in order to maintain its position as the Grand Master.
2	REFPRI	Reference primary, PTP secondary mode.
3	PTPPRI	PTP primary, Reference secondary mode.
4	DEBUG	Special debug mode.
5	SLAVE	The device is a slave to the grand master. It uses the Grand Master's PTP time source as its clock. It will only be a slave and never becomes a master unless the PTP Set Mode is changed.
-1	Off	PTP is disabled.

PTP:PULSE <ON|OFF>

This command will turn the 1PPS from the M88 on or off. If the PTP's pulse has been synchronized, the PTP's LED will blink.

This command has the following format:

```
PTP:PULSE <ON|OFF>
```

This command will query the state of this command:

```
PTP:PULSE?
```

PTP:IP?

This query will display the PTP port's IP address, either statically assigned or assigned from a DHCP server depending upon the PTP:IP:DHCP setting

PTP:IP:STATIC <XXX.XXX.XXX.XXX>

The PTP's IP will be set to a static IP address that the user enters with this command.

This command has the following format:

```
PTP:IP:STATiC <XXX.XXX.XXX.XXX>
```

This command will query the state of this command:

```
PTP:IP:STATiC?
```

PTP:DHCP <ON|OFF>

This command will enable or disable the DHCP setting on the PTP board. DHCP is enabled as the board's default IP. Once it obtains an IP the device will establish itself as the PTP Grand Master by default if a 1PPS signal is available.

This command has the following format:

```
PTP:DHCP <ON|OFF>
```

This command will query the state of this command:

```
PTP:DHCP?
```

PTP:IP:CONSOLE <XXX.XXX.XXX.XXX>

This sets the IP address of the console port.

This command has the following format:

```
PTP:IP:CONSOLE <XXX.XXX.XXX.XXX>
```

This command will query the state of this command:

```
PTP:IP:CONSOLE?
```

PTP:CONfig

This command resets the configuration of the PTP interface and resets the M88 to default settings. The default setting is PTP Master Mode with DHCP enabled. The query version of this command returns the configuration status (CONFIGURED / NOT CONFIGURED).

PTP:RESET

This command will issue a reset sequence to the M88 module.

PTP:MCEVersion?

This query returns the version number of the PTP module's application version.

PTP:CLKQuality <CLASS,ACCURACY,VARIANCE> [<int>[0,255], <int>[0,255], <short>[0,65535]>

This command sets or queries the clock quality parameters including clock class, accuracy and variance that are communicated to other PTP devices on the network. See the IEEE 1588 standard for additional information.

PTP:TIMESour <ATOMIC | GPS | RADIO | PTP | NTP | HANDSET | INTOSC>

This command sets or queries the time source parameter that is communicated to other PTP devices on the network. See the IEEE 1588 standard for additional information.

PTP:TIMESCAle <PTP | ARB >

This command sets or queries the timescale parameter that is communicated to other PTP devices on the network. See the IEEE 1588 standard for additional information.

PTP:PROfile <DEFAULT | G8265 | G8275.1 | G8275.2 | POWER>

This command sets or queries the profile for the PTP module. See the IEEE 1588 standard for additional information.

PTP:PORTData?

This query returns the output from the following `PTP:PORTData...` queries:

- `PTP:PORTData:ANNounce?`
- `PTP:PORTData:SYNC?`
- `PTP:PORTData:DELAYreq?`

PTP:PORTData:ANNounce <int> [-4, 5]

This command sets or queries the announce parameter for the PTP module. See the IEEE 1588 standard for additional information.

PTP:PORTData:SYNC <int> [-8, 2]

This command sets or queries the sync parameter for the PTP module. See the IEEE 1588 standard for additional information.

PTP:PORTData:DELAYreq <int> [-7, 7]

This command sets or queries the delay requests parameter for the PTP module. See the IEEE 1588 standard for additional information.

PTP?

This query shows the status of the PTP interface. [Table 9](#) describes the PTP? results.

Table 9 PTP? results

Configuration Status	<ul style="list-style-type: none">– Configured: Indicates the PTP Interface has been configured with the PTP SET MODE, PTP IP MODE, and IP ADDRESS if set to Static.– NOT CONFIGURED: Indicates that one of the parameters was not set or is not responsive.
PTP Set Mode	See Table 8
PTP IP Mode	<ul style="list-style-type: none">– DHCP: Puts the M88 in DHCP mode. It will boot up and request an IP address from the server. If it does not obtain an IP address it will indicate that the LINK is DOWN from the PTP Port Link status.– STATIC
PTP Port Link	<ul style="list-style-type: none">– LINK UP– LINK DOWN
PTP IP	Shows the programmed Console IP address
CONSOLE PORT LINK	LINK UP LINK DOWN
PTP CURRENT STATE	Lists the current state of the PTP engine.

Table 9 PTP? results

PTP SYNC STATE	<ul style="list-style-type: none"> – SYNCED: <ul style="list-style-type: none"> – In Master mode, this means the PTP engine is synchronized to the 1PPS source (GPS, STL, etc.) – In Slave Mode, this means the slave is synchronized to the master PTP clock. – NOT SYNCED: The PTP is not synchronized
PTP GRAND MASTER ID	Shows the MAC address of the Grand Master
GRAND MASTER OFFSET	This shows the difference between the Slave Clock and Master Clock. This is only shown in Slave mode.
CLOCK QUALITY	This shows the clock quality parameters from the <code>PTP:CLKQ?</code> query.
CLOCK SOURCE	Shows the clock source parameter from the <code>PTP:TIMES?</code> query

PTIME Subsystem

The PTIME subsystem regroups all the commands related to the management of the time. The following commands are supported:

- `PTIME:DATE?`
- `PTIME:TIME?`
- `PTIME:TIME:STRing?`
- `PTIME:TINTerval?`
- `PTIME:OUTput <ON|OFF>`
- `PTIME:LEAPsecond?`
- `PTIME:LEAPsecond:PENDING?`
- `PTIME:LEAPsecond:ACCumulated?`
- `PTIME:LEAPsecond:DATE?`
- `PTIME:LEAPsecond:DURATION?`

PTIME:DATE?

Returns the current calendar date. The local calendar date is referenced to UTC time. The year, month, and day are returned.

PTIME:TIME?

Returns the current 24-hour time. The local time is referenced to UTC time. The hour, minute, and second is returned.

PTIME:TIME:STRing?

This query returns the current 24-hour time suitable for display (for example, 13:24:56).

PTIME:TINterval?

This query is equivalent to the command SYNChronization:TINterval?

PTIME:OUTput <ON|OFF>

This command adds support for auto-initialization of time and date between two Jackson Labs Technologies, Inc. GPSDO units. This allows connecting two units together through the serial port with a null-modem cable, and having the master unit send time and date information to the slave unit. The slave unit's 1PPS reference input can also be driven by the master unit's 1PPS output signal, by setting the slave unit to external 1PPS sync mode using the SYNC:SOUR:MODE EXT command. This allows time-synchronization at the nanosecond level between two units which can be useful when operating in GPS denied environments. The following command returns the PTIME output setting stored in NV memory:

```
PTIME:OUTput?
```

Sending the following command will cause the unit to automatically generate GPS:INIT:DATE and GPS:INIT:TIME sentences described in “GPS:INITial:DATE <yyyy,mm,dd>” on page 38 and “GPS:INITial:TIME <hour,min,sec>” on page 38 on the serial port once per second:

```
PTIME:OUTput ON
```

PTIME:LEAPsecond?

This command returns the results of the four following queries:

- PTIME:LEAPsecond:PENDING?
- PTIME:LEAPsecond:ACCumulated?
- PTIME:LEAPsecond:DATE?
- PTIME:LEAPsecond:DURATION?

An example of a pending leapsecond event follows:

```
LEAPSECOND PENDING: 1
```

LEAPSECOND ACCUMULATED: 16

LEAPSECOND DATE: 2015,6,30

LEAPSECOND DURATION: 61



NOTE

The unit stores pending leap second events in NV memory and applies them correctly, even if the antenna is removed prior to the leap second, as long as the pending information has been stored in NV memory and the unit has a properly set RTC time and date.

This feature sets JLT units apart from competitive products that only apply a leap second correctly if the GNSS antenna is connected to the unit during the actual leap second event, and may thus miss the leap second event entirely.

PTIME:LEAPsecond:PENDING?

This command returns 1 if the GPS Almanac data contains a future pending leap second data and 0 if no future leap second is pending or Almanac data is not available. The GNSS receiver must have the GPS system enabled in “GPS:SYSTEM:SElect [GPS | SBAS | QZSS | GAL | BD ^ GLO]” on page 39 for the GPS Almanac to be available in GNSS receiver mode.

PTIME:LEAPsecond:ACCumulated?

This command returns the internally applied leap second offset between GPS time and UTC time as stored in the EEPROM (GPS Almanac not received yet) or as indicated by the GNSS receiver (GPS Almanac is available).

PTIME:LEAPsecond:DATE?

This command returns the date of the pending leap second, if available for current receiver mode.

PTIME:LEAPsecond:DURation?

This command returns the duration of the last minute of the day during a leap second event, if available for current receiver mode. The returned value is 59, 60 or 61 if GPS Almanac data is available, and 0 otherwise. A response of 60 indicates that no leap second is pending.

PTIME?

The PTIME? command is unrelated to OCXO disciplining. For more information on OCXO disciplining, please refer to [“SYNChronization Subsystem” on page 62](#).

This query returns the results of the following queries at once:

- PTIME:DATE?
- PTIME:TIME?
- PTIME:TINTErval?
- PTIME:OUTput?
- PTIME:LEAPsecond:ACCumulated?

SYNChronization Subsystem

This subsystem regroups the commands related to the synchronization of the PNT-62xx with the GNSS, STL, PTP, or external timing source. The list of the commands supported for this subsystem is the following:

- SYNChronization:HOLDOver:DURation?
- SYNChronization:HOLDOver:INITiate
- SYNChronization:HOLDOver:RECOvery:INITiate
- SYNChronization:HOLDOver:TUNCertainty:PREDicted?
- SYNChronization:SOURce:MODE
<STL|GPS|PTP|EXTernal|REF10Mhz|PRIority>
- SYNChronization:SOURce:PRIority <STL|GPS|PTP|EXTernal>
- SYNChronization:SOURce:PRIority:RESET DEFAULT
- SYNChronization:SOURce:PRIority:TOP <STL|GPS|EXTernal|PTP>
- SYNChronization:SOURce:MODE:EDGE <NEGative|POSitive>
- SYNChronization:SOURce:STATE?
- SYNChronization:SOURce:STATE:VALue?
- SYNChronization:HOLDOver:STATE?
- SYNChronization:TINTErval?
- SYNChronization:TINTErval:THREshold <int> [50,2000]
- SYNChronization:IMMEdiate
- SYNChronization:FEEstimate?
- SYNChronization:LOCKed?
- SYNChronization:OUTput:1PPS:RESET <ON|OFF>
- SYNChronization:OUTput:1PPS:WIDTH <int> <ms | us> [100us, 500ms]
- SYNChronization:HEALTH?
- SYNChronization:HEALTH:ALARMDelay:HOLDOver <int> [0,604800]
- SYNChronization?

SYNChronization:HOLDOVER:DURATION?

This query returns the duration of the present or most recent period of operation in the holdover and holdover processes. This is the length of time the reference oscillator was not locked to GNSS receiver 1PPS, and thus “coasting”. The time units are seconds.

The first number in the response is the holdover duration. The duration units are seconds, and the resolution is 1 second. If the Receiver is in holdover, the response quantifies the current holdover duration. If the Receiver is not in holdover, the response quantifies the previous holdover.

The second number in the response identifies the holdover state. A value of 0 indicates the Receiver is not in holdover; a value of 1 indicates the Receiver is in holdover.

SYNChronization:HOLDOVER:INITIATE

The SYNC:HOLD:INIT and SYNC:HOLD:REC:INIT commands allow the user to manually enter and exit the holdover state, even while GNSS signals are still being properly received. This forced-holdover allows the unit to effectively disable GNSS locking, while still keeping track of the state of the 1PPS output in relation to the UTC 1PPS signal as generated by the GNSS receiver.

When the unit is placed into forced-holdover with this command, the unit will indicate the time interval difference between the 1PPS output and the GNSS or STL or PTP 1PPS by using the SYNC:TINT? command. This allows the user to see the OCXO drift when not locked to GNSS signals for testing purposes, or to prevent the GNSS receiver from being spoofed and affecting the OCXO frequency accuracy. The measurement range is limited to +/-2,000ns phase offset. All other frequency-disciplining functions of the unit will behave as if the GNSS antenna is disconnected from the unit while in this forced-holdover state.

SYNChronization:HOLDOVER:RECOVERY:INITIATE

This command will disable the forced holdover state (see the SYNC:HOLD:INIT command). The unit will resume normal GNSS or STL or PTP locking operation after this command has been sent.

SYNChronization:HOLDOVER:TUNCERTAINTY:PREDICTED?

This query will print the holdover prediction for one day. Holdover is the length of time the reference oscillator was not locked to GNSS or STL or PTP 1PPS, and thus “coasting”. The time units are seconds with a resolution of 100 ns. The first number printed in response to this query is the holdover duration. The duration unit is 1 to represent one day. The second number in the response identifies the holdover state. A value of 0 indicates the receiver is not in holdover; a value of 1 indicates the Receiver is in holdover.

SYNChronization:SOURce:MODE <STL|GPS|PTP|EXTernal|REF10Mhz|PRiority>

The board may be configured to lock to an external PPS source rather than the GNSS or STL receiver or PTP module with this command.

This command selects between the EXTernal, GPS, PTP, STL, and PRiority sync modes as the 1PPS source. The GPS modes use the GNSS 1PPS input for disciplining the oscillator and synchronizing precise timing, the GPS mode also gates the 1PPS based on the GNSS status of the external receiver as indicated in the NMEA serial sentences from the GNSS receiver. The External mode uses the external 1PPS reference input to synchronize precise timing and discipline the oscillator regardless of the GNSS status.

By default, the unit is set to STL disciplining for the STL-2600™ order option. The unit may be hard-coded to only use the external PPS source by setting EXT, or it may be auto-switched by the firmware with PRiority settings to the external PPS signal if the internal GNSS receiver does not generate 1PPS signals for longer than 15 seconds due to a weak signal, or GPS failure. Setting the unit to the EXT setting will cause the unit to disable the GNSS receiver, and this setting may also be used to initiate a manual forced-holdover if the GNSS signal is suspect, or unreliable.

The STL mode will enable the STL as an external PPS source and the PTP mode will enable the PTP as an external PPS source.

The PRiority mode will select a new and stable reference signal for use if the current reference signal is removed or unstable. The new signal chosen will be based off an order of priority. The default order of priority is:

- 1 STL
- 2 GPS
- 3 PTP
- 4 EXTernal

For instance, the STL signal is used first. If the STL signal is later removed from the PNT-62xx or is no longer stable, the unit will use the GPS signal next if it is stable. If the GPS signal is removed or unstable, the PNT-62xx will then use the PTP signal if it is stable.

The command has the following format:

```
SYNChronization:SOURce:MODE <PTP|GPS|EXTernal|STL|PRIority>
```

The following command returns the current mode setting stored in NV memory:

```
SYNChronization:SOURce:MODE?
```

SYNChronization:SOURce:PRiority <STL|GPS|PTP|EXTernal>

This command will set or query the current priority order used with the SYNC:SOURCE:MODE PRI setting. This command has the following format:

```
SYNChronization:SOURce:PRIority <STL|GPS|PTP|EXTernal>
```

where multiple sources are listed separate by spaces. For example, the following command enables STL as the highest priority source followed by PTP as the second priority source:

```
SYNChronization:SOURce:PRIority STL PTP
```

The following command returns the current priority list setting stored in NV memory:

```
SYNChronization:SOURce:PRIority?
```

SYNChronization:SOURce:PRIority:RESET DEFAULT

This command is not currently supported in PNT-62xx. This command will reset the current priority levels to the default levels. The default levels are:

- 1 STL
- 2 GPS
- 3 PTP
- 4 EXT

SYNCHronization:SOURce:PRIority:TOP <STL|GPS|EXTernal|PTP>

This command is not currently supported in PNT-62xx. This command allows the priority list to be customized. The user can select a stable 1PPS source as the top or highest priority source with this command.

As an example, say this is the current priority list:

- 1 STL
- 2 GPS
- 3 PTP
- 4 EXT

If the PTP source is later determined by the user to be the highest priority source, the command should be entered like so:

```
SYNCHronization:SOURce:PRIority:TOP PTP
```

The new priority list will be as follows:

- 1 PTP
- 2 STL
- 3 GPS
- 4 EXT

This query will return the priority list's current top source:

```
SYNCHronization:SOURce:PRIority:TOP?
```

SYNChronization:SOURce:MODE:EDGE <NEGative|POSitive>

This command is not currently supported in PNT-62xx.

SYNChronization:SOURce:STATe?

This command returns the state of the `SYNC:SOUR:MODE` command, and may return GPS, STL, PTP or EXTERNAL.

SYNChronization:SOURce:STATe:VALue?

This command returns the state of the `SYNC:SOUR:MODE` command in numeric value, and may return 1 for STL, 2 for GPS, 3 for PTP or 4 for EXTERNAL.

SYNChronization:HOLDoVer:STATe?

This query returns the current holdover state with possible responses being NONE, MANUAL, or ON. NONE indicates the holdover state is off. MANUAL indicates the holdover is manually enabled with the `SYNChronization:HOLDoVer:INITiate` command. ON indicates that holdover is enabled due to lack of external or PTP PPS signal or valid GNSS/STL fix from GNSS/STL receiver.

SYNChronization:TINTerval?

This query returns the difference or timing shift between the PNT-62xx 1PPS output and the reference 1PPS signal indicated in `SYNChronization:SOURce:STATe?` query. The resolution is 1E-10 seconds.

SYNChronization:TINTerval:THReshold <int> [50,2000]

This command selects the oscillator driven 1PPS phase-offset threshold as compared to the reference 1PPS at which point the unit will initiate a counter-reset (jam-sync) aligning the oscillator driven 1PPS with the reference 1PPS phase. The oscillator phase is slowly and continuously adjusted toward 0ns offset to the reference 1PPS while the phase difference is less than the THReshold phase limit. The oscillator driven 1PPS phase is allowed to drift up to this threshold before a jam-sync is initiated.

The default setting is 300ns (1000ns for STL 1PPS), allowing a drift of up to +/- 300ns (1000ns for STL 1PPS). Reaching this selected threshold will cause a jam-sync phase-normalization to be initiated, which will also cause the `SYNC:HEALTH? Status` to indicate 0x200, and the lock status to be unlocked as indicated by the Green LED turning off for several minutes. Setting the threshold to larger values (i.e. 1000ns or higher) will prevent nuisance jam-sync events to happen to the 1PPS output phase, at the expense of potentially larger phase errors to accumulate on the 1PPS output

before the loop algorithms can pull the phase error toward 0ns.

The following command queries the state of
SYNChronization:TINterval:THReshold:

```
SYNChronization:TINterval:THReshold?
```

SYNChronization:IMMEdiate

This command initiates a near-instantaneous alignment of the GNSS/STL/PTP/EXT 1PPS and Receiver output 1 PPS. To be effective, this command has to be issued while not in holdover.

SYNChronization:FEEstimate?

This query returns the Frequency Error Estimate, similar to the Allan Variance using a 1000s measurement interval and comparing the GNSS/STL/PTP/EXT 1PPS to GNSS 1PPS offset.

Values less than 1E-012 are below the noise floor, and are not significant.

SYNChronization:LOCKed?

This query returns the lock state (0=OFF, 1=ON) of the PLL controlling the OCXO.

SYNChronization:OUTput:1PPS:RESET <ON|OFF>

This command allows the generation of the 1PPS signal upon power-on without an GNSS/Iridium antenna being connected to the unit or valid 1PPS input signal. By default the unit does not generate a 1PPS signal until the GNSS or STL receiver has locked onto the Satellites.

With the command SYNC:OUT:1PPS:RESET ON the unit can be configured to generate an asynchronous 1PPS output after power-on even if a GNSS/Iridium antenna is not connected to the unit. Once valid 1PPS input is received, the output 1PPS signal will align itself to UTC time by stepping in 10 equally spaced steps toward UTC alignment. The default setting is OFF which means the 1PPS output signal is disabled until proper GNSS/STL lock is achieved.

This command has the following format:

```
SYNChronization:OUTput:1PPS:RESET <ON|OFF>
```

This command will query the state of this command:

```
SYNChronization:OUTput:1PPS:RESET?
```

SYNChronization:OUTput:1PPS:WIDTH <int> <ms | us> [100us, 500ms]

This command allows configuration of the 1PPS active high pulse width. The default pulse width on the standard PNT-62xx is 200 milliseconds and the pulse can be configured from 100 microseconds to 500 milliseconds. The integer parameter is followed by optional us (microsecond) or ms (millisecond) units. The default unit is milliseconds. The output 1PPS signal is synchronized to UTC (USNO) on its rising edge if 3D fix is available.

This command has the following format:

```
SYNChronization:OUTput:1PPS:WIDTH <int> <ms | us >
[100us, 500ms]
```

The following command returns the current pulse width setting stored in NV memory:

```
SYNChronization:OUTput:1PPS:WIDTH?
```

The unit of parameter for this command can be either us or ms. For example, command

`SYNChronization:OUTput:1PPS:WIDTH 200000us` and command `SYNChronization:OUTput:1PPS:WIDTH 200ms` will both configure the pulse width to 200ms. If the 1PPS output signal is already available before sending this command, a 1PPS pulse with the specified pulse width will be generated on the next second and every second thereafter.

SYNChronization:HEALTH?

The `SYNChronization:HEALTH?` query returns a hexadecimal number indicating the system's health-status. Error flags are encoded in a binary fashion so that each flag occupies one single bit of the binary equivalent of the hexadecimal health-status flag.

The following system parameters are monitored and indicated through the health-status indicator. Individual parameters are 'Ored' together which results in a single hexadecimal value encoding the following system status information:

If the OCXO coarse-DAC is maxed-out at 255	HEALTH STATUS = 0x1;
If the OCXO coarse-DAC is mined-out at 0	HEALTH STATUS = 0x2;
If the phase offset to UTC is >250ns	HEALTH STATUS = 0x4;
If the run-time is < 300 seconds	HEALTH STATUS = 0x8;
If the GNSS receiver is in holdover > 60s	HEALTH STATUS = 0x10;
If the Frequency Estimate is out of bounds	HEALTH STATUS = 0x20;

If the power supply or OCXO voltage is too high	HEALTH STATUS = 0x40;
If the power supply or OCXO voltage is too low	HEALTH STATUS = 0x80;
If the short-term-drift (ADEV @ 100s) > 100ns	HEALTH STATUS = 0x100;
For the first 3 minutes after a phase-reset, or a coarsedac change:	HEALTH STATUS = 0x200;
If the GNSS receiver indicates a strong jamming signal of >=50 (range is 0 to 255) and is in holdover	HEALTH STATUS = 0x800;
If the servo loop is performing pre-filtering for unstable 1PPS input signal	HEALTH STATUS = 0x2000;

For example, if the unit is in GNSS/STL receiver holdover, the OCXO voltage is too high, and the UTC phase offset is > 250ns, then the following errors would be indicated:

- 1 UTC phase > 250ns: 0x4
- 2 OCXO voltage too high: 0x40
- 3 GNSS/STL receiver in holdover: 0x10

'Oring' these values together results in:

$$0x40 \mid 0x10 \mid 0x4 = 0x54$$

The unit would thus indicate: HEALTH STATUS: 0x54

A health status of 0x0 indicates a properly locked, and warmed-up unit that is completely healthy and does not have any pending events.

SYNChronization:HEAlth:ALARMDelay:HOLDover <int> [0,604800]

Configures a delay in seconds before indicating a health alarm to avoid unnecessary alarms from short holdover periods. A setting of 0 disables the delay and the maximum setting is 604,800 seconds or one week.

This command has the following format:

```
SYNChronization:HEAlth:ALARMDelay:HOLDover <int> [0,604800]
```

This command will query the state of this command:

```
SYNChronization:HEAlth:ALARMDelay:HOLDover?
```

SYNChronization?

This query returns the results of the following queries:

- SYNChronization:SOURce:MODE?

- SYNChronization:SOURce:STATe?
- SYNChronization:OUTput:1PPS:RESET?
- SYNChronization:OUTput:1PPS:WIDTH?
- SYNChronization:LOCKed?
- SYNChronization:HOLDoVer:STATe?
- SYNChronization:HOLDoVer:DURation?
- SYNChronization:FEEstimate?
- SYNChronization:TINTerval?
- SYNChronization:TINTerval:THReshold?
- SYNChronization:HEALth?

DIAGnostic Subsystem

This subsystem regroups the queries related to the diagnostic of the OCXO. The list of the commands supported for this subsystem is as follows:

- DIAGnostic:ROSCillator:EFControl:RELative <float> [-100.0, 100.0]
- DIAGnostic:ROSCillator:EFControl:ABSolute <float> [0.0, 5.0]
- DIAGnostic:LIFetime:COUNT?
- DIAGnostic:LIFetime:SECond?
- DIAGnostic?

DIAGnostic:ROSCillator:EFControl:RELative <float> [-100.0, 100.0]

This command sets the Electronic Frequency Control (EFC) output value of the internal reference oscillator. The parameter value should be a percentage between -100.0 to +100.0.

This command has the following format:

```
DIAGnostic:ROSCillator:EFControl:RELative [-100.0, 100.0]
```

This command will query the state of this command:

```
DIAGnostic:ROSCillator:EFControl:RELative?
```

DIAGnostic:ROSCillator:EFControl:ABSolute <float> [0.0, 5.0]

This command sets the Electronic Frequency Control (EFC) output value of the internal reference oscillator. The parameter value should be normalized to volts.

This command has the following format:

```
DIAGnostic:ROSCillator:EFControl:ABSolute [0.0, 5.0]
```


This command will query the state of this command:

```
DIAGnostic:ROSCillator:EFControl:ABSolute?
```

DIAGnostic:LIFetime:COUNT?

This command returns the number of hours the unit has been powered-on.

DIAGnostic:LIFetime:SECond?

This command returns the number of seconds the unit has been powered-on.

DIAGnostic?

Sending the command DIAG? returns the result of the three following queries:

- `DIAGnostic:ROSCillator:EFControl:RELative?` : Relative oscillator setting
- `DIAGnostic:ROSCillator:EFControl:ABSolute?` : Absolute oscillator setting
- `DIAGnostic:LIFetime:COUNT?` : Time since power-on in hours (lifetime)

An example of the syntax:

```
scpi > diag?  
EFControl Relative: 0.025000%  
EFControl Absolute: 5  
Lifetime : +871
```

CSAC Subsystem

The following commands are used to query the status of the CSAC or Rubidium oscillator. The following commands will return Command Error if the atomic oscillator is not detected or present.



NOTE

The CSAC nomenclature is used for compatibility with all legacy JLT CSAC GNSDO and JLT Rubidium GNSDO products.

CSAC:RS232?

This query returns the state (OK or FAIL) of the serial communication between the main CPU and the oscillator of the attached unit's internal microcontroller. When the state is

FAIL, there is a communication breakdown, and the unit should be power cycled to clear the communication error.

CSAC:STeer?

This query returns the current Frequency Adjustment in units of parts-per-trillion (1E-012). The Frequency Adjustment is relative to the latched frequency stored in the CSAC or MAC.

CSAC:TYPE?

This query returns the type/model of the connected atomic oscillator.

CSAC:LOCKed?

This query returns the lock status of the atomic oscillator. A value of 1 is returned if the CSAC or Rubidium is in atomic lock.

CSAC:STATus?

This query returns the status value of the CSAC or Rubidium clock.

If the Microsemi Rubidium is attached to the PNT-62xx, this query will return one of two values [0,1] as shown below. If the unit does not indicate STATUS 0 after 10 minutes from power-on, the Microsemi Rubidium may not have locked properly and may need to be power-cycled. This can happen if power supplies with insufficient current capability to handle the Microsemi Rubidium warm-up currents are used.

- 0 = The Microsemi Rubidium is locked and healthy
- 1 = The Microsemi Rubidium is not locked

If the CSAC is attached, one of the status values shown in [Table 10](#) will be displayed.

Table 10 CSAC Status definitions

Status	Definition
0	Locked
1	Microwave Frequency Steering
2	Microwave Frequency Stabilization
3	Microwave Frequency Acquisition
4	Laser Power Acquisition
5	Laser Current Acquisition
6	Microwave Power Acquisition

Table 10 CSAC Status definitions

Status	Definition
7	Heater Equalibration
8	Initial Warm-up
9	Asleep (ULP mode only)

CSAC:ALarm?

Returns the Alarm value of CSAC oscillator, as shown in [Table 11](#).

Table 11 Alarm values

Alarm	Definition
0x0001	Signal Contrast Low
0x0002	Synthesizer Tuning at Limit
0x0010	DC Light Level Low
0x0020	DC Light Level High
0x0040	Heater Power Low
0x0080	Heater Power High
0x0100	uW Power Control Low
0x0200	uW Power Control High
0x0400	TCXO Control Voltage Low
0x0800	TCXO Control Voltage High
0x1000	Laser Current Low
0x2000	Laser Current High
0x4000	Stack Overflow (Firmware Error)

CSAC:MODE?

This query returns the mode value of CSAC or Rubidium clock.

If the Microsemi Rubidium is attached to the PNT-62xx, this query will return one of two values:

- 0x0000 = Analog tuning is disabled
- 0x0001 = Analog tuning is enabled

If the CSAC is attached to the PTN-62xx, this query returns its mode as shown in [Table 12](#).

Table 12 Mode values

Mode	Definition
0x0001	Analog Tuning Enable
0x0002	Reserved
0x0004	Reserved
0x0008	1 PPS Auto-Sync Enable
0x0010	Discipline Enable
0x0020	Ultra-Low Power Mode Enable
0x0040	Reserved
0x0080	Reserved

CSAC:CONTrast?

This query returns an indication of signal level in CSAC oscillator, typically ~4000 when locked, and ~0 when unlocked.

CSAC:LASer?

This query returns the current (in mA) driving the laser in CSAC oscillator.

CSAC:TCXO?

This query returns the TCXO Tuning Voltage, 0-2.5 VDC tuning range ~ +/- 10 ppm.

CSAC:SIGnal?

If the Microsemi Rubidium is attached to the PNT-62xx, this query will return an indication of the Microsemi Rubidium Vapor Cell DC interrogation signal level in mV. If the CSAC is attached, this query will simply return the indication of signal level.

CSAC:HEATpackage?

If the Microsemi Rubidium is attached to the PNT-62xx, it will return the Physics package heater power in mW. If the CSAC is attached to the PNT-62xx, this query will return the Physics package heater power, typically 15mW under NOC will be returned.

CSAC:TEMP?

If the CSAC is attached to the PNT-62xx, this query will return the temperature measured by the unit in °C. Absolute accuracy is +/- 2°C. If a Microsemi Rubidium is attached to the PNT-62xx, the temperature measured by the Microsemi Rubidium oscillator unit is in °C.

CSAC:SN?

This query returns the Serial Number in the form *YYMMCSNNNNN* where *YYMM* is the year and month of production and *NNNNN* is the serialized unit of that month.

CSAC:FWver?

This query returns the firmware version of the CSAC or Rubidium unit.

CSAC:LIFETIME?

This query returns the accumulated number of hours the CSAC or Rubidium clock has been powered on since the last factory reset of the respective board. The value is stored in the external NVRAM and updated every hour when the unit is powered on.

CSAC:DDScenter?

This query is compatible with the Microsemi Rubidium. It will return the DDS frequency center current in Hertz.

CSAC:TECcontrol?

This query is compatible with the Microsemi Rubidium. It will return the TEC Control value in °C.

CSAC:STeer:LATch ONCE

This command stores the momentary steering offset into the respective unit's internal NVRAM. This is done automatically by the firmware once every 24 hours, so as not to damage the NVRAM which has a limited number of write cycles. The user may force this value to be stored by issuing the `CSAC:STeer:LATch ONCE` command.

CSAC:POWer <ON|OFF>

This command is compatible with the CSAC. By default the normal power mode is ON and sending `CSAC:POWer OFF` command will put the CSAC in ULP mode.

The power will always be shown as ON with the Rubidium attached to the PNT-62xx.

The CSAC may lose atomic lock while in ULP mode. JLT thus recommends keeping the `CSAC:POWer ON` setting for normal operation and optimal performance on PNT-62xx.

This command has the following format:

```
CSAC:POWer <ON | OFF>
```

The following command returns the current power setting where ON means normal power mode:

```
CSAC:POWer?
```

CSAC?

This command returns the result of the following queries:

- `CSAC:RS232?`
- `CSAC:STeer?`
- `CSAC:TYPE?`
- `CSAC:LOCKed?`
- `CSAC:STATus?`
- `CSAC:ALarm?`
- `CSAC:MODE?`
- `CSAC:CONTrast?`
- `CSAC:LASer?`
- `CSAC:TCXO?`
- `CSAC:SIGnal?`
- `CSAC:HEATpackage?`
- `CSAC:TEMP?`
- `CSAC:SN?`
- `CSAC:FWver?`
- `CSAC:LIFETIME?`
- `CSAC:DDScenter?`
- `CSAC:TECcontrol?`
- `CSAC:POWer?`

RFOUTput Subsystem

This subsystem regroups the commands related to the functionality of the on-board Micro-Transcoder order option. The list of the commands supported for this subsystem is as follows:

- `RFOUTput <ON|OFF>`
- `RFOUTput:POWER <float> [-200.0, 200.0]`
- `RFOUTput:DCBlock <ON|OFF>`
- `RFOUTput:RESET ONCE`
- `RFOUTput:ISP ON`
- `RFOUTput:SCPI <ASCII> <command>`
- `RFOUTput:SIM:RESTART ONCE`
- `RFOUTput:SIM:HOLDOVER <ON|OFF|LIMIT>`
- `RFOUTput:SIM:HOLDOVER:LIMIT <int> [5, 86400]`
- `RFOUTput:SIM:LNAV:SElect <AUTO|USER|LIVE>`

RFOUTput <ON|OFF>

This command will enable or disable the transcoding RF output signal on the Micro-Transcoder. Transcoding is enabled by default. If the Transcoder is not transcoding properly, try sending the RFOUT ON command once.

This command has the following format:

```
RFOUTput <ON|OFF>
```

This command will query the state of this command:

```
RFOUTput?
```

RFOUTput:POWER <float> [-200.0, 200.0]

This command sets the power level at the RF output jack on an individual satellite basis.

The `RFOUTput:POWER` command sets the simulator's RF output power from the perspective of a single satellite, not the entire constellation. When N satellites are transmitting, the total RF output power will be approximately $10 \cdot \log_{10} N$ dB greater than specified.

The nominal output power of a live GPS satellite signal at the surface of the earth is typically about -125 dBm, but is often a few dB higher to allow for a reduction in power as the satellite ages. Additionally, target GPS receivers often expect to be used with an amplified antenna, so the output power is typically set higher than -125 dBm for optimum performance of the target GPS receiver.

This command has the following format:

```
RFOUTput:POWer <float> [-200.0, 200.0]
```

This command will query the state of this command:

```
RFOUTput:POWer?
```

RFOUTput:DCBlock <ON|OFF>

This command will enable or disable the transcoding RF output signal on the Micro-Transcoder. Transcoding is enabled by default. If the Transcoder is not transcoding properly, try sending the RFOUT ON command once.

This command has the following format:

```
RFOUTput:DCBlock <ON|OFF>
```

This command will query the state of this command:

RFOUTput:RESET ONCE

This command will issue a reset sequence for the Micro Transcoder™ board once.

RFOUTput:ISP ON

This command will send the Micro Transcoder™ board into ISP mode for reprogramming. Refer to Chapter 4 of the Micro Transcoder™ User Manual for programming instructions.

RFOUTput:SCPI <ASCII> <command>

This command sends a SCPI command to the Micro Transcoder™ and can be used for changing settings not configurable through the PNT-62xx's SCPI interface. Refer to the *Micro Transcoder™ User Manual* for the complete list of configuration commands.

RFOUTput:SIM:RESTART ONCE

This command will stop the current simulation once and restart transcoding shortly for RF output of Micro Transcoder™ board.

RFOUTput:SIM:HOLDover <ON|OFF|LIMIT>

This command controls the behavior when the external PVT reference indicates that position information is invalid while operating in Transcoding simulation mode.

This command has the following format:

```
RFOUtpuT:SIM:HOLDOveR <ON|OFF|LIMIT>
```

When the LIMIT mode is selected, the limit time is specified with the SIM:HOLD:LIMIT command, and the RF output is disabled when the unit reaches the specified holdover time limit described in “RFOUtpuT:SIM:HOLDveR:LIMIT <int> [5, 86400]” on page 79.

This command will query the state of this command:

```
RFOUtpuT:SIM:HOLDOveR?
```

RFOUtpuT:SIM:HOLDveR:LIMIT <int> [5, 86400]

This command specifies the limit, in seconds, that the holdover state should remain active in the Limit simulation holdover mode. The maximum limit is 1 day or 86400 seconds. Once this holdover limit is reached, the RF output is disabled. For longer holdover periods, use the ON simulation holdover mode.

This command has the following format:

```
RFOUtpuT:SIM:HOLDveR:LIMIT <int> [5, 86400]
```

This command will query the state of this command:

```
RFOUtpuT:SIM:HOLDveR:LIMIT?
```

RFOUtpuT:SIM:LNAV:SELeCt <AUTO|USER|LIVE>

This command is not supported on the PNT-62xx.

MEASURE Subsystem

This subsystem regroups the queries related of some parameters that are measured on-board on the PNT-62xx. The list of the commands supported for this subsystem is the following:

- MEASure:APOWersupply?
- MEASure:BPOWersupply?
- MEASure:SUPPLY5VOLT?
- MEASure?

MEASure:APOWersupply?

This query returns the voltage supplied by voltage supply A.

MEASure:BPOwersupply?

This query returns the voltage supplied by voltage supply B.

MEASure:SUPPLY5Volt?

This query returns the voltage supplied by the 5V voltage source.

MEASure?

This query returns the result of the three following queries:

- MEASure:APOwersupply?
- MEASure:BPOwersupply?
- MEASure:SUPPLY5Volt?

System subsystem

This subsystem regroups the commands related to the general configuration of the PNT-62xx. The list of the commands supported for this subsystem follows:

- SYSTEM:COMMunicate:SERial:ECHO <ON|OFF>
- SYSTEM:COMMunicate:SERial:PROmpt <ON|OFF>
- SYSTEM:COMMunicate:SERial:BAUD <9600|19200|38400|57600|115200>
- SYSTEM:COMMunicate:SERial:FAST <ON|OFF>
- SYSTEM:COMMunicate:GNSS:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
- SYSTEM:COMMunicate:GNSS:MODE <ON|OFF>
- SYSTEM:COMMunicate:RSRSCPI:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
- SYSTEM:COMMunicate:RSRSCPI:MODE <ON|OFF>
- SYSTEM:COMMunicate:STL:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
- SYSTEM:COMMunicate:STL:MODE <ON|OFF>
- SYSTEM:COMMunicate:TOD:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
- SYSTEM:COMMunicate:TOD:MODE <ON|OFF>
- SYSTEM:COMMunicate:CSAC:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
- SYSTEM:COMMunicate:CSAC:MODE <ON|OFF>
- SYSTEM:COMMunicate:RSRGPS:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

- SYSTEM:COMMunicate:RSRGPS:MODE <ON|OFF>
- SYSTEM:COMMunicate:MCE:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
- SYSTEM:COMMunicate:MCE:MODE <ON|OFF>
- SYSTEM:POWer <SLEEP|DSLEEP|PDOWN|DPDOWN>
- SYSTEM:COMMunicate:DLOAD <STL|GNSS|TRANscoder>
- SYSTEM:STATus?
- SYSTEM:FACToryReset ONCE
- SYSTEM:CPURESET
- SYSTEM:ISP

SYSTEM:COMMunicate:SERial:ECHO <ON|OFF>

This command enables/disables echo on the SCPI serial port. This command has the following format:

```
SYSTEM:COMMunicate:SERial:ECHO <ON|OFF>
```

SYSTEM:COMMunicate:SERial:PROmpt <ON|OFF>

This command enables/disables the prompt “`scpi>`” on the SCPI command lines. The prompt must be enabled when used with the GPSCon utility discussed in [Chapter 3 “GPSCon Utility”](#). This command has the following format:

```
SYSTEM:COMMunicate:SERial:PROmpt <ON|OFF>
```

SYSTEM:COMMunicate:SERial:BAUD <9600|19200|38400|57600|115200>

This command sets the serial speed for SCPI serial port. The serial configuration is always 8 bit, 1 stop bit, no parity, no HW flow control. Upon Factory reset, the speed is set at 115200 bauds. Higher baud rates such as 115200 are suggested if several NMEA commands are enabled, or high rates of serial communications are expected to avoid serial port overflow. This command has the following format:

```
SYSTEM:COMMunicate:SERial:BAUD <9600|19200|38400|57600|115200>
```

SYSTEM:COMMunicate:SERial:FAST <ON|OFF>

This command turns the serial port’s fast mode on or off.

This command has the following format:

```
SYSTEM:COMMunicate:SERial:FAST <ON|OFF>
```

This command will query the state of this command:

SYSTem:COMMunicate:SERial:FAST?

SYSTem:COMMunicate:GNSS:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

This command sets the GNSS receiver's serial speed. This command will work for both the uBlox and Septentrio GNSS receivers. The serial configuration is always 8 bit, 1 stop bit, no parity, no flow control. The factory default setting is 115200.

This command has the following format:

```
SYSTem:COMMunicate:GNSS:BAUD <9600|19200|38400|57600|115200>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:GNSS:BAUD?
```

SYSTem:COMMunicate:GNSS:MODE <ON|OFF>

This command will enable or disable the GNSS port for communication. This command will work for both the uBlox and Septentrio GNSS receivers.

This command has the following format:

```
SYSTem:COMMunicate:GNSS:MODE <ON|OFF>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:GNSS:MODE?
```

SYSTem:COMMunicate:RSRSCPI:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

This command sets the serial speed for SCPI port of the Micro-Transcoder. The serial configuration is always 8 bit, 1 stop bit, no parity, no flow control. The factory default setting is 115200 baud.

This command has the following format:

```
SYSTem:COMMunicate:RSRSCPI:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:RSRSCPI:BAUD?
```

SYSem:COMMunicate:RSRSCPI:MODE <ON|OFF>

This command will enable or disable the communication for SCPI port of the Micro-Transcoder port.

This command has the following format:

```
SYSem:COMMunicate:RSRSCPI:MODE <ON|OFF>
```

This command will query the state of this command:

```
SYSem:COMMunicate:RSRSCPI:MODE?
```

SYSem:COMMunicate:STL:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

This command sets the STL serial speed. The serial configuration is always 8 bit, 1 stop bit, no parity, no flow control. The factory default setting is 115200 baud.

This command has the following format:

```
SYSem:COMMunicate:STL:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
```

This command will query the state of this command:

```
SYSem:COMMunicate:STL:BAUD?
```

SYSem:COMMunicate:STL:MODE <ON|OFF>

This command will enable or disable the STL port for communication.

This command has the following format:

```
SYSem:COMMunicate:STL:MODE <ON|OFF>
```

This command will query the state of this command:

```
SYSem:COMMunicate:STL:MODE?
```

SYSem:COMMunicate:TOD:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

This command sets the serial speed for the PTP TOD serial port. The serial configuration is always 8 bit, 1 stop bit, no parity, no flow control. The factory default setting is 115200 baud.

This command has the following format:

```
SYSTem:COMMunicate:TOD:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:TOD:BAUD?
```

SYSTem:COMMunicate:TOD:MODE <ON|OFF>

This command will enable or disable the communication for the PTP TOD serial port.

This command has the following format:

```
SYSTem:COMMunicate:TOD:MODE <ON|OFF>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:TOD:MODE?
```

SYSTem:COMMunicate:CSAC:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

This command sets the CSAC serial speed. The serial configuration is always 8 bit, 1 stop bit, no parity, no flow control. The factory default setting is 115200 baud.

This command has the following format:

```
SYSTem:COMMunicate:CSAC:BAUD <9600 | 19200 | 38400 | 57600 | 115200>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:CSAC:BAUD?
```

SYSTem:COMMunicate:CSAC:MODE <ON|OFF>

This command will enable or disable the CSAC port for communication.

This command has the following format:

```
SYSTem:COMMunicate:CSAC:MODE <ON|OFF>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:CSAC:MODE?
```

SYSTem:COMMunicate:RSRGPS:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

This command sets the serial speed for GPS port of the Micro-Transcoder port. The serial configuration is always 8 bit, 1 stop bit, no parity, no flow control. The factory default setting is 115200 baud.

This command has the following format:

```
SYSTem:COMMunicate:RSRGPS:BAUD <9600 | 19200 | 38400 | 57600  
| 115200>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:RSRGPS:BAUD?
```

SYSTem:COMMunicate:RSRGPS:MODE <ON|OFF>

This command will enable or disable the communication for GPS port of the Micro-Transcoder port.

This command has the following format:

```
SYSTem:COMMunicate:RSRGPS:MODE <ON|OFF>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:RSRGPS:MODE?
```

SYSTem:COMMunicate:MCE:BAUD <9600 | 19200 | 38400 | 57600 | 115200>

This command sets the serial speed for PTP MCE serial port. The serial configuration is always 8 bit, 1 stop bit, no parity, no flow control. The factory default setting is 115200 baud.

This command has the following format:

```
SYSTem:COMMunicate:MCE:BAUD <9600 | 19200 | 38400 | 57600 |  
115200>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:MCE:BAUD?
```

SYSTem:COMMunicate:MCE:MODE <ON|OFF>

This command will enable or disable the communication for PTP MCE serial port.

This command has the following format:

```
SYSTem:COMMunicate:MCE:MODE <ON|OFF>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:MCE:MODE?
```

SYSTem:POWer <SLEEP|DSLEEP|PDOWN|DPDOWN>

This command configures the power-down state of the microprocessor. The possible states include: sleep, deep sleep, power down mode, or deep power down mode.

The SLEEP command puts the device into a power saving state where all actions are stopped. Normal operations and full power can be resumed within a few seconds. Use the deep sleep command, DSLEEP, to turn the clock generator off. The processor does not need to keep its cache coherent, but maintains other states. The processor will take a bit longer to wake up. The PDOWN command will power down the device and clear the state of RAM. Use the DPDOWN command to put the device into a deep power down state for minimal power consumption.

SYSTem:COMMunicate:DLOAD <STL|GNSS|TRANscoder>

This command will enable the PNT-62xx to enter download/programming mode for the specified serial port. The ports that can be used for downloading are: STL, GNSS, or TRANscoder SCPI ports. The unit will require manual reset after the download is completed.

This command has the following format:

```
SYSTem:COMMunicate:DLOAD <STL|GNSS|TRANscoder>
```

This command will query the state of this command:

```
SYSTem:COMMunicate:DLOAD?
```

SYSTem:STATus?

This query returns a full page of GNSS status in ASCII format. The output is compatible with the GPSCon Windows program discussed in [Chapter 3 “GPSCon Utility”](#). The SYST:STAT? command is one of the most useful single commands to query as it contains a wealth of information.

This command is used by the GPSCon application.

SYSTem:FACToryReset ONCE

This command applies the Factory Reset setting to the EEPROM. All aging, tempco, and user parameters are overwritten with factory default values.

SYSTEM:CPURESET

This command causes the PNT-62xx processor to reset.

SYSTEM:ISP

This command causes the PNT-62xx processor to reset into In System Programming (ISP) mode for firmware upgrades. Please see [“Introduction” on page 22](#) for details on updating the firmware in ISP mode. Initiating this command is equivalent to shorting-out the ISP# pin 2 of header J15 to pin 1 (Ground) of header J15 of the PNT-62xx board during power-on.

Once the system is placed into ISP mode it will need to be power-cycled or an ISP-Reset command will need to be sent through the NXP ISP programming interface commands to establish a normal operating mode.

SERVO Subsystem

This subsystem regroups all the commands related to the adjustment of the servo loop:

- `SERVo?`
- `SERVo:MODE <SLOW|MEDium|FAST|AUTO>`
- `SERVo:MODE:FASTDURation <int> [60, 604800]`
- `SERVo:MODE:MEDDURation <int> [60, 604800]`
- `SERVo:DACGain <float> [0.001, 10000]`
- `SERVo:EFCScale <float> [0.0, 500.0]`
- `SERVo:EFCScale:MEDium <float> [0.0, 500.0]`
- `SERVo:EFCScale:FAST <float> [0.0, 500.0]`
- `SERVo:EFCDamping <int> [2, 4000]`
- `SERVo:EFCDamping:MEDium <int> [2, 4000]`
- `SERVo:EFCDamping:FAST <int> [2, 4000]`
- `SERVo:SLOPe <NEG|POS>`
- `SERVo:TEMPCompensation <float> [-4000.0, 4000.0]`
- `SERVo:AGINGcompensation <float> [-10.0, 10.0]`
- `SERVo:PHASECOrrrection <float> [-500.0, 500.0]`
- `SERVo:PHASECOrrrection:MEDium <float> [-500.0, 500.0]`
- `SERVo:PHASECOrrrection:FAST <float> [-500.0, 500.0]`
- `SERVo:COARSedac <int> [0, 255]`
- `SERVo:1PPSoffset <int> <ns> [-5000000, 5000000]`
- `SERVo:TRACe <int> [0, 255]`
- `SERVo:FASTlock <int> [1, 20]`
- `SERVo:FALEngth <int> [100, 20000]`

SERVo:FASTlock <int> [1,20]

The FASTlock command enables the FASTLOCK mode, and sets its gain parameter. Fastlock works by momentarily multiplying the EFCScale gain to a value determined by this `SERVo:FASTlock` parameter. Gain values of 1x to 20x can be set, with a gain of 1x effectively disabling the FASTLOCK feature.

By selecting gain values of > 1, the PLL loop parameter Proportional gain (`SERV:EFCscale`) will be increased after power on, thus increasing loop aggressiveness and improving lock PLL time. It is not desirable to maintain a high loop gain for longer than necessary to lock the PLL since high loop gains come at the expense of increased phase noise (reduced short term stability). The FASTLOCK mechanism will automatically reduce the FASTLOCK gain over a period of time specified by the `SERVo:FALength` command, during which time the FASTLOCK gain is slowly decreased from its initial value to 1.0x.

Setting the FASTLOCK gain to 2 for example will result in the Proportional gain value stored in the `SERVo:EFCscale` parameter to be multiplied by 2x initially after power on.

This dynamic gain is slowly reduced until the gain is back to 1.0x, the value stored in the `SERVo:EFCscale` parameter. For example if we set `SERVo:FASTlock` to 2, and `SERVo:FALength` to 3600, and `SERVo:EFCscale` is set to 0.7, initially the unit will multiply the `EFCscale` by 2x, and an effective `EFCscale` value of 1.4 is applied to the PLL loop.

This increased gain value difference will be reduced every second by 1/3600, so that the gain after two seconds would be: 1.3998, until after 3600 seconds the gain has been reduced back to its long term value of 0.70 as stored in the `SERVo:EFCscale` parameter.

Disabling the FASTLOCK mode is accomplished by setting the `SERVo:FASTlock` to 1. This will set the dynamic gain to 1.0, effectively disabling the fastlock feature.

This command has the following format:

```
SERVo:FASTlock <int> [1,20]
```

This command will query the state of this command:

```
SERVo:FASTlock?
```

SERVo:FALength <int> [100,20000]

This command adjusts the length of time during which the FASTLOCK feature is active. For more information, see the “[SERVo:FASTlock <int> \[1,20\]](#)” on page 88.

The length can be set from 100 seconds to 20000 seconds. The Dynamic FASTLOCK gain is slowly reduced until it reaches a gain of 1.0 after the `FALength` period of seconds. During this time the PLL loop gain is increased by the amount specified in the `SERVo:FASTlock` parameter, which will result in a faster initial phase lock to UTC after power-on, while giving the lowest possible noise floor (best short term stability) during normal operation.

This command has the following format:

```
SERVo:FALEngth <int> [100,20000]
```

This command will query the state of this command:

```
SERVo:FALEngth?
```

SERVo:COARSedac <int> [0,255]

This command sets the coarse DAC that controls the EFC. The PNT-62xx control loop automatically adjusts this setting. The user should not have to change this value, however it is very useful to measure loop stability when experimenting with alternate SERVO parameters by inserting a large frequency step into the OCXO, then monitoring the behavior of the PI loop as it corrects for the synthetic frequency error.

This command has the following format:

```
SERVo:COARSedac <int> [0,255]
```

This command will query the state of this command:

```
SERVo:COARSedac?
```

SERVo:MODE <SLOW|MEDIUM|FAST|AUTO>

This command is useful in setting the filter loop time constants for different mission profiles to accommodate different usage scenarios of the CSAC GPSDO. The loop time constant of the CSAC can be chosen with these settings.

The AUTO mode lets the firmware determine by itself which loop time constant is used, thus optimizing the units' performance dynamically depending on the environmental effects on the CSAC. The AUTO setting will quickly react to phase perturbations and will try to set `NORMa1` settings (long time constant) whenever the unit is in stable conditions to minimize residual noise, and to improve the ADEV performance of the filtered output as much as possible for a particular environment. `NORMa1` settings are useful in stationary applications, whereas FAST settings are preferred for mobile applications such as in vehicles, man-packs, or aircraft.

The following command returns the current mode setting:

```
SERVo:MODE?
```

SERVo:MODE:FASTDURation <int> [60, 604800]

This command sets the minimum duration for remaining in the fast filter state when the `SERVo:MODE AUTO` setting is enabled. This setting is useful for preventing cycling between filter states with an unstable reference.

The following command returns the current setting:

SERVo:MODE:FASTDURation?

SERVo:MODE:MEDDURation <int> [60, 604800]

This command sets the minimum duration for remaining in the medium filter state when the SERVo:MODE AUTO setting is enabled. This setting is useful for preventing cycling between filter states with an unstable reference.

The following command returns the current setting:

SERVo:MODE:MEDDURation?

SERVo:STATe?

This query responds with the current filter state as configured by the SERVo:MODE command. When the SERVo:MODE setting is SLOW, MEDIUM or FAST, the SERVo:STATe? response matches the mode setting. When the SERVo:MODE setting is AUTO, the SERVo:STATe? responds with the automatically selected state--SLOW, MEDIUM or FAST.

SERVo:DACGain <float> [0.001, 10000]

This command is used for factory setup ONLY.

This command will query the state of this command:

SERVo:DACGain?

SERVo:EFCScale <float> [0.0,500.0]

Controls the Proportional part of the PID loop. Typical values are 0.7 (double oven OCXO) to 6.0 (simple single oven OCXO). Larger values increase the loop control at the expense of increased noise while locked. Setting this value too high can cause loop instabilities.

This command has the following format:

SERVo:EFCScale <float> [0.0,500.0]

This command will query the state of this command:

SERVo:EFCScale?

SERVo:EFCScale:MEDium <float> [0.0,500.0]

This command controls the `SERVo:EFCScale` setting when the servo state as reported by the `SERVo:STATE?` query is MEDIUM. The servo state and this setting only apply for the STL synchronization source.

SERVo:EFCScale:FAST <float> [0.0,500.0]

This command controls the `SERVo:EFCScale` setting when the servo state as reported by the `SERVo:STATE?` query is FAST. The servo state and this setting only apply for the STL synchronization source.

SERVo:EFCDamping <int> [2,4000]

This command sets the Low Pass filter effectiveness of the DAC. Values from 2 to 50 are typically used. Larger values result in less noise at the expense of phase delay.

This command has the following format:

```
SERVo:EFCDamping <int> [2,4000]
```

This command will query the state of this command:

```
SERVo:EFCDamping?
```

SERVo:EFCDamping:MEDium <int> [2,4000]

This command controls the `SERVo:EFCDamping` setting when the servo state as reported by the `SERVo:STATE?` query is MEDIUM. The servo state and this setting only apply for the STL synchronization source.

SERVo:EFCDamping:FAST <int> [2,4000]

This command controls the `SERVo:EFCDamping` setting when the servo state as reported by the `SERVo:STATE?` query is FAST. The servo state and this setting only apply for the STL synchronization source.

SERVo:SLOPe <NEG|POS>

The parameter determines the sign of the slope between the EFC and the frequency variation of the OCXO. This parameter should be set to match the OCXO's EFC frequency slope.

This command has the following format:

```
SERVo:SLOPe <NEG|POS>
```

This command will query the state of this command:

```
SERVo:SLOPe?
```

SERVo:TEMPCOmpensation <float> [-4000.0, 4000.0]

This command is not currently supported in PNT-62xx. This parameter represents the value needed to compensate the temperature of the TCXO in holdover mode.

This command has the following format:

```
SERVo:TEMPCOmpensation [-4000.0, 4000.0]
```

This command will query the state of this command:

```
SERVo:TEMPCOmpensation?
```

SERVo:AGINGcompensation <float> [-10.0,10.0]

This parameter is a coefficient that represents the drift of the EFC needed to compensate the natural drift in frequency of the OCXO due to aging. This coefficient is automatically computed and adjusted over time by the Jackson-Labs firmware. This command has the following format:

```
SERVo:AGINGcompensation <float> [-10.0,10.0]
```

This command will query the state of this command:

```
SERVo:AGINGcompensation?
```

SERVo:PHASECOrrrection <float> [-500.0,500.0]

This parameter sets the Integral part of the PID loop. Loop instability will result if the parameter is set too high. Typical values are 10.0 to 30.0. This command has the following format:

```
SERVo:PHASECOrrrection <float> [-500.0,500.0]
```

This command will query the state of this command:

```
SERVo:PHASECOrrrection?
```

SERVo:PHASECOrrrection:MEDIum <float> [-500.0,500.0]

This command controls the `SERVo:PHASECOrrrection` setting when the servo state as reported by the `SERVo:STATe?` query is `MEDIUM`. The servo state and this setting only apply for the STL synchronization source.

SERVo:PHASECOrrrection:FAST <float> [-500.0,500.0]

This command controls the `SERVo:PHASECOrrrection` setting when the servo state as reported by the `SERVo:STATE?` query is `FAST`. The servo state and this setting only apply for the STL synchronization source.

SERVo:1PPSoffset <int> <ns> [-5000000,5000000]

This command sets the PNT-62xx 1PPS signal's offset to UTC in 5.55ns steps. The maximum configurable 1PPS offset is +/- 5ms.

Using the `SERV:1PPS` command results in immediate phase change of the 1PPS output signal.

This command has the following format:

```
SERVo:1PPSoffset <int> <ns> [-5000000,5000000]
```

This command will query the state of this command:

```
SERVo:1PPSoffset?
```

SERVo:SLOPe <NEG|POS>

The parameter determines the sign of the slope between the EFC and the frequency variation of the OCXO. This parameter should be set to match the OCXO's EFC frequency slope and should not be changed from the factory setting.

This command has the following format:

```
SERVo:SLOPe <NEG|POS>
```

This command will query the state of this command:

```
SERVo:SLOPe?
```

SERVo:QUIet <ON|OFF>

This command enables/disables readings done to the ADC value in continuous mode.

This command has the following format:

```
SERVo:QUIet <ON|OFF>
```

This command will query the state of this command:

```
SERVo:QUIet?
```

SERVo:DBGMode <int> [0, 255]

This command sets the debug level that enables/disables debug messages to print for debugging ONLY. A level of 0 indicates no debug messages will print and a level greater than 0 will begin printing debug messages.

This command has the following format:

```
SERVo:DBGMode [0, 255]
```

This command will query the state of this command:

```
SERVo:DBGMode?
```

SERVo:TRACe <int> [0,255]

This command sets the period in seconds for the debug trace. Debug trace data can be used with Ulrich Bangert's "Plotter" utility or Excel etc. to show UTC tracking versus time etc.

This command has the following format:

```
SERVo:TRACe <int > [0,255]
```

This command will query the state of this command:

```
SERVo:TRACe?
```

An example output is described here:

```
08-07-31 373815 60685 -32.08 -2.22E-11 14 10 6 0x54 [date][1PPS  
Count][Fine DAC][UTC offset ns][Frequency Error Estimate][Sats  
Visible][Sats Tracked][Lock State][Health Status]
```

See [“SYNChronization:HEAlth?” on page 68](#) for detailed information on how to decode the health status indicator values. The Lock State variable indicates one of the states in [Table 13](#).

Table 13 Lock state variables

Value	State
0	OCXO warmup
1	Holdover
2	Locking (OCXO training)
4	[Value not defined]
5	Holdover, but still phase locked (stays in this state for about 100s after GNSS lock is lost)
6	Locked, and GNSS active.

SERVo?

This command returns the result of the following queries:

- `SERVo:MODE?`
- `SERVo:STAtE?`
- `SERVo:MODE:FASTDURation?`
- `SERVo:MODE:MEDDURation?`
- `SERVo:DACGain?`
- `SERVo:EFCScale?`
- `SERVo:EFCScale:MEDium?`
- `SERVo:EFCScale:FAST`
- `SERVo:PHASECOrrEction?`
- `SERVo:PHASECOrrEction:MEDium?`
- `SERVo:PHASECOrrEction:FAST?`
- `SERVo:EFCDamping?`
- `SERVo:SLOPe?`
- `SERVo:COARSedac?`
- `SERVo:TEMPCompensation?`
- `SERVo:AGINGcompensation?`
- `SERVo:1PPSoffset?`
- `SERVo:TRACe?`
- `SERVo:FASTlock?`
- `SERVo:FALEngth?`

Firmware Upgrade

The following topics are discussed in this chapter:

- [“Introduction” on page 98](#)
- [“ISP Flash Loader Utility installation” on page 98](#)
- [“Putting the PCB into In-Circuit Programming \(ISP\) mode” on page 98](#)
- [“Downloading the firmware” on page 98](#)
- [“Verifying the firmware update” on page 104](#)

Introduction

The following sections provide instructions on how to upgrade the PNT-62xx firmware. Please follow the instructions in order to prevent accidentally corrupting the PNT-62xx Flash.

ISP Flash Loader Utility installation

Jackson Labs Technologies, Inc. recommends using the JLTerm application to upgrade the contents of Flash memory on the PNT-62xx. The JLTerm application can be downloaded for free from our support page at the link provided below. Alternatively, you can also use the Flash magic utility to perform the same upgrade.

The JLTerm application is available for download at:

<http://www.jackson-labs.com/index.php/support>

The Flash Magic utility is available for download on the Flash Magic website:

<http://www.flashmagictool.com/>

Follow the directions given on the website for installing the utility on your computer.

Putting the PCB into In-Circuit Programming (ISP) mode

Two methods are supported for enabling the PNT-62xx in System Programming (ISP) mode. Issuing the SCPI command `SYST:ISP` discussed in “[SYSTEM:ISP](#)” on page 87 in JLTerm or another terminal program causes the board to reset into ISP mode from normal operation.

If Flash Magic is used instead of the JLTerm, a power cycle is required after programming has finished to restart the board with the updated firmware. Although the `SYST:ISP` command is recommended, Flash Magic will be useful if the PNT-62xx has stopped communicating.

The board can also be put into ISP mode by shorting-out the ISP# pin 2 of header J15 to pin 1 (Ground) of header J15 of the PNT-62xx board during power-on.

Downloading the firmware

Download the latest version of PNT-62xx firmware as well as JLTerm from the Jackson Labs Technologies, Inc. support page on the JLT website and store it in a place that will be remembered. The firmware file should be in .hex format.

The unit needs to be connected to the computer's USB serial port prior to firmware download. The PNT-62xx is Micro-USB compatible.

Using the JLTerm programming terminal

- 1 Download the JLTerm application from <http://www.jackson-labs.com/index.php/support>.
- 2 Install and open the JLTerm application.
- 3 Select the COM port in JLTerm as needed on your PC.

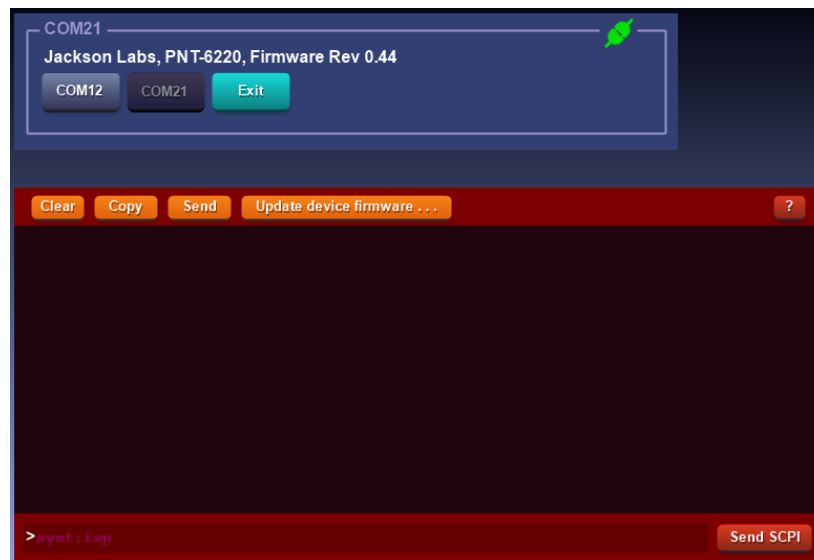
Once a successful connection is established, the connection icon becomes green, as shown in [Figure 14](#). The PNT-62xx must be in normal operation with working SCPI communication prior to JLTerm connection.



NOTE

If there is no valid response from the COM port, check for valid driver and port number for the COM port in the Device Manager on your computer. The COM port number may be conflicting with another COM port device. Each device should have a different COM port. Ensure GPSCon is not running in the background and using the same COM port.

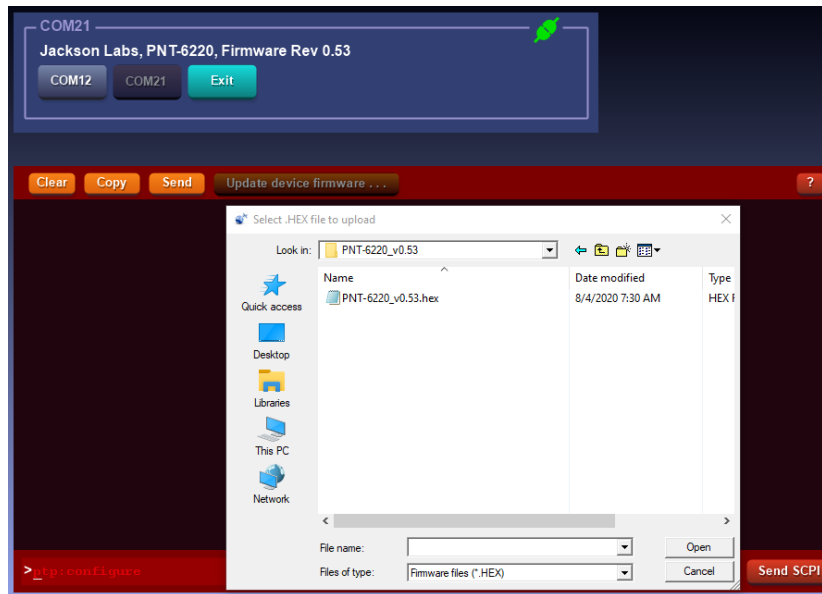
Figure 14 Successful connection



If necessary, change the COM port number, install or update the driver, and unplug and reconnect the serial cable, then try to establish a connection again. In the case of an unsuccessful connection to JLTerm after several attempts, follow the instructions in [“Putting the PCB into In-Circuit Programming \(ISP\) mode” on page 98](#) and [“Using the Flash Magic programming utility” on page 101](#) for an alternative firmware upgrade method.

- 4 Once the device is connected in JLTerm, click the orange **Update device firmware...** button.
- 5 Choose the correct hex file to program the device and click **Open** in the pop-up, as shown in [Figure 15](#). The firmware automatically downloads and the board is reset.

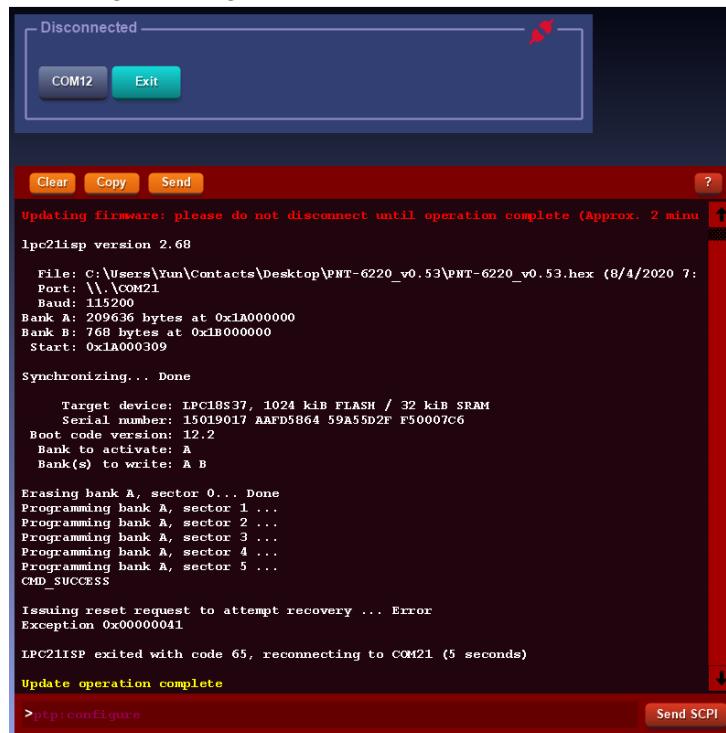
Figure 15 Open Hex file and download firmware



- 6 If an error occurs during the programming process:
 - a Check the USB cable connection.
 - b While the unit is still in ISP mode after the error occurred, follow the steps in [“Using the Flash Magic programming utility” on page 101](#) and attempt to finish the firmware upgrade using Flash Magic.

Figure 16 shows an error in programming.

Figure 16 Error in programming



Using the Flash Magic programming utility

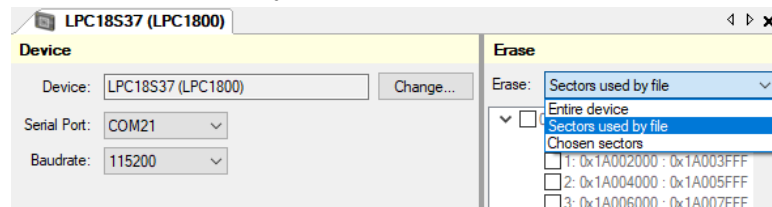
Perform the following steps to use the Flash Magic programming utility.

NOTE

The following procedure is for Flash Magic version 12.1 or later. For version 11.20 or older, refer to [“Using the Flash Magic classic version” on page 102](#).

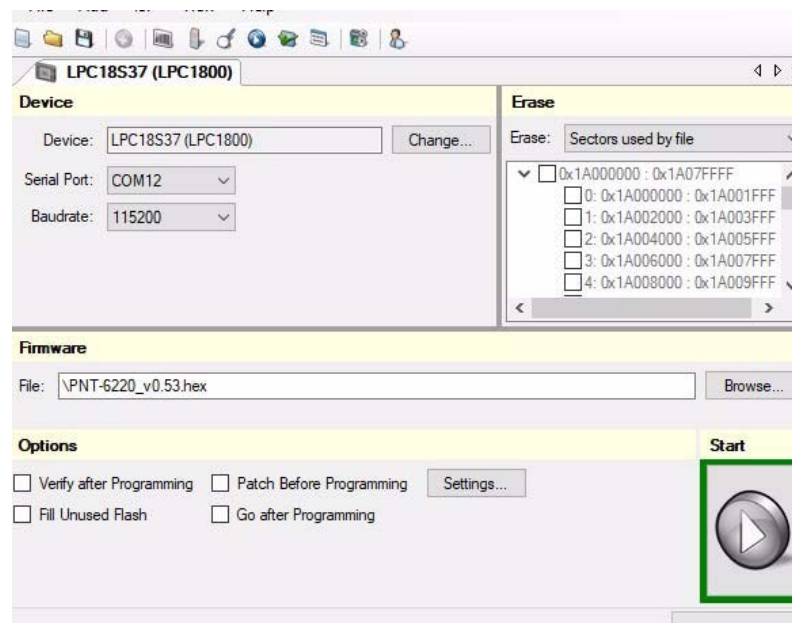
- 1 Put the PNT-62xx into ISP mode, as described in [“Putting the PCB into In-Circuit Programming \(ISP\) mode” on page 98](#).
- 2 Open the Flash Magic utility.
- 3 Select Device LPC18S37:
 - a Click **Change...**
 - b Select **LPC1800 > LPC18S37**.
- 4 Select Erase > Sectors used by file, as shown in [Figure 17](#).


Figure 17 Erase Sectors used by file



- 5 Change the COM port in the Flash Magic application as needed and select Baud Rate 115200, as shown in [Figure 18](#).

Figure 18 Baud rate



- 6 Under **Step 3 – Hex File**, browse for the hex file that you downloaded in [“Downloading the firmware” on page 98](#).
- 7 Check again for the Erase option **Sectors used by file** in [Figure 17](#).
- 8 In the Start section, press the gray start button .

The firmware is downloaded to the processor.

- 9 Verify the firmware update as described in “[Verifying the firmware update](#)” on page 104.

Using the Flash Magic classic version

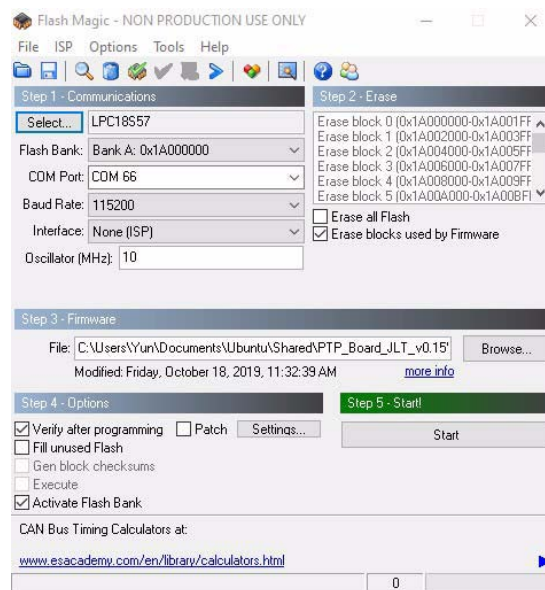


NOTE

The following procedure is for Flash Magic version 11.20 or earlier. For version 12.1 or later, refer to “[Using the Flash Magic programming utility](#)” on page 101.

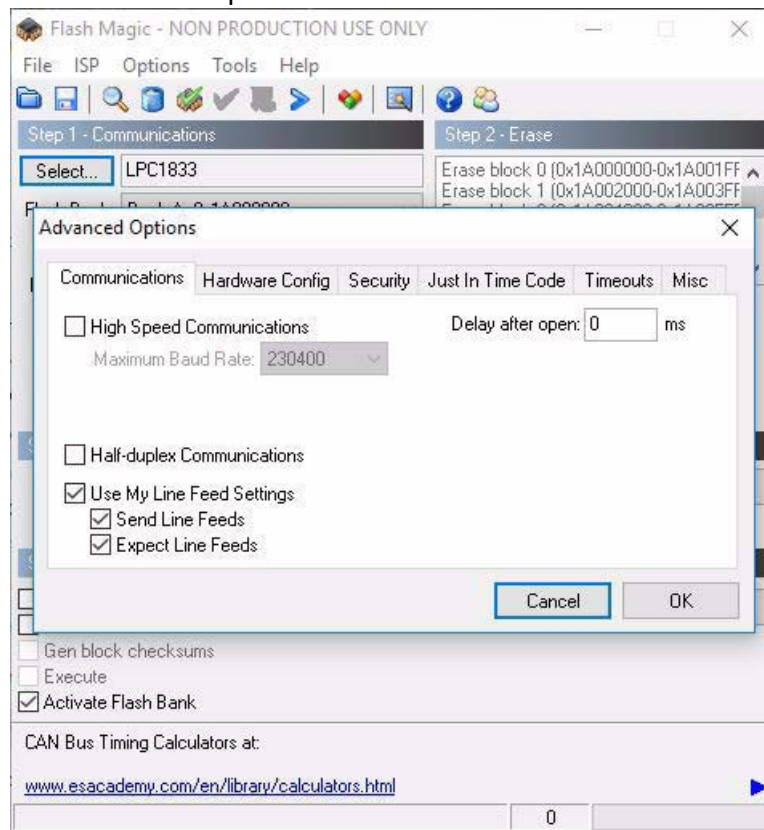
- 1 Put the PNT-62xx into ISP mode, as described in “[Putting the PCB into In-Circuit Programming \(ISP\) mode](#)” on page 98.
- 2 Open the Flash Magic application.
- 3 Set the COM port in the Flash Magic application as needed on our PC.
- 4 Set **Interface to None (ISP)**, as shown in [Figure 19](#).

Figure 19 Flash Magic Programming Utility Classic Version



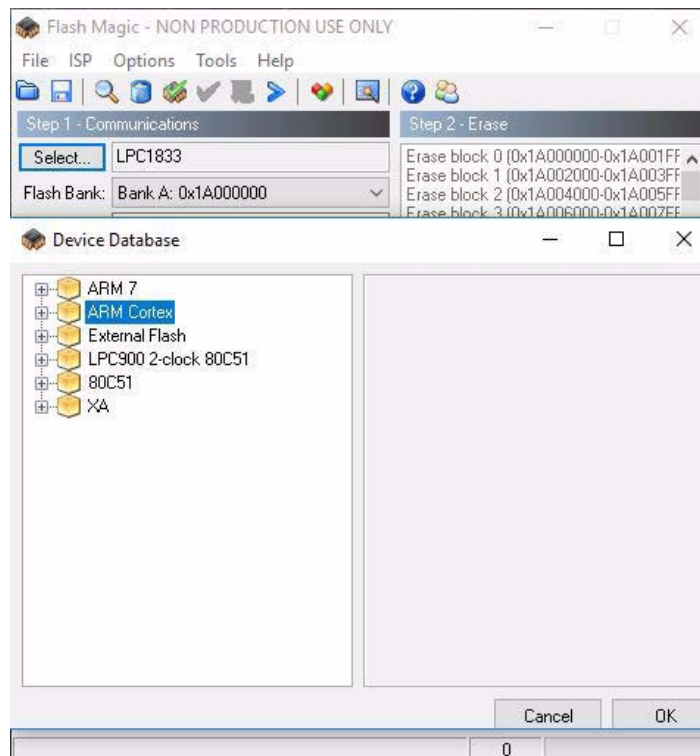
- 5 Open the **Options** and **Advanced Options** tabs on the application.
- 6 Ensure that the **Use my Line Feed settings**, **Send Line Feeds**, and **Expect Line Feeds** options are all highlighted and selected, as shown in [Figure 20](#).

Figure 20 Communications options



- 7 Click **OK** to return to the main menu.
- 8 Click the **Select Device** button. The Device Selection window appears, as shown in Figure 21.

Figure 21 Device selection



- 9 Expand the **ARM CORTEX** folder and select the appropriate processor, in this case **LPC18S37**.
- 10 Configure the following parameters, as shown in Figure:
 - **Baud Rate:** 115200
 - **Oscillator (MHz):** 10.0
- 11 Check the **Erase blocks used by Hex File** box.



ALERT

Do NOT check the box marked **Erase all Flash**. This will erase factory calibration data, and the unit will not operate and will have to be returned to the factory. Checking this box on the ISP utility will void the warranty.

- 12 Under **Step 3 – Hex File**, browse for the hex file that you downloaded in [“Downloading the firmware” on page 98](#).
- 13 Under **Step 4 – Options**, check **Activate Flash Bank**.
- 14 Proceed to **Step 5** and press **Start**. The firmware is downloaded to the processor.
- 15 Verify the firmware update as described in [“Verifying the firmware update” on page 104](#).

Verifying the firmware update

Power cycle the unit with the pin 1 of J15 and pin 2 of J15 (ISP#) left floating.

During power on, the unit sends an ID string out of the serial port at 115200 Baud by default. The firmware version can also be queried by sending the *IDN? command. Verify that the firmware version is the version that was downloaded.

Certification and Warranty

This chapter discusses the following topics:

- [“Certification” on page 106](#)
- [“Warranty” on page 106](#)
- [“Exclusive Remedies” on page 106](#)

Certification

Jackson Labs Technologies, Inc. certifies that this product met its published specifications at time of shipment.

Warranty

This Jackson Labs Technologies, Inc. hardware product is warranted against defects in material and workmanship for a period of 1 (one) year from date of delivery. During the warranty period Jackson Labs Technologies, Inc. will, at its discretion, either repair or replace products that prove to be defective. Jackson Labs Technologies, Inc. does not warrant that the operation for the software, firmware, or hardware shall be uninterrupted or error free even if the product is operated within its specifications.

For warranty service, this product must be returned to Jackson Labs Technologies, Inc. or a service facility designated by Jackson Labs Technologies, Inc. Customer shall prepay shipping charges (and shall pay all duties and taxes) for products returned to Jackson Labs Technologies, Inc. for warranty service. Except for products returned to Customer from another country, Jackson Labs Technologies, Inc. shall pay for return of products to Customer. If Jackson Labs Technologies, Inc. is unable, within a reasonable time, to repair or replace any product to condition as warranted, the Customer shall be entitled to a refund of the purchase price upon return of the product to Jackson Labs Technologies, Inc.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Customer, Customer-supplied software or interfacing, unauthorized modification or misuse, opening of the instruments enclosure or removal of the instruments panels, operation outside of the environmental or electrical specifications for the product, or improper site preparation and maintenance.

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Document revision history

Table 1 PNT-62xx Assured Position, Navigation, and Timing Reference User Guide, 22171774

Revision	Date	Details
R000	April 2023	Initial release of document.



22171774
R000, April 2023
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