



SyncSystem 4380A



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This is the first release of this document.

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Table of Contents

1	General Information	6
1.1	Introduction	6
1.2	Ordering Information	6
2	Installation	8
2.1	Powering on the 4380A	8
2.2	Application Start Up	8
2.3	Communicating with the 4380A	8
2.3.1	DHCP	9
2.3.2	Static IP Addresses	9
2.3.2.1	Network	9
2.3.2.2	Console Cable	9
2.3.3	Setting a Static IP Address	10
2.3.4	USB Ports	10
2.4	Antenna Installation	10
2.4.1	Antenna Location	11
2.4.2	Setting the Antenna Voltage	12
2.4.3	Outdoor Antenna Grounding	13
2.4.4	Antenna Mask Angle	13
2.4.5	Positioning Modes	14
2.4.5.1	Dynamic Position Mode	14
2.4.5.2	Auto Position Mode	14
2.4.5.3	Manual Position Mode	15
2.5	4380A Installation	17
2.5.1	Power Supplies	17
2.5.2	Input/Output Cards	17
2.5.3	4394A (PPS/DC IRIG)	17
2.5.4	4376A RS-422 PPS	19
2.5.5	4394A-ECL (PPS-ECL)	20
2.5.6	4395B-10 (10MHz)	21
2.5.7	4395B-5 (5MHz)	22
2.5.8	4395B-1 (1MHz)	22
2.5.9	4387A Series (Modulated IRIG/NASA36)	22
2.5.10	4396A/4397A 2MHz Output Card	24
2.5.11	4374A T1 (1.544MHz) Output Card	24
2.5.12	4393A Time Interval Counter (TIC) Card	24
2.5.13	4383A IRIG Input Card	25
2.6	Antenna Delay Calibration	26
2.7	On Time Point (OTP)	27
2.8	Using an External Frequency Reference:	27
2.9	Setting the System Time Manually	29
2.9.1	Force Time	29
2.9.2	External Reference	30
2.9.3	Disable the GNSS Tracking Alarms	30

2.10	User Configuration Files	30
2.10.1	Factory / Default User Configuration Files	30
2.10.2	Diff Command	31
2.10.3	FTP and Real-Time (rt) Configuration Files	31
2.10.4	System Configuration Files (Syscfg)	33
2.11	Powering the System Off.....	34
3.	Operations	35
3.1	Front Panel	35
3.1.1	Power Supply Indicators.....	35
3.1.2	Alarm Indicator.....	35
3.1.3	SYNC Indicator	35
3.1.4	Outputs Indicator	36
3.1.5	Fans.....	36
3.1.6	Status Pushbutton	37
3.2	Rear Panel	37
3.3	Software	38
3.3.1	Current Version	38
3.3.2	Software Updates.....	38
3.3.2.1	Flash Card Replacement	38
3.3.2.2	Remote Software Update	39
3.3.3	GNSS Firmware Updates	40
3.4	User Interfaces.....	40
3.4.1	Telnet	40
3.4.1.1	Real Time Data Port (1135).....	41
3.4.1.2	Command Port (1700).....	41
3.4.1.3	Diagnostic Port (1800).....	43
3.4.1.4	Status Port (1900)	44
3.4.1.5	Average TIC Data Port (2100).....	44
3.4.1.6	Raw TIC Data Port (2101).....	45
3.4.2	File Transfer Protocol (FTP)	45
3.4.3	Network Time Protocol (NTP)	46
3.4.4	Simple Network Management Protocol (SNMP).....	46
3.5	Status Command	46
3.6	GNSS Data Logging.....	47
3.6.1	FTP Data Logging	47
3.6.2	Real Time Data Logging	49
3.7	WAAS Satellites	50
3.8	System Verification.....	51
4	Theory of Operations.....	59
4.1	Generation of Timing Signals	59
4.2	GNSS.....	59
4.3	Output Signals.....	59
4.4	GNSS Data Collection	60
4.5	Startup Sequence	60
5	Maintenance	62
5.1	Fan Filter	62

5.2	Antenna and Antenna Cable Inspection	62
6	Troubleshooting.....	63
6.1	Front Panel Indications.....	63
6.2	Alarm Light	63
6.3	Power Supplies	63
6.4	Outputs Indicator.....	64
6.5	GNSS Performance	66
6.5.1	Poor GNSS Receiver Performance.....	66
6.5.2	GNSS Not Tracking.....	67
6.6	Internal Clocks	68
6.7	External Reference	69
6.8	PTD Value is Noisy.....	71
6.9	Over Temperature and Fans	71
6.10	PPS Outputs.....	72
6.11	IRIG Outputs	73
6.12	NASA36 Outputs.....	73
6.13	TIC Measurements	74
6.14	Software Update Failure	74
6.15	Configuration Not Readable.....	75
6.16	Communication Problems	75
6.16.1	LAN	75
6.16.2	USB-to-Serial Adapter (94000-115200) (Command Port)	75
6.16.3	External Reference Adapter (94001-5071A).....	75
6.17	Syslog Command.....	75
6.18	System Configuration Issues (syscfg)	76
	Appendix A System Specifications	77
	Appendix B CE Declaration	83

Figures

Figure 1	Antenna Location	11
Figure 2	Antenna Cable.....	12
Figure 3	Rear Panel Output Card Locations.....	17
Figure 4	Input/Output Cards.....	17
Figure 5	Timing System Diagram	27
Figure 6	External Frequency Reference	28
Figure 7	4380A Front Panel	35
Figure 8	4380A Rear Panel	37
Figure 9	4380A Rear Panel Connections	38

Tables

Table 1	Power Supply Indicator Status	35
Table 2	Alarm Indicator	35
Table 3	Sync Indicator.....	36
Table 4	Outputs Indicator.....	36
Table 5	System Command List	43
Table 6	Maintenance Schedule.....	62

1 General Information

1.1 Introduction

The 4380A Sync System is a state-of-the-art GNSS disciplined time and frequency reference. The low noise synthesizer (LNS), in conjunction with GNSS measurements and the Rubidium option, provide outputs that are characterized by the short-term stability of the OCXO and the long-term stability of the GNSS constellation. Additionally, it provides the user with the capability to enhance the frequency stability and holdover performance of the unit by using an external cesium (Cs) clock as the reference. This provides a scalable architecture that allows users to fulfill a wide range of current and future requirements with a single unit. The 4380A is suitable for a variety of precise time and frequency applications.

The 1 Pulse per Second (1 PPS) accuracy and frequency stability of the 4380A is further enhanced by using a dual-frequency (L1/L2) GNSS receiver. The dual-frequency receiver applies corrections to the GNSS timing signals that remove a significant portion of the errors due to ionospheric delay.

In applications where reliability is a must, the 4380A is capable of operating from an AC (100 – 240VAC, 50-60 Hz) or DC Power 48 VDC (22 to 60 VDC) source and comes with two fully redundant hot swappable power supplies. The unit is capable of operating from a single supply in the event one of the two power supplies fails.

1.2 Ordering Information

4380A (Sync System): Standard dual frequency GNSS time and frequency standard. Dual AC input supplies included. Requires external frequency reference, fiber reference, or internal Rubidium (RB). The unit does not include any daughter cards (see below) or fiber SFP modules.

4830A-ACAC-G1R: Two AC Input power supplies. 100-240VAC, 50/60Hz with GPS and internal Rubidium.

4830A-ACDC-G1R: One AC Input power supply, 100-240VAC, 50/60Hz and one DC input power supply (22 to 60 VDC) with GPS and internal Rubidium.

4830A-DCDC-G1R: Two DC Input power supplies, (22 to 60 VDC) with GPS and internal Rubidium.

Input/Output Cards: The 4380A has a wide selection of input/output cards available:

1. 4376A RS-422 4 Output 1PPS Card
2. 4395B-10 Four Low Phase Noise 10 MHz Sinewave Outputs
3. 4395B-5 Four Low Phase Noise 5 MHz Sinewave Outputs
4. 4395B-1 Four Low Phase Noise 1 MHz Sinewave Outputs
5. 4394A: Programmable PPS and DC IRIG Module. Users can define the signal types and operating parameters. Default set up is two 1PPS Outputs (Ports 1 and 2) and two DC IRIG Outputs (Ports 3 and 4) (Default Timecode = B000)
6. 4394A-ECL Two Programmable differential PPS-ECL Outputs
7. 4387A Four Modulated IRIG Outputs (Default Timecode = B120) or NASA36.

8. 4387A-1V Four 1V Modulated IRIG Outputs (Default Timecode = B120) or NASA36
9. 4387A-6V Four 6V Modulated IRIG Outputs (Default Timecode = B120) or NASA36
10. 4396A/4397A Four 2.048MHz (E1) outputs that comply with ITU-T Rec. G.703
11. 4372A-T Four input/output single mode fiber optic module for supplying signals to a TSC-4340 or 4380A
12. 4393A Four Channel TIC Card. Users can measure the 1PPS of up to four different devices relative to the internal clock and obtain these measurement results in real time.
13. 4383A IRIG Input Card. Users can set the system time manually using an IRIG Time Source. Ports 1 and 2 support DC IRIG and Ports 3 and 4 support AM IRIG.

Options:

94000-115200 USB Console Cable: Allows users to connect to the system Command Port via a serial cable.

94001-5071A USB External Reference Communication Cable: Provides a serial communications port to an external frequency reference (i.e. 5071A).

94020: Rail Kit for Racks 20" to 32" deep

94021: Rail Kit for Racks 24" to 30" deep

92000: L1 L2 GNSS Antenna

9200-12: 12dB inline amplifier

9200-21: 21dB inline amplifier

9201-TT: Lightning Arrestor

Notes:

1. Antenna cables sold separately.
2. All units include network time protocol (NTP), Ethernet control, and data logging capabilities.
3. Contact Microsemi (www.microsemi.com) for current pricing and availability.
4. 94000-115200 and 94001-5071A are DTE devices; this may require the use of a null modem serial cable.

2 Installation

The 4380A provides a number of features which may require additional setup and this section provides a guideline for the basic setup. After completing this section, the 4380A will produce timing outputs to the coarse calibration accuracies specified in Appendix A. The 4380A is designed to be quickly and easily integrated with other system components. Just a few steps are required in setting up the system so that it will begin producing accurate timing outputs. In order to set the system up, users will need to power up the system and set up communications in order to have access to the system command port.

2.1 Powering on the 4380A

Apply power to the system by supplying input power to at least one of the two power supplies. When power is applied to the 4380A the front panel will go through a self test and then the 4380A will begin booting up.

Note: If power is applied to both power supplies, the Status Indicator on the front panel of both power supplies should be green. If power is applied to only one of the two supplies, then the power supply without input power should have a red Status Indicator and the units Alarm Indicator should be red.

Note: The 4380A front panel Power-On Self Test (POST) will occur even if the software flash has been removed from the unit.

- A. The Date/Time display will sequentially test each segment on each individual position within the display.
- B. One at a time, each position of the display will display the number 8 starting from the far left and working to the right.
- C. Each LED below the Date/Time Display (Alarm, Sync, & Output) will be turned on one at a time starting from the left to right. As each LED is tested it will be green, then red, and then turn off with the exception of the Sync indicator, this indicator will turn red, then green, then off.
- D. The Date/Time display will then display “-9876543210” on the front panel.
- E. Lastly the Date/Time display will have a “-” in the center of each position in the display.
- F. When the unit starts the application, the Alarm and Sync lights will turn RED. The Outputs indicator will remain red until NTP is locked and the outputs are turned on.

Caution: The default antenna supply voltage is **ZERO**. If the antenna requires power from the 4380A to operate, the system will stay in this mode until the antenna is properly configured. This prevents the system from potentially damaging any antennas until the antenna supply voltage is set properly by the end user.

2.2 Application Start Up

Once the application has started, the front panel display will display a dash in the center of each segment. As the application loads the segments will move to the bottom, blank, top, then center until the system has been able to set the date and time. Refer to the Software Users Guide for more information.

2.3 Communicating with the 4380A

Operators are capable of communicating with the system through a LAN connection or via one of the USB Ports when using 94000-115200 USB to Serial cable to access the command port.

2.3.1 DHCP

The 4380A runs DHCP by default and will therefore automatically be assigned an IP address if it is connected to a network with a DHCP server. The 4380A will display the current IP address assigned to the unit in the Date/Time display after pressing and releasing the Display pushbutton on the front panel. Users can use this IP Address to access the systems command port.

Note: If the LAN Cable is not connected or the unit does not obtain an IP Address from a DHCP Server, an IP Address is not assigned and the front panel display button will not display an IP address for the system. Once the LAN cable is connected to the unit, it will automatically attempt to obtain an IP address from a DHCP Server. If this does not work you may need to power cycle the unit.

2.3.2 Static IP Addresses

If you require a Static IP Address there are two options to set the network parameters in the system.

2.3.2.1 Network

If the network has a DHCP Server you can obtain the IP Address (*ip addr*) by pressing and releasing the Display pushbutton on the front panel. Telnet into the system using “telnet *ip addr* 1700”. Once the “4380A>” prompt is displayed run the *network_config* command to manually configure the IP address for the unit. See Section (2.2.3).

If the network does not have a DHCP Server, press and hold the front panel display pushbutton for ~10 seconds until the display shows the IP Address of 192.168.0.1. This temporarily sets the IP Address of the unit. Telnet into the system using “telnet 192.168.0.1 1700”. Once the “4380A>” prompt is displayed use the *network_config* command to manually configure the IP address for the unit. (See section 2.3.3).

Note: If the LAN Cable is removed and reconnected the unit will attempt to obtain an IP Address from the DHCP Server. If the default static IP Address (192.168.0.1) was set it may get reset. Press the Display Button on the front panel again to make sure the IP Address is still set. If not, press and hold the button until the default static IP Address is set again.

2.3.2.2 Console Cable

This feature allows local users to set the unit up without having to access the system via the network. Connect a terminal to one of the USB ports on the rear panel using the USB to Serial adapter cable (94000-115200). Changes can be made using any terminal program (e.g., HyperTerm, TeraTerm) from the serial port of a computer/terminal. The communication settings are 115200 Baud, No Parity, 8 Data Bits, and 1 Stop Bit. Once connectivity is established, the user will see the 4380A> command prompt. Execute the *network_config* command to set the IP Address, Netmask, Broadcast IP, and/or Default Gateway for the system if you are using a static IP Address. See Section (2.3.3).

Note: We recommend that the USB-to-Serial Adapter (94000-115200) is installed in one of the two USB ports when the system is powered on. If not, you may need to power the system down, plug the cable in and re-apply power. The USB/Serial Cables are programmed to provide users access to the command port (94000-115200) or to communicate with a 5071A Cesium Clock (94001-5071A). These cables are **NOT** interchangeable.

Caution: By default, pressing and holding the Display pushbutton on the front panel for ~10 seconds will reset the IP address to the default of 192.168.0.1. The default IP address will display on the front panel after it is set. If the button is held down too long and the IP Address is set to the default by mistake, you may be able to clear this by pulling the LAN connection on the rear panel and plugging the connector back in. If not, power-cycle the unit to restore the proper network settings. This front panel IP reset feature can be disabled using the *frontpanel_button* command. Users are cautioned that the reset feature is ON by default and must be turned off if this is not the desired behavior.

2.3.3 Setting a Static IP Address

Use the following steps to set the IP Address on the 4380A.

- A. Telnet into the system *telnet ip addr 1700* or connect to the unit via the Console Cable and the 4380A> prompt should appear.

- B. Use the *network_config* command and options to set the system to the desired network settings.

```
network_config --mode <DHCP|static> --ip <ip addr> --mask <mask> --broadcast  
<broadcast> --gateway <gateway>]
```

[Example]

```
network_config --mode static --ip 192.168.1.50 --mask 255.255.255.0 --broadcast  
192.168.1.255 --gateway 192.168.1.1
```

- C. These network settings will take effect immediately. Users should see the following:

```
<working> ..... Once timed out, the network connection will drop.
```

- D. Users connected via the network will need to reconnect to the system using the newly assigned static IP Address. Users do not need to save these changes; they are automatically stored on the system. The 4380A will start up with the new settings each time it is rebooted or power cycled.

- E. Users can also view the current network settings using the *network* command. This will display the current user settings.

```
4380A>network  
[mode] static  
[static]  
[broadcast] 192.168.150.255  
[default_gateway] 192.168.150.1  
[ip] 192.168.150.61  
[netmask] 255.255.255.0  
[OK] 2015-08-05T14:23:28Z
```

2.3.4 USB Ports

The USB ports on the rear panel allow:

- Users to access the command port (94000-115200). See section 2.3.2.2. Users can set the IP Address on the box following the instructions in section 2.3.3.B-C. The system will automatically connect to the command port and provide the 4380A> command prompt.
- The 4380A to communicate with a 5071A Cesium Clock (94001-5071A). See section 2.7.

Note: Microsemi recommends if you are going to use these cables that the cables should be plugged into the unit when it is powered on.

2.4 Antenna Installation

Installing the antenna properly requires careful planning. The antenna location itself must be selected based solely on the ability to reliably receive the GNSS signal. This should be one of the primary factors in selecting the installation location of this unit depending on the length of the antenna cable.

Note: The antenna cable should have less than 10 dB of loss at 1.5 GHz. If this is not possible due to the cable type or length of cable then additional in-line amplifiers will be need to be installed or you will need a cable type with less loss.

The antenna included with the 4380 has a 5/8" coarse threaded mounting screw hole on the bottom. This threaded hole allows the antenna to be easily and securely mounted on a 5/8" coarsely threaded rod.

Threaded rods are available at most hardware stores and will need to be mounted securely to the side of a building or other stationary object. Once the rod is properly secured it will provide a stable mount for the antenna.

2.4.1 Antenna Location

The 4380A is typically mounted in a standard 19" equipment rack, but the unit may also be operated from a bench top. No matter which location is chosen, the installation location should be selected keeping in mind that access to a suitable antenna location will be necessary for proper operation.

- A. Placement of the GNSS antenna is extremely important. It should be placed so that it has clear view of as much sky as possible. Any obstructions such as antennas, large metal objects, or buildings will limit the performance of the 4380A. The GNSS antenna should have an unobstructed line of sight to the sky. (See Figure 1.)
- B. In selecting a location for the antenna, its proximity to the 4380A should also be considered. Ideally, the antenna will be close enough to the 4380A so loss through the antenna cable is minimized.

WARNING: An outside antenna system should not be located in the vicinity of overhead power lines or other electric light or power circuits, or where it can fall into such power lines or circuits. When installing an outside antenna system, extreme care should be taken to keep it from touching such power lines or circuits as contact with them might be fatal.

AVERTISSEMENT: Un système extérieur d'antenne ne devrait pas être situé à proximité des lignes à haute tension aériennes ou d'autres circuits de lumière électrique ou de puissance, ou où il peut tomber dans de tels lignes à haute tension ou circuits. En installant un système extérieur d'antenne, le soin extrême devrait être pris pour le garder de toucher de tels lignes à haute tension ou circuits comme entrent en contact avec eux force soyez mortel.

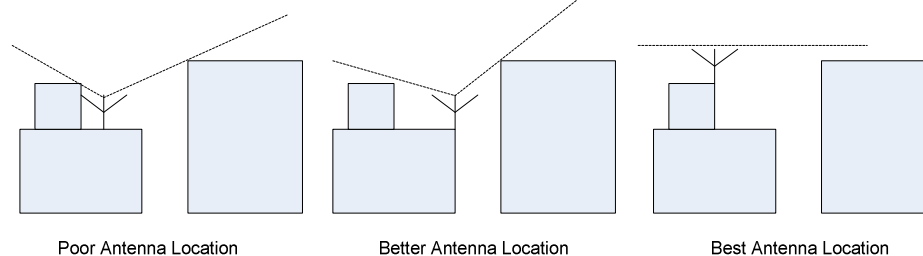


Figure 1 Antenna Location

- C. Once a suitable antenna location has been identified, it is necessary to ensure that the GNSS signal that reaches the 4380A is of suitable quality. The unit requires a minimum of 15dB gain from the antenna gain combined with the amount of loss in the antenna cable. The antenna included with the 4380A has 25dB of gain so the total cable losses in the system must not exceed 10 dB at 1.5 GHz. If you are using a different antenna please ensure the antenna gain combined with the cable loss will provide sufficient signal strength for the 4380A.
- D. If the location of the antenna dictates that a longer cable must be used, then a line amplifier will need to be inserted into the signal path or you will need to run an antenna cable with less loss. A line amplifier is a device used to amplify the GNSS signal to overcome the losses resulting from longer cable runs. In selecting a line amplifier, it is necessary to make sure that it provides an adequate amount of gain and that it operates from 1200MHz to 1600MHz.
- E. The amount of gain required from a line amplifier can be calculated by knowing the total loss of the antenna cables being used. The signal loss due to a cable varies depending upon the frequency

of the signal. For the purposes of GNSS antennas, the cable loss should be calculated at 1500MHz. The manufacturer of the cable being used should be able to provide an estimate of the cable loss at 1500MHz. Once the cable loss is known, it can be inserted into Equation 2-1 to calculate the required gain of the line amplifier.

$$MIN_Gain(dB) = \frac{Cable_Loss(dB / 100 ft) * Cable_Length(ft)}{100} - 12 \quad \text{Eq. 2-1.}$$

- F. The *MIN_Gain* value in Equation 2-1 serves as the minimum gain required from the line amplifier being used. It is possible to use amplifiers with a slightly higher gain than the minimum value but it will not improve the performance of the system. Using amplifiers with significantly higher gain values can also cause degradation of the GNSS signal because it overdrives the input of the GNSS receiver.
- G. Placement of the line amplifier is also a concern in a properly designed system. Placing the amplifier too far from the antenna may cause unexpected degradation in the GNSS signal and the performance will remain poor. The best place for the amplifier is typically half way between the antenna and the 4380A. This allows the line amplifier to benefit from any surge protection that may be installed near the antenna, but is still close enough to the antenna so as not to degrade the signal significantly. Figure 2 shows the block diagram of a typical installation that requires a longer antenna cable. Another consideration when installing the line amplifier is how it will receive power. Some amplifiers are powered using a DC bias on the antenna cable and others are powered from AC adapters directly. Please contact Microsemi if you require assistance in selecting the right amplifier for your application.



Figure 2 Antenna Cable

The antenna mount should be secured to a stable structure such as a building, antenna mast, or other suitable mounting platform.

- H. The antenna is designed to withstand rain, snow, and dust. When selecting the mounting location for the antenna, try to find a location that will not become buried in snow and/or covered by foliage. Keep the top surface of the antenna clean and brush off any ice and snow to ensure that your antenna performs optimally. In addition, ensure the connector remains clean and dry.

2.4.2 Setting the Antenna Voltage

The 4380A is capable of providing antenna power (0, 5, 12VDC) by DC biasing the antenna cable, but this can cause damage to an antenna if the wrong voltage is applied. Prior to connecting an antenna to the unit, ensure the antenna voltage is set properly. The 4380A is shipped from the factory with the default antenna voltage of 0 volts. If this is not the desired configuration, then follow the steps below to set the proper antenna voltage.

- A. Telnet into the system command port `telnet ip addr 1700` or connect via the USB Port and the 4380A> prompt should appear.

- B. At the 4380A> prompt, type *settings gnss* and press enter, this will display the user configurable GNSS settings for the unit to view and verify the current voltage being supplied to the antenna is correct.

```
4380A>settings gnss
[antenna_delay] 0.000000000000000e-00
[antenna_voltage] 0.000000000000000e+00
[datum] wgs84
[mask_angle] 1.000000000000000e+01
[positioning]
[auto_hours] 1.200000000000000e+01
[manual_position]
[altitude] 1.963225000000000e+02
[latitude] 3.992277661000000e+01
[longitude] -7.758567306000000e+01
[mode] auto
[tracking_timeout] 1800
[OK] 2015-08-05T14:28:57Z
```

- C. To change the value, type *antenna_voltage* and set the desired value (0, 5, or 12) and press enter. The system should respond with “OK”.

```
4380A>antenna_voltage 12
[OK] 2015-08-05T14:30:16Z
```

Note: If you enter an incorrect value you will get the following error message:

```
4380A>antenna_voltage 3
Usage : antenna_voltage <0 | 5 | 12>
[ERROR] 2015-08-05T14:30:53Z
```

- D. You can verify the setting is correct by typing *settings gnss:antenna_voltage* and pressing enter, this will display the current antenna voltage setting.

```
0 VDC      0.000000000000000e+00
5 VDC      5.000000000000000e+00
12VDC     1.200000000000000e+01
```

The antenna voltage setting can also be verified using a voltmeter. To verify the antenna voltage, apply the probes to the ANTENNA connector on the rear panel. The center conductor should be at a higher potential than the 4380A chassis. This voltage reading indicates the voltage being provided to the antenna. If no voltage is present, then the antenna is not being powered by the 4380A.

- E. If this setting is correct, type *save* to save the current user default configuration on the system to ensure the system provides the proper antenna voltage after a reboot or power cycle.

2.4.3 Outdoor Antenna Grounding

If an outside antenna is connected to the 4380A, be sure the antenna is grounded so as to provide some protection against voltage surges and built-up static charges. Article 810 of the National Electrical Code, ANSI/NFPA 70 provides information with regard to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding connectors, location of antenna discharge unit, connection to grounding electrodes, and requirements for the grounding electrode.

2.4.4 Antenna Mask Angle

Adjustment of the antenna mask angle may be necessary for installations with severe multipath problems. The mask angle of the antenna refers to the elevation angle above the horizon at which all satellites above it are tracked. It may be possible to track satellites below the mask angle, but the data is intentionally omitted because it is unreliable. Installations with severe multi-path problems may find that they get better timing performance out of the 4380A when using a higher mask angle. To set the mask angle, access the system

via the command port and use the *mask_angle* command to set the desired mask angle for the receiver. Mask angle value is in degrees.

```
4380A>mask_angle 10
[OK] 2015-08-05T15:05:12Z
```

You can verify the current value of the mask angle by sending the *settings gnss:mask_angle* command.

```
4380A>settings gnss:mask_angle
1.0000000000000000e+01
[OK] 2015-08-05T15:04:43Z
```

If this setting is correct, type *save* to save the current user default configuration on the system to ensure the system uses the proper mask angle after a reboot or power cycle.

2.4.5 Positioning Modes

The 4380A offers three different modes for determining the antenna position and determining receiver operation: dynamic, auto, and manual.

2.4.5.1 Dynamic Position Mode

The Dynamic mode is typically used for systems located on mobile platforms.

Note: The system default mode is dynamic. Users at static locations should change this to auto or manual based on the information provided below.

2.4.5.2 Auto Position Mode

The Auto mode is recommended for static locations where the antenna location has not been surveyed. When using the Auto mode, the 4380A will automatically determine the location of its antenna. It does this by averaging its calculated position solutions over a period specified by the *auto_hours* parameter. The factory default for the position period is 12 hours. It is recommended that the auto positioning period should be set to at least 4 hours. Once the position_period expires, the 4380A will enter the fixed position mode (*status gnss:position:fixed*). Fixing the antenna position reduces the noise of the GNSS measurements and increases the frequency stability of the timing outputs.

To set the positioning mode to auto, use the *position_mode* command on the command port.

```
4380A>position_mode auto
[OK] 2015-08-05T15:26:06Z
```

To set the positioning period, use the *position_period* command. If not specified, the value will be in hours. Users can set this value to minutes using *m* after the value.

```
4380A>position_period 12
[OK] 2015-08-05T15:26:06Z
```

Select the proper datum, WGS84 (default) or NAD83, using the *datum* command.

```
4380A>datum wgs84
[OK] 2015-08-05T15:28:14Z
```

Use the *settings gnss* command to verify the correct datum is being used.

```
4380A>settings gnss
[antenna_delay] 2.6500000000000000e-07
[antenna_voltage] 1.2000000000000000e+01
[datum] wgs84
[mask_angle] 1.0000000000000000e+01
[positioning]
```



```
[auto_hours] 1.20000000000000e+01
[manual_position]
[altitude] 1.96354500000000e+02
[latitude] 3.99227579600000e+01
[longitude] -7.75856695600000e+01
[mode] auto
[tracking_timeout] 1800
[OK] 2015-08-05T15:27:19Z
```

If these settings are correct, type *save* to save the current user default configuration on the system to ensure the system uses the positioning mode and period after a reboot or power cycle.

Note: If the unit is rebooted, power cycled, or the application is restarted with the positioning mode set to auto, the system will go through the process of determining its antenna position based on the position period (*auto_hours*). Once that period expires, the system will again set itself fixed and use the new determined solution as the fixed position. It will do this each time this occurs. The [ptd] or UTC offset value reported by the system will be noisier during the auto position period and will become significantly quieter when the antenna position is fixed.

In addition to automatically determining its antenna location, the 4380A generates a RINEX (Receiver INdependent EXchange) format observation file. This file format is a standard used by the GNSS community and provides all the necessary GNSS measurements for determining the antenna location. The file can be retrieved from the system by using ftp (login: ftp, password: ftp) to log in and retrieve the file. The file will be in the “rinex” subdirectory and will have a “.yyj” extension where [yy] represents the last two digits of the current year. Many online processing centers are available (e.g., <http://www.ngs.noaa.gov/OPUS>, <http://sopac.ucsd.edu/cgi-bin/SCOUT.cgi>) and will process the observation file free of charge. Doing this improves the position estimate of the antenna and is recommended for precise time recovery. After this is complete, it is possible to set the position mode to manual using the coordinates provided by those services.

Note: The receiver has a countdown timer to show the amount of time left (*position_period*) while in the auto positioning mode. Once this timer counts to zero, the RINEX file will be generated, the receivers position (*status gnss:position:fixed*) will be true, and the [time_remaining] field will no longer be present in the status message.

```
4380A>status gnss:auto_positioning
[time_remaining] 10 hours, 51 minutes
[OK] 2015-08-05T15:32:05Z

4380A>status gnss:position

[alt] 1.96569900000000e+02
[fixed] false
[lat] 3.99227557996100e+01
[lon] -7.75856712212799e+01
[OK] 2015-08-05T15:32:33Z
```

2.4.5.3 Manual Position Mode

If the location of the antenna is known, then the Manual mode should be used. This mode uses the information provided by the datum, latitude, longitude, and altitude parameters to fix the antenna position at startup.

Note: This bypasses the auto positioning period and the 4380A will not generate a RINEX observation file. This mode of operation is recommended ONLY if the antenna position is known. Once you set any of these three parameters (lat, lon, or alt), the 4380A will automatically go into *manual* mode.

Caution: If the operator enters the manual position incorrectly, the system will indicate it is tracking satellites in the status output, however the system may show the gnss status as “not tracking” both in the status results and on the front panel. To correct this problem ensure the position is entered correctly. If this does not work, set the unit to the auto position mode and re-survey the antenna position.

```
4380A>status gnss:satellite:number
9
[OK] 2015-08-05T15:36:14Z

4380A>status gnss:mode:desc
tracking
[OK] 2015-08-05T15:37:27Z
```

To manually set the antenna position, use the following steps:

- A. Select the proper datum, WGS84 (default) or NAD83, using the *datum* command.

```
4380A>datum wgs84
[OK] 2015-08-05T15:42:42Z
```

- B. Set the latitude for the antenna using the *latitude* command.

```
4380A>latitude 38.46627893094
or
4380A>latitude 38.46627893094N
```

Note: Default is [N]orth. If you are in the southern hemisphere make sure there is an [S]outh after the latitude or a (-) before the latitude.

```
4380A>latitude -38.46627893094
or
4380A>latitude 38.46627893094S
```

- C. Set the longitude for the antenna using the *longitude* command.

```
4380A>longitude 77.44086542274004
or
4380A>longitude 77.44086542274004E
```

Note: Default is [E]ast. If you are in the Western hemisphere make sure there is an [W]est after the latitude or a (-) before the latitude.

```
4380A>longitude -77.44086542274004
or
4380A>longitude 77.44086542274004W
```

- D. Set the altitude for the antenna using the “*altitude*” command. Default value is ellipsoid height meters. Users can specify the height in feet by using *F* after the value.

```
4380A>altitude 51.573999999999998
or
4380A>altitude 169.206037003 F
```

- E. Verify the current settings are correct using the *settings gnss* command or narrow it down further with the *settings gnss:positioning>manual_position* and *settings gnss:datum* commands.

```
4380A>settings gnss:positioning>manual_position
[altitude] 5.1573999999999998e+01
[latitude] 3.8466278930940000e+01
[longitude] -7.7440865422740004e+01
```

```
4380A>settings gnss:datum
wgs84
[OK] 2015-08-05T15:43:31Z
```

The operator also has the option of setting the manual mode and entering all three parameters on the same command line using the *fix_position (current | lat, lon, alt)* command.

```
4380A> fix_position 38.46627893094 -77.44086542274004 51.573999999999998
```

Warning: If the operator uses this command and does not provide any of the arguments, the unit will set its position based on the current system status (*status gnss:position*) value. Doing this may cause accuracy issues because of position errors.

If these settings are correct, type *save* to save the current position on the system to ensure the system uses the manual positioning mode after a reboot or power cycle.

2.5 4380A Installation

The 4380A is ready for installation into a standard 19" (48.3 cm) rack using either slides or shelves and will take up 1U of rack space. The 4380A has the following options for the slides:

94020 = Rail Kit, 20-32" Rack Depth

94021 = Rail Kit, 24-30" Rack Depth

2.5.1 Power Supplies

The 4380A operates with two power supplies capable of operating on different power sources. The 4365A (AC Power Supply) and 4366A (DC Power Supply) are available. The 4380A is capable of operating on one power supply in the event that the other fails or its input source fails. Power Supply #1 is on the left and Power Supply #2 is on the right when looking at the front of the unit. See Appendix A for the specifications on the Power Supplies.

2.5.2 Input/Output Cards

The 4380A will operate with several different types of input and output cards. These cards can be operated in any of the six slots. The unit will automatically detect and configure the system based on the card(s) installed. The card slots are identified by slot number so the operator is capable of identifying the cards physical location in the chassis. The view below is from the rear of the unit from left to right.

Slot 1	Slot 3	Slot 5
Slot 2	Slot 4	Slot 6

Figure 3 Rear Panel Output Card Locations

Each input/output card typically has four connectors with the port number identified as shown below in Figure 4. See Appendix A for the specifications of each card.

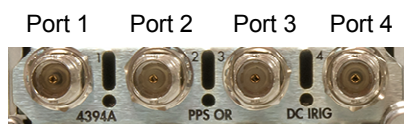


Figure 4 Input/Output Cards

2.5.3 4394A (PPS/DC IRIG)

The factory default for this module provides two 1PPS outputs (Outputs 1 and 2) and two DC IRIG (B000) outputs (Outputs 3 and 4).

The output types are user selectable/programmable. Users can change the signal types (PPS/DC IRIG), the PPS signal parameters, and the IRIG signal types on individual output ports.

- **PPS:** Valid PPS settings are 1, 10, 100, 1K, 10K, 100K, and 1M PPS. To set the PPS signal parameters use the *pps* command:

```
4380A> pps [slot#] [port#] [pulse period] [pulse width]
```

The following example sets the PPS on Slot 1, Port 2 to 1MPPS and the pulse width to 500 ns (1/2 the duty cycle).

```
4380A>pps 1 2 1e-6 5e-7
```

[OK] 2015-08-05T15:52:31Z

The following rules apply:

1. PERIOD - period of pulse in seconds(max of 1, min of 1e-6)
2. WIDTH - pulse width in seconds (minimum of 5e-7)
3. For PPS Rates where the duty cycle is 10 μ s or greater, the *pulse_width* must be a multiple of 10 μ s, at least 10 μ s wide, and at most half the duty cycle of the *pulse_period*.
4. For PPS rates where half the duty cycle is less than 10 μ s, the *pulse_width* must be exactly one-half the *pulse_period*. (See example above.)

The system will generate an error message if the values are not correct or entered improperly.

Usage: <slot#> <port#> <pulse period> <pulse width>
[ERROR] 2015-08-05T15:53:07Z

To verify the settings use the *settings hardware:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A> settings hardware:slots:1
[4394A]
[ports]
[1]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-04
[type] pps
[2]
[pps_period] 1.000000000000000e+00
[pps_width] 5.000000000000000e-01
[type] pps
[3]
[format] A
[signal_word] 3
[type] irig
[4]
[format] B
[signal_word] 0
[type] irig
[OK] 2015-08-05T15:51:30Z
```

- **IRIG:** Valid DC IRIG Codes are A (000,003,007), B (000,003,007), D002, E002, G002, and H002. Default is B000. To set the IRIG Code for the individual ports, use the *irig* command:

```
4380A> irig [slot#] [port#] [Code A-H] [Code Format <NNN>]
```

The following example sets the IRIG for Slot 1, Port 3 to A 003.

```
4380A>irig 1 3 A 003
```

[OK] 2015-08-05T16:02:16Z

The system will generate an error message if the operator attempts to enter an unsupported or invalid code.

To verify the settings, use the *settings hardware:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A> settings hardware:slots:1
[4394A]
[ports]
[1]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-04
[type] pps
[2]
[pps_period] 1.000000000000000e-06
[pps_width] 5.000000000000000e-07
[type] pps
[3]
[format] A
```

```
[signal_word] 3
[type] irig
[4]
[format] 8
[signal_word] 0
[type] irig
[OK] 2015-08-05T16:02:45Z
```

Note: The system will drop the leading zeros in the signal_word.

To verify the card is working properly, use the *status hardware:outputs:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A>status hardware:outputs:slots:1
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4394A
[OK] 2015-08-05T16:03:59Z
```

Warning: The user configuration for the specific output formats are stored on the system itself. Replacement modules will automatically be configured with the correct output format as long as the replacement card is installed in the same slot. Moving the output module to a different slot causes the system to configure the module with the default output format(s) until that card slot is properly configured by the user.

Avertissement: La configuration d'utilisateur pour les formats spécifiques de rendement sont stockées sur le système lui-même. Des modules de rechange seront automatiquement configurés avec le format correct de rendement tant que la carte de rechange est installée dans la même fente. Déplacer le module de rendement à une fente différente fait configurer le système le module avec les formats de rendement de défaut jusqu'à ce que ce logement pour carte soit correctement configuré par l'utilisateur.

2.5.4 4376A RS-422 PPS

The factory default for this module provides four 1PPS outputs. Users can change the PPS signal parameters, on individual signal outputs.

Valid PPS settings are 1, 10, 100, 1K, 10K, 100K, and 1M PPS. To set the PPS signal parameters use the *pps* command:

```
4380A> pps [slot#] [port#] [pulse period] [pulse width]
```

The following example sets the PPS on Slot 1, Port 2 to 1MPPS and the pulse width to 500 ns (1/2 the duty cycle).

```
4380A>pps 1 2 1e-6 5e-7
[OK] 2015-08-05T15:52:31Z
```

The following rules apply:

1. PERIOD - period of pulse in seconds(max of 1, min of 1e-6)
2. WIDTH - pulse width in seconds (minimum of 5e-7)
3. For PPS Rates where the duty cycle is 10 μ s or greater the *pulse_width* must be a multiple of 10 μ s, at least 10 μ s wide, and at most half the duty cycle of the *pulse_period*.
4. For PPS rates where half the duty cycle is less than 10 μ s, the *pulse_width* must be exactly one-half the *pulse_period*. (See example above.)

The system will generate an error message if the values are not correct or entered improperly.

```
Usage: <slot#> <port#> <pulse period> <pulse width>
[ERROR] 2015-08-05T15:53:07Z
```

To verify the settings use the *settings hardware:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A>settings hardware:slots:5
[tsc4376]
[ports]
[1]
[pps_period] 1.0000000000000000e+00
[pps_width] 1.0000000000000000e-04
[type] pps
[2]
[pps_period] 1.0000000000000000e+00
[pps_width] 1.0000000000000000e-04
[type] pps
[3]
[format] B
[pps_period] 1.0000000000000000e+00
[pps_width] 1.0000000000000000e-04
[type] pps
[4]
[format] B
[pps_period] 1.0000000000000000e+00
[pps_width] 1.0000000000000000e-04
[type] pps
[OK] 2015-02-05T20:36:
```

To verify the card is working properly, use the *status hardware:outputs:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A>status hardware:outputs:slots:5
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4376A
[OK] 2015-02-05T20:27:05Z
```

2.5.5 4394A-ECL (PPS-ECL)

This module provides two 1PPS outputs. The output types are user selectable/programmable. Users can change the PPS signal parameters. Valid PPS settings are 1, 10, 100, 1K, 10K, 100K, and 1M PPS. To set the PPS signal parameters use the *pps* command:

```
4380A> pps [slot#] [port#] [pulse period] [pulse width]
```

The following example sets the PPS on Slot 1, Port 2 to 1PPS and the pulse width to 10µs.

```
4380A>pps 1 2 1 1e-5
[OK] 2015-08-05T15:52:31Z
```

The following rules apply:

1. PERIOD - period of pulse in seconds(max of 1, min of 1e-6)
2. WIDTH - pulse width in seconds (minimum of 5e-7)
3. For PPS Rates where the duty cycle is 10 µs or greater the *pulse_width* must be a multiple of 10 µs, at least 10 µs wide, and at most half the duty cycle of the *pulse_period*.

4. For PPS rates where half the duty cycle is less than 10 μ s, the *pulse_width* must be exactly one-half the *pulse_period*.

The system will generate an error message if the values are not correct or entered improperly.

```
Usage: <slot#> <port#> <pulse period> <pulse width>
[ERROR] 2015-08-05T15:53:07Z
```

To verify the settings, use the *settings hardware:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A> settings hardware:slots:1
[4394]
[ports]
[1]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-04
[type] pps
[2]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-05
[type] pps
[3]
[format] A
[signal_word] 3
[type] irig
[4]
[format] B
[signal_word] 0
[type] irig
[OK] 2015-08-05T15:51:30Z
```

To verify the settings, use the *status hardware:outputs:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A> status hardware:output:slots:1
[4394]
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] n/a
[4]
[status] n/a
[power] enabled
[type] 4394A-ECL
[OK] 2015-08-05T15:51:30Z
```

Warning: The user configurations for the specific output formats are stored on the system itself. Replacement modules will automatically be configured with the correct output format as long as the replacement card is installed in the same slot. Moving the output module to a different slot causes the system to configure the module with the default output format(s) until that card slot is properly configured by the user.

Avertissement: Les configurations d'utilisateur pour les formats spécifiques de rendement sont stockées sur le système lui-même. Des modules de rechange seront automatiquement configurés avec le format correct de rendement tant que la carte de rechange est installée dans la même fente. Déplacer le module de rendement à une fente différente fait configurer le système le module avec les formats de rendement de défaut jusqu'à ce que ce logement pour carte soit correctement configuré par l'utilisateur

2.5.6 4395B-10 (10MHz)

No programming is required for these modules. These modules will also work in any of the 6 card slots. To verify these cards are working properly, use the *status hardware:outputs:slots:N* command (N = slot number) to obtain the current status for a particular card.

```
4380A>status hardware:outputs:slots:3
[ports]
  [1] [status] good
  [2] [status] good
  [3] [status] good
  [4] [status] good
[power] enabled
[type] 4395A-10
[OK] 2015-08-05T16:06:29Z
```

2.5.7 4395B-5 (5MHz)

No programming is required for these modules. These modules will also work in any of the 6 card slots. To verify these cards are working properly, use the *status hardware:outputs:slots:N* command (N = slot number) to obtain the current status for a particular card.

```
4380A>status hardware:outputs:slots:4
[ports]
  [1] [status] good
  [2] [status] good
  [3] [status] good
  [4] [status] good
[power] enabled
[type] 4395B-5
[OK] 2015-08-05T16:37:43Z
```

2.5.8 4395B-1 (1MHz)

No programming is required for these modules. These modules will also work in any of the 6 card slots. To verify these cards are working properly, use the *status hardware:outputs:slots:N* command (N = slot number) to obtain the current status for a particular card.

```
4380A>status hardware:outputs:slots:5
[ports]
  [1] [status] good
  [2] [status] good
  [3] [status] good
  [4] [status] good
[power] enabled
[type] 4395B-1
[OK] 2015-08-05T16:37:43Z
```

2.5.9 4387A Series (Modulated IRIG/NASA36)

This module provides four Amplitude Modulated (AM) IRIG Outputs or the NASA36 Serial Time Code. Valid AM IRIG Codes are A (130, 133, 137), B (120, 123, 127), E (111, 112, 121), G (141, 142, 147), and H (111, 112, 121, 122, 127). The default time code is B120. The 4387A-6V module provides 6 Vpp output signals.

- **IRIG:** To set the IRIG Code for the individual ports use the *irig* command:

```
4380A> irig [slot#] [port#] [Code A-H] [Code Format <NNN>] [epoch]
```


The following example sets the IRIG Code for Slot 5, Port 3 to G 141 and the epoch off (epoch is off by default). The epoch option is not required to properly execute this command and can be left off the command line.

```
4380A>irig 5 3 G 141
[OK] 2015-08-05T16:35:12Z
```

The system will generate an error message if the operator attempts to enter an unsupported or invalid code.

To verify the settings, use the *settings hardware:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A>settings hardware:slots:5
[4387]
[ports]
[1]
[epoch_127] false
[format] B
[signal_word] 120
[type] irig
[2]
[epoch_127] false
[format] B
[signal_word] 120
[type] irig
[3]
[epoch_127] false
[format] G
[signal_word] 141
[type] irig
[4]
[epoch_127] false
[format] B
[signal_word] 120
[type] irig
[OK] 2015-08-05T16:40:12Z
```

- **NASA36:** To set the NASA 36 Code for the individual ports, use the *nasa36* command:

```
4380A> nasa36 [slot#] [port#]
```

The following example sets the Time Code for Slot 5, Port 3 to NASA 36.

```
4380A>nasa36 5 3
OK
[OK] 2015-08-05T16:41:25Z
```

The system will generate an error message if the operator attempts to enter an unsupported or invalid code.

To verify the settings, use the *settings hardware:slots:N* command (where N=Slot #) to obtain the current settings for a particular card.

```
4380A> settings hardware:slots:5
[4387]
[ports]
[1]
[epoch_127] false
[format] B
[signal_word] 120
[type] irig
[2]
[epoch_127] false
[format] B
[signal_word] 120
[type] irig
[3]
[epoch_127] false
[format] B
```

```
[signal_word] 127
[type] nasa36
[4]
[epoch_127] false
[format] B
[signal_word] 120
[type] irig
```

Warning: The user configuration for the specific output formats are stored on the system itself. Replacement modules will automatically be configured with the correct output format as long as the replacement card is installed in the same slot. Moving the output module to a different slot causes the system to configure the module with the default output format(s) until that card slot is properly configured by the user.

Avertissement: La configuration d'utilisateur pour les formats spécifiques de rendement sont stockées sur le système lui-même. Des modules de rechange seront automatiquement configurés avec le format correct de rendement tant que la carte de rechange est installée dans la même fente. Déplacer le module de rendement à une fente différente fait configurer le système le module avec les formats de rendement de défaut jusqu'à ce que ce logement pour carte soit correctement configuré par l'utilisateur.

2.5.10 4396A/4397A 2MHz Output Card

No programming is required for these modules. These modules will also work in any of the 6 card slots. To verify these cards are working properly, use the *status hardware:outputs:slots:N* command (N = slot number) to obtain the current status for a particular card.

```
4380A>status hardware:outputs:slots:3
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4397A
[OK] 2015-08-05T16:06:29Z
```

2.5.11 4374A T1 (1.544MHz) Output Card

No programming is required for these modules. These modules will also work in any of the 6 card slots. To verify these cards are working properly, use the *status hardware:outputs:slots:N* command (N = slot number) to obtain the current status for a particular card.

```
4380A>status hardware:outputs:slots:3
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4374A
[OK] 2015-08-05T16:06:29Z
```

2.5.12 4393A Time Interval Counter (TIC) Card

This module has four input ports that can be used to measure the time interval between the internal 1PPS and up to four external sources and will work in any of the 6 card slots. The default averaging period for

the measurements is 10 seconds and can be adjusted using the *ptdavg* command. Valid settings are 1, 10, 20, 60, 300 seconds. This setting is global and applies to all of the TIC Cards installed in the 4380A.

```
ptdavg 20
OK
[OK] 2015-08-05T16:42:56Z
```

To verify the averaging interval, use the *settings ptd_port* command

```
4380A>settings ptd_port
[averaging_interval] 20
[OK] 2015-08-05T16:49:56Z
```

To verify the card is working properly, use the *status hardware:outputs:slots:N* command (N=Slot #) to obtain the current status for a particular card.

```
4380A>status hardware:outputs:slots:4
[ports]
  [1]
    [status] good
  [2]
    [status] good
  [3]
    [status] good
  [4]
    [status] good
  [power] enabled
  [type] 4393A
[OK] 2015-08-05T16:53:04Z
```

2.5.13 4383A IRIG Input Card

This module has four input ports that can be used to recover time from an IRIG time source. Ports 1 and 2 support DC IRIG (Default B007) and Ports 3 and 4 support AM IRIG (Default B127). By default Port #1 is active, to select another source or IRIG format, use the *irig_input* command. If the IRIG Source does not provide the year as part of the time code message, (i.e. B000/B120), the user can specify the year with the command.

```
4380A>irig_input [slot#] [port#] [irig type] <year>
```

To verify the system settings, use *settings hardware:slots:N* where N = the slot # where the card is installed.

```
4380>settings hardware:slots:6
[4383]
  [port]
    [1]
      [enabled] true
      [format] B007
    [2]
      [enabled] false
      [format] B007
    [3]
      [enabled] false
      [format] B127
    [4]
      [enabled] false
      [format] B127
```

To verify the card is working properly, use the *status hardware:outputs:slots:N* command (N=Slot #) to obtain the current status for a particular card. The selected IRIG Source will report as good, the other ports will show as disabled.

```
4380>status hardware:outputs:slots:6
[ports]
  [1]
    [status] good
  [2]
    [status] disabled
```

```
[3]
[status] disabled
[4]
[status] disabled
[power] enabled
[type] 4383A
[OK] 2015-02-03T18:09:24Z
```

2.6 Antenna Delay Calibration

Utilizing the 4380A as a precise time recovery system requires a complete calibration of the 4380A and distribution system. Cables and distribution equipment external to the 4380A affect the calibration of the overall system and will result in an offset from UTC(USNO). This section assumes the on-time-point (OTP) of the system is the rear panel outputs on the 4380A. This may not be the desired location for the OTP; users should refer to section 2.7 for information on changing the location of the OTP for the system.

For applications requiring the highest level of accuracy, the 4380A should be calibrated at Microsemi. This process involves installing the user's antenna and antenna cable at the factory and comparing the PPS outputs to a system which has a known offset to UTC(USNO). Once the calibration is complete, the antenna delay value is provided to the customer when the unit is delivered to the user. The PPS outputs will be accurate to the precise calibration levels specified in Appendix A as long as the user installs the antenna at a surveyed location. If a surveyed antenna location is not available, the 4380A can be used to survey the location. See Section 2.4.5 on determining the antenna position.

A coarse calibration of the 4380A is accomplished by accounting for the individual system delays and combining them to determine the overall delay of the system. This method is generally less accurate because the individual delays in the system are estimated and may not be entirely accurate. Equation 2-2 gives the general formula for performing a coarse calibration of the 4380A.

$$antenna_delay(seconds) = \frac{Length_of_Antenna_Cable(meters)}{Signal_Velocity(meters/sec)}$$

Eq. 2-2

The *Signal_Velocity* refers to the velocity of the GNSS signals as they travel through the antenna cable. This information can be obtained from the manufacturer of the cable. It is typically specified as a percentage of the speed of light and it is up to the user to calculate the actual *Signal_Velocity*. Calculation of the *Signal_Velocity* is shown in Equation 2-3. It is calculated using the speed of light and the *Velocity_of_Propagation* given by the cable manufacturer. If the *Velocity_of_Propagation* is not available or the accuracy of the PPS signal is not important to the application, then 0.85 may be used as a typical value.

$$Signal_Velocity(meters/sec) = 299792458 * Velocity_of_Propagation$$

Eq. 2-3

Once the 4380A delay has been calculated, it must be entered into the system using the *antenna_delay* command. The example below is using a delay value of 118.5ns. Once the antenna delay value has been properly set, use the *save* command to save the current delay to ensure the system uses the correct delay value after a reboot or power cycle. Users can verify the value was set properly by using the *settings gnss:antenna_delay* command and reviewing the settings.

Note: The new delay value will take effect immediately and could cause an alarm if the delay value forces the UTC(USNO) offset to be larger than 100 ns. The system will steer the internal clock to remove the antenna delay. If the alarm light came on it will go out once the UTC Value is within +/-100. The 4380A outputs will now be accurate to the coarse calibration accuracy specified in Appendix A.

```
4380A>antenna_delay 1.185E-7
[OK] 2015-08-05T16:43:29Z
```

```
4380A>settings_gnss:antenna_delay
1.185000000000000e-07
[OK] 2015-08-05T16:55:38Z
```

2.7 On Time Point (OTP)

The OTP of a system is defined as the point at which the timing signals coincide with UTC(USNO). Typical systems use distribution amplifiers and cabling to distribute timing signals from a single source to multiple users. This distribution network will delay the timing signals and affect their accuracy. For this reason, it is important to select an appropriate OTP so that the desired timing signals are accurate when they reach the user.

This section describes calibration of the 4380A assuming that the OTP of the system is the rear panel of the 4380A. This is not generally a convenient location for the OTP of the system because there will be a delay associated with the distribution of the signals to the user. Figure 5 illustrates how to move the OTP of the system from the rear panel of the 4380A to the user inputs. In moving the OTP of the system, it is imperative that the distribution delays from the 4380A to each of the users is equal. This will ensure that all users receive accurate timing signals.

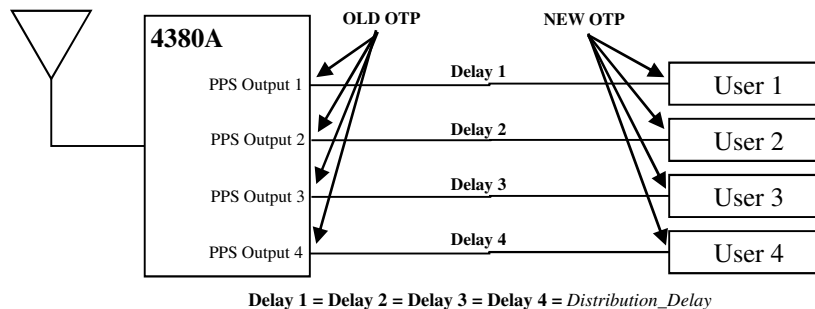


Figure 5 Timing System Diagram

Once the delay of the distribution network is known the OTP of the system can be shifted from the output of the 4380A to the input of user equipment. Use the *dist_delay* command to enter the delay value into the 4380A and move the OTP to the end user systems. Once entered use the *save* command to save this delay value to ensure the unit is properly aligned at startup.

2.8 Using an External Frequency Reference:

Users may decide to provide an EXTERNAL frequency reference to the 4380A. The external frequency reference may be monitored by the 4380A via a RS232 connection through either of the USB Connectors on the rear of the unit (94001-5071A). The Microsemi 5071A is currently the only model supported; users should contact Microsemi about the possibility of utilizing other clocks. The serial port on the 5071A must be set to 9600 Baud, No Parity, 8 Data Bits, and 1 Stop Bit (9600,N,8,1) and a null modem serial cable will be required.

WARNING: Prior to setting the reference to external, ensure the 10MHz signal from the reference is connected to the 10MHz IN connector on the rear of the 4380A. If not, the 4380A outputs may not remain within specifications and it could take up to several hours for the system to begin providing outputs within their specifications.

AVERTISSEMENT: Avant de placer la référence à externe, assurez le signal 10MHz de la référence est relié au 10MHz DANS le connecteur sur l'arrière du 4380A. Sinon, les sorties 4380A peuvent ne pas demeurer selon des caractéristiques et il pourrait prendre à plusieurs heures pour que le système commence à fournir des sorties selon leurs caractéristiques.

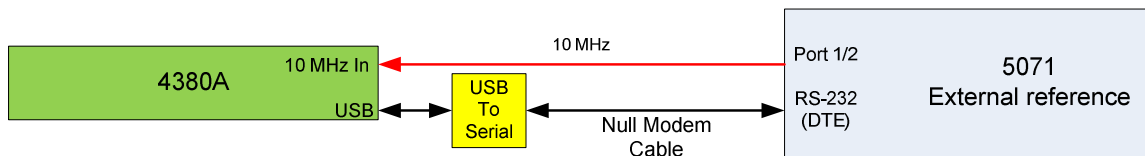


Figure 6 External Frequency Reference

Current status can be determined using the *status reference:frequency:external* command.

```
4380A>status reference:frequency:external
```

```
[communications] N/A
[locked] true
[signal] present
[OK] 2015-08-05T17:17:08Z
```

signal missing	10MHz reference signal is not present. Do NOT select the reference type as External.
cannot communicate	10MHz reference signal is present, but the system is unable to communicate with the 5071A
locked	10MHz reference signal is present and the system is able to communicate with the 5071A
not monitored	10MHz reference signal is present. The system will not attempt to communicate with the external reference.

Note: Make sure the USB-to-Serial Converter (94001-5071A) is installed on one of the two USB ports when the system is powered on. If not, power the system down, plug the cable in and re-apply power. The USB/Serial Cables are programmed to communicate with an external reference (94001-5071A) or to provide users access to the command port (94000-115200). These cables are **NOT** interchangeable.

To set the type of reference, use the *reference_type* command. If users are operating with a Microsemi 5071A and they will set the system up so the 4380A is communicating with the 5071A, select *hp5071A*, if not select *cesium*.

```
4380A>reference_type hp5071a
[OK] 2015-08-05T16:51:17Z
```

Caution: If the system is unable to communicate with the external reference and the *reference_type* is *hp5071A*, the Alarm light will come on and the Osc Lock light will go out and remain this way after you switch to the external reference. Make sure that you select the proper *reference_type* before switching to external.

Attention: Si le système ne peut pas communiquer avec la référence externe et le *reference_type* est *hp5071A*, la lumière d'alarme avancera et la lumière de serrure d'oscillateur s'éteindra et rester de cette façon après toi commutez à la référence externe. Assurez-vous que vous choisissez le *reference_type* approprié avant le changement à externe.

To set the reference to external, use the *reference* command via the command port.

```
4380A>reference external
[OK] 2015-08-05T17:19:32Z
```

Note: The Alarm light will come on and the Sync light will go out for a few seconds when you switch references. The system should clear all alarm indications within a few seconds.

To verify the settings use the *settings reference* command to check the current settings.

```
4380A>settings reference
[external]
  [type] hp5071A
[source] internal
[steering]
  [source] gnss
```

```
[timescale]
[kas2]
  [avgfiltermax] 0
  [tseepoch] 0
  [tsfiltermax] 2
  [tsfilterref] N/A
  [tsinterval] 3600
  [tstimeconstant] 10800
[OK] 2015-08-05T17:22:04Z
```

If these settings are correct, type *save* to save the proper reference and reference type in the default user configuration file on the system to ensure the system starts up properly after a reboot or power cycle.

Caution: Users should allow the external frequency reference to free run and should not manually enter corrections/adjustments into the clock. The 4380A characterizes the clock's frequency relative to GNSS and manual/user adjustment of the clock frequency may cause the 4380A outputs to not meet specification following the adjustment.

Attention: Les utilisateurs devraient permettre la référence externe de fréquence à élevé en plein air et ne devraient pas manuellement écrire des corrections/ajustements dans l'horloge. Le 4380A caractérise la fréquence de base à GNSS relatif et l'ajustement de manuel/utilisateur de la fréquence de base peut faire ne pas répondre les sorties 4380A à des spécifications suivant l'ajustement.

WARNING: After replacing an external frequency reference, the *restart -cold* command must be executed on the 4380A by the operator to reset the KAS2 steering algorithm. If not, the 4380A outputs may not remain within specifications and it could take up to 9 days for the system to provide outputs within specifications.

AVERTISSEMENT: Après remplacement d'une référence externe de fréquence, le relancement - la commande froide doit être exécutée sur le 4380A par l'opérateur pour remettre à zéro l'algorithme de la direction KAS2. Sinon, les sorties 4380A peuvent ne pas demeurer selon des caractéristiques et il pourrait prendre à 9 jours pour que le système fournisse des sorties selon des caractéristiques.

2.9 Setting the System Time Manually

The 4380A is capable of operating without the GNSS Receiver and maintains system time through several methods

2.9.1 Force Time

The *force_time* command has several options and users have the flexibility of choosing the method(s) that will work best based on installation and system architecture. Once the command has been successfully completed, NTP will lock to the new system time and the unit will enable the outputs.

- Default – Sets the system time to 01 Jan 2012 00:00:00
- Now – Sets the system time to the operating systems time.
- Date/Time – Allows the user to specify the date and time in the yyyy-mm-dd-hh:mm:ss format
- NTP – The system obtains the time from an NTP Server and sets the system time.
- IRIG – The system obtains the time from an IRIG Time source and sets the system time. If the time code selected from the *irig_input* command does not provide the year, the user must specify the year on the command line.

If for any reason the system is unable to successfully set the system time it will report an error.

Note: The *force_time* command will not work unless the *steer_source* is set to manual.

2.9.2 External Reference

When setting the time manually, it is recommended users provide a 1PPS and 10MHz. Users can select the proper clock type for the 10MHz input using the *reference_type* command and then switching to reference external when the system is properly set up. Users will need to edit the *node.cfg* file to use one or more 1PPS references from the 4393A Card as a steer source.

2.9.3 Disable the GNSS Tracking Alarms

When using the system with manual time recovery, users can set the system up to ignore the GNSS Tracking Alarms normally set when the system is not tracking GNSS. This can be done by setting the timeout to ZERO.

```
4380A> gnss_tracking_timeout 0
```

To confirm the system settings, use the *settings gnss:tracking_timeout* command.

```
4380A>settings gnss:tracking_timeout
0
[OK] 2015-02-03T19:11:19Z
```

Caution: Setting the timeout to zero is only recommended with time sources other than GNSS. This setting will inhibit the GNSS Tracking alarm even if the unit is using GNSS as the time source.

2.10 User Configuration Files

The 4380A provides the flexibility of operating using different user configurations. Users are able to save these configurations for system settings and ftp | real-time data logging and recall them when needed via the command port.

2.10.1 Factory / Default User Configuration Files

The 4380A will boot up with the **FACTORY** configuration settings automatically and will continue to use these settings until any changes to the configuration are made **and** saved as the user default settings (*default*). To save the user *default* file simply type *save* and press enter. This will save the updated configuration and the 4380A will boot up (either from power on or after a reboot/restart command) using the settings in the user *default* file. To see if the user settings have been saved, use the *list* command to obtain a list of the possible user configuration files. If there are no user configuration files available the system will report *no files*.

```
4380A>list          4380A>list
default            or  no files
```

Note: The user *default* file is used at start up if it is present, otherwise the unit will start up with the factory *default* file. Users are encouraged to set **AND** save their default system settings based on their application so the system will start up properly when powered up or after a reboot or restart.

Users can create other configuration files. Simply make the desired changes to the system configuration, type *save* and a filename to identify the configuration, and press enter. The system will save this configuration containing the new settings. To use this configuration file, use the *list* command to bring up a list of the possible configuration files, and use the *load* command to have the system load and start running with the desired user configuration settings. Use the *settings* command to ensure the system is using the desired settings based on the newly loaded configuration file.

```
4380A>save example
[OK] 2015-08-05T17:22:04Z

4380A>list
example
default

[OK] 2015-08-05T17:23:34Z
```



```
4380A>load example
[OK] 2015-08-05T17:24:27Z
```

Note: The system will recognize case sensitive alphanumeric characters, -, ' ', and _. If any other characters are used, the system will inform the user that the filename is not valid and will not save the settings.

```
4380A>save te%^$st
Illegal Filename
[ERROR] 2015-08-05T17:29:17Z
```

Users can also remove any configuration files that are no longer needed on the system. Use the *list* command to bring up a list of the available configuration files and use the *delete <filename>* command to remove the desired file. Users must provide the filename of the file to be removed from the system, if not the system will provide an error message reminding the user to identify the file to be removed.

```
4380A>delete example
OK
[OK] 2015-08-05T17:19:48Z

4380A>delete
FILENAME
FILENAME      Name of file

[ERROR] 2015-08-05T17:19:59Z
```

Caution: Users can delete the user *default* file. If this is done and a new user default configuration file is not saved, the system **will** use the factory defaults when rebooted, restarted, or power cycled.

Attention: Les utilisateurs peuvent supprimer le dossier de défaut d'utilisateur. Si ceci est fait et un nouveau dossier de configuration de défaut d'utilisateur n'est pas sauvé, le système emploiera les défauts d'usine quand rechargé, remis en marche, ou puissance fait un cycle.

2.10.2 Diff Command

The 4380A will track changes to the system settings that have been made and have not been saved. Use the *diff* command to provide a complete list of settings that have been modified but not saved. In the example below the *ptdavg* has been changed to 20 seconds but not saved. The system will report the current setting and the saved (original) setting in the report.

```
4380A>ptdavg 20
[OK] 2015-08-05T17:41:39Z
4380A>diff

[current]
[ptd_port]
[averaging_interval] 20
[original]
[ptd_port]
[averaging_interval] 10
[OK] 2015-08-05T17:41:53Z
```

2.10.3 FTP and Real-Time (rt) Configuration Files

The 4380A will boot up with the **FACTORY** ftp | rt log file settings automatically and will continue to use these settings until any changes to the gnss logging functions are made **and** saved as the user default log settings (*default*). This will save the updated logging configuration and the 4380A will use these settings each time the system is power cycled, rebooted, or restarted. To save the default log file settings simply type *save_logs ftp* or *save_logs rt*. To see if the user settings have been saved use the *list_logs ftp* or *list_logs rt* command to obtain a list of the possible configuration files. If there are no user configuration files available the system will report *no files*.

```
4380A>list_logs ftp      4380A>list_logs rt
default                  default
```

or if there are no log settings files,

```
4380A>list_logs ftp
no files
```

Note: The ftp | rt user *default* files are used at start up if they are available otherwise the system will use the factory default settings. To modify the ftp or real-time logging behavior, make the changes needed based on your application and type *save_logs ftp* or *save_logs rt*. Users are encouraged to set the user default ftp | rt settings based on their application so the system will properly configure the logging after a reboot or power cycle.

Users can create other logging configuration files. Simply make the desired changes to the logging configuration, type *save_logs ftp* or *save_logs rt* and a filename to identify the configuration and press enter. The system will save this configuration containing the new settings. To use this log configuration use the *list_logs ftp* or *list_logs rt* command to bring up a list of the possible configuration files and use the *load_logs ftp* or *load_logs rt* command to have the system load and start running with the desired configuration settings. Use the *settings* command to ensure the system is using the desired settings based on the newly loaded logging configuration file.

```
4380A>save_logs ftp example
[OK] 2010-05-25T17:32:27Z

4380A>list_logs ftp
(working)

example
default

[OK] 2015-08-05T18:31:43Z

4380A>load_logs ftp example
[OK] 2015-08-05T18:31:43Z
```

Note: The system will recognize case sensitive alphanumeric characters, -, ' ', and _. If any other characters are used the system will inform the user that the filename is not valid and will not save the settings.

```
4380A>save_logs rt te%^\$st
illegal filename
[OK] 2015-08-05T20:52:41Z
```

The log files contain a header at the start of each line proceeded by a # indicating the data type for that line of data. If the user is logging multiple data types it allows them to sort out the data fields.

FTP:

```
#RANGEA,COM1_5,0,58.5,FINE,1518,243060.000,00a00008,5103,3311;20 ...
#RXHWLEVELSA,COM1_5,0,58.5,FINE,1518,243060.000,00a00008, ...
#WAAS9A,COM1_5,0,54.5,SATTIME,1518,243239.000,00a00008 ...
```

Real-Time:

```
$GP GGA,200240.00,3827.9772032,N,07726.4522017,W,9,08,1.5,51.663,M,,03,0138*14
$GP GGA,200241.00,3827.9771961,N,07726.4521871,W,9,08,1.5,51.692,M,,03,0138*1C
$GP GGA,200242.00,3827.9771900,N,07726.4521733,W,9,08,1.5,51.703,M,,04,0138*1F
```

Users can also remove any logging configuration files that are no longer needed on the system. Use the *list_log ftp|rt* command to bring up a list of the available configuration files and use the *delete_logs ftp|rt <filename>* command to remove the desired file. Users must provide the filename of the file to be removed from the system, if not the system will provide an error message reminding the user to identify the file to be removed.

```
4380A>delete_logs ftp example
OK
[OK] 2010-05-25T17:33:43Z
```

```
4380A>delete_logs ftp
<ftp | rt> FILENAME
FILENAME      Name of file

[ERROR] 2015-08-05T20:55:19Z
```

Caution: Users can delete the *default* file(s). If this is done and a new user default logging configuration is not saved, the system will use the factory defaults when rebooted, restarted or power cycled.

Attention: Les utilisateurs peuvent supprimer les dossiers de défaut. Si ceci est fait et une configuration de notation de nouveau défaut d'utilisateur n'est pas sauveée, le système emploiera les défauts d'usine quand rechargé, remis en marche ou puissance fait un cycle.

Use the *settings gnss_logging:ftp* or *gnss_logging:rt* command to ensure the system is using the desired settings based on the newly loaded configuration file. Use the *save* command to save the current system settings and this will also save the log settings and the system will use these settings after a power cycle, restart, or reboot.

2.10.4 System Configuration Files (Syscfg)

The system is capable of allowing users to monitor and verify system configurations using the *syscfg* command. The files can be set up so critical system parameters can be checked against user defined nominal values and when the system settings do not match the nominal values the system provides a user defined alarm string to describe the configuration mismatch. This applies to any data set the system generates on Port 1900. Users can define the field and the nominal value. Users are cautioned that these values reported on Port 1900 are checked and must exactly match the value in the *syscfg* file. As an example, if you are operating in the dynamic positioning mode you would not want to set a nominal value for the altitude, latitude or longitude. You can however set the nominal value to “dynamic” for the positioning mode to alert you if someone places the unit in the incorrect positioning mode.

By default the system is operating in the “Standalone” mode and in this mode these parameters are not checked against the information provided on Port 1900. To enable this feature users will need to set the nominal values in the */mod/tsc/syslog/localcfg.py* file. If no user specific parameters are set the system will use the factory default file */usr/tsc/syscfg/syscfg_default.py*. Once the settings are entered users can turn this feature on using the *syscfg* command. See Appendix D for examples.

```
4380A>syscfg --mode system
Set Mode

[OK] 2013-09-05T23:53:17Z
```

Users can export the file using the *--export* option, download it via FTP, and edit the file in an editor of their choice. A Linux editor is recommended to prevent the Carriage Returns/Linefeeds from becoming and issue. Once the file has been edited users can upload the new file and then use the *--import* option to bring in the new file. Once successfully imported the system will load and begin using the imported file. See Appendix D for the detailed command information.

To check the status of this feature use the *settings syscfg* command.

```
4380A>settings syscfg

[mode] system
[OK] 2013-09-05T23:51:48Z
```

If configuration errors are detected the system will light the front panel alarm light and the alarms command will provide an indication of the error.

```
4380A>alarm
[alarm] syscfg -- Incorrect format in slot 6 port 2: expected=B, actual=H
[OK] 2013-09-05T23:54:07Z

4380A>alarms
[syscfg]
```

```
[occurrences] 1
[set]
  [what] Incorrect format in slot 6 port 2: expected=B, actual=H
  [when] 2013-09-05-23:53:16.800
```

```
[OK] 2013-09-05T23:55:35Z
```

To get a complete list of the configuration errors use the *status syscfg:errors* command.

```
4380A>status syscfg:errors
```

```
  [1] Incorrect format in slot 6 port 2: expected=B, actual=H
  [2] Incorrect signal word in slot 6 port 2: expected=120, actual=121
[OK] 2013-09-05T23:56:38Z
```

To stop using this feature use:

```
4380A>syscfg --mode standalone
Set Mode
```

```
[OK] 2013-09-05T23:53:17Z
```

Once the system has been set up for the correct mode use the *save* command to save the current system settings and the system will use these settings after a power cycle, restart, or reboot.

2.11 Powering the System Off

To remove power from the 4380A remove the input power sources from Power Supply #1 and #2.

3. Operations

Two distinct tasks are performed by the 4380A 1) collection of GNSS measurement data 2) the generation of timing signals. These two tasks are entirely separate except for the fact that they must share CPU time and data from the GNSS receiver. Because the generation of timing signals requires that events (e.g., clock steering) occur at very specific times, operational precedence is always given to timing tasks. As a result, any operations concerning the collection and storage of GNSS data are postponed until all timing operations have been completed.

3.1 Front Panel

The 4380A has several front panel indicators to provide the operator with the overall status of the unit as well as a visual alarm indication if a problem with the hardware or the unit detects a condition that would cause the output signals to be outside of their timing specifications. More detailed status information can be retrieved using the *status* command on the Command Port.



Figure 7 4380A Front Panel

3.1.1 Power Supply Indicators

Each power supply has a front panel indicator that provides the operator an instant visual indication of the supply status. Power Supply #1 is on the left, power supply #2 is on the right as viewed from the front.

Indicator	Status
Off	No power is being provided to the 4380A.
Green	Power supply is good and is supplying power.
Red	4380A has power to the other module and this module has failed, is not seated properly, or is unplugged from its power source.

Table 1 Power Supply Indicator Status

3.1.2 Alarm Indicator

The Alarm LED will turn red when the unit is not producing timing within their specifications or the system has suffered a major hardware failure.

Indicator	Status
Off	Unit has no current alarms.
Green	This indicator should only turn green during the front panel POST.
Red – Flashing ½ second	This indicator reflects the unit has a non-critical alarm Failed validation/self test.
Red	This indicator reflects the unit has a critical alarm

Table 2 Alarm Indicator

3.1.3 SYNC Indicator

The SYNC indicator on the 4380A shall indicate the current status of the internal, external, steer source, or timescale references. Indications shall be based on the reference type currently in use as specified by the operator.

Indicator	Status
Off	Unit is starting up.
Flashing Red	Non Critical Alarm
Green - Flashing	Normal Operations <ul style="list-style-type: none"> • ¼ Second TCXO is Locked • ½ Second RB is Locked • 1 Second LNS is Locked The LNS indication overrides the RB/TXCO Locked The RB locked indication overrides the TXCO Locked
Green	Normal Operations <ul style="list-style-type: none"> • System is locked to Time, TOD, and Frequency Source <ul style="list-style-type: none"> ○ The GNSS receiver is in fine time mode (< 50 ns) and is tracking at least 4 satellites. ○ Timescale – System has enough clock inputs and is able to compute the timescale ○ PPS Steer Source ○ External Reference
Red Flashing	GNSS RX: <ul style="list-style-type: none"> • Is tracking less than 4 satellites. • System is unable to communicate with the GNSS receiver. • GNSS not tracking for more than 30 minutes (30 = default, User settable) • GNSS receiver hardware error • Antenna shorted Time scale is missing or unable to communicate with one or more clocks, is still able to compute the time scale PPS Steering has input, unable to communicate with reference External reference is present, unable to communicate with reference
Red	Complete failure or interruption of one or more of the Time, TOD, and Frequency Sources.

Table 3 Sync Indicator

3.1.4 Outputs Indicator

This indicator shall provide the operator a visual indication regarding the NTP Server Status and output modules installed in the rear card slots on the unit.

Indicator	Status
Off	Outputs not yet enabled, NTP has not started.
Green - Flashing	NTP is locked, outputs are not enabled.
Green	Outputs are enabled and reporting their status is good. NTP is locked
Red Flashing	Output ports are good, NTP is not locked.
Red	Output Port failure, NTP may or may not be locked.

Table 4 Outputs Indicator

3.1.5 Fans

Each fan is monitored by the 4380A. Any issues with the fans will be reported as an issue under the status for the fans. Fan #1 is on the left and fan #2 is on the right. To check the status of the fans use the following commands on the command port.

```
4380A>status hardware:fan
```

```
[1] true
[2] true
[OK] 2015-08-05T20:57:47Z
```

true indicates the fan is working
false indicates the fan is off

```
4380A>status health:fan
```

```
[1] [active] false
    [occurrences] 0
[2] [active] false
    [occurrences] 0
[OK] 2015-08-05T20:58:17Z
```

The active line will display false when the fans are functioning normally and true for one or both fans if they are not. If a fan is having issues you will see the number of occurrences increment up from 0 as each event occurs.

3.1.6 Status Pushbutton

When pressed, this button will display the 4380A's current IP Address if the address has been by a DHCP Server or statically. If the system is set up to use DHCP and it was unable to obtain an IP Address the system will set the IP Address to 0.0.0.0 and will not display an IP Address when this button is pressed.

After displaying the IP address (if set) the unit will display the system status screen.

The third feature of this button is enabled by default. If this button is pressed for ~10 seconds it will set the IP Address on the system to 192.168.0.1. This is a temporary setting and it will not survive a system reboot or power cycle and may even reset if the LAN cable is pulled from the rear panel. This feature can be disabled using the *frontpanel_button* command and setting the value to 0. Once set the value can be confirmed using the *settings hardware* command. Make sure to *save* the system settings.

```
4380A>frontpanel_button 0
OK
4380A>settings hardware
[enable_fp_button] false
```

3.2 Rear Panel

All hardware interfaces and connectors are located on the rear panel of the 4380A. The system can provide eight types of output timing signals: 1 PPS, 10 MHz, 5MHz, 1MHz, DC IRIG, AM IRIG, NASA36, and the downstream 4380A reference signals depending on which output modules are installed and the system configuration settings. Each output module has four connectors. These outputs can be used to directly feed other instruments or feed a distribution system that provides any number of user outputs. The on-time-point (OTP) of the system is typically at the output of the BNC connectors (Section 2.6) but it can be adjusted to be any point in an integrated system by accounting for distribution delays and adjusting the antenna delay value (Section 2.7).



Figure 8 4380A Rear Panel

Under normal operations the only inputs required for operation of the 4380A are at least one power source and a GNSS Antenna. GNSS is the source of time (UTC) for the unit and the 4380A will not start up normally without it. Once at least four satellites have been acquired the unit will continue to output timing signals even when the GNSS antenna is removed. However, the accuracy of these outputs will degrade over time.

Connection to a local area network (LAN) is supported by the 4380A. This allows users to access the unit remotely and also provides error monitoring capabilities. In addition, the 4380A can serve as the source of network time for other systems on the network if using network time protocol (NTP). The system can only

support ~100 NTP users. The USB ports can be used in conjunction with a USB-to-Serial conversion cable to allow users access to the command port via a local terminal and/or allows the system to communicate with an external reference (5071A). The GNSS Antenna connector is used to connect the GNSS Antenna to the system. The 10MHz IN connector is used to provide the 10MHz signal input from an external frequency reference. See Figure 9.

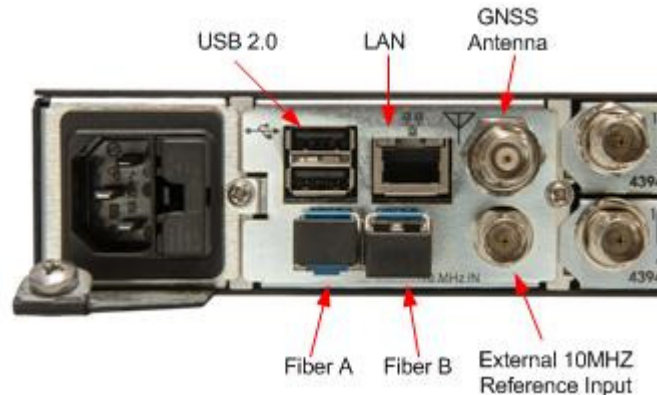


Figure 9 4380A Rear Panel Connections

3.3 Software

3.3.1 Current Version

4380A: Users can obtain the current software version via the command port using the *status unit:ver* command.

```
4380A>status unit:ver
Sync System-1-0-0
[OK] 2015-08-05T21:06:30Z
```

CAUTION: Do **NOT** remove the software flash while the unit is on, it may cause an unrecoverable error on the flash rendering the system inoperative.

GNSS Receiver: Users can obtain the current GNSS firmware version by sending the *status gnss:model* command.

```
4380A>status gnss:model
[hw_version] OEMV3G-4.01-X2T
[name] L12LV
[serial_number] DAB08410131
[sw_version] 3.803
[OK] 2015-08-05T21:07:04Z
```

3.3.2 Software Updates

Upgrading the software can be accomplished via two methods.

3.3.2.1 Flash Card Replacement

This requires removing the currently installed flash disk and installing a new one which has the updated software. Power the system down, pull the unit from the rack and remove the top cover. Press and release the SD card located in the SD Card slot, remove the current flash disk, and replace it with the new flash. Once the new flash is securely installed install the opt cover, install the unit in the rack, and power the system up.

Caution: The system network and user configuration settings are **NOT** saved and the system will need to be set up.

Attention: Les arrangements de configuration de réseau et d'utilisateur de système ne sont pas sauves et le système devra être établi.

3.3.2.2 Remote Software Update

The 4380A software can be updated remotely over the network. Users can download the new software image onto the flash and run the *software_update* command to load the new software onto the flash. Once the software has successfully been updated the system will automatically reboot. The system network and user configuration files will be saved and reloaded onto the new software image and you will not need to set the system up. To update the system with the new software:

1. FTP into the 4380A and log in (username: update, password: update).
2. Switch to binary transfer mode if needed, upload (put) the .iso file, and quit ftp.

```
localhost> ftp 192.168.1.254
Connected to 192.168.1.254.
220 Sync System FTP server (Version 6.00LS) ready.
Name (192.168.1.254:localhost): update
331 Guest login ok, send your email address as password.
Password: update
230 Guest login ok, access restrictions apply.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> binary Use this command to switch to binary if needed.
200 Type set to I.
ftp> put Sync System.Sync System-1-0-1.iso
local: Sync System.Sync System-1-0-1.iso remote: Sync System.Sync System-1-0-1.iso
229 Entering Extended Passive Mode (|||53133|)
150 Opening BINARY mode data connection for 'Sync System.Sync System-1-0-1.iso'.
100%
|*****
| 9644 KB 397.51 KB/s 00:00 ETA
226 Transfer complete (unique file name:Sync System.Sync System-1-0-1.iso).
10856448 bytes sent in 35.75Seconds 303.68Kbytes/sec.

ftp> quit
221 Goodbye.
```

3. Use the *software_update <filename>* command to update the software. When the application launches, users should see the following information on the console as the updater application run through the routine to update the system software.

```
4380A>software_update Sync System-1-0-1.iso
common_updater.sh: Invoked with command line: /updates/Sync System-1-0-1.iso --noreboot
common_updater.sh: Extracting new updater from /updates/src/cpio-image.gz
common_updater.sh: New updater extracted, launching it now.
common_updater.sh: Invoked with command line: /updates/Sync System-1-0-1.iso --noreboot --stage2
common_updater.sh: Stage 2 updater running
common_updater.sh: System is currently running from /dev/mmcsd0s1; applying updates to /dev/mmcsd0s2
common_updater.sh: Creating filesystem on /dev/mmcsd0s2a ..... done.
common_updater.sh: Creating filesystem on /dev/mmcsd0s2e ..... done.
common_updater.sh: Invoking product-specific pre-extract function
common_updater.sh: Preserving current syslog
common_updater.sh: Capturing data to be preserved across the update
common_updater.sh: Storing files ..... done.
common_updater.sh: Extracting updates from image file /updates/src/cpio-image.gz
common_updater.sh: Unpacking files ..... done.
common_updater.sh: Restoring overlay data to be preserved across the update
common_updater.sh: Unpacking files ..... done.
common_updater.sh: Editing new /etc/fstab to change /dev/mmcsd0s1 to /dev/mmcsd0s2
common_updater.sh: Invoking product-specific post-extract function
Sending command words: 0x03a50301 0x00000000
common_updater.sh: FPGA warmstart register has been cleared; a coldstart will occur
common_updater.sh: Cleaning up temporary files and flushing all data to disk
common_updater.sh: Setting bootable flag in partition 2
```

```
common_updater.sh: UPDATE SUCCESSFUL
Outputs disabled
Warm start successfully disabled
Rebooting...
[OK] 2015-08-05T15:17:53Z
```

4. Once the update is complete the system will automatically reboot. Local users will see the front panel display lock up for ~2 minutes. After this the system will begin launching the application and local users will see the typical boot process. The application start up will take ~2 minutes. Once the SYNC light is on it will take an additional 1.5 to 2 minutes for NTP to lock and for the outputs to be enabled.

Note: Users can obtain the new software image and software release notes from Microsemi <http://ftd.microsemi.com/time> >Products > Time & Frequency Distribution > GPS Instruments > SyncSysmte 4380A > Documents . Refer to the Software Release Notes for specific instructions related to a particular revision of software.

Caution: If the software update is not applied and the unit is power cycled users will need to upload the .iso file again in order to update the system software. The .iso file will be wiped from the system since it is held in volatile memory.

Attention: Si la mise à jour de logiciel n'est pas appliquée et l'unité est les utilisateurs faits un cycle par puissance devra télécharger le dossier de .iso encore afin de mettre à jour le logiciel système. Le dossier de .iso sera essuyé du système puisqu'on le tient dans la mémoire volatile.

3.3.3 GNSS Firmware Updates

Updating the firmware on the GNSS receiver requires that the GNSS receiver be removed from the system, updated, and reinstalled. The GNSS Firmware version can be checked using the *status gnss:model* command.

```
4380A>status gnss:model
[hw_version] OEMV3G-4.01-X2T
[name] L12LV
[serial_number] DAB08410131
[sw_version] 3.803
[OK] 2015-08-05T21:07:04Z
```

3.4 User Interfaces

Software interfaces on the 4380A are limited in their ability to provide users with real-time control. Adjusting some system parameters during operation of the 4380A can seriously impact the timing performance of the unit and therefore the ability to adjust these parameters is limited by the software. Once properly installed, the 4380A serves as a stand-alone device which requires little to no interaction. Remote error monitoring capabilities are provided as a means to ensure that the unit is powered and operating properly.

3.4.1 Telnet

One advantage of accessing the 4380A via telnet is that multiple telnet sessions may be active at once. It is recommended that users connect directly to the desired port based on the function(s) they are going to perform.

- 1135 Real Time Logging
- 1700 Command
- 1800 Diagnostics
- 1900 Status
- 2100 Average TIC Data (4393A Card)

- 2101 Raw TIC Data (4393A Card)

3.4.1.1 Real Time Data Port (1135)

Certain applications require that GNSS data be retrieved in a timely manner. For this purpose, Port 1135 may be configured to provide real-time data output. Users can specify which logs are output and users may request any of the ASCII logs specified in the user manual for the Novatel OEM6 receiver (<http://www.novatel.com/support/info/documents/>). See the *log* command.

3.4.1.2 Command Port (1700)

System commands can be issued to the 4380A via the command port. These commands provide a limited set of operations to be used for remote control of the system. Typically, a remote monitoring station may record an error that indicates user intervention is required. The remote monitoring station would then be able to access the command port via the Ethernet and issue the commands required for recovering from the error. The following list provides a short description of each command.

Note: All commands are in lowercase and the commands **are** case sensitive.

Command	Description
Basic Commands	
help, h or ? <command>	Display help for a command or list all commands. Proper format is to proceed the command with help, h, or ? help <command>
quit	Closes the command connection and terminates the telnet connection.
Status Commands	
show	Shows the current system factory (config), user configuration (settings), network (network), and system status (status) values. This command is the equivalent of sending these 4 commands at the same time.
status	Shows the values of all runtime status variables
alarm	Shows the current alarm state
alarms	Shows active alarms
config	Shows unit configuration parameters
network	Show network interface configuration. Note: These settings do not apply if the mode=DHCP.
syslog	Dump the system log file.
diag	Adjust diagnostic logging levels.
diag_port	Switch to the diagnostic port (1800).
ptdavg_port	Switches the command port display to port 2100 to view the average measurement results.
ptdraw_port	Switches the command port display to port 2101 to view the raw measurements every second.
status_port	Switch to the status port (1900)
Settings	
settings	Shows the current user control/configuration settings.
diff	Displays any difference between the current system settings and the saved user configuration file.
load	Restore system configuration settings from a file on the disk
save	Save current configuration settings to disk. save <filename>. Default = <default>
list	List available user configuration files available on disk. If there are no files listed the 4380A is using the factory default settings.
delete	Deletes specified user system configuration files.
Manual Time Setting Commands	

force_time	Manually set the time and enable outputs when GNSS is not available
adjust_time	Manually adjust the time in 1 second increments when in manual time mode
adjust_pps	Manually adjust the sub-second time of the system when in manual time mode.
steer_frequency	Manually change the frequency of the instrument's outputs.
steer_phase	Manually change the phase of the instrument's outputs
GNSS Commands	
latitude	Sets latitude, Default [N], option [S] or [-].
longitude	Set longitude. longitude <degrees> [E](default) or [W]
altitude	Set Antenna altitude Default units = [m]meters, optional [ft] feet
fix_position	Sets a static location based on current GNSS determined position location or it allows the operator to enter the latitude, longitude, and altitude. [current] or [<latitude> <longitude> <altitude>]. Default = Current.
position_period	Set GNSS auto-positioning period. position_period <period> [h]ours(default) or [m]inutes.
position_mode	Set GNSS position mode. position_mode [autolmanualldynamic]
antenna_delay	Sets GNSS antenna delay in seconds.
antenna_voltage	Set GNSS antenna voltage (0,5,12)
mask_angle	Set mask angle. mask_angle <degrees>
datum	Set GNSS datum, Default = wgs84, option nad83
gnss_tracking_timeout	Set GNSS tracking lost timeout in seconds.
Logging Commands	
log_interval	Sets the GNSS logging interval for ftp files, in minutes log_interval <interval in minutes> [1-1400]
log_number	Sets the maximum number of GNSS ftp log files. log_files <number>
log_compression	Enable or disable GZIP compression for the ftp log files. 0=Off 1=On
log_filename	Set name pattern of log files log_filename <user timestamp> Timestamp – files are named based on the date/time they were created with an optional suffix. User – Users supplies file prefix name, Unique ID, and suffix for the filename.
log (ftplrt) [type].	Add a GNSS log. User must specify if the log is for ftp or real time (rt) logs, and the log type desired from the Novatel receiver.
unlog (ftp rt) [type]	Clear specified GNSS logs. unlog (rt ftp) [type] Default = all logs.
log_enable (ftplrt)	Enable or disable GNSS logging, Specify ftp or real time (rt) then off/on. 0=Off, 1=On
list_logs (ftplrt).	Lists the user gnss logging settings for the ftp or real-time (rt) configuration files. If there are no files listed the 4380A is using the factory default settings.
save_logs (ftplrt).	Save GNSS logging settings to disk. logs_save (rt ftp) <filename>. Default = <default>.
load_logs (ftplrt).	Restore the ftp or rt user logging configuration settings from file(s) on the disk
delete_logs (ftplrt)	Deletes specified user ftplrt logging configuration files.
Reference Commands	
reference	Indicates which frequency reference to use (internal external timescale)
reference_type	Indicates which frequency reference is providing the external reference input (cesium hp5071a maser)
steer_source	Sets the phase measurement source (gnss manual)

Hardware Output Commands	
irig	Allows the operator to set the IRIG codes on the 4394A (DC IRIG) and 4387A (AM IRIG) Cards.
irig_input	Allows the operator to set the IRIG input codes on the 4383A IRIG input Card.
jam_sync	Synchronizes the system 1 PPS to the reference input.
pps	Allows the operator to set the PPS parameters on the 4394A and 4394A-ECL Cards.
nasa36	Allows the operator to enable the Nasa36 time code on the selected 4387A (AM IRIG) card port.
Clock Commands	
add_clock	Add a clock to the timescale
config_clock	Change settings of a timescale clock
edit_clock	Change the kas2 settings of a timescale clock
remove_clock	Remove a clock from the timescale
System Commands	
clear_alarms	Clears latched alarm events.
firewall	Configures system firewall.
frontpanel_button	Enables(1) or disables (0) the front panel button from resetting the units IP address if held in for ~10Seconds.
hostname	Allows user to change domain / hostnames.
network_config	Set up network settings. [--mode DHCP static] [--ip <ip>] [--mask <netmask>] [--broadcast <broadcast>] [--gateway <gateway>]
prompt	Allows the operator to change the command prompt for the current session or make the changes part of the system default settings.
ptdavg	Allows the user to set the averaging interval (in seconds) for the TIC cards installed in the unit. Valid intervals are 1, 10, 20, 60 and 300 seconds.
reboot	Reboots the 4380A
restart	Restarts the application without rebooting the system
software_update	Execute the software update routine.
syscfg	System Configuration commands
Other Commands	
avgfiltermax	Change the average filter max
remote_ntp_offset	Returns the offset in seconds between Sync System time and that of an external NTP server

Table 5 System Command List

Access to the 4380A command port is available via telnet (Port 1700) and through the USB Ports located on the back of the unit via the 94000-115200 Console Cable. The 4380A is a DTE device utilizing the RS232 communication protocol. Settings for the port are 115,200 baud, 8 data bits, 1 stop bit, no parity, and no flow control. It is sometimes necessary to access the system via the USB port because the 4380A may not be accessible via the network until the IP Address has been set.

3.4.1.3 Diagnostic Port (1800)

The 4380A provides an IP port to aid in diagnosing system errors. Each of the subsystems within the 4380A provides diagnostic output that can aid in identifying system errors. It is typically not necessary for users to access the diagnostic port because all system errors are reported on the front panel (Alarm Light), in the alarms list (*status alarm*) and/or can be recovered using the *syslog* command.

Diagnostic messages are only displayed on the diagnostic port. If users wish to save the messages provided by the diagnostic port then the output of this port must be saved to a file. It is recommended that diagnostic

messages be saved only to remote systems and not locally on the 4380A. Storing files locally may cause the file system to exceed its storage capacity and the 4380A will no longer operate.

The options for the diagnostic outputs include error, info, or debug messages from the sub-systems listed below. To determine the current settings telnet into the command port and use the *settings diaglog* command.

```
4380A>settings diaglog
[clock] info
[cp1d4370] info
[gnss] info
[kas2] info
[lnsrawstate] info
[software] info
[timecode] info
[tsc4370] info
[tsgather] info
[warmstart] info
[OK] 2015-08-07T20:35:22Z
```

To change the settings use the *diag* command then specify which subsystem you would like to change (gnss, kas2, clock, tagnss, timecode, tsc4370), then specify which message types (error, info, or debug) you would like to see for that subsystem. Example – if you want to look at the debug messages for the GNSS use the *diag gnss debug* command. You can verify this by using the *settings diaglog* command.

```
4380A>diag gnss debug
[OK] 2015-08-07T20:36:07Z
4380A>settings diaglog
[clock] info
[cp1d4370] info
[gnss] debug
[kas2] info
[lnsrawstate] info
[software] info
[timecode] info
[tsc4370] info
[tsgather] info
[warmstart] info
[OK] 2015-08-07T20:36:24Z
```

Users can modify these settings as needed and are able to save these settings to the default start up if desired by typing *save*. These settings can also be saved to a different configuration file if desired by typing *save* and providing a configuration filename.

3.4.1.4 Status Port (1900)

This port provides users with real time system status updates. As the fields that are displayed using the config, settings, status, and network commands are updated internally they are forwarded to this port in real time. Users wanting to display system parameters, measurements, and/or alarms in real time are able to use the data provided by the status port to update their displays in real time. See Appendix C for an example of the data provided by the status port.

3.4.1.5 Average TIC Data Port (2100)

This port provides users with average measurement results from each of the 4393A TIC Cards installed in the 4380A. The measurements will only be available for the port(s) on the card(s) that detect a 1PPS input. The measurements will automatically be output once the averaging is complete based on the *settings ptd_port* value.

Ch0 - Ch41 (20 event average):	7.964 ns	1276616379 S	594583 us;	sd: 0.053169 ns
Ch0 - Ch42 (20 event average):	8.444 ns	1276616379 S	596166 us;	sd: 0.045333 ns
Ch0 - Ch43 (20 event average):	15.995 ns	1276616379 S	597470 us;	sd: 0.053169 ns
Ch0 - Ch44 (20 event average):	15.695 ns	1276616379 S	598818 us;	sd: 0.035163 ns
Ch0 - Ch41 (20 event average):	7.938 ns	1276616399 S	594336 us;	sd: 0.042749 ns

```
Ch0 - Ch42 (20 event average): 8.418 ns 1276616399 S 595947 uS; sd: 0.052346 ns
Ch0 - Ch43 (20 event average): 15.995 ns 1276616399 S 597289 uS; sd: 0.053169 ns
Ch0 - Ch44 (20 event average): 15.712 ns 1276616399 S 598651 uS; sd: 0.067684 ns
```

The data fields are described below:

- Ch0: 4380A internal 1PPS
- ChXY: X = Slot #, Y = Port #.
- (NN event averaging): Number of averages used to compute the results.
Note: Typically the value of the *settings ptd_port*. This value may be different for a set of measurements once the outputs are enabled, the user changes the averaging value, or the port is connected or disconnected during the measurement period.
- NN.NNN ns: Measurement results.
- XXXXXXXXXXXX S: The second (from 1 Jan 1970) when the average was computed.
- NNNNNNN uS: The fractional second the average was computed. This value plus the number of seconds provides the time stamp when the average was computed.
- sd: X.XXXXXX ns: Standard deviation of the measurement.

3.4.1.6 Raw TIC Data Port (2101)

This port provides users with raw measurement results from each of the 4393A TIC Cards installed in the 4380A. The measurements will only be available for the port(s) on the card(s) that detect a 1PPS input. The measurements will automatically be output once per second.

```
Ch0 - Ch43 (1 event average): 16.042 ns 1276616720 S 134860 uS; sd: 0.000000 ns
Ch0 - Ch44 (1 event average): 15.698 ns 1276616720 S 171247 uS; sd: 0.000000 ns
Ch0 - Ch41 (1 event average): 7.917 ns 1276616720 S 234528 uS; sd: 0.000000 ns
Ch0 - Ch42 (1 event average): 8.469 ns 1276616720 S 272801 uS; sd: 0.000000 ns
Ch0 - Ch41 (1 event average): 7.917 ns 1276616721 S 131575 uS; sd: 0.000000 ns
Ch0 - Ch42 (1 event average): 8.367 ns 1276616721 S 147795 uS; sd: 0.000000 ns
Ch0 - Ch43 (1 event average): 16.042 ns 1276616721 S 161232 uS; sd: 0.000000 ns
Ch0 - Ch44 (1 event average): 15.698 ns 1276616721 S 193148 uS; sd: 0.000000 ns
```

The data fields are described below:

- Ch0: 4380A internal 1PPS
- ChXY: X = Slot #, Y = Port #.
- (NN event averaging): Should always display 1 event average.
- NN.NNN ns: Measurement results.
- XXXXXXXXXXXX S: The second (from 1 Jan 1970) when the average was computed.
- NNNNNNN uS: The fractional second the average was computed. This value plus the number of seconds provides the time stamp when the average was computed.
- sd: 0.00000 ns: Standard deviation should always be ZERO.

3.4.2 File Transfer Protocol (FTP)

Allows users to:

- Obtain the FTP log files and the RINEX files. The gnss log files are available in the ftp user's home directory and the rinex files are available in the rinex subdirectory. User name and password = ftp. The ftp user has read and write access for the GNSS log files and the ftp user can delete the GNSS log files as needed. The ftp user can get to the RINEX files using the change directory command (*cd rinex*) and has read permissions but is unable delete the files in the rinex subdirectory.
- Upload a new software version (.iso) and use the *software_update* command to update the system software. User name and password = update.
- Manage the systems mibs files (SNMP)

3.4.3 Network Time Protocol (NTP)

Network Time Protocol (NTP) is provided for the dissemination of time to other devices on the network. The NTP structure classifies devices based upon levels referred to as stratum levels. Stratum-1 indicates a clock that is obtaining time from a reference clock. The 4380A NTP server is a stratum 1 server. To check the status of the internal NTP Server telnet into port 1700 and use the *status reference:ntp* command. locked = true indicates the system is providing accurate time, false indicates it is not. The source should indicate that it is using the internal reference clock. The 4380A is capable of supporting ~100 NTP Clients.

```
4380A>status reference:ntp
[locked] true
[source] internal refclock
[OK] 2015-08-07T20:38:40Z
```

3.4.4 Simple Network Management Protocol (SNMP)

The 4380A includes an SNMP agent to provide external monitoring of system status via a Network Management System (NMS). The agent provides the ability to get status but does not provide SNMP trap or set capability. SNMP is a protocol used by devices to share system information with a SNMP NMS responsible for monitoring the status of multiple devices. When polled by the NMS the 4380A retrieves the desired system information and provides it to the NMS.

The system supports SNMP Version 3 and the community string (-c) is tsc.

The Management Information Base (MIB) files describe the structure of the management data of a device subsystem and are stored on the 4380A in the MIBS subdirectory of the FTP directory. They can be retrieved from the unit via a FTP client (username: ftp, password: ftp)

3.5 Status Command

The 4380A provides overall system status, health, and measurement results via the *status* command available on the command port (1700). For more detailed information and a description of the fields refer to Appendix B.

Status provides a sequence of field names to distinguish various devices and information from one another. Each information field has a unique ID. Users can display the entire set of data fields using the *status* command. It is possible to further refine the data requested by adding additional information fields to the command line. For example, if the user simply wanted to get the information on this system type *status unit*.

```
4380A>status unit
[network]
[MAC] 00:30:96:00:01:02
[broadcast] 192.168.0.255
[default_gateway] 192.168.0.1
[ip] 192.168.0.60
[netmask] 255.255.255.0
[serial_number] SP00265
[start] 2015-08-05-14:21
[uptime] 2 days, 6 hours, 18 minutes
[ver] Sync System-5-1-0
[OK] 2015-08-07T20:40:45Z
```

Users can further refine the requested data fields by adding the desired information line to the field to look for specific data. If the user wanted to look for the system uptime, the user would simply add a ":" then the sub-category under unit. Additional subcategories can be added to the command line, separated with the ":".

```
4380A>status unit:uptime
3 days, 4 hours, 42 minutes
[OK] 2015-08-07T20:41:43Z
```



```
4380A>status health:fan:1
[active] false
[occurrences] 0
[OK] 2015-08-07T20:41:57Z
```

3.6 GNSS Data Logging

Certain applications require that GNSS data be retrieved in a timely manner. There are two available options for this purpose.

- FTP Data Logging
- Real Time Data

3.6.1 FTP Data Logging

Data can be recorded and stored on the 4380A and can be retrieved via a FTP client (username: ftp, password: ftp). The logs that are stored are determined by the user and can be one of any of the ASCII logs specified in the Novatel OEMV user manual. To set up data logging users will need to follow the steps outlined below to set up the type of data to be logged, log file intervals, maximum number of log files to store, set up the filename schema, set the file compression on or off, and then turn the logging on. Users can also verify the data logging configuration settings.

The OEM6 user manual is also available at: (<http://www.novatel.com>)

- A. Access the system via the command port.
- B. Use the *log ftp <novalog>* command to set up the data type to be sent over the data port. The *novalog* text on the command line specifies which data type to forward over this port. Some examples are provided below.

```
4380A> log ftp timea ontime 1
ionutca  unchanged    // log IONO & UTC data
rawalma  unchanged    // log almanac on startup
rangea   ontime 60    // L1/L2 observations @ 60 seconds
```

- C. Set the interval for the log file to the desired value using the *log_interval* command. Log interval value is in minutes and can be between 1 and 30 minutes. Default is 15 minutes.

```
4380A>log_interval 15
[OK] 2015-08-07T20:43:00Z
```

- D. Set the maximum number of log files for the system to hold in memory using the *log_number* command. If the logs in the storage directory exceed the maximum number of logs then the oldest log will be deleted to ensure that there is room for new logs. Default is 100 log files.

```
4380A>log_number 4
OK
[OK] 2015-08-07T20:53:31Z
```

Note: Your data retrieval setup will need to take these values into account. The maximum time the logs will be available on the system is the *log_interval* * *log_files*, in the examples above that is 60 minutes. If you are not retrieving the files frequently enough you will lose data.

- E. Use the *log_filename (user|timestamp)* to set up the file naming scheme. Default is *timestamp*.
 - a. When using the **user** file naming scheme you will also need to provide the file prefix, the number of digits you would like to use as the unique file identifier, and the suffix for the file.

```
4380A>log_filename user Test 4 dat
```

```
[OK] 2015-08-07T20:53:45Z
```

File will be stored as: Test####.dat, where the # is a sequence of 4 numbers and characters to uniquely identify the file name.

Note: When the files are stored using the “user” option, the filename will not end with a .gz extension even if the compression is turned on.

- b. When using the **timestamp** file naming scheme the files are written out at the `log_interval` setting and time stamped starting with the last two digits of the year, two digit month, two digit day, two digit hour, and two digit minute when the log was opened. Example (File 0810021530) log was opened 2 Oct 2008 at 15:30 (UTC). This command will also accept an optional suffix to append to the filename (i.e. .nov = 0810021530.nov).

```
4380A>log_filename timestamp <suffix>
[OK] 2015-08-07T20:53:56Z
```

Warning: If the 4380A is currently logging data and you change the file naming convention you may wipe out any saved files stored in memory. Ensure these files are downloaded prior to making any changes to prevent a possible loss of data.

- F. If file compression is desired use the `log_compression` command and turn the compression on (1) or off (0). Default is on (1)

```
4380A>log_compression 0 (Compression=off)
[OK] 2015-08-07T20:54:52Z
```

Note: When using compression in conjunction with the timestamp filename option the file will end with the .gz file extension. User defined filenames will not have the .gz extension appended to the filename. Users will need to keep this in mind when they attempt to open these files.

- G. You can verify the data logging settings using the `settings gnss_logging:ftp` command.

```
4380A>settings gnss_logging:ftp
[compression] true
[enable] true
[file_count] 100
[filename]
[digits] 3
[prefix] user
[suffix] nov
[type] timestamp
[interval] 15
[log_selection]
[bestposa] ontime 7200
[ionutca] ontime 7200
[rangea] ontime 60
[rawalma] onchanged
[rawephema] onchanged
[rxhwlevelsa] ontime 60
[waas9a] onchanged
[OK] 2015-08-07T20:55:18Z
```

- H. If needed, turn the ftp logging on using the `log_enable` command.

```
4380A>log_enable ftp 1
[OK] 2015-08-07T20:55:37Z
```

Once the data logging is enabled the settings `gnss_logging:ftp:enable` value will = true.

Users can make changes to the desired information that is being logged by using the `log` command to add logs as described above or delete a desired log using the `unlog` command. To delete the desired data type use the `unlog ftp [datatype]` command to remove the desired data from the list. Users can remove all of the log files simply using the `unlog ftp all` command.

```
4380A>unlog ftp waas9a
[OK] 2015-08-07T20:56:19Z

4380A>settings gnss_logging:ftp

[compression] true
[enable] true
[file_count] 100
[filename]
[digits] 3
[prefix] user
[suffix] nov
[type] timestamp
[interval] 15
[log_selection]
[bestposa] ontime 7200
[ionutca] ontime 7200
[rangea] ontime 60
[rawalma] onchanged
[rawephema] onchanged
[rxhwlevelsa] ontime 60
[waas9a] onchanged
[OK] 2015-08-07T20:56:49Z
```

Once the desired changes are made save the set up using the *save_logs ftp* command.

```
4380A>save_logs ftp
[OK] 2010-05-25T19:07:37Z
```

Note: If you do not save the setup the system will come back up with the factory defaults when the system is rebooted, restarted, or power cycled and any changes that were made will not be retained. Users can also save these settings to a different configuration file if desired by adding the filename to the *save_logs ftp* command.

3.6.2 Real Time Data Logging

For this purpose, Port 1135 may be configured to provide real-time gnss log output. Which logs are output will be specific to the application but users may request any of the ASCII logs specified in the user manual for the Novatel OEM6 receiver <http://www.novatel.com>.

To set up the real time data logging users will need to follow the steps outlined below to set up the type of data to be logged and then turn the logging on. Users can also verify the data logging configuration settings.

- A. Telnet into the command port (1700).
- B. Use the *log rt <novalog>* command to set up they data type to be sent over the data port. The *novalog* text on the command line specifies which data type to forward over this port. Some examples are provided below.

```
4380A>log rt timea ontime 1

ionutca onchanged           // log IONO & UTC data
rawalma onchanged           // log almanac on startup
rangea ontime 60            // L1/L2 observations @ 60 seconds
ionutca ontime 7200         // log IONO & UTC data every 2 hours
rawephema onchanged         // log broadcast ephemerides
waas9a onchanged            // log WAAS data
```

- C. If needed, turn the real time logging on using the *log_enable rt* command.

```
4380A>log_enable rt 1
[OK] 2015-08-08T13:55:49Z
```

- D. You can verify the real time log settings using the *settings gnss_logging:rt* command.

```
4380A>settings gnss_logging:rt
```

```
[enable] true
[log_selection]
  [gpggartk] ontime 1
  [ptds] ontime 20
  [rangea] ontime 30
  [timea] ontime 1
  [waas9a] onchanged
[OK] 2015-08-08T13:56:26Z
```

E. The data requested will now be available on port 1135.

Users can make changes to the desired information that is being logged by using the `log` command to add logs as described above or delete a desired log using the `unlog` command. To delete the desired data type use the `unlog rt [datatype]` command to remove the desired data from the list. Users can remove all of the log files simply using the `unlog rt all` command.

```
4380A>unlog rt waas9a
[OK] 2015-08-08T13:59:56Z

4380A>settings gnss_logging:rt
[enable] true
[log_selection]
  [gpggartk] ontime 1
  [ptds] ontime 20
  [rangea] ontime 30
  [timea] ontime 1
[OK] 2015-08-08T14:00:13Z
```

Once the desired changes are made save the set up using the `save_logs rt` command.

```
4380A>save_logs rt
[OK] 2015-08-08T14:04:43Z
```

Note: If you do not save the setup the system will come back up with the factory defaults when the system is rebooted, restarted, or power cycled and any changes that were made will not be retained. Users can also save these settings to a different configuration file if desired by adding the filename to the `save_logs rt` command.

3.7 WAAS Satellites

The 4380A is capable of tracking up to two of the Wide Area Augmentation Systems (WAAS) satellites. These satellites broadcast GNSS signals with information that is useful in improving the accuracy of GNSS. The 4380A automatically determines which of up to two nearest satellites to track based on the current antenna position. This data from these satellites can be made available using the ftp/rt log file settings for the OEMV (i.e. WAAS9A onchange).

```
# WAAS Satellite Tracking Configuration
#
# Name      PRN      Longitude (Deg E)  Doppler  Window
AMR         133       -98.0              0         50
CRW         135       -133.0             0         50
CRE         138       -107.3             0         50
AORE        120       -15.5              0         50
ARTEMIS     124        21.5              0         50
IORW        126        25.0              0         50
IORE        131        64.5              0         50
MTSAT-1R    129        140                0         50
MTSAT-2     137        145                0         50
```

3.8 System Verification

After the system installation and setup are complete, users can verify the system is operating properly by looking at several of the system operating parameters to verify the values are correct. If there are no red LEDs lit on the front panel, the system is operating correctly based on the current user settings. Details of the system operation can be observed using the following steps:

- A. Access the command port.
- B. Type *status* and press enter. This command displays numerous fields that indicate system status.
- C. There should be no active alarms on the system.

```
4380A> status
[alarm] no alarm
```

- D. The GNSS Receiver should be tracking at least 4 satellites, the signal description should be good and the system should show it is locked onto L1 and L2 ([freq] dual) and the receiver should be reporting an accurate position.

```
[gnss]
[auto_positioning]          This only applies when the position_mode=auto and
[time_remaining] 8 hours, 26 seconds the system has not completed the survey
[mode]
  [desc] tracking
  [value] 4
[model]
  [hw_version] OEMV3G-4.00-X2T
  [name] L12LV
  [serial_number] DAB08190172
  [sw_version] 3.400
[position]
  [alt] 4.999890000000000e+01
  [fixed] false             Auto position mode - position_period has not expired
  [lat] 3.846628110427000e+01
  [lon] -7.744086206042000e+01
[satellite]
  [number] 7
  [signal]
    [avg] 4.531842422485352e+01
    [desc] Good
    [enum] 2
    [freq] dual
    [max] 4.987799835205078e+01
    [min] 3.897399902343750e+01
```

1. Look at the [satellite] [signal] [desc] field to get an idea on signal quality:
 - a. Good: Indicates that the signals being received from the GNSS satellites are at an appropriate level.
 - b. Fair: The signal level is either too high or too low. GNSS is being received and the system will function but the levels are not optimal. An in-line amplifier may be required if the cable loss is too great.
 - c. Poor: Signal quality is very bad. System will perform very sporadically. An in-line amplifier will be required if the cable loss is too great.
2. The [satellite] [number] field should be at least 4. If the value is 0 then no satellites are being tracked. Wait ten-fifteen minutes after the Oscillator Lock light is Green to give the system a chance to acquire satellites. If the value is still 0 fifteen minutes after the Oscillator Lock light turned green then there is likely a problem with the antenna setup.

If you are using the manual position mode and the system is reporting satellites but the GNSS Tracking indicator is off the position entered is incorrect. Verify the position was entered correctly. If this problem persists, switch the system to the **auto** mode (*position_mode auto*) and allow the system to resurvey the antenna position.

3. The [gnss] [satellite] [signal] [freq] field indicates whether single frequency or dual frequency measurements are being received from the receiver. If only single frequency measurements are being received then check the antenna and make sure that it is the Novatel (L1/L2) antenna included with the unit. If you are not using the supplied antenna the system may be connected to a single frequency (L1) antenna.

- E. Both fans should be operating properly.

```
[hardware]
  [fan]
    [1] true
    [2] true
```

- F. Verify the system hardware is operating properly by ensuring the system is displaying the proper serial number, the outputs are enabled, the power supply status is good and it displays the correct model #.

```
[mainboard]
  [EUID] 00:30:96:02:00:00:f6
  [serialnum] U12121
  [type] 4380A
[outputs]
  [enabled] true
[slots]
  [1]
    [ports]
      [1]
        [status] good
      [2]
        [status] good
      [3]
        [status] good
      [4]
        [status] good
    [power] enabled
    [type] 4394A
  [2]
    [type] empty
[3-6] Should reflect the installed card.
```

Note: Slots [1-6] will display information based on which slots have cards in them and what type of cards are installed. If a card is not installed the type will be **empty**.

- G. The warmstart table may be true or false. If the unit has been running for under an hour this may be false.

```
[warmstartable] true Filter has enough data to warm start the system during a
restart/reboot.
```

- H. The power supply status should show both power supplies operating normally. The slots fields should show which cards are installed in each slot (or empty if no card is present), the port status for all four outputs are good (=1) and power is enabled.

```
[power]
  [numsupplies] 2
  [supplies]
    [1]
      [status] good
      [type] 4385A
    [2]
      [status] good
      [type] 4385A
```

- I. The system will also report the internal temperature as measured by the unit.

```
[temperature] 37
```

- J. Each of the units hardware conditions is monitored and reported as system health should report false and have zero active errors.

```

[health]
  [clock_freq_step]
    [active] false
    [occurrences] 0
  [clock_phase_step]
    [active] false
    [occurrences] 0
  [clock_starvation]
    [active] false
    [occurrences] 0
  [clock_steer]
    [active] false
    [occurrences] 0
  [clock_wander]
    [active] false
    [occurrences] 0
[fan]
  [1]
    [active] false
    [occurrences] 0
  [2]
    [active] false
    [occurrences] 0
[firmware_version_mismatch]
  [active] false
  [occurrences] 0
[gnss_communication_error]
  [active] false
  [occurrences] 0
[gnss_error]
  [active] false
  [occurrences] 0
[gnss_invalid_fixed_position]
  [active] false
  [occurrences] 0
[gnss_tracking]
  [active] false
  [occurrences] 0
[hp5071]
  [electron_multiplier_voltage]
    [active] false
    [occurrences] 0
  [locked]
    [active] false
    [occurrences] 0
  [oscillator_control]
    [active] false
    [occurrences] 0
  [signal_gain]
    [active] false
    [occurrences] 0
[leapseconds]
  [internal_error]
    [active] false
    [occurrences] 0
  [unknown]
    [active] false
    [occurrences] 0
[ocxo_freq_control]
  [active] false
  [occurrences] 0

```

Note: Any GNSS Errors recorded when the unit first starts up may be reported, if so, they will always have a date of 1 Jan 1998.

- K. Each port [1-4] on each output module [1-6] should have zero active errors and the [outputs disabled] and [outputs unlocked] active blocks should be false. The [power supply] [0-1] active blocks should also be false.

```

[output_modules]
  [1]
    [active] false
    [occurrences] 0
    [ports]
      [1]

```

```

        [active] false
        [occurrences] 0
    [2]
        [active] false
        [occurrences] 0
    [3]
        [active] false
        [occurrences] 0
    [4]
        [active] false
        [occurrences] 0
[2]
    [active] false
    [occurrences] 0
    [ports]
        [1]
            [active] false
            [occurrences] 0
        [2]
            [active] false
            [occurrences] 0
        [3]
            [active] false
            [occurrences] 0
        [4]
            [active] false
            [occurrences] 0
[3]
    [active] false
    [occurrences] 0
    [ports]
        [1]
            [active] false
            [occurrences] 0
        [2]
            [active] false
            [occurrences] 0
        [3]
            [active] false
            [occurrences] 0
        [4]
            [active] false
            [occurrences] 0
[5]
    [active] false
    [occurrences] 0
    [ports]
        [1]
            [active] false
            [occurrences] 0
        [2]
            [active] false
            [occurrences] 0
        [3]
            [active] false
            [occurrences] 0
        [4]
            [active] false
            [occurrences] 0
[6]
    [active] false
    [occurrences] 0
    [ports]
        [1]
            [active] false
            [occurrences] 0
        [2]
            [active] false
            [occurrences] 0
        [3]
            [active] false
            [occurrences] 0
        [4]
            [active] false
            [occurrences] 0
[outputs_disabled]
    [active] false
    [occurrences] 0
[over_temperature]

```



```

[active] false
[occurrences] 0
[power_supply]
[1]
[active] false
[occurrences] 0
[2]
[active] false
[occurrences] 0

```

- L. The [ref_unlocked] fields are reporting the clock status and system performance information. The reference should be locked ([ref_unlocked] [active] = false). The syscfg active block should be false. TCXO should also not be reporting any errors.

```

[ref_unlocked]
[active] false
[occurrences] 0
[syscfg]
[active] false
[occurrences] 0
[tcxo_failure]
[active] false
[occurrences] 0

```

- M. Once the system obtains a sufficient amount of clock data the kas2 values will be available.

```

[kas2]
[aging] 1.034079545296274e-21
[coldstart_time] 2015-08-05T14:34:30Z
[deviation_scalar] 1.000000000000000e+00
[frequency] -1.498015356088144e-13
[phase] 1.390605625690108e-09
[ptd] 8.827366060000000e-10
[steer] -2.226820215582848e-10
[warmstart_time] N/A

```

- N. The leap seconds block should reflect the current # of leap seconds -10. The effective time should reflect the # of seconds since 1970 the current leap second occurred. The future leap second value should equal the current value unless there is a leap second pending.

```

[leapseconds]
[current] 35
[effectivity_time] 2014-01-01-00:00:00
[future] 35

```

- O. The system should show that NTP is locked (true) and that the system is using the internal clock.

```

[ntp]
[locked] true
[source] internal refclock

```

- P. The system should report the outputs are enabled

```

[outputs] enabled

```

- Q. The system will also show if the external & internal clocks have been detected and the system will provide the internal operating temperature. If an external 10MHz signal is not being provided, the *reference:external* field will display *signal missing*. The *ocxo_freq_control* should also be between -98 and 98.

Reference_type = hp5071A

```

[frequency]
[external]
[communications] N/A
[locked] true
[signal] present
[internal]
[locked] true
[timescale]
[clocks]
[Cesium1]
[1_pps_present_slot_4_port_1] true

```

```

[communications] N/A
[id] 1365
[Cesium2]
[1_pps_present_slot_4_port_2] true
[communications] N/A
[id] 1559
[hp5071]
[can_communicate] false
[lns]
[locked] true
[ntp]
[locked] true
[source] internal refclock
[ocxo_freq_control] 2
[OK] 2015-08-08T14:28:03Z

```

Reference_type = Cesium

```

[external] not monitored
[hp5071]
[can_communicate] false
[internal] locked
[lns] locked
[locked] true
[ocxo_freq_control] 0

```

- R. If the 4380A has a 4393A Card that is actively making measurements the system will report those measurements as they are computed for each channel. The system will update the status when the ptd_avg expires and the averaged values are computed.

```

[tic_measurements]
[channel]
[31] 1.317307692300000e-08
[32] 1.461538461500000e-08
[33] 1.432692307700000e-08
[34] 1.916666666700000e-08

```

- S. The system will report when the status message was reported to the user.

```
[time] 2015-08-08-14:30:26
```

- T. The [unit] will display the system network information, serial number, the startup time (when NTP Locked), the uptime since the last power cycle, reboot, or restart and the software version running on the system, and the time the *status* command was executed.

```

[network]
[MAC] 00:30:96:00:00:98
[broadcast] 192.168.150.255
[default_gateway] 192.168.150.1
[ip] 192.168.150.61
[netmask] 255.255.255.0
[serial_number] SP00235
[start] 2013-07-18-12:50
[uptime] 4 hours, 42 minutes, 16 seconds
[ver] Sync System-5-1-0
[OK] 2015-08-08T14:30:26Z

```

- U. Send the *settings* command and verify the user defined set up parameters are correct.

```

4380A>settings
[command_port]
[prompt]
[enable] true
[text] 4380A>
[diaglog]
[clock] info
[cpld4370] info
[gnss] info
[kas2] debug
[lnsrawstate] info
[smcp] info
[software] info
[tagnss] info
[timecode] info

```

```

[4380] info
[tsgather] info
[warmstart] info
[gnss]
[antenna_delay] 2.374500000000000e-07
[antenna_voltage] 0.000000000000000e+00
[datum] wgs84
[mask_angle] 1.000000000000000e+01
[positioning]
[auto_hours] 1.200000000000000e+01
[manual_position]
[altitude] 1.957604000000000e+02
[latitude] 3.992277932811000e+01
[longitude] -7.758567672868000e+01
[mode] manual
[tracking_timeout] 1800
[gnss_logging]
[ftp]
[compression] false
[enable] true
[file_count] 10
[filename]
[digits] 3
[prefix] user
[suffix]
[type] timestamp
[interval] 5
[log_selection]
[bestposa] ontime 7200
[ionutca] ontime 7200
[rangea] ontime 60
[rawalma] unchanged
[rawephema] unchanged
[rxhwlevels] ontime 60
[waas9a] unchanged
[rt]
[enable] true
[log_selection]
[gpqgartk] ontime 1
[ptds] ontime 20
[rangea] ontime 30
[timea] ontime 1
[waas9a] unchanged
[hardware]
[enable_fp_button] true
[slots]
[1]
[4394A]
[ports]
[1]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-04
[type] pps
[2]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-04
[type] pps
[3]
[format] B
[signal_word] 0
[type] irig
[4]
[format] B
[signal_word] 0
[type] irig
[2]
[4394A]
[ports]
[1]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-04
[type] pps
[2]
[pps_period] 1.000000000000000e+00
[pps_width] 1.000000000000000e-04
[type] pps
[3]
[format] B
[signal_word] 0

```

```

                                [type] irig
                                [4]
                                [format] B
                                [signal_word] 0
                                [type] irig
                                [4]
                                [4395]
                                [ports]
                                [1]
                                [2]
                                [3]
                                [4]
                                [5]
                                [empty]
                                [6]
                                [4387]
                                [ports]
                                [1]
                                [2]
                                [3]
                                [4]
                                [ptd_port]
                                [averaging_interval] 10
                                [reference]
                                [external]
                                [type] hp5071a
                                [source] external
                                [smcp]
                                [syscfg]
                                [mode] standalone
                                [OK] 2015-08-08T14:31:37Z

```

- V. At this point if there are no alarms the 4380A is functioning properly. Network connectivity should be checked to ensure that data is being transmitted properly.
- W. Log files will be available to the ftp user after the specified log period has expired as long as the ftp logging is enabled. If in the auto positioning mode the rinex file will be available after the auto_positioning period has expired. The real-time logs will be available on Port 1135.
- X. TIC Measurements will be available (Raw = 2101, Avg = 2100) if one or more 4393A cards are installed and there are 1PPS signals detected on the input ports.
- Y. If operations are normal and the setup is proper type *save* at the command prompt to save the system default settings or *save filename* to save the settings to a different configuration file. Use the *save_logs ftp* and *save_logs rt* commands to save the ftp or real time logging default settings or add a filename to these commands to save the settings to a different configuration file.

Note: If you do not save the user *default* settings the system will come up with the *factory default* values the next time the system reboots or is power cycled.

4 Theory of Operations

Two distinct tasks are performed by the 4380A: collection of GNSS measurement data or the deterministic alignment to an external source and the generation of timing signals. Because the generation of timing signals requires that events (e.g., clock steering) occur at very specific times, operational precedence is always given to timing tasks. As a result, any operations concerning the collection and storage of GNSS data are postponed until all timing operations have been completed.

4.1 Generation of Timing Signals

A rubidium standard (when installed) serves as the short term and holdover with no GNSS frequency reference for the 4380A. The frequency of the Rubidium is measured and the low noise OCXO is steered to be on frequency. The frequency adjustments made to the OCXO allow it to be aligned with UTC(USNO) which is the source of GNSS time and is used as a long term frequency reference. In doing this, the 4380A exhibits the short-term frequency stability characteristics of the Rubidium while exhibiting the long-term characteristics of GNSS. The OCXO provides low phase noise performance for the 10 MHz outputs.

The 10MHz output provided by the OCXO serves as the time base for the 4380A. All timing signals (e.g., 1 PPS, IRIG-B, 10 MHz) are derived from this reference and thus exhibit the same frequency and phase characteristics. The 100 MHz TCXO which is the clock for the main FPGA is divided by 10 and phase locked to the OCXO 10 MHz output. The rear panel 10 MHz plug in card has a D/A converter which is used along with a sine look up table to provide a 10 MHz signal from the 100 MHz internal clock. This D/A output is then filtered and distributed to the four outputs of the plug in card. The FPGA which is clocked by the 100 MHz TCXO provides 1 PPS and serial time codes which are used by the 1 PPS/DC IRIG and AM IRIG cards to produce 1 PPS and IRIG time codes.

4.2 GNSS

The GNSS receiver locks its internal reference to the 10MHz signal provided by the OCXO frequency reference. A 1 PPS signal is then generated by the receiver which has a fixed phase relationship to the frequency reference. Measurements of this PPS are made to determine its offset to UTC(USNO) and this information is passed to the CPU via a serial port. These measurements are used in generating a timescale that estimates the clock offset from UTC(USNO). The CPU slowly adjusts the frequency of the OCXO to align the PPS to be coincident with UTC(USNO). Depending on the type of frequency reference, this adjustment period varies from a day (rubidium) to several months (external cesium), although rough alignment to within 10 ns occurs on the order of a few hours in either case. Commands are sent by the CPU to the Low Noise Synthesizer clock to adjust the analog control voltage to the OCXO as a means of affecting this steering.

4.3 Output Signals

The PPS signal from the GNSS receiver/reference source is used to align both the IRIG-B signal and the CPU clock to UTC(USNO). At startup this PPS is used to align the internally generated 1 PPS and IRIG-B signal with the correct 10 MHz clock cycle. From that point on the 1 PPS and IRIG-B signals are kept on time by using the OCXO 10MHz signal as its reference. The 1 PPS signal from the GNSS receiver generates an interrupt to the ARM 9 processor which serves as an indicator of the top-of-second. This is used by the CPU along with messages received from the GNSS receiver to set the CPU time to UTC(USNO). In doing this, the CPU can serve as a stratum-1 network time protocol (NTP) server and provide time to other computers and systems on the network. The OCXO control voltage is polled every LNS time constant in order to weed out transients due to steering allowing the system to accurately determine if the OCXO control voltage is at a minimum or maximum value. The averaging of this control voltage provides more stable steering over time.

The fiber optic outputs from the 4372A/4372A-T module, when plugged into a Master 4380A, contain a proprietary bit stream with 1 PPS marker and time code information. The Slave 4380A decodes this bit stream, extracts the time code, and steers its internal OCXO to the frequency and phase of the fiber signal. When shipped from the factory, the downstream 4380As will automatically switch to input B upon loss of input A. When Fiber A is restored, the unit will automatically switch back to input A after input A is detected as good for 60 seconds. The user can select manual switching or disable the automatic return to input A as a reference after input A has failed. A TSC-4340A fiber optic distribution chassis may be connected to an output of the 4372A module to provide up to 8 outputs which can be connected to downstream 4380As.

The 4393A Time Interval Counter (TIC) provides the capability to measure up to four external 1PPS sources against the internal 1PPS. The measurement data is collected by the unit and provided on telnet ports 2100 and 2101. Port 2100 is the averaged measurement, where the default is 10 seconds. The averaging time can be changed to 1, 10, 20 60, or 300 seconds using the *ptdavg* command. Port 2101 provides one second measurement data. The 4393A can be used in any of the slots in the 4380A. Multiple 4393A cards can be installed in the unit when more than four 1PPS measurements are required. Data collected can be used by an external system to create a paper clock based on the measurements.

4.4 GNSS Data Collection

GNSS measurement data is available to users in a variety of log formats. The 4380A uses a Novatel OEM6 (dual-frequency and WAAS capable) as its GNSS receiver and thus any logs generated by the receiver are available to users. For a complete description of logs and their formats refer to the OEM6 manual at <http://www.novatel.com>.

Logs on the 4380A are handled in two ways. They are either stored in volatile memory for retrieval by FTP or they are output to the Ethernet port in real-time. Logs stored in volatile memory are referred to as ionospheric logs and may be compressed to increase the capacity of the storage area. A total of 16 MB is dedicated to the storage of ionospheric logs and as storage capacity is approached older logs will be deleted to make room for newer logs. Real-time logs are logs requested by the user for output to the Ethernet port on the rear panel of the 4380A. They are provided to the user in a timely manner but are not stored on the system.

All logs must be enabled at startup through the use of configuration files. Ionospheric logs are specified in the ftp configuration file and real-time logs are specified in the real-time configuration file. Ionospheric logs are always generated by the 4380A but the Ethernet port (1135) must be configured at startup in order to receive the desired real-time logs.

4.5 Startup Sequence

A very specific sequence exists for starting each of the internal devices within the 4380A. This sequence exists to ensure that the unit generates the appropriate timing outputs and that they are all in sync with each other. Startup time of the 4380A varies from 5 to 45 minutes depending upon how long the unit has been powered off but the timing outputs are not enabled until 1 PPS and 10 MHz are accurate.

The 10MHz frequency reference measurements are made on either the internal OCXO, Rb oscillator, or an external Cs source. In either case the 4380A waits for the frequency reference to indicate that it has warmed up and is providing a stable signal. The internal Rb is generally warm and operational within 10 minutes but external references may take longer. Once the frequency reference is operational, the front panel indicator "SYNC" will illuminate green. This indicates that the frequency reference is the 4380A is locked to the frequency reference and the startup operations will continue.

Once the frequency is locked, the GNSS receiver is restarted using the 10 MHz signal as its reference. The receiver will begin generating the 1 PPS outputs but they will not be aligned to UTC(USNO). A search algorithm is used by the GNSS receiver which attempts to acquire and track the signal received from GNSS

satellites. This process usually takes 5 to 10 minutes but may take as long as 30 minutes depending upon how long the 4380A has been powered off. After four satellites are being tracked by the GNSS receiver, the PPS output is adjusted so that it is aligned with UTC(USNO). The green “SYNC” light on the front panel will also illuminate to indicate to the user that the system is currently tracking the GNSS signal.

To serve as a Stratum-1 network time protocol (NTP) server requires that the system’s CPU clock be aligned with UTC(USNO). The process of locking the CPU clock to UTC(USNO) requires setting the system time to UTC(USNO) and using the PPS received from the GNSS receiver to continuously steer the CPU clock. If the unit has been powered off for a long period of time the CPU time may be multiple seconds off. In these cases, a coarse adjustment of system time is performed and then the startup sequence is restarted. This process should only happen once and only in cases where the system has been powered off.

5 Maintenance

The recommended maintenance schedule for the 4380A is outlined in Table 6. Although this schedule is sufficient for most applications, it may be necessary to increase the number of scheduled maintenance events for extremely dusty or dirty environments. Contact Microsemi if there are questions about the scheduled maintenance cycle.

A minimal amount of maintenance is required for the 4380A. It is designed to operate continuously over long periods of time with little to no interaction. The primary factor in maintaining a working unit is to verify that it remains dust free and the antenna and antenna cable are in good condition. The following maintenance schedule is applicable.

Interval	Maintenance Required
Monthly	None
Semi-Annual	None
Annual	1. Fan Filter ¹ 2. Antenna & Antenna Cable Inspection

Table 6 Maintenance Schedule

5.1 Fan Filter

The fan filters helps protect the system from accumulating dust inside the unit as well and allows the fans to provide the proper level of cooling for the internal components. It is important to keep this filter clean to allow the proper level of air flow to prevent the system from overheating. To clean the filter:

1. Remove the fan assembly from the front by loosening the two captive screws.
2. Remove the filter from the fan assembly.
3. Use a vacuum cleaner to clean the fan filter of any accumulated dust.
4. Re-install the filter and assembly into the chassis. Take care to feed the cable into the chassis while inserting the fan assembly.

5.2 Antenna and Antenna Cable Inspection

The Antenna and antenna cables are a common source of failure because they are exposed to harsh environmental elements. The following process outlines the steps required in performing an inspection of the antenna and antenna cable.

1. Follow the antenna cable from the rear of the 4380A to the antenna. Look for any severe bends in the cable or damage to the shielding of the cable.
2. Remove any severe bends in the cable and replace any cables that have damaged shielding.
3. Examine the portions of the cables that are exposed to the elements. Look for signs of excessive weathering such as a deterioration of the outermost insulator. Replace any cables that appear severely weathered.
4. Inspect the antenna. Clean any buildup of dirt or other contaminants from the surface of the antenna. These contaminants may degrade the strength of the GNSS signal. If the antenna has been damaged by the weather, replace it.
5. Verify that the antenna is still securely mounted.

¹ In extreme operating environments it may be necessary to clean the fan filter more frequently.

6 Troubleshooting

The following section provides some basic troubleshooting information to assist users in case they suspect there is an issue with the system.

6.1 Front Panel Indications

You can use the front panel indicators to assess the status and operation of the unit. Under normal operating conditions the user should see:

- Green Status Indicator is green on both power supplies
- The front panel clock should display the last two digits of the year, the correct Julian Date (see Appendix D.) and the correct time (UTC). The time should also increment each second.
- The Alarm Light is Off
- The Sync and Outputs lights are green.

6.2 Alarm Light

The alarm light will turn red when the unit has detected a hardware failure or an event has occurred that may cause the timing signals output by the unit to be outside of their specifications.

- Red (Flashing)
 - Non Critical System alarm
 - System failed validation/startup tests.
 - Either power supply missing/failed or without AC/DC input power.
- Red (Steady)
 - Any output module reporting a failure or is not locked to the reference
 - GNSS has not been tracking for at least 30 minutes or there is a hardware error
 - Reference clock wander has exceeded 100 ns from UTC
 - The Rubidium is unlocked.
 - Over temperature (65 C)
 - External Reference
 - System is unable to communicate with the external reference source or,
 - 10MHz input from the external reference is missing and
 - Reference=external.
 - If syscfg is enabled, use the `status syscfg:errors` command to get the current list of configuration alarms.

If the alarm light is on users can determine the exact cause of the alarm by accessing the command port and typing the `alarms` command and obtain a list of the current alarms.

If the alarm light was on and is currently off, users can connect to the command port and type the command `status health` to view alarm occurrences or the `syslog` command to obtain the list of errors from the system log file.

6.3 Power Supplies

The system has two power supplies and is capable of operating from either supply in the event one of them fails. If one of the status indicators on the power supply front panel is red there is a problem with that supply. The front panel alarm light should also be on. Power supply #1 is on the left and Power Supply #2 is on the right. The possible problems are listed below:

- Power Supply has failed
- Internal Fuse is open

- Power Supply is unplugged, make sure the power supply is plugged in
- Power Source has failed; check to ensure the power source is available and connected to the rear panel of the unit.

Users can also check the current system using the *alarm* and the *status health:power_supply* commands to check the system status.

```
4380A> alarm
power_supply:2 -- AC/DC supply missing, or hardware error
4380A>status health:power_supply

[1]
[active] false
[occurrences] 0
[2]
[active] true
[occurrences] 1
[set]
[what] AC/DC supply missing, or hardware error
[when] 2015-08-05-14:26:02.523
[OK] 2015-08-08T14:38:52Z
```

If the fault condition has cleared, users are able to check the events in the system using the *status health:power_supply* commands to check on events that occurred earlier.

```
4380A>status health:power_supply

[1]
[active] false
[occurrences] 0
[2]
[active] false
[cleared]
[what] No errors
[when] 2015-08-06-16:14:38.874
[occurrences] 1
[set]
[what] AC/DC supply missing, or hardware error
[when] 2015-08-05-14:26:02.523
```

6.4 Outputs Indicator

This indicator provides the status for the NTP Server and system outputs.

This indicator will turn RED if the 4380A detects a hardware fault with one or more of the output modules. Verify the output modules are locked to reference and the outputs are enabled using the *status health:outputs_disabled* command and verify both active and occurrences = 0.

```
4380A>status health:outputs_disabled

[active] false
[cleared]
[what] outputs are enabled
[when] 2015-08-06-20:51:14.207
[occurrences] 0
[set]
[what] Outputs are disabled
[when] 2015-08-05-14:25:56.817
[OK] 2015-08-08T14:41:32Z
```

Users can determine which output module(s) has failed:

- Based on which systems the 4380A is driving are no longer operating properly
- By unplugging the output modules, one at a time, to see which output module was at fault.

Note: If this does not work there may be more than one output module that failed. Pull them all and reinsert them one at time to see which one(s) cause a FAULT.

- By using the *status health:output_modules* command and/or the *syslog* command and checking both the active = true and/or occurrences is greater than 0.

```
4380A>status health:output_modules
```

```
[1]
[active] false
[occurrences] 0
[ports]
  [1]
    [active] false
    [occurrences] 0
  [2]
    [active] false
    [occurrences] 0
  [3]
    [active] false
    [occurrences] 0
  [4]
    [active] false
    [occurrences] 0
[2]
[active] false
[occurrences] 0
[ports]
  [1]
    [active] false
    [occurrences] 0
  [2]
    [active] false
    [occurrences] 0
  [3]
    [active] false
    [occurrences] 0
  [4]
    [active] false
    [occurrences] 0
[3]
[active] false
[occurrences] 0
[ports]
  [1]
    [active] false
    [occurrences] 0
  [2]
    [active] false
    [occurrences] 0
  [3]
    [active] false
    [occurrences] 0
  [4]
    [active] false
    [occurrences] 0
[5]
[active] false
[occurrences] 0
[ports]
  [1]
    [active] false
    [occurrences] 0
  [2]
    [active] false
    [occurrences] 0
  [3]
    [active] false
    [occurrences] 0
  [4]
    [active] false
    [occurrences] 0
[6]
[active] false
[occurrences] 0
[ports]
  [1]
    [active] false
    [occurrences] 0
  [2]
    [active] false
```

```
[occurrences] 0
[3]
[active] false
[occurrences] 0
[4]
[active] false
[occurrences] 0
```

The Outputs indicator will be flashing green when the NTP server is locked and capable of providing time within specifications to other systems on the network and the outputs are not enabled.. When the NTP Server is operating outside of its specification the indicator will flashing red. To look at the current status of the internal NTP Server use the *status reference:ntp* command. If the NTP Server is operating properly the user will see the following:

```
4380A>status reference:ntp

[locked] true
[source] internal refclock
[OK] 2015-08-08T15:01:03Z
```

6.5 GNSS Performance

There are several factors that could impact the performance of the GNSS receiver.

6.5.1 Poor GNSS Receiver Performance

There are several issues that can cause poor performance with the GNSS receiver. This may be reflected in the signal quality parameter or the fact the 4380A Sync indicator flashes red periodically. Use the *status gnss* command to look at the current system status.

```
4380A>status gnss

[mode]
[desc] tracking
[value] 4
[mode1]
[hw_version] OEMV3G-4.00-X2T
[name] L12LV
[serial_number] DAB08400198
[sw_version] 3.400
[position]
[alt] 5.050310000000000e+01
[fixed] true
[lat] 3.846628161218000e+01
[lon] -7.744086549511999e+01
[satellite]
[number] 8
[signal]
[avg] 4.723037719726562e+01
[desc] Good
[enum] 2
[freq] dual
[max] 4.942499923706055e+01
[min] 4.031800079345703e+01
```

- Poor antenna location.
 - Make sure that there are no obstructions between the GNSS antenna and the sky. If you are inside a building, surrounded by tall buildings, or in a tunnel the GNSS antenna will not have a clear view of the sky.
 - The GNSS receiver requires signals from at least four satellites, even partial obstructions can prevent your GNSS receiver from functioning properly.
- Ensure the mask angle is not set too low or too high.
 - If set too low the receiver might not be able to track the satellites because of obstructions
 - If set too high, the receiver will not be able to use all of the available satellites to determine a fix and determine the correct time.
 - Ensure the mask angle is correct using the *settings gnss:mask_angle* command. Default = 10 degrees.

```
4380A>settings gnss:mask_angle  
1.0000000000000000e+01
```

- Ensure you are using the correct positioning datum.
 - Default is WGS84.
 - System is capable of using the NAD-83 datum.
 - Ensure any manually entered position is using the correct datum using the *settings gnss:datum* command

```
4380A>settings gnss:datum  
wgs84
```

6.5.2 GNSS Not Tracking

The Sync will start flashing red if the 4380A is not tracking at least 4 GNSS Satellites. The indicator may also go start flashing if the manually entered position is incorrect. If the position error is large enough the indicator will turn red and the GNSS receiver is unable to track properly depending on how large the position error is. If the system is not tracking GNSS for 30 or more minutes, the Alarm indicator will turn red. Users can look at the GNSS performance and look at the number of events and the last time GNSS was not tracking properly using the *status gnss* command

```
4380A>status gnss  
  
[mode]  
  [desc] not tracking  
  [value] 3  
[model]  
  [hw_version] OEMV3G-4.00-X2T  
  [name] L12LV  
  [serial_number] DAB08190113  
  [sw_version] 3.400  
[position]  
  [alt] 1.8410799999999998e+01  
  [fixed] true  
  [lat] 3.8466365580420003e+01  
  [lon] -7.7440877483110000e+01  
  [mode]  
    [enum] 0  
[satellite]  
  [number] 0  
  [signal]  
    [avg] 0.0000000000000000e+00  
    [desc] Poor  
    [enum] 0  
    [freq] single  
    [max] 0.0000000000000000e+00  
    [min] 0.0000000000000000e+00
```

Note: If the system is reporting it is *not tracking* yet it shows it is tracking 4 or more satellites the manually entered position may be incorrect. Verify the position settings and correct any errors. If the position is not known or the error will not clear change the *position_mode* to auto and resurvey the antenna position. This should clear the GNSS Tracking Error. Users can obtain the position information after the *auto_hours (position_period)* has expired by processing the RINEX file.

Possible causes are:

- Poor antenna location.
- Mask Angle set improperly.
- Antenna Cable Failure
 - Failed lightning protection device. If a lightning protection device has been installed in the RF & DC path ensure the device has not failed and is not open (no continuity).
 - Bad Cable. The cable may have failed due to exposure to the weather, kinking, or bending. Inspect the antenna cable and correct any issues and replace any cables that appear to be weathered.

- Improper Antenna Cable. The cable may be either too long or the improper type. Microsemi recommends using low loss coaxial cables for the GNSS antenna cable. Cable losses cannot exceed 10dB when using the antenna supplied with the 4380A.
- Antenna Failure
 - Loss of Power. Antenna requires 5-18Vdc to operate properly. Disconnect the cable from the antenna and measure the DC voltage between the center pin (+) and shield (-) to ensure the antenna operating voltage is present. If not, check the cable continuity and DC Power Source.

Note: The DC Power source may be a BIAS Tee or the 4380A. Ensure the antenna voltage is available from the proper source.

 - Failed Antenna. If the DC Power source is available and at the proper level and the antenna cable continuity is good, replace the antenna.
- User entered an invalid position
 - GNSS Tracking indicator is OFF. Enter the correct position for the antenna. Use the *status health:gnss_error* command to look at the status of the GNSS hardware.

6.6 Internal Clocks

If you suspect there may be an issue with the internal clocks use the *status health* and *status reference* commands to look at the status of the internal clocks.

Note: The example below has been edited to show the relevant fields in the system health status for the clocks.

```
4380A>status health
[clock_freq_step]
[active] false
[occurrences] 0
[clock_phase_step]
[active] false
[occurrences] 0
[clock_starvation]
[active] false
[occurrences] 0
[clock_steer]
[active] false
[occurrences] 0
[clock_wander]
[active] false
[occurrences] 0

4380A>status reference
[frequency]
[external]
[communications] N/A
[locked] true
[signal] present
[internal]
[locked] true
[timescale]
[clocks]
[Cesium1]
[1_pps_present_slot_4_port_1] true
[communications] N/A
[id] 1365
[Cesium2]
[1_pps_present_slot_4_port_2] true
[communications] N/A
[id] 1559
[hp5071]
[can_communicate] false
[lns]
[locked] true
[ntp]
[locked] true
[source] internal refclock
```

```
[ocxo_freq_control] 2
[OK] 2015-08-08T14:46:32Z
```

Users can also check the status of the time scale to ensure the UTC offset value [ptd] is under +/- 100 ns from UTC and the clock is being steered

```
4380A>status kas2
[aging] 1.100073337398044e-21
[coldstart_time] 2015-08-05T14:34:30Z
[deviation_scalar] 1.000000000000000e+00
[frequency] -1.286384790183644e-13
[phase] 1.287980469829245e-09
[ptd] 1.463024104000000e-09
[steer] -2.227125689387322e-10
[warmstart_time] N/A
```

Users may use the *jam_sync* command to synchronize the system 1 PPS to the reference input.

```
4380A>jam_sync
[OK] 2015-08-08T15:56:04Z
```

Then use the *status kas2* command to ensure the internal clock offset has jumped to the reference.

```
4380A>status kas2
[aging] 2.498557764780871e-24
[coldstart_time] 2015-08-08T14:59:54Z
[deviation_scalar] 1.000000000000000e+00
[frequency] 7.612250351220100e-13
[phase] -7.549350148732179e-09
[ptd] -7.227491861000000e-09
[steer] -2.218719571828842e-10
[warmstart_time] N/A
[OK] 2015-08-08T15:57:29Z
```

Note: Using the *jam_sync* command will cause the internal clock to steer very hard in order to synchronize with the external reference.

6.7 External Reference

If you suspect there may be issues with the external reference use the *status health* and *status reference* commands to look at the status of the external reference and internal clocks.

Note: The example below has been edited to show the relevant fields in the system health status for the clocks.

```
4380A>status health
[clock_freq_step]
[active] false
[occurrences] 0
[clock_phase_step]
[active] false
[occurrences] 0
[clock_starvation]
[active] false
[occurrences] 0
[clock_steer]
[active] false
[occurrences] 0
[clock_wander]
[active] false
[occurrences] 0
```

Reference_type = cesium

```
4380A>status reference
[frequency]
[external]
[communications] N/A
```

```
[locked] true
[signal] present
[internal]
[locked] true
[hp5071]
[can_communicate] false
[lns]
[locked] true
[ntp]
[locked] true
[source] internal refclock
[ocxo_freq_control] 5
[OK] 2013-09-04T14:10:03Z
```

Reference_type = hp5071a

```
4380A>status reference
[external] locked
[hp5071]
[can_communicate] true
[electron_multiplier_voltage] 1.1420000000000000e+03
[osc_freq_control] -1.1790000000000000e-01
[power] AC
[serial_number] US38390769(S)
[signal_gain] 1.4400000000000000e-01
[internal] locked
[lns] locked
[locked] true
[ocxo_freq_control] 2
[OK] 2015-08-08T14:52:09Z
```

Users can also check the status of the time scale to ensure the UTC offset value [ptd] is under +/- 100 ns from UTC and the clock is being steered

```
4380A>status kas2
[aging] 1.115608749949706e-21
[coldstart_time] 2015-08-05T14:34:30Z
[deviation_scalar] 1.0000000000000000e+00
[frequency] -1.291366569251172e-13
[phase] 1.282074219678497e-09
[ptd] 1.2410647980000000e-09
[steer] -2.227252349257469e-10
[warmstart_time] N/A
[OK] 2015-08-08T14:53:27Z
```

If there is an issue with the 10MHz Input it will show in the *status reference:frequency:external* command. The front panel Alarm light will be RED and the Oscillator Lock light will be OFF.

```
4380A>status reference:frequency:external
[communications] N/A
[locked] false
[signal] missing
[OK] 2015-08-08T14:58:00Z
```

When the 10 MHz signal is restored the Alarm light will remain on, the Oscillator lock light will remain out and the GNSS Tracking indicator may go out for ~30 seconds. Once the GNSS Tracking indicator is lit the system will report the kas2 values.

If the 4380A is unable to communicate with the external reference the operator will get an indication of the error. The front panel Alarm light will be RED and the Oscillator Lock light will be OFF.

```
4380A>status alarm
ref_unlocked -- cannot communicate with device
4380A>status reference
[external] cannot communicate
[hp5071]
[can_communicate] false
[electron_multiplier_voltage] 1.1420000000000000e+03
```



```
[osc_freq_control] -1.1780000000000000e-01
[power] AC
[serial_number] US38390769(S)
[signal_gain] 1.4400000000000000e-01
[internal] locked
[lns] unlocked
[locked] false
[ocxo_freq_control] 2
[OK] 2015-08-08T14:59:57Z
```

Once communications are restored the system will clear the alarm indications and resume normal operations.

6.8 PTD Value is Noisy

The PTD (UTC Offset) value will be much noisier when the 4380A is in the dynamic mode and during the positioning period while in the AUTO mode.

- Static position users should use the AUTO mode when the antenna position is unknown. After the auto_hours has expired, the antenna position will be determined by the receiver and the 4380A will switch to the fixed position mode. Once this happens, the PTD value will be significantly quieter. Users should put the system in Manual positioning mode and save settings once AUTO mode is complete in order to prevent AUTO mode from occurring after a power failure.
- If the antenna position is known, users should put the system in Manual positioning mode and enter the latitude, longitude, and altitude of the antenna.
- Poor antenna location and/or multipath issues can cause instabilities, relocate the antenna to a more suitable location.

```
4380A>settings gnss
[antenna_delay] 0.0000000000000000e+00
[antenna_voltage] 0.0000000000000000e+00
[datum] wgs84
[mask_angle] 1.0000000000000000e+01
[positioning]
[auto_hours] 1.2000000000000000e+01
[manual_position]
[altitude] 1.5927290000000000e+03
[latitude] 4.001941422777778e+01
[longitude] -1.052390962444445e+02
[mode] auto
```

6.9 Over Temperature and Fans

The 4380A monitors the internal temperature will trigger an alarm to be displayed on the front panel and the *status alarm* list when the internal temperature reaches or exceeds 65°C. To check the current temperature on the system use the *status hardware:temperature* command.

```
4380A>status hardware:temperature
31
```

Users can look to see if the unit had any temperature issues by using the *status health:over_temperature* command

```
4380A>status health:over_temperature
[active] false
[occurrences] 0
```

The 4380A monitors the fans on the front panel to ensure they are operating, to check the current status of the fans use the *status hardware:fan* command. Both fans should show a status of 1 indicating it is operating normally.

```
4380A>status hardware:fan
[1] true
[2] true
```

Users can look to see if the unit had any issues with either of the fans by using the *status health:fan* command

```
4380A>status health:fan
[1]
[active] false
[occurrences] 0
[2]
[active] false
[occurrences] 0
```

Note: If the unit is reporting an over temperature condition and the fans are not reporting an error, ensure the ambient temperature is less than 65°C and the fan filters are clean.

6.10 PPS Outputs

The 4380A is capable of providing different PPS outputs on each port of the 4394A/4376A cards and on ports 1 and 2 of the 4394A-ECL card. By default the 1PPS signal is a 100 μ s wide pulse. Users can modify these settings. Users are cautioned to ensure they connect the correct cables to the correct output ports to avoid any problems.

To verify the settings use the *settings hardware:slots:N* command (where N=Card Slot #) to verify the system settings.

```
4380A> settings hardware:slots:1
[4394A]
[ports]
[1]
[pps_period] 1
[pps_width] 1.000000000000000e-04
[type] pps
[2]
[pps_period] 1
[pps_width] 1.000000000000000e-04
[type] pps
[3]
[format] B
[signal_word] 0
[type] irig
[4]
[format] B
[signal_word] 0
[type] irig
```

To check the status of the output card use the *status hardware:outputs:slots:N* command (where N=Card Slot #) to verify the card status.

```
For a 4394A card:
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4394A
```

For a 4394A-ECL card:

```
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] n/a
[4]
```

```
[status] n/a
[power] enabled
[type] 4394A-ECL
```

For a 4376A-RS422 PPS card:

```
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4376A
```

6.11 IRIG Outputs

The 4380A is capable of providing different DC IRIG outputs on each port of the 4394A card and AM IRIG outputs on the 4387A card. By default ports #3 and #4 on the 4394A card are set to B000. The 4387A outputs are set to B120 by default. Users can modify these settings. Users are cautioned to ensure they connect the correct cables to the correct output ports to avoid any problems.

To verify the settings use the *settings hardware:slots:N* command (where N=Card Slot #) to verify the system settings.

```
4380A> settings hardware:slots:1
[4394A]
[ports]
[1]
[pps_period] 1
[pps_width] 1.0000000000000000e-04
[type] pps
[2]
[pps_period] 1
[pps_width] 1.0000000000000000e-04
[type] pps
[3]
[format] B
[signal_word] 0
[type] irig
[4]
[format] B
[signal_word] 0
[type] irig
```

To check the status of the output card use the *status hardware:outputs:slots:N* command (where N=Card Slot #) to verify the card status.

```
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4387A
```

6.12 NASA36 Outputs

The 4380A is capable of providing NASA 36 Time Code outputs on each port of the 4387A AM IRIG card. The 4387A outputs are set to IRIG B120 by default. Users can modify these settings. Users are cautioned to ensure they connect the correct cables to the correct output ports to avoid any problems.

To verify the settings use the *settings hardware:slots:N* command (where N=Card Slot #) to verify the system settings.

```
4380A>settings hardware:slots:5
```

```
[tsc4387]
[ports]
[1]
[format] B
[signal_word] 120
[type] irig
[2]
[format] B
[signal_word] 120
[type] irig
[3]
[format] B
[signal_word] 120
[type] nasa36
[4]
[format] B
[signal_word] 120
[type] irig
```

To check the status of the output card use the *status hardware:outputs:slots:N* command (where N=Card Slot # of the 4387A) to verify the card status.

```
4380A> status hardware:outputs:slots:5
```

```
[ports]
[1]
[status] good
[2]
[status] good
[3]
[status] good
[4]
[status] good
[power] enabled
[type] 4387A
```

6.13 TIC Measurements

The 4380A is capable of providing up to 4 TIC measurements on a single 4393A Card. The measurement average (Port 2100) is 10 seconds by default. The raw measurements are output on each active channel (Port 2101).

- Raw Measurements (Port 2101):
 - All of the active channels should have a measurement once per second. If not the 1 PPS input from the device under test is missing.
 - Inactive inputs ports (channels) will not report measurements.
- Average Measurements (Port 2100):
 - The number of samples (nn event average) should match the *settings ptd_port* value. If not:
 - The cable from the device under test was disconnected/reconnected during the measurement process.
 - 4380A outputs were enabled during the measurement period.
 - 1PPS from the source was interrupted during the measurement process.
 - The 1PPS signal is missing
 - Make sure the interval is set properly, the unit will not report the measurement results and the average for that period until the period expires (i.e. 300 seconds = 5 minutes).

6.14 Software Update Failure

There are three common issues that cause this command to fail:

1. The user did use the a binary (type I) file transfer to upload the image.
2. The user misspelled the file name when using the *software_update* command.

3. The system was power cycled or rebooted after the file was loaded and prior to launching the `software_update` routine.

6.15 Configuration Not Readable

The internal bus used to communicate with the plug in modules and power supplies to determine their type and serial number is the I2C bus. If this alarm occurs the system should continue to operate correctly, but the unit should be power cycled at a convenient time to resolve this extremely rare condition. If the alarm is still active after a power cycle, return the unit for repair.

6.16 Communication Problems

This section describes some of the errors associated with communications problems and some potential sources of those issues.

6.16.1 LAN

- LAN Connector unplugged.
- DHCP
 - When the system is operating press the “Display” button on the front panel. If the IP Address is set it should switch to those displays and give the local operator the IP Address. If not, the IP Address was not set it will not display the IP Address and the unit will assign an IP Address of 0.0.0.0. Plug the LAN Connector into the rear of the unit and if a DHCP server is available, the unit should obtain an IP Address.
 - Power cycle the unit.
- Static
 - Verify the static IP address Netmask, Broadcast IP, and Gateway were set properly using the `network` command.
 - If incorrect, Use the `network_config` command to set the correct Mode, IP address, netmask, broadcast, and gateway.

6.16.2 USB-to-Serial Adapter (94000-115200) (Command Port)

- USB to Serial adapter the improper type (94000-115200)
- Improper baud rate set on terminal serial port
 - 115200,N,8,1, no flow control.
- Incorrect serial cable type (requires Null Modem cable.)

6.16.3 External Reference Adapter (94001-5071A)

- USB to Serial adapter the improper type (94001-5071A)
- Incorrect serial cable type (requires Null Modem cable.)
- Communication settings on the reference device are incorrect.
 - Refer to the 5071A manual and set the system to 9600,N,8,1.

Note: Communications are only used when the external frequency reference is a hp5071A. If you are using a different cesium clock use the `reference_type cesium` command to set the proper reference clock type. This also applies when using the 5071A and the 4380A will not be communicating with the clock.

6.17 Syslog Command

All system error messages can be listed using the `syslog` command on the command port. The following information is typically contained in this log during startup. The date/time will be set to Jan 1 00:00:00 when the system is first powered on or rebooted since the time is not set until the GNSS receiver is tracking.

```
4380A>syslog
```

```
Jan 1 00:01:21 Sync System newsyslog[411]: logfile first created
Jan 1 00:01:22 Sync System syslogd: restart
... (These messages pertain to the system boot/application start up process
Jan 1 00:03:25 Sync System Sync System[536]: .017 0x0060eb00 [GNSS] Tracking
Jan 1 00:03:33 Sync System Sync System[536]: .005 0x0060e900 [GpsHardware] Setting
system clock to 2010-06-15-13:30:52
Jun 15 13:30:52 Sync System Sync System[536]: .001 0x0060e900 [Tsc4370] Sending time
2010-06-15-13:30:52 to the FPGA
Jun 15 13:30:52 Sync System Sync System[536]: .007 0x0060e900 [GNSSLogging] Starting GNSS
user logs
Jun 15 13:30:52 Sync System Sync System[536]: .048 0x0060e900 [KAS2] System time is
valid, starting KAS2 processing
Jun 15 13:30:52 Sync System Sync System[536]: .052 0x00643d00 [Engine] Thread
Log::Manager starts
Jun 15 13:30:52 Sync System Sync System[536]: .319 0x0060e900 [KAS2] Reference is locked
and system time is valid, starting KAS2 processing
Jun 15 13:30:52 Sync System Sync System[536]: .317 0x00678100 [Engine] Thread ensemble
starts
Jun 15 13:30:54 Sync System Sync System[536]: .064 0x00587f00 [Ntp] Starting NTPD
```

Error Logs: After startup the system tracks all events and alarm conditions (asserted) and when those alarms cleared (cleared) as they occurred in chronological order.

```
Jun 15 13:30:55 Sync System Sync System[536]: .350 0x00587f00 NtpPipewriter: change in
leap second info, mLeapCurr now 24 was 0, mLeapPend now 0 was 0
Jun 15 13:30:55 Sync System ntpd[555]: ntpd 4.2.0-a Fri Jun 11 16:51:53 UTC 2010 (1)
Jun 15 13:30:55 Sync System ntpd[555]: precision = 84.267 usec
Jun 15 13:30:55 Sync System ntpd[555]: no IPV6 interfaces found
Jun 15 13:30:55 Sync System ntpd[555]: kernel time sync status 2040
Jun 15 13:30:55 Sync System ntpd[555]: Starting tsc ntp reference clock
Jun 15 13:31:46 Sync System ntpd[555]: synchronized to REFCLK(25,0), stratum=0
Jun 15 13:32:49 Sync System ntpd[555]: synchronized to REFCLK(25,0), stratum=0
Jun 15 13:32:56 Sync System Sync System[536]: .784 0x00643300 NTP has locked
Jun 15 13:32:56 Sync System Sync System[536]: .793 0x00643300 [Sync SystemHardware]
Turning on hardware outputs
```

6.18 System Configuration Issues (syscfg)

Operators can set the system up to report set up or installation errors (i.e. a card in the wrong slot). When set up properly and enabled the system can report errors made in the system settings so operators are able to quickly detect set up errors, system errors, and if a card is in the wrong slot or the incorrect card was installed in a slot.

For a complete list of the configuration errors detected by the system use the *status syscfg:errors* command. If the errors are not correct you may need to edit the configuration files.

Factory Default: /usr/tsc/syscfg/syscfg_default.py. This file should not be edited. These are the factory default settings for the unit. If necessary you can use this file as a reference guide.

User File: /mod/tsc/syscfg/localefg.py

Appendix A System Specifications

Environmental

Operating Temperature	0° - 50° C, 95% Humidity, non-condensing
Storage Temperature	-20° - 70° C, 95% Humidity, non-condensing

Physical

Size	17"W x 19"D x 1.75"H.
Weight	20 Lbs (9.1kg) - two power supplies & 4 plug-in modules.

10 MHz Input

Quantity	1
Connector Type	BNC (F)
Input Power	+10 dBm to +17 dBm
Input Impedance	50 Ω

Timing Performance

UTC(USNO) Offset (w/ GNSS)	
- Precise Calibration	15 ns RMS
- Coarse Calibration	100 ns RMS
Allan Deviation (Locked to GNSS)	1 s <6E-13 10 s <8E-13 100 s <8E-13
Frequency Accuracy	1E-11 @ one day
Holdover Accuracy, 10Mhz Output	5E-11/month with internal Rb reference Holdover in external reference mode is dependent on the external reference

Ethernet Interface

Quantity	1
Connector	RJ-45
Protocol	TCP/IP
Speed	10/100 Base-T
Network Time Protocol (NTP) Server	NTPv4 as defined in RFC-5905 compatible with NTPv3 (RFC-1305) and earlier versions.
- Stratum	Level 0/Level 1 when locked to GNSS
- Client Support	~100 client request per second
File Transfer Protocol	
- Log Files	User:ftp, Password: ftp
- Software Update	User: ftp, Password: ftp
Ports	
- Command Port	1700
- Debug Port	1800
- Status Port	1900
- Real-Time GNSS Data	1135
- TIC Average Data Port	2100
- TIC Raw Data Port	2101

USB Command Port Cable (94000-115200)

Connector	DB9 (M)
Communications Parameters	115200,N,8,1
Type	DTE

USB External Reference Port Cable (94001-5071A)

Connector	DB9 (M)
Communications Parameters	9600,N,8,1
Type	DTE

GNSS Receiver

Antenna Connector	TNC(F)
Output Voltage	0, 5, or 12VDC - (User Selectable), Default = 0
Input Frequency	L1 (1575 MHz) L2 (1272 MHz)
Antenna Cable	Cable loss not to exceed 10 dB.

Code Generator Module (4391)

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50 Ω
Code	
- Intervals	Default – 4MHz Square Wave (8,000,000 bits)
- Levels (Ports 1 & 2)	TTL into 50 Ω
- Levels (Ports 3 & 4)	>2.4V peak to peak into 50 Ω
- Bit Rate	<ul style="list-style-type: none"> - Bit-rate programmable for 1 bps to 8 Mbps with 1bps resolution - Up to 32 Mbits of user defined code stored in onboard SRAM memory for Time Code signal. - Stored bit pattern is outputted at specified delay with desired bitrates - On-Time Delay per clock rate - Four different codes can be loaded - Play out repeats at end of code, Maximum 8 Mbit file per port

PPS / DC IRIG Module (4394A)

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50 Ω
Signals	PPS (2) DC IRIG (2) - Default
PPS	
- Intervals	Default – 1 PPS, Valid PPS values are 1 M, 100 K, 10 K, 1 K, 100, 10, & 1
- Levels	>2.4V into 50 Ω
- Pulse Width	Default - ~100 μ s +/-10 μ s. Pulse width is variable in integer counts of 100 MHz clock period.
- Rise Time	< 1.5 ns
- Jitter	<200 ps
- Skew	<+/-2 ns
DC IRIG	Default - B000
- Types	A000, A003, A007, B000, B003, B007, D002, E002, G002, H002
- Levels	>2.4V = High, <.8V = Low

PPS ECL (4394A-ECL)

Characteristic	Description
Number of outputs	Two differential ECL
Output connectors	TNC(F)
Load Impedance	100 Ω Line to Line (\pm 10.0 Ω)
Transition Time (20% to 80 %)	700 ps max.
Voltage Output High(V_{OH})	-1025 mv to -880 mv
Voltage Output Low(V_{OL})	-1810 mv to -1620 mv
- Intervals	Default – 1 PPS, Valid PPS values are 10 M, 1 M, 100 K, 10 K, 1 K, 100, 10, & 1
- Pulse Width	Default - ~100 μ s +/-10 μ s. Pulse width is variable in integer counts of 100 MHz clock period.
- Jitter	<80 ps
- Skew	<+/-75ps

RS-422 PPS Module (4376A)

Characteristic	Description
Number of outputs	Four
Output connectors	DE-15(F)
Impedance	100 Ω Differential
Pins	PPS1 (+ 1 & - 9), PPS2 (+ 3 & - 11), PPS3 (+ 5 & - 13), PPS4 (+7 & - 15)
Grounds	Pins 2, 4, 6, 8, 10, 12, 14
- Intervals	Default – 1 PPS, Valid PPS values are 10 M, 1 M, 100 K, 10 K, 1 K, 100, 10, & 1
- Levels	> 2V and < 2V into 100 Ω , 1 <= V_{cm} <= 3.3 V
- Pulse Width	Default - ~100 μ s \pm 1 μ s. Pulse width is variable in integer counts of 100 MHz clock period.
- Rise/Fall Time	< 10ns
- Jitter	<120 ps
- Skew	<+/-500ps

10 MHz Module (4395B-10)

This module provides four 10 MHz outputs. The module also monitors each output for levels below approximately 10 dBm, after which an alarm is raised.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50 Ω
Amplitude	+13dbm +/- 2dBm
Signal	Sine Wave
Harmonics	< -40dBc
Phase Noise	<div>4380A</div> <div>0.1Hz -80 dBc/Hz</div> <div>1 Hz -110 dBc/Hz</div> <div>10 Hz -132 dBc/Hz</div> <div>100 Hz -136 dBc/Hz</div> <div>1 kHz -141 dBc/Hz</div> <div>10 kHz -141 dBc/Hz</div> <div>100 kHz -155 dBc/Hz</div> <div>1 MHz -155 dBc/Hz</div>

5 MHz Module (4395B-5)

This module provides four 5 MHz outputs. The module also monitors each output for levels below approximately 10 dBm, after which an alarm is raised.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50 Ω
Amplitude	+13 dBm +/- 2 dBm
Signal	Sine Wave
Harmonic	< -40 dBc
Phase Noise	<div>4380A</div> <div>0.1Hz -86 dBc/Hz</div> <div>1 Hz -116 dBc/Hz</div> <div>10 Hz -138 dBc/Hz</div> <div>100 Hz -142 dBc/Hz</div> <div>1 kHz -146 dBc/Hz</div> <div>10 kHz -146 dBc/Hz</div> <div>100 kHz -157 dBc/Hz</div> <div>1Mhz -157 dBc/Hz</div>

1 MHz Module (4395B-1)

This module provides four 1 MHz outputs. The module also monitors each output for levels below approximately 10 dBm, after which an alarm is raised.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50 Ω
Amplitude	+13dbm +/- 2dBm
Signal	Sine Wave
Harmonics	< -40dBc
Phase Noise	4380A 0.1Hz -100 dBc/Hz 1 Hz -130 dBc/Hz 10 Hz -145 dBc/Hz 100 Hz -154 dBc/Hz 1 kHz -158 dBc/Hz 10 kHz -160 dBc/Hz 100 kHz -160 dBc/Hz 1 MHz -160 dBc/Hz

Amplitude Modulated (AM) IRIG Module (4387A, 4387A-6V, 4387A-1V)

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50 Ω
Amplitude into 50 Ω	3.5 Vpp (6 Vpp for 4387A-6V) (2.8Vpp for 4387A-1V)
Modulation Ratio	3:1
IRIG types	Default - B120
Supported Types	A130, A133, A137, B120, B123, B127, E 111, E112, E121, E122, E127, G141, G142, G147, H111, H112, H121, H122, H127 or NASA36

1.544 T1 Module (4394A)

This module provides four 1.544MHz outputs. The module also monitors each output for levels below approximately 10 dBm, after which an alarm is raised.

Characteristic	Description
Number of outputs	Four
Output connectors	RF-45, Pin 4 TX Ring, Pin 5 TX tip
Impedance	100 Ω
Signal	ANSI T1.102: Digital Hierarchy Electrical Interface
Time Code	None, frequency output only

2.048MHz Module (4396A)

This module provides four 2.048MHz outputs. The module also monitors each output for levels below approximately 10 dBm, after which an alarm is raised.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	75 Ω
Signal	Complies with ITU-T Rec. G.703 paragraph 13
Time Code	None, frequency output only

2.048MHz Module (4397A)

This module provides four 2.048MHz outputs. The module also monitors each output for levels below approximately 10 dBm, after which an alarm is raised.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	75 Ω
Signal	Complies with ITU-T Rec. G.703 paragraph 9
Time Code	HDB3.PCM31, all zeros except time slot 16, which is all ones

Time Interval Counter (4393A)

Characteristic	Description
Number of inputs	Four
Input connectors	BNC(F)
Impedance	50 Ω
Input Voltage (50 Ω)	5 Vpk
Minimum Input Pulse Width	10 μ s
Maximum Input Pulse Width	500 ms
Resolution	< \pm 50 ps
Accuracy	< \pm 500 ps to internal 1 PPS across all inputs. Individual inputs can be calibrated using a calibrated cable delay. Contact factory for details.

IRIG Input Card (4383A)

Characteristic	Description
Number of inputs	Four
Input connectors	BNC(F)
Inputs	DC IRIG – Ports 1 and 2, AM IRIG Ports 3 and 4
Impedance	50 Ω
DCLS Input Voltage (50 Ω)	> 2Vpk and < 5Vpk.
AM Input Voltage (50 Ω)	> 600mV pk-pk and < 6.0Vpk-pk.
Time Codes	B000 to B007 and B120 to B127
AM IRIG Ratio	2:1 to 4:1, Nominal 3:1

AC Power Supply (4385B)

100–240 V AC, 50-60 Hz, ~.75A, Power Factor Corrected to PF 0.97
Power Main Fuse AC Input: Two 250 V~1 A T (Time delay) 5 x 20 mm

DC Power Supply (4386A)



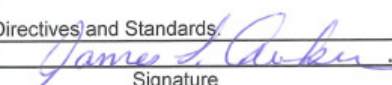
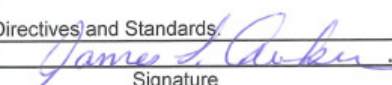
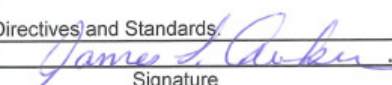
48 VDC (22 to 60 VDC), Power Inlet Type, DC input Mates with 3 pin Amp Part#: 1-350346-0 connector with female sockets Amp Part# 925661-1

Power Supply Cord Set, DC input Minimum 1.5 mm² (14 AWG) with a 15 A fuse or circuit breaker. A 20A circuit breaker may be used if the external wiring is jacketed 14 AWG, with maximum length of 20 feet.

DC Input: Two 250 V~4 A T (Time delay) 5 x 20 mm

Power Consumption: 55W Total (fully loaded chassis). The power supplies share approximately half the load. A single power supply is capable of operating the unit.

Appendix B CE Declaration

 EU DECLARATION OF CONFORMITY In accordance with ISO/IEC GUIDE 22 and EN 45014  Microsemi Frequency and Time Corporation 4775 Walnut Street Boulder, CO 80301 USA											
<p>This declaration has been issued under the sole responsibility of the manufacturer. The object of the declaration is in conformity with the relevant Union harmonization legislation</p> <p><u>SyncSystem MODEL NO. 4380A and family</u></p> <p>CONFORMS TO THE FOLLOWING EUROPEAN UNION DIRECTIVES:</p> <p>CE Safety <u>2014/35/EU Low Voltage Directive (LVD)</u> EN 61010-1: Safety Requirements for Electrical Equipment for Measurement Control and Laboratory Use – Part 1: General Requirements 3rd Edition dated June 10, 2010</p> <p>CE Electromagnetic Compatibility <u>2014/30/EU Electromagnetic Compatibility (EMC) Directive</u> EN 61326-1: 2013 (Basic) EN55011 Group1, Class A Radiated Emissions 150 kHz – 30 MHz (230VAC 50~48Vdc) EN55011 Group1, Class A Conducted Emissions 150 kHz – 30 MHz (230VAC 50~) EN61000-4-2 Electrostatic Discharge EN61000-4-3 Radiated RF Immunity EN61000-4-4 Electrical Fast Transient/Burst @ 48Vdc EN61000-4-4 Electrical Fast Transient/Burst @ 230VAC / 50 Hz EN61000-4-5 Surge Immunity @ 48Vdc EN61000-4-5 Surge Immunity @ 230 VAC / 50 Hz EN61000-4-6 Conducted RF Immunity at 48Vdc EN61000-4-6 Conducted RF Immunity at 230 VAC /50 Hz EN61000-4-8 Power Frequency H-Field Immunity EN61000-4-11 Voltage Dips and Interruptions</p> <p>CE WEEE <u>Waste Electrical and Electronic Equipment Directive (WEEE) 2012/19/EU</u> Microsemi FTD products comply with the WEEE Directive. For more information on the Microsemi Frequency & Time Corporation WEEE environmental program, please contact us at ftd.rohs@microsemi.com.</p> <p>CE RoHS <u>Restriction of the Use of Certain Hazardous Substances (RoHS) Directive</u> <u>(2011/65/EU of the European Parliament and Council)</u> This product is RoHS compliant. This product is exempted from the Restrictive Substance Requirements of the RoHS Directive under Category 9 (Monitoring and Control Instruments including Industrial Monitoring and Control instruments) as defined by 2011/65/EU Annex 1. Reference RoHS Directive 2011/65/EU Article 4, Paragraph 3. For more information on Microsemi Frequency & Time Corporation's RoHS program, please contact us at ftd.rohs@microsemi.com.</p> <p>This certification applies to all standard options and accessories supplied with the Model 4380A Units.</p> <p>I declare that the equipment specified above conforms to the above Directives and Standards.</p> <table border="1"><tr><td>1 March 2016</td><td>James L Auker</td><td>Regulatory Compliance Eng</td><td></td></tr><tr><td>Date</td><td>Name</td><td>Title</td><td>Signature</td></tr></table>				1 March 2016	James L Auker	Regulatory Compliance Eng		Date	Name	Title	Signature
1 March 2016	James L Auker	Regulatory Compliance Eng									
Date	Name	Title	Signature								