ND2310D

10 Channel Distribution Amplifier

Available Options:

- Ethernet Monitoring
- DC Input
- Square Wave
- PPS
- SNMP
- CAN Bus (for use with Novus redundant systems)

Contents

Safety 3
Mounting 4
Summary 5
Controls and Indicators – Front Panel 7
Channel Status 8
Status LEDs 9
Input Status 9
Power Supply Status 10
Amplitude Alert Threshold 11
Input Threshold 15
Input Select (when used with Novus select references) 16
Latch Channel Values 18
Save Configuration 18
Fault Status 19
Power Switch 20
Distribution Amplifier Cabling - Synchronizing NR2310D-O/G and ND2310D 20
Distribution Amplifier Cabling - Synchronizing Two NR2110D-O/G and ND2310D: ... 22
RS232 DB9 Port 23
Rear Panel 24
Channel Outputs – BNC or SMA 24
Signal Input A/B 24
DC Input 25
AC Input 25
RS232 DB-9 25
CAN Connector (optional) 26
Functional Description 28
Bandwidth 29
Phase Noise 29
Outputs 30
Built-in Test 30
Power Supplies 30
Programming Guide (RS232 Port: Front and Rear) 31
RS232 Commands 32
Status String ($GPNVS) Channel Measurements 34
SNMP Reference 34
Specifications 35
Technical Specifications 35
Environmental and Mechanical 36
LIMITED HARDWARE WARRANTY 37

Safety

This product has been designed and manufactured to recognized safety standards and rules. The product is a sophisticated electronic instrument that should be installed and operated by highly trained professionals.

Installation of this equipment should comply with all local electrical codes.

Utilization of this equipment in a manner inconsistent with the operating instructions can be dangerous.

DANGER

There are no user serviceable parts within the unit. Removal of the cover to access interior parts will expose the user to dangerous voltages.

DANGER

The unit may be powered from more than one power source. Care must be taken to be certain all power sources are removed before installation or during removal of the equipment.

DANGER

The unit must be operated with a secure earth ground to the chassis. The electrical path for earth ground is through the power connector. The power switching device that controls power to the equipment must never interrupt the chassis ground connection.

The equipment contains complex electronic components that can be damaged by electrostatic discharge. Observe all recognized standards for the handling of complex electronic devices to avoid high voltage discharge to the equipment. Be certain the equipment chassis and operator are at equipotential before handling the equipment.

Mounting

The equipment is meant to operate in a horizontal - top up configuration.

The equipment is meant to mounted into a 19 inch standard NEMA cabinet. The unit occupies a single “1RU”. Mounting spaces above and below the equipment may be used as required.

Please observe the operating temperature range for the equipment. If mounted into a closed rack, be certain that the total heat load in the cabinet does not result in an interior operating temperature that exceeds the equipment maximum rated temperature.

If cooling must be used, care should be given to prevent cooling mechanical vibration from the coupling into the equipment. Mechanical shock and vibration may introduce noise into the electronic signals inside the equipment that may degrade the performance of the equipment.

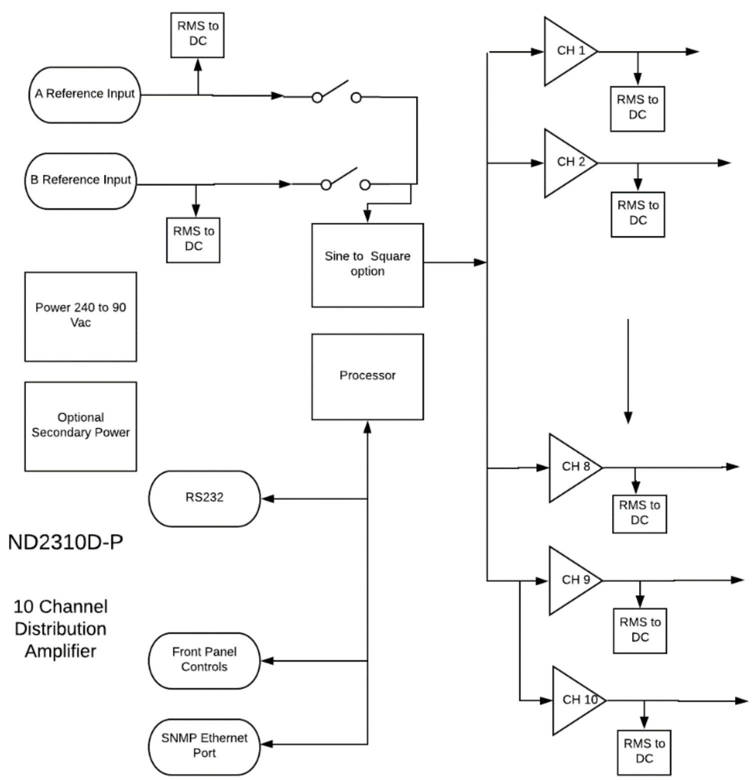
For applications where there is significant shock and vibration, Novus offers equipment with interior mechanical design features to minimize the effects of vibration and shock on the equipment performance.

Summary

The ND2310D is a ten channel wide-bandwidth distribution amplifier. While primarily used for 10 MHz reference distribution, it has a functional bandwidth from DC to 12 MHz but is filtered for the lowest phase noise at 10MHz. For applications other than 10 MHz the unit must be factory configured.

The platform is also available for pulse distribution. PPS or 10 MHz Square wave at either 3.3 or 5 Vdc levels. It has an internal sine to square wave converter if the square wave option is selected. The pulse and sine versions are not interchangeable.

The sine linear amplifiers are low phase noise design to preserve the integrity of the reference signal. All outputs are transient, and fault protected. The unit is set up with ten outputs and dual inputs A and B. Gain is factory set for 0 dB.



The amplifier can also be optionally redundantly powered. The redundancy feature adds a second power supply which may be AC or DC. The dual input design monitors the input signals and selects the active signal or the prioritized signal. Each output channel is monitored against a defined set of thresholds. If a fault is detected, monitoring will report the fault serially,

The unit features extensive reporting via the rear panel RS232 port - equipment status, output voltage on each channel and redundancy status. By being able to monitor the output voltage, the user can detect cabling issues that cause an impedance change and replace cabling before it completely fails. Reporting is also easily accessible via the front panel display.

SNMP v02 is also available for remote monitoring and control. Appendix D details the capability and features.

Nominal power is global AC power, but a DC power option can be ordered that acts as the back-up power supply. Nominally 24 Vdc, this port is used for power when AC power fails. Switching between power sources is automatic and there is no transient power outage at the equipment level. The primary power supply is followed by low noise linear converter assemblies. DC power in the range of -60Vdc to +60 Vdc can be accommodated in three unique ranges.

Controls and Indicators – Front Panel

This section describes the functionality of the front panel controls and indicators. Two buttons above the status LEDs provide navigation through the menus.

In general, the NEXT button advances through the menus to the next screen, while the SELECT button chooses between the available values on a menu.

Menus that allow selectable adjustments are the Input Threshold, Alert Threshold, and the Attenuation setting. To adjust these values from the front panel, hold down both buttons for two seconds, until the value begins to flash. To leave the menu with the new value, hold down both buttons until the value is solid.

Screen Saver: After one hour, the OLED display will turn off, unless activated by a fault condition, or by a user input, such as pressing the NEXT or SELECT buttons.

Channel Status

The channel status can be determined by reading the actual RMS value on the output of each stage. This is compared to a threshold limit that is set by the user as a percentage variation from a saved value. The default variation value is set at ±25% percent from the current state of the amplifier and is user-programmable in 5% increments from ±10% to ±60%.

For pulsed applications, the reported amplitude is the logic level one amplitude.

The range of acceptable channel amplitude can be narrowed around a connected balanced line, so that a channel status below the alert threshold indicates a shorted line, while a channel status above the alert threshold window indicates a potential disconnected cable.

The threshold value at which a channel alert is triggered can be programmed on the alert threshold screen or programmed via the RS232 port. Once set, the unit would continue to monitor each channel and a deviation beyond the set limits would be reported as a failure on the front panel and via RS232.

The channel status feature can quickly detect a cabling failure. Any change in the load impedance will change the output voltage with respect to the divider formed by the output impedance of the amplifier and the load impedance. Failing cables and connectors can be detected early.

The current threshold limits are displayed in addition to the actual measured value. These values reflect the percentage threshold defined in the alert threshold settings. If the output value is too low to give a valid reading, the display will read “LOW.”

The status is displayed on the front panel and is accessible over the RS232 serial bus via DB9. Channel statuses can be cycled into view or can remain on a single channel. This feature can be accessed via the NEXT button, by advancing to the channel status screen. To cycle through channels in sequence, press the SELECT button.

Status LEDs

There are three status LEDs which provide a quick indication of valid unit operation.

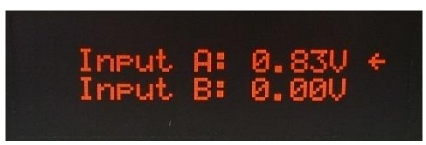
Alert LED: The alert LED will illuminate flashing red to indicate an input failure or a power supply failure. The alert LED will **not** flash red if any valid input signal is present.

Fault LED: One of the output channels has been faulted.

Oven: Not used - set to steady Green

Input Status

The status of either input (A or B) can be monitored from the input status screen. The input values a displayed in Vrms. When an input is selected, an arrow appears next to the value indicating that the source on that input is relayed to the output channels.



If no input is present, or the input selection priority does not have an input value which is above the input threshold, the alert LED flashes red, and the screen indicates “Connect Source.” The error is also noted in the fifth field of the $GPNVS string, with the following values:

0 = At least one valid input is available and is relayed to the channel outputs.
1 = Input A is selected and is below the input threshold.
2 = Input B is selected and is below the input threshold.

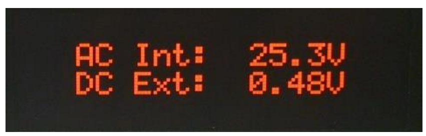
For pulsed applications, the input signal can be 3.3 or 5 Volt CMOS. The input impedance is 1000 Ohms.

For details on the status strings, see section 5.0 Programmer’s Guide.

When using a Novus frequency reference, there is a separate (optional) CAN bus between the unit and the references. The CAN bus communicates to the distribution amplifier and the references, a complete status of the reference. Information regarding internal BIT, lock, frequency error are all communicated to make an A/B selection while in the Auto mode. In the manual mode, the distribution amplifier will remain connected to the manually selected A or B regardless of the source status.

Power Supply Status

The power supply status screen provides DC voltage values of the two available power supply sources. The 90-250V AC input is internally connected to an internal 24V AC-DC convertor which powers the internal supplies with 24V. This is diode-connected with the external 24V DC input, which can be used in addition to, or in place of, the AC input.



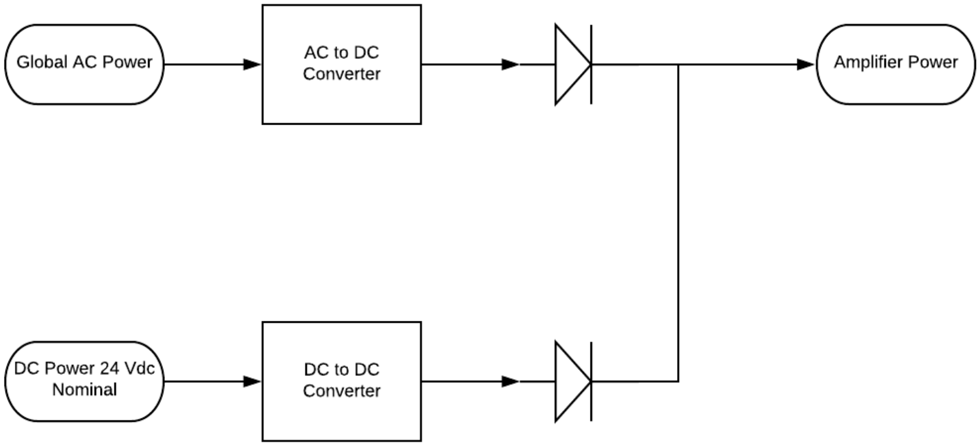
The values of both DC supplies are measured internally to validate connections. The measured values of the AC/DC convertor and the DC input are reported in the third and fourth fields of the second $GPNVS status string.

For details on the status strings, see section 5.0 Programmer's Guide.

In addition to direct value measurements, each redundant system has a power supply status byte which is reported in the third $GPNVS status string, in the seventh and eighth fields respectively.

Any measurement of the power supply which results in an alert condition will be reported in the power supply status byte.

0x80 = External AC not connected.
0x40 = External DC not connected.



Redundant power supplies operate on either the AC input or DC input, and function independently. All functionality and reporting for an individual power supply and amplifier is independent of its redundant copy.

Amplitude Alert Threshold

The alert threshold screen allows the user to adjust the tolerance from the reference voltage which, if exceeded in either direction, the output channels will report a fault status. The default threshold value is set at ±25% percent from the current state of the amplifier, and is user- programmable in 5% increments, from ±10% to ±60%.

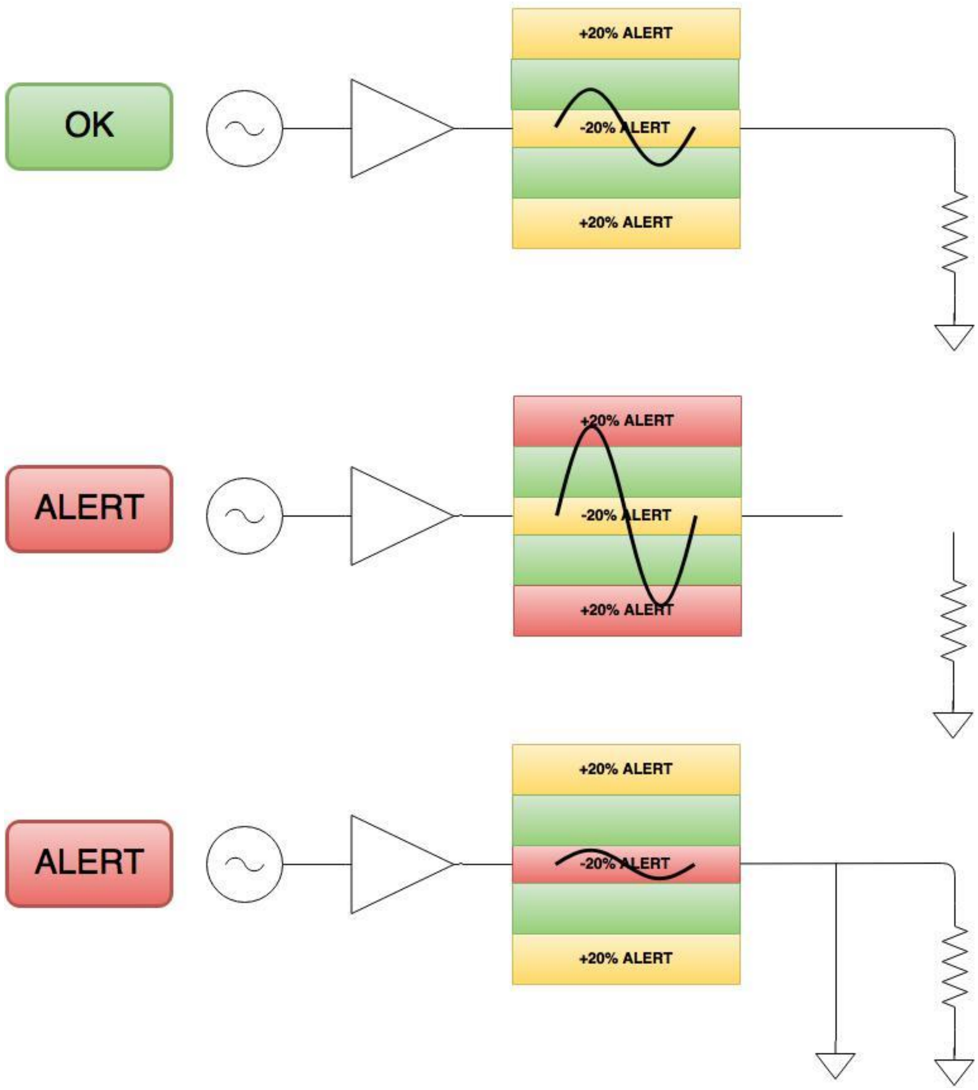
Each channel has a reference voltage which can be set, all at once, by latching the channel's current value in the latch channel average screen.

Each channel's reference voltage can be set individually by writing the value serially with the $SET command. After saving the current configuration on a channel, any subsequent deviation on that channel which exceeds the alert threshold percentage will trigger an alert.

Steps to ensure correct alert configuration:

1. Connect source input(s) to channel A and/or B.
2. Connect distribution cabling to channels 1 through 16.
3. Set alert threshold to desired range.
4. Save current channel voltages with the latch channel values screen.
5. Save current settings on the save configuration screen.

Note: Alert threshold can be different for Input A and Input B, allowing for variation in the input source. To accommodate both inputs, set alert threshold for Input A and Input B.



The alert threshold can be optimized so that a channel short or an impedance change will cause an alert.

Example:

The output of Channel 1 is connected to a high impedance input and reports 1.25Vrms at the output. The output of Channel 2 is connected to a 50 Ohm terminated input and reports 0.90Vrms at the output.

Input A is connected to a ~0.95V 10MHz source.

Alert threshold for input A is set to +/-20%.

The current state is saved in the save configuration screen.

The Channel 1 Alert will report when:

- The Channel 1 output is higher than 1.50Vrms
- The Channel 1 output is lower than 1.00Vrms
-
-

The Channel 2 Alert will report when:

- The Channel 2 output is higher than 1.08Vrms
- The Channel 2 output is lower than 0.72Vrms

Pressing the SELECT button toggles the view between the A and B input alert threshold settings.

To adjust the alert threshold from the front panel, hold the NEXT and SELECT buttons down simultaneously for two seconds. The percentage value will begin flashing. To increase the value, press the SELECT button. To decrease the value, press the NEXT button.

When the desired value is reached, press the NEXT and SELECT button simultaneously to leave the settings mode.

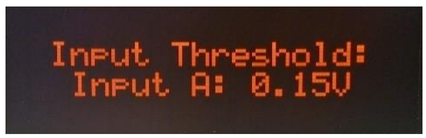
The alert threshold settings can be modified via the RS232 serial port with the $FLTTHRA and $FLTTHRB commands.

For details on the alert threshold, see section 5.0 Programmer's Guide.

Input Threshold

The input threshold screen allows the user to monitor and set the threshold at which the input is regarded as invalid or faulted.

The input threshold value is the absolute voltage (user-programmable between 0.1Vrms and 1Vrms) below which the input fault will occur, and the auto input select will consider the signal invalid. The default minimum value is set to 0.3Vrms.



Pressing the SELECT button toggles the view between the A and B input threshold settings.

To adjust the input threshold from the front panel, hold the NEXT and SELECT buttons down simultaneously for two seconds. The percentage value will begin flashing. To increase the value, press the SELECT button. To decrease the value, press the NEXT button.

When the desired value is reached, press the NEXT and SELECT button simultaneously to leave the settings mode.

The input threshold settings can be modified via the RS232 serial port with the $INPTHRA and $ INPTHRB commands.

For details on the input threshold, see section 5.0 Programmer's Guide.

Input Select (when used with Novus select references)

The input select screen allows the user to monitor and select the input priority for inputs A and B. Pressing the SELECT button with advance through the following settings:

- Input A Select
- Input B Select
- Auto Select (Priority A)
- Auto Select (Priority B)

Example: Input select is set to Auto (A). Input A threshold is set to 0.5Vrms. Input B threshold is set to 0.5Vrms.

Input A	***Input B***	***Selection***
0.90V	*0.4V*	***A***
0.90V	*No Connection*	***A***
No Connection	*0.6V*	***B***
0.4V	*0.6V*	***B***
No Connection	*No Connection*	***Last Selected***

The default setting is Auto (A). Input A select and Input B select will select only A or B respectively.

Input select priority can also be programmed via the RS232 port with the $INP command:

- $INP=0: Input A Select
- $INP=1: Input B Select
- $INP=2: Auto Select (Priority A)
- $INP=3: Auto Select (Priority B)

The input source can also be selected automatically based on Lock Status or Holdover Status, with an <u>optional</u> CAN connector between the ND2310 and NR2110 units supplying input signal.

Switch input on loss of GNSS lock

To select Priority Input on Lock (must have CAN connection to NR2110):

- $PRLK=1 via serial port
- $INP=2 or $INP=3

If the input source indicates loss of GNSS lock, the ND2310 will select the backup signal if the backup unit reports GNSS lock is valid.

Switch input on expiration of holdover

To select Priority Input on holdover (must have CAN connection to NR2110):

- $PRHR=1 via serial port
- $INP=2 or $INP=3

The ND2310 will select the primary input as long as the primary unit reports holdover is valid, regardless of loss of GNSS lock. The holdover period can be adjusted with the $HOP command via the serial port.

- $HOP=<n> (where n is [s], default n = 86400)

For details on the input priority programming, see Programmer's Guide.

Latch Channel Values

The latch channel values screen allows the user to save the current channel output values for use as the reference value for alert settings.

A channel alert is triggered when a channel output voltage exceeds or falls below a percentage of the reference value. This reference value is 1.10Vrms as a default but can be set by the user.

There are two ways to set the reference voltage. The RS232 serial port allows for setting an individual channel's reference voltage with the $SET command. The user can also use the latch channel values to take a snapshot of all current outputs and use these as the reference values.

All channel reference values are with respect to the active Input (A or B). If Input A and input B are both present, this allows for setting references on both inputs to accommodate variation in amplitude between the two inputs.

Save Configuration

The save configuration screen allows the user to save the current settings for alert threshold, input threshold, attenuation, input select, reference voltage and any other settings that have been modified via the RS232 port.

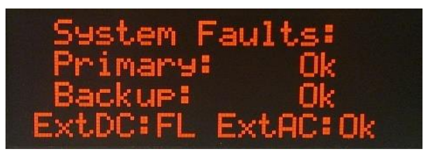
To save the current settings, press the SELECT button twice.

The save configuration action is equivalent to the $SAVEFL command on the serial port.

Fault Status

The fault status screen allows a quick overview of any channel faults from the front panel. The total fault count is listed, as well as a visual flashing indication of any channels that are beyond the threshold values.

Press SELECT to advance to the system fault screen.



The system fault screen indicates any failures in the primary system or the redundant backup system. All internal power supplies are monitored (24V, +8V, -8V, 5V) on both the primary and backup systems. A failure on one of these supplies will be indicated with a “PS FAIL” fail warning for either system. A communication failure would be indicated by a “Com FAIL” indicator. Either of these fault statuses will result in the change of the primary to the backup system. The individual statuses of the internal power supplies are also available via the RS232 serial port.

The presence of a valid DC input voltage is indicated on this screen, as well as a valid AC power input. If either of these supplies are not present, a “FL” indication will be shown next to the appropriate input.

Power Switch

The rear panel power switch controls AC power input to the unit. If the optional DC input is provided with 24V, or a valid DC supply, the unit will operate. If the unit is powered with the DC option, the rear panel switch does not remove DC power.

The AC and DC input option provides a redundant and automatic backup source in the case of failure of either input.

Distribution Amplifier Cabling - Synchronizing NR2310D-O/G and ND2310D

This installation procedure assures that the distribution amplifier in the source and the external distribution amplifier have the same cable delay.

Procedure:

1. Install the NR2310D-O/G in a 19" rack. Be sure to secure the unit with appropriate fasteners to the rack.
2. Install the ND2310D above or below the NR2310D and again secure with appropriate fasteners. Be sure the cable can reach between the units.
3. There are two SMA or BNC cables (customer choice) installed on the back of the NR2310D-O/G. One cable is attached to the #2 10 MHz port and the other end is running to Input A. The other cable is attached to #1 of 10 MHz and is hanging loose. **Note:** The cable length for the 10 MHz to Input A must be the same for both cables or the leading edge of the units will not be synchronized. Also, these units are calibrated so the start of the PPS and the 10 MHz Square Wave are synchronized using the cables attached. Changing cable could cause this calibration to change.

NR2310D

ND2310D

4. Attach the free end of the cable on #1 10 MHz to the Input A port one the ND2310D.
5.

NR2310D

ND2310D

6. Carefully tighten the SMA connector with a 5/16” wrench until 8 in-lbs. torque. Be careful to not over tighten to damage the connector.
7. Attach an antenna to the ANT port of the NR2310D-O/G-SQ.
8. Attach a load to each of the channels or terminate with a 50-Ohm load. Note the channels will report a fault if left unused/non-terminated.
9. If needed, attach the PPS to desired equipment.

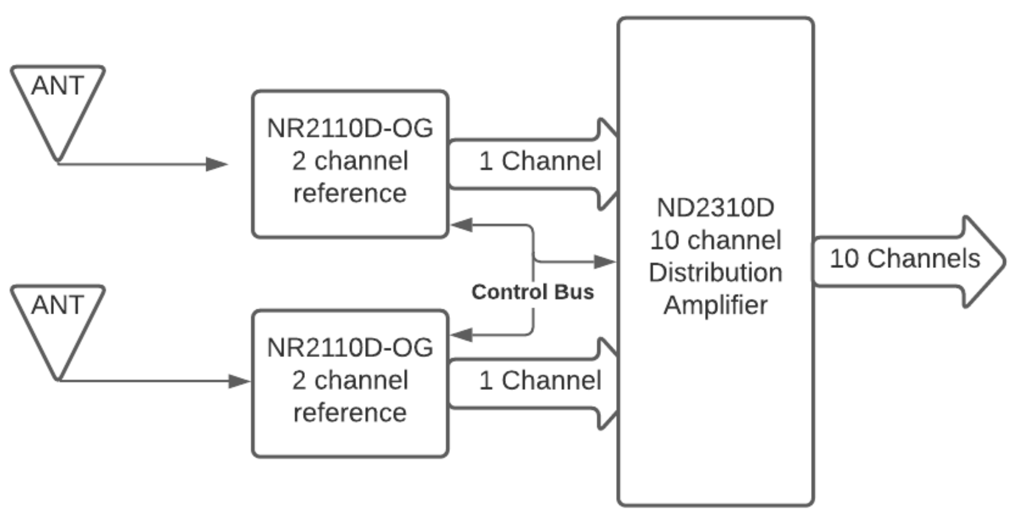
Distribution Amplifier Cabling - Synchronizing Two NR2110D-O/G and ND2310D:

A partially redundant ten channel reference system can be implemented with two single channel sources and a ten-channel distribution amplifier. While not a completely redundant system, this configuration provides a high level of redundancy at a lower cost than a fully redundant system.

The Novus ten channel distribution amplifier will accept two sources. In this case, the two sources will be the Novus NR2110D-O/G single channel GNSS locked frequency references. Each of the single channel sources will be connected to the A or B input channels of the ND2310D distribution amplifier.

Each of these input sources will be monitored for amplitude and, if in the AUTO mode, the ND2310D distribution amplifier will select the active channel. However, amplitude is not a sufficient test for a redundancy decision. What if both sources were active, but one was GNSS-locked and the other had lost GNSS-lock for some reason? An amplitude test would not be able to detect this condition.

To handle this case, and others that go beyond amplitude, Novus has a proprietary CAN bus between the three units. This CAN bus communicates, lock, BIT, loop lock and other parameters so the ND2310 can make a redundancy selection.



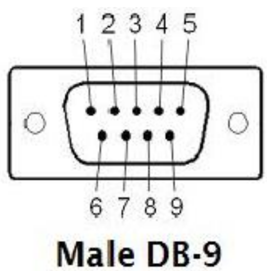
RS232 DB9 Port

The front panel RS232 port allows convenient setup of the unit in addition to the rear panel RS232 which may be connected to a more permanent instrumentation setup.

The front panel RS232 port will respond to the same commands as the rear panel, and any changes made will be reported on both serial ports. To receive the status strings on the front panel port, the command $ACTFRP=1 is input.

See complete list of functionalities in the Programmer's Guide Section 5.0. The default Baudrate for the front panel serial port is 115200 baud, 8 bits, 1 stop bit, no parity.

RS232 Serial Port: Front Panel Pin Connections



Pin	Function	I/O
1	NC	
2	Command Port TX	O
3	Command Port RX	I
4	NC	
5	GND	GND
6	NC	
7	NC	
8	NC	
9	NC	

RS232 programming functionality is described in detail in Section 5.0.

Rear Panel

Channel Outputs – BNC or SMA

There are ten outputs across the left-hand side of the rear panel. They are labeled 1 through 10. Nominally, the outputs are 50 Ohm impedance.

Signal Input A/B

Standard impedance is 50 Ohms. Maximum signal input is 1.5 Vrms. By default, Auto(A) priority is selected, meaning Signal A is considered primary and B is used if A is detected as being out-of-tolerance. The user can change the Signal Input priority via the front panel Input Select screen, or via RS232, based on a need for, or the presence of, a particular source.

For pulse inputs, there is signal condition that will trigger on a pulse as low as 0.5 Vdc.

DC Input

The DC input connector is a - pin Amphenol circular connector, P/N DL3102A10SL-3P. The mating connector is available as P/N DL3106A10SL-3S.

The default DC input voltage is 24Vdc. Custom voltage ranges can be provided from -60Vdc to +60Vdc.

Pin A goes to the most negative voltage of the DC source. For a 24V source input this would be the ground or return output from the DC source.

Pin B goes to the most positive DC voltage of the DC source. For a 24V source input this would be the positive output from the DC source.

Pin C goes to the Earth ground of the DC source.

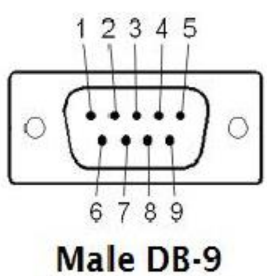
AC Input

The AC input accepts 90-250Vac, 50-60Hz. IEC 320-C14 Compliant.

RS232 DB-9

An RS232 port is provided for local setup, and status monitoring. The embedded processor provides status strings, as well as command responses.

RS232 Serial Port: Rear Panel Pin Connections



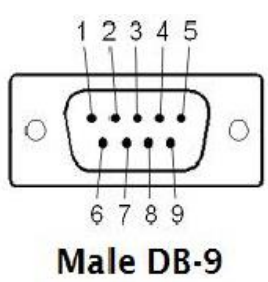
Pin	Function	I/O
1	NC	
2	Command Port TX	O
3	Command Port RX	I
4	NC	
5	GND	GND
6	NC	
7	NC	
8	NC	
9	NC	

The default settings for the rear panel RS232 port are 115200 baud, 8 bits, 1 stop bit, no parity.

CAN Connector (optional)

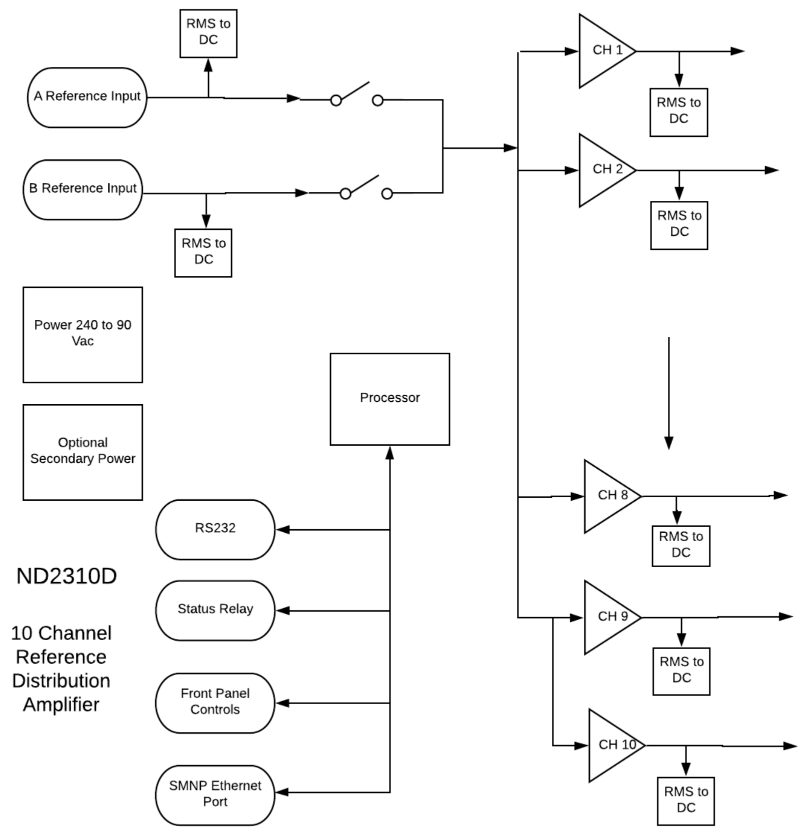
The ND2310D has an optional CAN bus connection for interrogation of external input source reference NR2x10. The bus provides proprietary status signaling to ensure input status is known, including BIT, GNSS lock, holdover status and health of the input source.

The CAN bus features a male DB9 connector to connect a CAN splitter cable. The connections are intended to be parallel across the ND2310D distribution amplifier and up to two NR2110 GNSS locked references.



Pin	Function	I/O
1	NC	
2	CAN_L	I/O
3	CAN_GND	GND
4	NC	
5	NC	
6	NC	
7	CAN_H	I/O
8	NC	
9	NC	

Functional Description



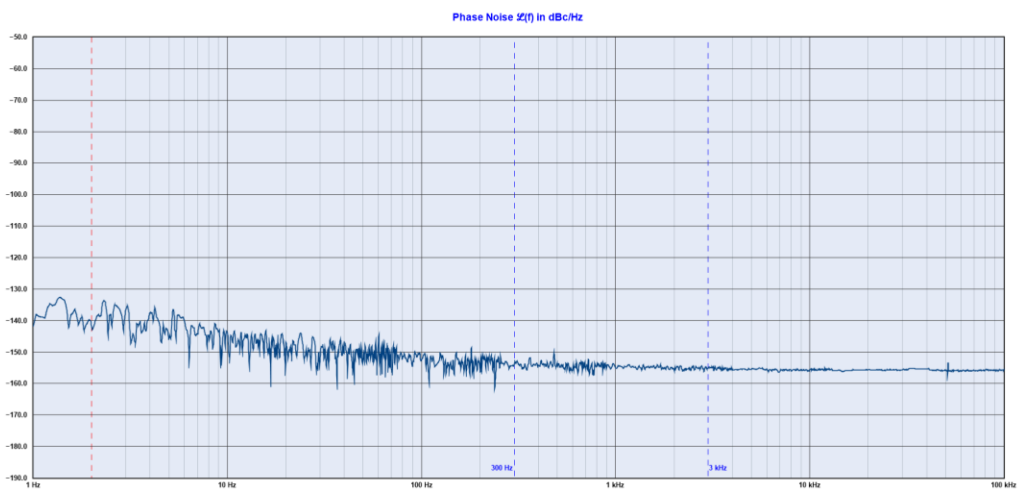
Bandwidth

20 KHz to 10MHz. Gain flatness is ±2dB. The amplifier is available with output drive to DC. Though the unit operates well across wide bandwidth, filtering and design have been optimized to reduce phase noise at 10 MHz.

For optional pulsed applications, 10 MHz to PPS at CMOS levels into 50 Ohms.

Phase Noise

Low phase noise contribution is achieved through careful PCB design, component selection and minimization of power supply noise. Below is a typical phase noise performance for a 10 MHz reference application:



Filename	Input Freq	Input Amplitude	Sample Interval	dBc/Hz at 2 Hz	RMS Noise (degs)	Duration	Acquired	Instrument
ND2310D-R Input B Ch 2.tim (Unsaved)	10.000 MHz	8.4 dBm	0.010 s	−141.9	7.70E−5	3m 0s	18000 pts	TimePod 5330A

Outputs

Each output is fault and electrostatic discharge protected. Each output is independent, and any output can be faulted for an indefinite period of time with no permanent damage. Each output is connected to a monitor circuit that detects a local fault on the output. The fault status is indicated on the front panel. The fault status and the protection on each output facilitates installation to help prevent damage. A channel fault will not activate an ALERT state and the status relay will not be opened.

The nominal application is for a 10 MHz sine wave output in the range of 1 Vrms. Square wave output at 3.3 or 5 Vdc or PPS at 3.3 or 5 Vdc is available.

Built-in Test

There are numerous power supplies in the design to meet special needs and noise reduction. All power supply voltages are monitored and can be accessed via RS232. In addition, all current channel statuses or Vrms values can be monitored, as well as power supply health.

Power Supplies

The unit is designed to accept power in the range of 90 to 264Vac, 50 to 60 Hz. This allows global application. The design is such that no action need be taken to operate from global power types. This feature avoids installation damage that occurs in designs that require an input power switch mode be used.

There is an EMI filter between the internal power supply and the available power being used. This filter minimizes the electrical noise from entering the circuitry and negatively impacting noise performance.

Also, in most applications, the equipment that surrounds this unit is sensitive and the filter also reduces noise that could impact the performance of other equipment.

If the DC Power option is installed, the unit can be powered from nominal 24 Vdc. The output of the DC-to-DC converter is effectively diode OR’d with the AC supply and the DC power supply becomes the prime when the AC power fails.

Programming Guide (RS232 Port: Front and Rear)

The ND2310D can accept user commands which will provide specific fault detection performance which may be customized by the user. The settings can be saved in non-volatile flash memory.

If the user makes one or more changes which are intended to be kept between power-off cycles, the command “$SAVEFLASH*51 <CR><LF>” will update flash to reflect all current settings.

Table 1 shows a complete list of input commands and descriptions. In general, a command may be input without “=” or an additional value, and the unit will respond with the current setting’s value. If the input is not understood, the microcontroller will return the value “$?*3F<CR><LF>”

NOTE: All commands should be prefixed with “$”, and followed by <cr><lf>. Checksum can be enabled which requires the command to be followed by an asterisk and a two digit hex value.

Example: $<*COMMAND*>*XX<cr><lf>.

The checksum can be required for all input commands, and the requirement for a checksum can be enabled or disabled (default setting is disabled). The checksum method is the two-hexadecimal character representation of an XOR of all characters in the sentence between, but not including, the $ and the * character.

Example: $NVS1=1*76

Note: Commands are general purpose and references to channels above the unit channel count are to be treated as examples.

RS232 Commands

Setting	Command	Response	Description
RS232 REAR PANEL BAUD RATE	$BAUDNV	$BAUDNV=<current Baud Rate>	Query Baud Rate on rear panel RS232. (Default = 115200). Front Panel is 115200 baud.
	$BAUDNV=38400		Assign Baud rate to Rear Panel RS232 port. Default is 115200. Available baudrates are 9600, 19200, 38400, 57600, 115200, 230400. Note: Front panel baud rate is set to 115200.
INPUT PRIORITY SELECT	$INP $INP=2	$INP=<current INPUT priority>	Query or set the Input Priority Setting to A, B, or AUTO (A) or AUTO (B). 0 = Select Input A 1= Select Input B 2 = Auto Select (Prioritize Input A) (Default) 3 = Auto Select (Prioritize Input B)
CHANNEL FAULT THRESHOLD FACTOR	$FLTTHRA $FLTTHRB $FLTTHRA=0.15	$FLTTHR<n>=<current Channel Fault threshold factor (from 0.05 to 0.95)>	Query or set the ratio at which the Channel output monitors report a fault. For example, if the FLTTHRA is set to "0.15", the Channel Fault Word will report an error if the measured value is greater or less than ±15% of its target value, when sourced from Input A. Number format must be in the form <n.nn>
INPUT LOW THRESHOLD VALUE (V)	$INPTHRA $INPTHRB $INPTHRA=0.20	$INPTHR<n>=<current InputThreshold (from 0.05V to 1.00V)>	Query or set the absolute voltage at which the Input monitor reports a llow input fault. For example, if the THR is set to "0.3", the Channel Fault Byte will report an error if the measured Vpp is lower than 0.3V.

PRIORITIZE INPUT ON LOCK STATUS (REQUIRES CAN CONNECTION)	$PRLK $PRLK=1	$PRLK=<current PRLK>	$PRLK prioritizes input based on GNSS and Loop Lock status of input source (CAN connected Novus NR reference). When $PRLK is active, the input will switch to secondary input source if primary input source indicates GNSS lock is lost and secondary input source has GNSS lock. If $PRLK is enabled, $PRHR is disabled.
PRIORITIZE INPUT ON HOLDOVER STATUS (REQUIRES CAN CONNECTION)	$PRHR $PRHR=1	$PRHR=<current PRHR>	$PRHR prioritizes input based on valid holdover indicator of input source (CAN connected Novus NR reference). When $PRHR is active, the input will switch to secondary input source if primary input source indicates holdover period has expired. If $PRHR is enabled, $PRLK is disabled.

Setting	Command	Response	Description
CAL FACTORS	$CAL<n>=nn.nn	$CAL<n>=nn.nn	Query or set Cal Factors for specific ADC conversions. See list of Cal Factors numbered for appropriate measurement parameters. These settings should only be changed by an authorized technician.
	$CAL1=11.10		
SAVE ALL CAL FACTORS TO FLASH MEMORY	$SAVECAL	$SAVED CAL. $SAVE CAL FAILED.	This command will translate all Calibration Factors to flash string and write. Data is then read back for verification, and result reported. This will update Cal Factors in flash to the current Cal Settings.
STATUS OUTPUT	$STAT<n>	<$GPNVS,1….>	Query NVS<n> String. Useful for status output on demand when user does not require regular string output.
	$STAT1		Outputs current $GPNVS,1 string on demand.
	$STAT2	<$GPNVS,2….>	Outputs current $GPNVS,2 string on demand.
	$STAT3	<$GPNVS,3….>	Outputs current $GPNVS,3 string on demand.
ACTIVATE FRONT PANEL STATUS STRINGS	$ACTFRP=0	$ACTFRP=n	Set Front Panel RS232 to automatically output $GPNVS strings. 1 = Enable, 0 = Disable (Default)
SAVE ALL VALUES TO FLASH MEMORY	$SAVEFLASH	$SAVED TO FLASH. $FLASH SAVE FAILED.	This command will translate all current variables to flash string and write. Data is then read back for verification, and result reported.
RESET ALL TO DEFAULT	$RESETALL	$RESET FLASH VARIABLES.	Resets all user settings to default values and overwrites flash memory with defaults.
INVALID INPUT		$?	Command not recognized.

Status String ($GPNVS) Channel Measurements

See Appendix C: $GPNVS Status String Definitions

SNMP Reference

See Appendix D SNMP Reference

Specifications

Technical Specifications

Linear amplifier bandwidth	20KHz to 15MHz ±2db, 1.2 Vrms max (option to DC available) Bandwidth limited for 10 MHz reference applications.
Impedance	50 Ohm
Channel skewing	< 1 ns (typical < 200 ps).
Latency	< 25 ns
Gain	0 dB
Phase noise	1 Hz -130 dBc/Hz
	10 Hz -140 dBc/Hz
	100 Hz -150 dBc/Hz
	1000Hz -150 dBc/Hz
Pulse	
Levels	Accepts 3.3 or 5 Vdc logic levels.
Input impedance	1 kOhm
Output load	50 Ohm for 3.3 or 5.5 logic levels (factory configurable)
Pulse frequency	From 1 pps to 10 MHz square
Rise and fall times	< 3 ns
Channel skewing	< 1 ns (typical < 200 ps).
Latency	< 25 ns
Channel status, system	channel status, system status - front panel display – serial port
Rear panel connectors	10 output, signal in and system status - BNC
Harmonics	< -30db
Remote interface & control	
Protocol	RS232 NMEA-0183
Connector	DB-9
Location	Rear panel
Protocol	Bit plus stop
Standard Baud Rates	Selectable 4800, 9600, 19200, 38400, 57600 or 115200 bps
Connectivity	Ethernet: 10/100M RJ-45 (option)
SNMP	v2 (option)
Serial port	RS232
AC input	90 to 250 Vac, 50/60Hz, IEC 320-C14
DC input	24V, 2A

Environmental and Mechanical

Operating temperature	0 to 50°C non-condensing
Storage temperature	-40 to 70°C
Height	1RU (~1.73”)
Width	19.0”
Depth	12.0”
Weight	5.5 lbs.
AC input	90 to 250 Vac, 50/60Hz, less than 10 Watts

LIMITED HARDWARE WARRANTY

Novus Power Products (hereinafter Novus) warrants its products to the original end user (“original purchaser”) and warranty is not transferrable. Novus guarantees that the NOVUS hardware products that you have purchased from NOVUS are free from defects in materials or workmanship under normal use during the LIMITED WARRANTY PERIOD. The LIMITED WARRANTY PERIOD starts on the date of shipment and for the period of 1 (one) year to be free from defects caused by faulty materials or poor workmanship, provided:

(a) NOVUS is notified in writing by Buyer of such defect prior to the expiration of the warranty period, and

(b) after receiving return material authorization (RMA) from NOVUS, the defective item is returned with transportation prepaid to NOVUS, Independence, Missouri, with transportation charges prepaid by Buyer …see RMA policy in Terms and Conditions, and

(c) NOVUSs’ examination of such unit shall disclose to its satisfaction that such defect(s) exist and have not been caused by misuse, neglect, improper installation, improper storage, unauthorized modifications, inadequate maintenance, operation outside the environmental specifications for the product, repair alteration, or accident. NOVUS assumes no risk or liability for results of the use of products purchased from it, including but without limiting the generality of the foregoing: (1) the use in combination with any electrical or electronic components, circuits, systems, assemblies or any other materials or substances; (2) unsuitability of any product for use in any circuit or assembly. Removal or tampering with tamper-proof label on merchandise will void warranty coverage unless with the written authorization from NOVUS

(d) an evaluation fee will be charged to Buyer to cover inspection and testing costs for any item returned by Buyer under this paragraph which is found to be within specifications and/or otherwise not the responsibility of NOVUS under the terms and conditions of this paragraph or any other part of this Agreement..

Your dated sales or delivery receipt is your proof of the purchase date. You may be required to provide proof of purchase as a condition of receiving warranty service. You are entitled to hardware warranty service according to the terms and conditions of this document if a repair to your NOVUS product is required during the limited warranty period. Our obligation at NOVUS is limited to repair or replace products which prove to be defective.

Should Novus be unable to repair or replace the product within a reasonable amount of time, the customer’s alternate remedy shall be a refund of the purchase price upon return of the product to Novus. The liability of NOVUS under this warranty is limited to replacing, repairing or issuing a credit, at its option, for any such item returned by Buyer under the terms of this warranty.

EXCLUSIONS: The above warranty shall not apply to defects resulting from improper or inadequate maintenance by the customer, customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product or improper site preparation and maintenance (if applicable). For probes, cables, antennas and accessories, the warranty period is 90 (ninety) days.

PRODUCT SPECIFICATIONS: Published specifications whether contained herein or in any other materials or documents distributed to Buyer by Novus do not become final or binding on NOVUS until approved by NOVUS. NOVUS expressly reserves the right to change or modify specifications at any time without prior notice.

WARRANTY LIMITATIONS: NOVUS MAKES NO OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, WITH RESPECT TO THIS PRODUCT. NOVUS SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN ALL CIRCUMSTANCES NOVUS’ MAXIMUM LIABILITY IS LIMITED TO THE PURCHASE PRICE OF THE PRODUCTS SOLD. NOVUS SHALL NOT, UNDER ANY CIRCUMSTANCES BE LIABLE UPON A CLAIM OR ACTION IN CONTRACT, TORT, INDEMNITY OR CONTRIBUTION OR OTHER CLAIMS RELATING TO THE PRODUCTS IT SELLS WHICH EXCEEDS THIS LIABILITY LIMIT. NOVUS SHALL NOT BE LIABLE FOR THIRD PARTY CLAIMS FOR DAMAGES AGAINST THE CUSTOMER, OR FOR MALFUNCTION, DELAYS, INTERRUPTION OF SERVICE, LOSS OF BUSINESS, LOSS OR DAMAGE TO EXEMPLARY DAMAGES, WHETHER OR NOT NOVUS HAS BEEN MADE AWARE OF THE POSSIBILITY OF SUCH CLAIMS OR DAMAGES.

.

LIMITATION OF REMEDIES: REGARDLESS OF WHETHER ANY REMEDY SET FORTH HEREIN FAILS OF ITS ESSENTIAL PURPOSE, IN NO EVENT WILL NOVUS BE LIABLE TO YOU FOR ANY SPECIAL, CONSEQUENTIAL, INDIRECT OR SIMILAR DAMAGES, INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF DATA OR BUSINESS INFORMATION (OR OTHER PECUNIARY LOSS) ARISING OUT OF THE USE OF OR INABILITY TO USE THE HARDWARE SUPPLIED THEREWITH EVEN IF NOVUS OR ANYONE ELSE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY. EXCLUDED DAMAGES SHALL INCLUDE, BUT ARE NOT LIMITED TO: COSTS OF REMOVAL AND INSTALLATION, LOSSES SUSTAINED AS THE RESULT OF INJURY TO ANY PERSON, OR DAMAGE TO PROPERTY.

EXCLUSIVE REMEDIES: THE REMEDIES PROVIDED HEREIN ARE THE CUSTOMERS' SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL NOVUS BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONNSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

User Manual **$GPNVS**

Appendix C: $GPNVS Status String Definitions

Contents

1.0 The $GPNVS Serial Status String ... 3
1.1 Status String ($GPNVS,1) Fault Bytes ... 4
1.2 Status String ($GPNVS,2) Channel Values 1-8 ... 5
1.3 Status String ($GPNVS,3) Power Supply Values ... 6
1.4 Status String ($GPNVS,4) Channel Values 9-16 ... 7
1.5 Status String ($GPNVS,5) Sensors ... 8
1.6 Status String ($GPNVS,6) Status Bytes ... 9
1.6.1 Status String ($GPNVS,6) Status Bytes; Standard ... 9
1.6.2 Status String ($GPNVS,6) Status Bytes; Rubidium ... 10
1.7 Status String ($GPNVS,7) Status Bytes ... 11
1.8 Event String ($GPNVS,8) Event Status ... 12
1.9 Status String ($GPNVS,9) Frequency Measurement ... 13
1.9.1 Standard Frequency Measurement String ... 13
1.9.2 NR6720-HS Frequency Measurement String ... 14
1.10 PPS Alignment String ($GPNVS,10) PPS Status ... 15
1.12 PPS Alignment String ($GPNVS,9) PPS Status ... 16
1.11 Response String ($GPNVS,R) ... 17
1.12 Discipline Selection String ($GPNVS,13) ... 18
2.0 Combined NMEA/Status RS232 ... 19
2.1 Status String ($GPNVS,1) Fault Bytes ... 19
2.2 Status String ($GPNVS,2) Channel Values ... 20
2.3 Status String ($GPNVS,3) Power Supply Values ... 21
3.0 Status Byte Key ... 22

1.0 The $GPNVS Serial Status String

Novus products provide, in many cases, serial data output from a standard GNSS receiver matching the NMEA 0183 protocol. This is usually a direct connection to the receiver.

In addition to NMEA, Novus Products which provide an additional RS232 serial port for status monitoring, will be set up to meet the following protocols. These are designed to be standardized across different products, and easy to port and use via serial-to-ethernet connections.

Many products will have some, but not all, of the following strings, if configured for the optional status RS232.

The following products comply with this document:

1. ND0115
2. NR2310-OG
3. NR2315
4. NR2110-O
5. NR2110-OG (Separate Status Port)
6. NR2110-OG (Combined NMEA/Status Port)
7. NR6720
8. NR2304

Note: The NR2110-OG with combined NMEA and Status Port complies with section 2.0 "Combined NMEA/Status RS232"

1.1 Status String ($GPNVS,1) Fault Bytes

$GPNVS	1	hhmmss	mmddyy	A	A	nn	nn	0x0000	0x00	0x00	n	n	*	XX
1	2	3	4	5	6	7	8	9	10	11	12	13		14

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	1
3.	Time (UTC)	hhmmss
4.	Date	mmddyy
5.	GPS 1 Lock (Valid)	"A" = Valid, "V" = Not Valid, "N" = N/A
6.	GPS 2 Lock (Valid)	"A" = Valid, "V" = Not Valid, "N" = N/A
7.	# of Sats in View (1)	Greater of GPS or GNSS count, "N" = N/A
8.	# of Sats in View (2)	Greater of GPS or GNSS count, "N" = N/A
9.	Channel Fault Byte	0x0000 to 0xFFFF (Hex OR'd value)
10.	Power Supply Fault Byte	0x00 to 0xFF (Hex OR'd value)
11.	Error Message Byte	0x00 to 0xFF (Hex OR'd value)
12.	Antenna 1	"0" = Ok, "1" = Error, "N" = N/A
13.	Antenna 2	"0" = Ok, "1" = Error, "N" = N/A
14.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,1,233518,092516,A,A,10,11,0x0000,0x00,0x00,0,0*23

1.2 Status String ($GPNVS,2) Channel Values 1-8

$GPNVS	2	hhmmss	ddmmyy	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	*	XX
1	2	3	4	5	6	7	8	9	10	11	12		13

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	2
3.	Time (UTC)	hhmmss
4.	Date	mmddyy
5.	Channel 1 Vrms	0.00 to 3.30 [V]
6.	Channel 2 Vrms	0.00 to 3.30 [V]
7.	Channel 3 Vrms	0.00 to 3.30 [V]
8.	Channel 4 Vrms	0.00 to 3.30 [V]
9.	Channel 5 Vrms	0.00 to 3.30 [V]
10.	Channel 6 Vrms	0.00 to 3.30 [V]
11.	Channel 7 Vrms	0.00 to 3.30 [V]
12.	Channel 8 Vrms	0.00 to 3.30 [V]
13.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,2,233518,092516,2.56,2.48,2.51,2.60,2.44,2.53, 2.51,2.60*6C

Note: For units with fewer than the number of channels listed, a null value will be present.

1.3 Status String ($GPNVS,3) Power Supply Values

$GPNVS	3	hhmmss	ddmmyy	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	n	nn	*	XX
1	2	3	4	5	6	7	8	9	10	11	12	13	14		15

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	3
3.	Time (UTC)	hhmmss
4.	Date	mmddyy
5.	Power Supply 1	-30.0 to 30.0 [V]
6.	Power Supply 2	-30.0 to 30.0 [V]
7.	Power Supply 3	-30.0 to 30.0 [V]
8.	Power Supply 4	-30.0 to 30.0 [V]
9.	Power Supply 5	-30.0 to 30.0 [V]
10.	Power Supply 6	-30.0 to 30.0 [V]
11.	Power Supply 7	-30.0 to 30.0 [V]
12.	Power Supply 8	-30.0 to 30.0 [V]
13.	Built in Test (BIT)	0 = Ok, 1 = Fail
14.	Temperature (C)	-40 to 99
15.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,3,233518,092516,-7.84,7.93,-11.8,12.1,0.00,0.00,0.00,1.92,0,
26*62

Note: Depending on configuration, Power Supply values will be defined differently, and some Power Supply values may not be present.

1.4 Status String ($GPNVS,4) Channel Values 9-16

$GPNVS	4	hhmmss	ddmmyy	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	*	XX
1	2	3	4	5	6	7	8	9	10	11	12		13

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	4
3.	Time (UTC)	hhmmss
4.	Date	mmddyy
5.	Channel 9 Vrms	0.00 to 3.30 [V]
6.	Channel 10 Vrms	0.00 to 3.30 [V]
7.	Channel 11 Vrms	0.00 to 3.30 [V]
8.	Channel 12 Vrms	0.00 to 3.30 [V]
9.	Channel 13 Vrms	0.00 to 3.30 [V]
10.	Channel 14 Vrms	0.00 to 3.30 [V]
11.	Channel 15 Vrms	0.00 to 3.30 [V]
12.	Channel 16 Vrms	0.00 to 3.30 [V]
13.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,4,233518,092516,2.56,2.48,2.51,2.60,2.44,2.53,2.51,2.60*6A

Note: For units with fewer than the number of channels listed, a null value will be present.

1.5 Status String ($GPNVS,5) Sensors

$GPNVS	5	hhmmss	ddmmyy	nnn	nn	±nn	*	XX
1	2	3	4	5	6	7		8

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	5
3.	Time (UTC)	hhmmss
4.	Date	mmddyy
5.	Potentiometer	Hex Value 000 to FFF
6.	Fan PWM %	0 to 90
7.	Temperature	-40 to 99 [C]
8.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,5,233518,092516,45,00,25*70

1.6 Status String ($GPNVS,6) Status Bytes

There are two different Status Strings; one for everything except the NR2304 and one for the NR2304.

1.6.1 Status String ($GPNVS,6) Status Bytes; Standard

$GPNVS	6	0	A	0	0x0000	0x00	0x00	0x00	0	0x0000	0x0000	0x0000	*	XX
1	2	3	4	5	6	7	8	9	10	11	12	13		14

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	6
3.	Active PCB Assembly	0 or 1
4.	GNSS Lock	A = Locked, V = Unlocked
5.	Input Error	0 = Ok, 1 = A Error, 2 = B error
6.	Channel Status Word	0x0000 to 0xFFFF
7.	Primary PS Status	0x00 to 0xFF
8.	Secondary PS Status	0x00 to 0xFF
9.	Active PCB Status	0x00 to 0xFF
10.	Checksum Status	00 to 999
11.	Channel Fault Bin	0x0000 to 0xFFFF
12.	Primary PCB Amp Status	0x0000 to 0xFFFF
13.	Backup PCB Amp Status	0x0000 to 0xFFFF
14.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,6,0,A,0,0x0000,0x40,0x40,0x00,00,0x0000,0x0000,0x0000*63

See Status Byte Table for details.

1.6.2 Status String ($GPNVS,6) Status Bytes; Rubidium

$GPNVS	6	nnn	0x0000	nnn	0/1	*	XX
1	2	3	4	5	6		7

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	6
3.	Heat Sink Temperature	0-255
4.	Heater Current Voltage	0x0000-0x0136
5.	Measured Voltage in Heater	0-255
6.	Rb Locked	0 = Unlocked 1= Locked
7.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,9,136,0x002A,90,1*7E

1.7 Status String ($GPNVS,7) Status Bytes

$GPNVS	7	nnnnnn	nnnnnn	A	nn	0x00	0	0	0	nnnnnn	n.nn	n.nn	*	XX
1	2	3	4	5	6	7	8	9	10	11	12	13		14

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	7
3.	Time	hhmmss
4.	Date	mmddyy
5.	GPS Lock	"A" = Valid, "V" = Not Valid
6.	# of Sats in View (1)	Greater of GPS or GNSS count, "N" = N/A
7.	Error Byte	0x00 to 0xFF
8.	Freq Diff	±999 (last count, clock cycles)
9.	PPS Diff	±999 (last count, clock cycles)
10.	Freq Correction Slice	±999 (DAC bits, per second)
11.	DAC Value	Integer Representation, n x 1/(2^20)
12.	Power Supply	Vdc
13.	Power Supply	Vdc
14.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,7,161505,081617,A,12,0x00,-1,-2,0,505610,+5.05,-4.66*58

1.8 Event String ($GPNVS,8) Event Status

$GPNVS	8	0	0	0	0	0	0	0	nnnnnn	0	*	XX
1	2	3	4	5	6	7	8	9	10	11		12

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	8
3.	Discipline Counter	0 = Off, 1 = Disciplined to Synthetic PPS
4.	User Enabled	0 = Off, 1 = On
5.	Event Enabled (System)	0 = Events Disabled, 1 = Events Enabled
6.	GPS Lock Achieved	0 = No Lock, 2 = Locked or previously locked
7.	Event Index	0-512, Current count of events in RAM
8.	Event Errors (RAM)	0
9.	Event Index	0-512, Current count of events in Flash
10.	Event Errors (Flash)	0
11.	Event Time Alignmet	2 = LS applied, 1 = GPS, 0 = RTC
12.	Estimated Accuracy	0-999999 [ns]
13.	Edge Detect Direction	0 = Falling Edge, 1 = Rising Edge
14.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,8,1,1,1,2,0,0,2,000005,0*60

1.9 Status String ($GPNVS,9) Frequency Measurement

The frequency measurement string has two versions, one standard version, and one for the NR6720.

1.9.1 Standard Frequency Measurement String

$GPNVS	9	hhmmss	ddmmyy	(n)nnnnnnn.nnn	nnn	(-)nn	*	XX
1	2	3	4	5	6	7		8

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	9
3.	Time (UTC)	hhmmss
4.	Date	mmddyy
5.	Measured Frequency	9999900.000 to 10000100.000
6.	Frequency Alert Range	0 – 240 (units of 0.0083 Hz)
7.	Temperature	-40 to 99 [C]
8.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,9,233518,092516,10000000.003,240,25*70

1.9.2 NR6720-HS Frequency Measurement String

$GPNVS	9	nnnnnnn.nnn	n.nnnnn	nnnnnnnn.nn	0	±n.nn	±n.nn	*	XX
1	2	3	4	5	6	7	8		9

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	9
3.	Frequency (Loop Period)	10000000.000
4.	DAC Voltage (Double)	2.00000
5.	Frequency (per second)	10000000.0
6.	Loop Period	0-99
7.	Antenna Current Mon	0.00 to 3.30V
8.	Sine Output RMS	0.00 to 3.30V
9.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,9,+10000000.003,+1.97493,+10000000.0,15,+1.03,+1.30*4A

1.10 PPS Alignment String ($GPNVS,10) PPS Status

$GPNVS	10	0	0	0	±n	±n	n	n	n.n	n	n	n	0	±n	n.n	n	*	XX
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		18

#	**Description**	**Range**
1.	Identifier	$GPNVS
2.	String ID	10
3.	PPS Stability Enabled	0 = Off, 1 = On
4.	PPS Disciplining to GPS	0 = Off, 1 = Actively Synchronized
5.	PPS Output Type	0 = Synthetic PPS, 1 = GPS PPS
6.	PPS Difference	±250 [ns]
7.	PPS Avg Difference	±250 [ns]
8.	PPS Avg Count	1-20
9.	PPS Synch Threshold	1-250
10.	PPS pull Cal Factor	0.1 to 10.0
11.	PPS active Time Cal Factor	0 to 9
12.	Frequency Variance	0-9999 (clock cycles per Loop period)
13.	Frequency Var Threshold	0-100 (clock cycles per Loop period)
14.	PPS Stabile Mode Post-Warm up	0 = Off, 1 = On
15.	PPS Slope Indicator	±250 (clock cycles per second)
16.	PPS Slope Cal Factor	0.1 to 10.0
17.	PPS Slope Distance	14 to 60 (seconds)
18.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,10,1,0,0,+0,+0,2,100,0.5,3,2,10,1,0,1.0*46

1.12 PPS Alignment String ($GPNVS,9) PPS Status

$GPNVS	9	nnn	0x0000	nnn	0/1	*	XX
1	2	3	4	5	6		7

#	Description	Range
8.	Identifier	$GPNVS
9.	String ID	9
10.	Heat Sink Temperature	0-255
11.	Heater Current Voltage	0x0000-0x0136
12.	Measured Voltage in Heater	0-255
13.	Rb Locked	0 = Unlocked 1= Locked
14.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,9,136,0x002A,90,1*7E

1.11 Response String ($GPNVS,R)

$GPNVS	R	n	<response>	*	XX
1	2	3	4		5

#	Description	Range
1.	Identifier	$GPNVS
2.	Response ID	R
3.	Command Success	1 = Success, 0 = Fail
4.	Response	<see example responses>
5.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,R,SET01=1.00*6F

1.12 Discipline Selection String ($GPNVS,13)

$GPNVS,	13,	n,	n,	n,	n,	n,	,	,	*	XX
1	2	3	4	5	6	7	8	9		10

#	Description	Range
1.	Identifier	$GPNVS
2.	String ID	13
3.	Priority Discipline Source	0 = GNSS, 1 = 10MHz input, 2 = Optical input
4.	Current Discipline Source	0 = GNSS, 1 = 10MHz, 2 = Optical, 3 = Holdover
5.	GNSS Lock	0 to 3, 0 = Unlocked, 3 = Fully Locked
6.	RF Present	0 = No RF source, 1 = RF Source found
7.	Opto Present	0 = No Optical source, 1 = Optical Source Found
8.	Loop Lock	1 = Lock, 0 = Loop acquiring lock
9.	Reserved	
10.	NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,13,0,0,3,0,0,1,*5C

2.0 Combined NMEA/Status RS232

NR2110-OG Combined NMEA?Status Port

2.1 Status String ($GPNVS,1) Fault Bytes

$GPNVS	1	hhmmss	mmddyy	A	nn	0x00	0x00	0x00	*	XX
1	2	3	4	5	6	7	8	9		10

# Description	Range
15. Identifier	$GPNVS
16. String ID	1
17. Time (UTC)	hhmmss
18. Date	mmddyy
19. GPS Lock (Valid)	"A" = Valid, "V" = Not Valid
20. # of Sats in View	Greater of GPS or GNSS count
21. Channel Fault Byte	0x00 to 0x3F (Hex OR'd value)
22. Power Supply Fault Byte	0x00 to 0x1F (Hex OR'd value)
23. Error Message Byte	0x00 to 0x0F (Hex OR'd value)
24. NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,1,233518,092516,A,10,0x00,0x00,0x00*62
Time: 23:35:18; Sep. 25, 2016, GPS locked; 10 Satellites in view; No channel faults; No power supply faults; No error messages.

2.2 Status String ($GPNVS,2) Channel Values

$GPNVS	1	hhmmss	mmddyy	n.nn	n.nn	n.nn	n.nn	n.nn	n.nn	*	XX
1	2	3	4	5	6	7	8	9	10		11

# Description	Range
14. Identifier	$GPNVS
15. String ID	2
16. Time (UTC)	hhmmss
17. Date	mmddyy
18. Channel 1 Vrms	0.00 to 6.60 [V]
19. Channel 2 Vrms	0.00 to 6.60 [V]
20. Channel 3 Vrms	0.00 to 6.60 [V]
21. Channel 4 Vrms	0.00 to 6.60 [V]
22. Channel 5 Vrms	0.00 to 6.60 [V]
23. Channel 6 Vrms	0.00 to 6.60 [V]
24. NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,2,233518,092516,0.99,1.01,1.06,0.97,1.52,1.54*4E

2.3 Status String ($GPNVS,3) Power Supply Values

$GPNVS	3	hhmmss	mmddyy	n.nn	n.nn	n.nn	n.nn	n.nn	*	XX
1	2	3	4	5	6	7	8	9		10

# Description	Range
15. Identifier	$GPNVS
16. String ID	2
17. Time (UTC)	hhmmss
18. Date	mmddyy
19. -5Vdc Power Supply(opt)	-30.0 to 30.0 [V]
20. +5Vdc Power Supply	-30.0 to 30.0 [V]
21. 10kΩ Thermistor(opt)	0.00 to 3.30 [V]
22. +5Vdc Power Supply(opt)	-30.0 to 30.0 [V]
23. OCXO Control Voltage	0.00 to 3.30 [V]
24. NMEA Checksum	*XX (xor'd value of bytes between $ and *)

Example:
$GPNVS,3,233518,092516,-4.84,4.93,1.45,4.90,2.12*42

3.0 Status Byte Key

	Hex Value (OR'd)	Channel ID	Channel Status Word
Channel Status Byte	0x1<<0	Channel 1 Fault	General Channel Fault
	0x1<<1	Channel 2 Fault	
	0x1<<2	Channel 3 Fault	
	0x1<<3	Channel 4 Fault	
	0x1<<4	Channel 5 Fault	
	0x1<<5	Channel 6 Fault	
	0x1<<6	Channel 7 Fault	
	0x1<<7	Channel 8 Fault	
	0x1<<8	Channel 9 Fault	
	0x1<<9	Channel 10 Fault	
	0x1<<10	Channel 11 Fault	
	0x1<<11	Channel 12 Fault	
	0x1<<12	Channel 13 Fault	
	0x1<<13	Channel 14 Fault	
	0x1<<14	Channel 15 Fault	

	Hex Value (OR'd)	Channel ID	Channel Fault Bin
Channel Fault Bin	0x1<<0	Channel 1 Fault	External Fault: The ND0100 has completed an internal amplifier gain test and both primary and backup assemblies are functional. The fault is external to the ND0100 (cabling, short, etc) Amp Gain Test for Alert is enabled with $AMP=1 command via RS232
	0x1<<1	Channel 2 Fault	
	0x1<<2	Channel 3 Fault	
	0x1<<3	Channel 4 Fault	
	0x1<<4	Channel 5 Fault	
	0x1<<5	Channel 6 Fault	
	0x1<<6	Channel 7 Fault	
	0x1<<7	Channel 8 Fault	
	0x1<<8	Channel 9 Fault	
	0x1<<9	Channel 10 Fault	
	0x1<<10	Channel 11 Fault	
	0x1<<11	Channel 12 Fault	
	0x1<<12	Channel 13 Fault	
	0x1<<13	Channel 14 Fault	
	0x1<<14	Channel 15 Fault	

	Hex Value (OR'd)	Channel ID	Primary PCB Amp Status
Primary PCB Amp Status	0x1<<0	Channel 1 Fault	Internal Fault Primary Assembly: The channel has failed an internal gain test on the primary PCB assembly, and the channel is not functional on the primary board. Amp Gain Test for Alert is enabled with $AMP=1 command via RS232
	0x1<<1	Channel 2 Fault	
	0x1<<2	Channel 3 Fault	
	0x1<<3	Channel 4 Fault	
	0x1<<4	Channel 5 Fault	
	0x1<<5	Channel 6 Fault	
	0x1<<6	Channel 7 Fault	
	0x1<<7	Channel 8 Fault	
	0x1<<8	Channel 9 Fault	
	0x1<<9	Channel 10 Fault	
	0x1<<10	Channel 11 Fault	
	0x1<<11	Channel 12 Fault	
	0x1<<12	Channel 13 Fault	
	0x1<<13	Channel 14 Fault	
	0x1<<14	Channel 15 Fault	

	Hex Value (OR'd)	Channel ID	Backup PCB Amp Status
Backup PCB Amp Status	0x1<<0	Channel 1 Fault	Internal Fault Backup Assembly: The channel has failed an internal gain test on the backup PCB assembly, and the channel is not functional on the secondary board. Amp Gain Test for Alert is enabled with $AMP=1 command via RS232
	0x1<<1	Channel 2 Fault	
	0x1<<2	Channel 3 Fault	
	0x1<<3	Channel 4 Fault	
	0x1<<4	Channel 5 Fault	
	0x1<<5	Channel 6 Fault	
	0x1<<6	Channel 7 Fault	
	0x1<<7	Channel 8 Fault	
	0x1<<8	Channel 9 Fault	
	0x1<<9	Channel 10 Fault	
	0x1<<10	Channel 11 Fault	
	0x1<<11	Channel 12 Fault	
	0x1<<12	Channel 13 Fault	
	0x1<<13	Channel 14 Fault	
	0x1<<14	Channel 15 Fault	

	Hex Value (OR'd)	**Status Message**
Active Board Status	0x1<<0	Flash Read Boot Error (Deprecated)
	0x1<<1	Potentiometer Read/Set Fail
	0x1<<2	Reserved
	0x1<<3	Reserved
	0x1<<4	PCB Assembly Input A/B Select Fail
	0x1<<5	Reserved
	0x1<<6	Reserved
	0x1<<7	Reserved

	Hex Value (OR'd)	**Status Message**
Primary and Secondary Power Supply Status	0x1<<0	PS 1 Fault
	0x1<<1	PS 2 Fault
	0x1<<2	PS 3 Fault
	0x1<<3	PS 4 Fault
	0x1<<4	PS 5 Fault
	0x1<<5	PS 6 Fault
	0x1<<6	PS 7 Fault
	0x1<<7	PS 8 Fault

	Hex Value (OR'd)	**Status Message**
Error Status	0x1<<0	FLASH_NOT_FOUND
	0x1<<1	FLASH_NOT_SAVED
	0x1<<2	LOOP_VOLT_ERROR
	0x1<<3	ANTENNA_VOLT_ERROR
	0x1<<4	GPS_FAILURE
	0x1<<5	POTENTIOMETER_ERROR
	0x1<<6	RAM_MEMORY_ERROR
	0x1<<7	Reserved

User Manual **SNMP**

Appendix D: SNMP Configuration

Contents

1.0 SNMP Network Configuration 3
1.1 Default Settings 3
1.2 Login - Ethernet 6
1.3 Login - Serial RS232 (Rear Panel) 5
1.4 Default Login 6
1.5 Navigation .... **Error! Bookmark not defined.**
1.6 Static/Dynamic setting IP Address .... **Error! Bookmark not defined.**
1.7 Change Password .... **Error! Bookmark not defined.**
1.8 SNMP Agent 7
1.10 SNMP: $GPNVS NMEA Data 8
1.11 Serial Commands via SNMP 11
1.12 Troubleshooting 12

1.0 SNMP Network Configuration

Novus products configured with SNMP option will act as an SNMP agent, providing detailed status and health information about the unit.

1.1 Default Settings

By default, the IP address of the Novus product is statically assigned. The default settings are:

Field	Setting
Network	Static
IP Address	192.168.7.200
Subnet Mask	255.255.255.0
Default Gateway	192.168.7.254

To change the IP address or other settings, follow the Login procedure in section 1.2.

Login	Password
root	novus123

1.2 Setting Static IP via the RS232 Serial Port

The Linux NTP/SNMP submodule static IP address can be updated via the serial port. The user should set and query each of the following in order:

Command	Description
$ETHIP	Static IP Address
$ETHMK	Subnet Mask
$ETHGW	Default Gateway
$ETHUP	Update submodule

When the $ETHIP, $ETHMK, and $ETHGW commands are set and verified by query, the user can send the $ETHUP command to send the new values to the linux submodule, and reset.

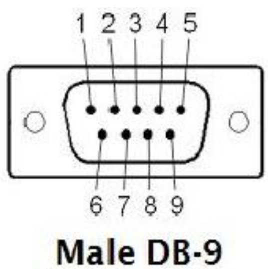
Setting	Command	Response	Description
IP ADDRESS	$ETHIP $ETHIP=n.n.n.n	$ETHIP=192.168.7.200	Set or query IP address buffer to send to onboard Linux SNMP/NTP linux module. Set in conjunction with $ETHMK and $ETHGW. When all three are set, forward to module with $ETHUP command.
SUBNET MASK	$ETHMK $ETHMK=n.n.n.n	$ETHMK=255.255.255.0	Set or query Subnet Mask buffer to send to onboard Linux SNMP/NTP linux module. Set in conjunction with $ETHIP and $ETHGW. When all three are set, forward to module with $ETHUP command.
DEFAULT GATEWAY	$ETHGW $ETHGW=n.n.n.n	$ETHGW=192.168.7.254	Set or query Default Gateway buffer to send to onboard Linux SNMP/NTP linux module. Set in conjunction with $ETHIP and $ETHMK. When all three are set, forward to module with $ETHUP command.
UPDATE LINUX SUBMODULE ETHERNET ROUTE	$ETHUP	$ETHUP	After setting IP ADDRESS, SUBNET MASK, and DEFAULT GATEWAY, send the $ETHUP command to update the route table on the Linux SNMP/NTP module. The module will restart and the displayed IP Address information will update after this command is sent.

1.3 Serial RS232 (Rear Panel)

To connect to the rear panel RS232 port. You will need a serial cable with pinout that is shown below.

This RS232 level port defaults as the NMEA/Command interface and can be accessed by your preferred terminal program such as PuTTY, using a Serial Com port. The default baud rate is 38400 (depending on the model), 8 bit, no parity, 1 stop bit. (Note: Remember to check the pinout.)

RS232 Serial Port: Rear Panel Pin Connections



Pin	Function	I/O
1	NC	
2	Command Port RX	I
3	Command Port TX	O
4	NC	
5	GND	GND
6	NC	
7	NC	
8	NC	
9	NC	

1.3 Login - Ethernet

Use a terminal such as PuTTY to open an SSH connection to IP address of the unit on Port 22. You will see the "`login as:`" prompt, where you can enter the login and password.

Proceed to 1.4.

1.4 Default Login

Login using the default login and password:

Login	Password
root	novus123

```
login as: root
root@xxx.xxx.xxx.xxx's password: novus123
```

1.8 SNMP Agent

The Novus unit features an onboard Linux submodule operating as an SNMPv2 agent. The SNMP data is broadcast from the unit on Port 161. SNMP traps are communicated on Port 162.

Read Community and Write Community is "novus."

The software Novus SNMP Agent is automatically started on bootup.

The SNMP agent OID values are pulled from the $GPNVS string data and include all the available status output that the $GPNVS strings provide. Not all Novus units provide all $GPNVS strings, or all specific parameters in $GPNVS strings. The fields populated in the OIDs are from the specific unit's $GPNVS values. Any fields not available from $GPNVS strings will be a null value.

1.10 SNMP: $GPNVS NMEA Data

A selection of the $GPNVS field values are used to populate the SNMP OIDs. This allows much of the direct monitoring of the serial RS232 port to be done via the SNMP browser.

SNMP	$GPNVS String	$GPNVS String Field	Data Type
nsFaultsObjs			
nsFaultGPS1Lock.0	1	5	Integer
nsFaultGPS2Lock.0	1	6	Integer
nsFaultSatView1.0	1	7	Gauge
nsFaultSatView2.0	1	8	Gauge
nsFaultChannelBytes.0	1	9	OctetString
nsFaultPowerSupplyByte.0	1	10	OctetString
nsFaultErrMsgByte.0	1	11	OctetString
nsFaultAnt1Stat.0	1	12	Integer
nsFaultAnt2Stat.0	1	13	Integer
nsChannelObjs			
nsChannel1Vrms.0	2	5	OctetString
nsChannel2Vrms.0	2	6	OctetString
nsChannel3Vrms.0	2	7	OctetString
nsChannel4Vrms.0	2	8	OctetString
nsChannel5Vrms.0	2	9	OctetString
nsChannel6Vrms.0	2	10	OctetString
nsChannel7Vrms.0	2	11	OctetString
nsChannel8Vrms.0	2	12	OctetString
nsChannel9Vrms.0	4	5	OctetString
nsChannel10Vrms.0	4	6	OctetString
nsChannel11Vrms.0	4	7	OctetString
nsChannel12Vrms.0	4	8	OctetString
nsChannel13Vrms.0	4	9	OctetString
nsChannel14Vrms.0	4	10	OctetString
nsChannel15Vrms.0	4	11	OctetString
nsChannel16Vrms.0	4	12	OctetString

SNMP	$GPNVS String	$GPNVS String Field	Data Type
nsStatusPSObjs			
nsPS1Status.0	3	5	OctetString
nsPS2Status.0	3	6	OctetString
nsPS3Status.0	3	7	OctetString
nsPS4Status.0	3	8	OctetString
nsPS5Status.0	3	9	OctetString
nsPS6Status.0	3	10	OctetString
nsPS7Status.0	3	11	OctetString
nsPS8Status.0	3	12	OctetString
nsBITStatus.0	3	13	Integer
nsPSTemp.0	3	14	OctetString
nsSensorObjs			
nsSensorPotentiometer.0	5	5	Gauge
nsSensorFanPWM.0	5	6	Gauge
nsSensorTemperature.0	5	7	OctetString
nsSysObjs			
nsSysIdentifier.0			OctetString
nsSysActivePCBAssy.0	6	3	Gauge
nsSysGNSSLock.0	6	4	Integer
nsSysInputErr.0	6	5	Integer
nsSysChanStatusWord.0	6	6	OctetString
nsSysPriPSStatus.0	6	7	OctetString
nsSysSecPSStatus.0	6	8	OctetString
nsSysActivePCBStatus.0	6	9	OctetString
nsSysChksumStatus.0	6	10	Gauge
nsSysChanFaultBin.0	6	11	Gauge
nsSysPriPCBAmpStatus.0	6	12	OctetString
nsSysBkupPCBAmpStatus.0	6	13	OctetString

SNMP	$GPNVS String	$GPNVS String Field	Data Type
nsSysGPSLock.0	7	5	Integer
nsSysSatView.0	7	6	Gauge
nsSysErrorByte.0	7	7	OctetString
nsSysFreqDiff.0	7	8	OctetString
nsSysPPSDiff.0	7	9	OctetString
nsSysFreqCorSlice.0	7	10	OctetString
nsSysDACValue.0	7	11	Gauge
nsSysPS1VDC.0	7	12	OctetString
nsSysPS2VDC.0	7	13	OctetString
nsEventObjs			
nsEventDiscCounter.0	8	3	Integer
nsEventUserEnabled.0	8	4	Integer
nsEventSysEnabled.0	8	5	Integer
nsEventGPSLock.0	8	6	Integer
nsEventRAMIndex.0	8	7	Gauge
nsEventTimeAlignment.0	8	8	Integer
nsEventEstAccuracy.0	8	9	Gauge
nsEventEdgeDetDir.0	8	10	Integer
nsMeasureObjs			
nsMeasureFreq.0	9	3	OctetString
nsMeasureAlert.0	RES	RES	OctetString
nsMeasureTemp.0	3	14	OctetString
nsPPSObjs			
nsPPSStability.0	10	3	Integer
nsPPSDiscGPS.0	10	4	Integer
nsPPSOutputType.0	10	5	Integer
nsPPSDifference.0	10	6	OctetString
nsPPSCalFactor.0	10	10	OctetString
nsPPSTimeCalFactor.0	10	11	Gauge
nsPPSFreqVar.0	10	12	Gauge

1.11 Serial Commands via SNMP

The SNMP configuration allows the same RS232 serial commands from the Programmer's Guide to be sent over the SNMP browser interface.

To send a serial command, issue an SNMP set on the "nsCommand" OID. Change the value of the OctetString to the desired serial command. Upon a successful Set, the "nsResult" field will contain the response from the unit.

1.12 Troubleshooting

If changes were made to the network settings that render the unit unable to communicate, please contact customer service for instructions on writing to the SSD card directly.