195-NL32

User Manual

NL32 NovaLogger

NL32 NovaLogger Firmware Version 1.27

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Receiving and Unpacking

Carefully unpack all components and compare to the packing list. Notify NovaLynx Corporation immediately concerning any discrepancy. Inspect equipment to detect any damage that may have occurred during shipment. In the event of damage, any claim for loss must be filed immediately with the carrier by the consignee. Damages to equipment sent via Parcel Post or UPS require the consignee to contact NovaLynx Corporation for instructions.

Returns

If equipment is to be returned to the factory for any reason, call NovaLynx between 8:00 a.m. and 4:00 p.m. Pacific Time to request a Return Authorization Number (RA#). Include with the returned equipment a description of the problem and the name, address, and daytime phone number of the sender. Carefully pack the equipment to prevent damage or additional damage during the return shipment. Call NovaLynx for packing instructions in the case of delicate or sensitive items. If packing facilities are not available take the equipment to the nearest Post Office, UPS, or other freight service and obtain assistance with the packaging. Please write the RA# on the outside of the box.

Warranty

NovaLynx Corporation warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment from the factory. NovaLynx Corporation's obligations under this warranty are limited to, at NovaLynx's option: (i) replacing; or (ii) repairing; any product determined to be defective. In no case shall NovaLynx Corporation's liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by NovaLynx Corporation, or that has been subjected to misuse, negligence, or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

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CONTENTS

1 FORWARD

Thank you for purchasing NovaLynx products. NovaLynx has been designing and manufacturing weather instruments since 1988. NovaLynx represents several well-known brands of quality manufacturers, including Gill Instruments, RM Young, Kipp & Zonen, and Vaisala. It is our hope that our products will meet all your monitoring requirements.

2 INTRODUCTION

The 195-NL32 NovaLogger is a rugged instrument designed to operate in the extremes of cold and hot weather experienced worldwide. As the key component of a meteorological system, it collects and stores data from many types of sensors. Stored data is uploaded to a USB flash drive or accessed through the RS232 serial port or Ethernet port. Real-time data is also available through these ports.

The NovaLogger is compatible with voltage and current output sensors, thermistors, and some serial output type sensors. Plug & Measure™ technology is available for selected sensors, making setup easier. Other sensor types are programmed through a menu selection and parameter entry process.

Depending on the application, the NovaLogger uses very little power, making it suitable for remote monitoring.

Model 195-NL32-A includes:

195-NL32	NovaLogger (photos next page)
110-WS-16P	AC Adapter, 100-240 VAC input, 12 VDC output, 3 foot cable
110-WS-16Tester	Tester with DB9 connector (flashes LED to indicate serial data)
1205-06	Mini serial cable DB9, M/F, 6 feet
1205-08	USB 2.0 cable A/B, M/M, 6 feet
-	Screw drivers (1 Phillips, 1 slotted)

Model 195-NL32N-A includes all the above plus:

NEMA-4X Fiberglass enclosure with mast mounting hardware
12 Volt, 7 Ah Battery, Fuse (1 Amp, slow blow, 3AG 0.25" x 1.25" cartridge)
Mini digital voltmeter

Accessories (purchase separately):

110-WS-16USB Keyspan TRIPP-LITE USB adapter
Sensors, Solar panels, Towers and Tripods – see www.NovaLynx.com

3 CONNECTIONS

Back Side Connections

Peripheral port
Serial Ports 1 & 2
Ethernet connector

Top Side Connections

Alarms 1 & 2
Solar (current) input
General purpose analog channels 1 thru 15

DC power out, SDI-12 port, Rain input, Wind speed and direction inputs 1 & 2,
Serial ports 3 & 4

Serial ports 5 thru 10

Earth ground, Serial Port 1 (DB9), LED Indicators, Power input connector

Front Side Connections
USB Flash Drive port (left)
USB Communications port
Transfer button/LED

4 TECHNICAL SPECIFICATIONS

Environmental	
Operating temperature range	-40 to +85°C
Storage temperature range	-60 to +85°C
Humidity	0 to 90% RH
Vibration	10-500 Hz to 2 G
Power	
Voltage range	9-35 VDC (40 VDC absolute maximum) *reverse polarity protected*
Peak current	80 mA at 12 VDC (all ports active) *protected by 2A fuse*
Nominal current	45 mA at 12 VDC
Sleep mode current	75 uA at 12 VDC
Battery life	> 10 years for memory and clock
Analog Inputs	
Voltage input channels	16 at 14-bit resolution (one channel dedicated to battery monitor)
Voltage input ranges	25mV, 50mV, 100mV, 250mV, 500mV, 1V, 2.5V, and 5V
Current input channels	1 at 14-bits resolution
Current input ranges	0.25uA, 10 uA, 40 uA, 100 uA, 1 mA
Temperature input channels	15 at 14-bit resolution
Temperature input range	-50 °C to +60°C with 10K ohm J-type thermistor
Wind speed (AC or DC pulsed)	2 channels at 1400 Hz each
Wind direction	2 channels at 10 bits resolution
Digital Inputs/Outputs	
Rain input	Pulse counter rain gauge input, 12 Hz max
Alarm outputs	2 open collector high/low threshold outputs. (20Vdc, 2A max)
Communications Ports	
RS-232/422/485 ports	4 fixed RS-232 ports, 6 software configurable multi-protocol ports
Bit rates	Up to 1Mbps RS-232, 10 Mbps RS-485/422
Modem port	One RS-232 with RTS/CTS, switched modem power
USB port	One B-type USB port
Memory port	One A-type USB port, 6GB capacity
SDI-12 port	One standard compliant port (not supported in current firmware)
Ethernet port	10/100 Base TX
WiFi port	IEEE 802.11 b/g (not supported)
Features	
Calendar clock	Date, time, leap year, 2 time-of-day alarms
On-board data memory	8 MB non-volatile flash
Dimensions (195-NL32)	7-13/16" x 5-5/16" x 2" (198 x 135 x 51 mm)
Dimensions (195-NL32N)	15" x 11-1/4" x 5-3/4" (381 x 286 x 146 mm)
Weight / Shipping (195-NL32)	2.5 lbs / 5 lbs (1.13 kg / 2.27 kg)
Weight / Shipping (195-NL32N)	16 lbs / 20 lbs (7.26 kg / 9.07 kg)

5 PRE-INSTALLATION SETUP

The NovaLogger can be operated before installation to become familiar with the menus and programming features. You will need a DC power supply (9 to 35 Vdc), a USB A/B cable or serial cable with DB9 connectors, and a computer with a terminal program such as HyperTerminal, TeraTerm or Putty to communicate with the NovaLogger. The sensors need not be connected for these tests.

5.1 Power Supply Connection (9-35 Vdc)

The power supply is normally pre-wired to the NovaLogger. To turn on the logger, simply plug the AC Adapter into a 100-240VAC outlet. Units that are mounted in the NEMA enclosure are powered by connecting the red battery lug to the positive terminal of the battery. When the AC cord is connected the battery will be charged. If your logger is not pre-wired, locate the two power input terminals marked V+ and GND on the top side of the NovaLogger. Use a small flat-blade screwdriver to press down on the GND terminal's spring-loaded button and insert the ground wire from a power supply. Connect the positive wire to the V+ terminal in the same way. Turn on the power and observe that the POWER LED on the top of side of the NovaLogger is ON.

5.2 Serial Connection (USB)

The USB port is the easiest way to link your computer to the NovaLogger.

1. Locate the USB A/B cable (included with the logger). Plug the B connector into the NovaLogger and then connect the other end to your computer. Connect power to the NovaLogger.
2. Wait a few seconds for the computer's operating system to recognize the NovaLogger.
3. Open a terminal emulator application on the computer (see Section 5.4 for details).
4. Select the communications port that is being used to establish a connection with the NovaLogger. Look for something similar to COMx: USB Serial Port (COMx).
5. Pause momentarily to allow the terminal emulator to establish a connection.
6. Type **mm<ENTER>** to display the main menu.

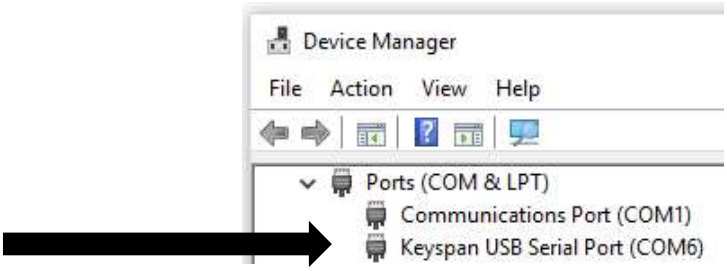
5.3 Serial Connection (RS232)

Locate the serial cable (included with the logger) and connect it to the Serial Port 1 connecter on the top side of the NovaLogger. If your computer has a serial port with a DB9 connector, plug the other end of the cable into that port (this is usually COM1).

If your computer does not have a DB9 type serial port then you will need an adaptor such as the Keyspan TRIPP-LITE USB adapter (Part# 110-WS-16USB). Connect the serial cable to the adapter, then connect the adapter to the computer's USB port. In most cases the computer will recognize the adapter and load the proper driver. If this does not occur, locate the TRIPP-LITE CD and load the driver from there or download it from TRIPP-LITE at the following URL:

https://www.tripplite.com/support/product/part-number/USA19HS

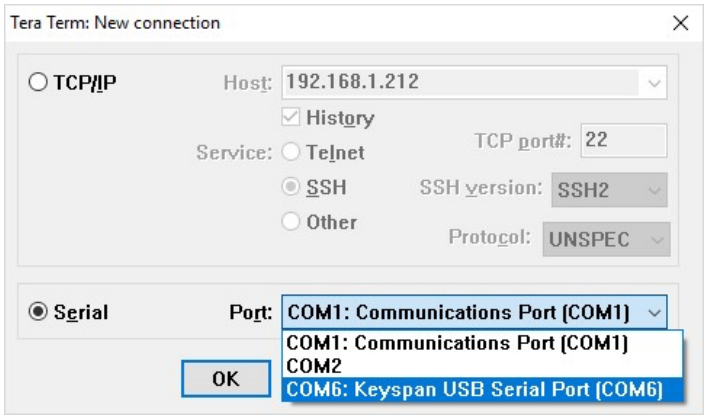
Navigate to the Device Manager screen on your computer (Start Menu / Control Panel / Device Manager) and view the Ports (COM & LPT) list to determine whether the Keyspan USB Serial Port is recognized. Note the COM number assigned by the computer (see illustration below).

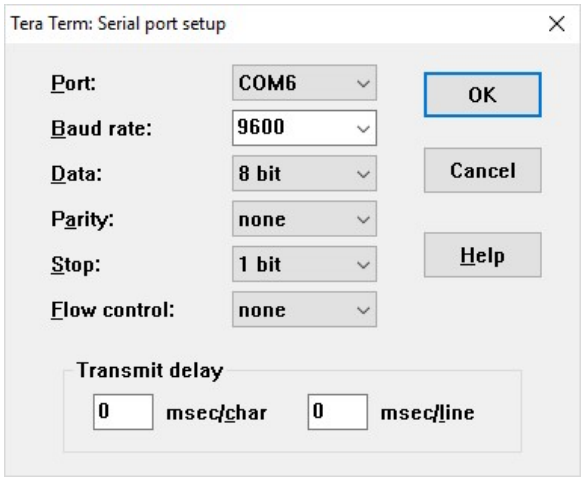


5.4 Terminal Program Settings

Launch a terminal program and enable the serial port as in the following TeraTerm example. (TeraTerm is a free program that can be downloaded from the internet.)

Select the COM Port and then the NovaLogger default settings: **9600 baud, 8 bit, no parity, 1 stop bit, no handshake.**

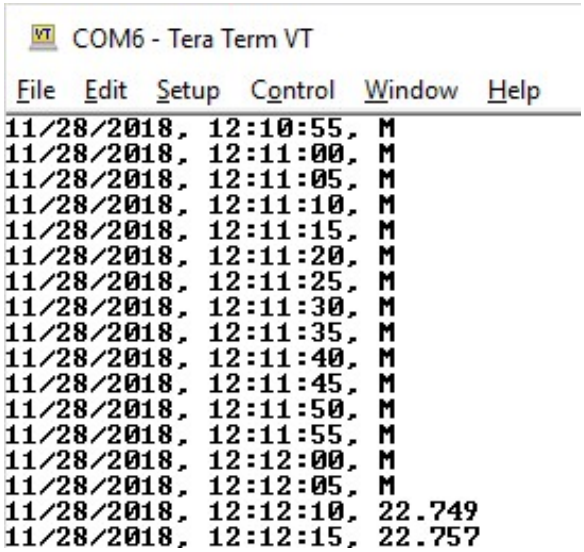




After the connection is made you will see data from the logger presented in Row / Column format similar to the screen shown here.* The number of columns will vary depending on how many sensors have been enabled on the logger.

Notice the date and time in columns 1 and 2. Compare to local time to see whether the logger's clock is properly set.

In the example, notice that "M" appears in the third column until a resistor was connected to simulate a temperature sensor on analog input #1. If the logger is operating without the sensors attached you may see an error (M=Missing) in several columns. (resistor connected)



*The Row/Column output format is the factory default on Serial Port 1 and the USB port. To view it from the Ethernet connection, see Section 5.11.

5.5 Menu Navigation

On your computer keyboard, type
mm<ENTER>
The menu should look like this:

```
Main Menu
DCP  04/04/2019 11:58
---------------------
1. Status: Error
2. View Live Data
3. View Log
4. Off-load Data
5. Erase Log
6. Configure Station
7. Exit
```

The main menu leads to sub-menus by entering the number of your choice. If nothing is entered the menu will time out and the Row/Column display will return.

Appendix pages B1 thru B5 illustrate the menu structure of the NovaLogger.

5.6 Configure Station Settings

From the Main Menu, type
6<ENTER> Configure Station
1<ENTER> Station Settings
The menu should look like this:

```
Station Settings
----------------
1. Station Name:    DCP
2. Wind Interval:   5 seconds
3. Set the Clock:   04/04/2019 11:55 (Thursday)
4. Battery Saver:   OFF
5. Telnet Password:
6. Exit
```

Item 1 Enter a name for the station
Item 2 Set the integration time for the wind sensors: 3, 5, 10 or 15 seconds.
Item 3 Set the Clock

Enter the current date [MM/DD/YYYY format]:
Input the correct date and press <ENTER>.
If you do not wish to change the date, press <ENTER> to skip.
Enter the current time in 24-hour format (HH:MM[:SS]):
Input the time and press <ENTER>. The Seconds field is optional.
If you do not wish to change the time, press <ENTER> to skip.
An internal battery will keep the clock operating whenever the main power source is disconnected.

Item 4 Not available with the current firmware.
Item 5 Enter a password if you plan to use the Ethernet connection.

5.7 Configure Logger Settings

From the Main Menu, type
6<ENTER> Configure Station
2<ENTER> Logger Settings
The menu should look like this:

```
Logger Settings
---------------
1. Averaging Period: 1 minutes
2. Logging Interval: 5 minutes
3. Log Derived Values: Yes
4. Automatically offload data to USB: No
5. Configure logger Emails: Disabled
6. Exit
```

Item 1 Set the averaging period for all sensors from 1 to 60 minutes
Item 2 Set the logging interval from 1 to 60 minutes
Item 3 Log Derived Values (e.g. Dew Point and Heat Index are derived if a temperature and humidity sensor are each configured as primary sensors; these can be logged if needed.)
Item 4 If you plan to leave a USB flash drive connected for continuous upload, then enter "Y"
Item 5 Not available with the current firmware.

5.8 View Sensor Configuration

From the Main Menu, type
6<ENTER> Configure Station
3<ENTER> Sensors
1<ENTER> Sensor Configuration
Sensor Configuration Example:

```
                              | Sensor Configuration |
-------------------------------------------------------------------------------
    Name     Type              Model                     Input      Cal.  Status
-------------------------------------------------------------------------------
 1. WS      *Wind Speed       200-WS-01/02              WND SPD2   0.000 Healthy
 2. RN      *Precipitation    Tipping Bucket Gauge      RAIN       0.010 Healthy
 3. BP      *Pressure         110-WS-16BP               A01        0.000 Healthy
 4. RH      *Humidity         110-WS-16TH               A02        0.000 Healthy
 5. TP      *Temperature      225-501/110-WS-16TH       A03        0.000 Healthy
 6. WD      *Wind Direction   200-WS-02E/05E            WND DIR2   0.000 Healthy
-------------------------------------------------------------------------------
(Primary sensors are indicated by a '*' next to the type)
```

Sensors can be added [A], deleted [D], or updated [U] from this menu. NovaLynx has pre-programmed all sensors that were ordered with the NovaLogger. Refer to Section 6.3 to add additional sensors.

5.9 View Live Data

The sensors must be connected to see valid data. Live data is useful for verifying that each sensor is working properly. Live data is displayed in three formats.

From the Main Menu, type
2<ENTER> View Live Data
1<ENTER> Formatted Weather Data
(Complete weather station example.)

```
                    ====================
                    | Current Conditions |
================================================================================
  Station: NL32                                          03/15/2018  08:03:25
================================================================================

WIND              :  NNW at 0.0 mph
10-Min PEAK       :  9.2 mph
WIND CHILL        :  70.6 F
TEMPERATURE       :  70.6 F
TODAY'S LOW/HIGH  :  Low:   68.7 F at 07:24   High:   70.6 F at 08:03
HUMIDITY          :  3 %
TODAY'S LOW/HIGH  :  Low:      2 % at 07:57   High:      3 % at 08:03
HEAT INDEX        :  70.6 F
DEW POINT         :  -12.8 F
BAROMETER         :  28.27 inHg
TODAY'S LOW/HIGH  :  Low: 28.26 inHg at 07:57   High: 28.27 inHg at 08:03
PRECIPITATION     :  Past Hr: 0.00 in   Today: 0.00 in   This Month: 0.00 in

================================================================================
```

-OR-
2<ENTER> Formatted Data by Sensor Name

```
DCP  Current Values
------------------------------
     Pot:    V = 4.964 V
------------------------------
```

-OR-
3<ENTER> Scrolling Data by Sensor Name

```
Current Values
--------------
Press 'p' or 'P' to pause.
Press any other key to quit.

Pot:    V = 4.963 V
Pot:    V = 4.962 V
Pot:    V = 4.964 V
```

5.10 Set up the Ports

The NL32 NovaLogger has 14 data ports, not all of which will be needed for any one application. Ports that are not being used should be disabled to conserve power.

From the Main Menu, type
6<ENTER> Configure Station
4<ENTER> Ports
NOTE: The '' in front of a port number indicates the port currently in use.*

```
                    ------------------------------
                    | Current Port Configuration |
-------------------------------------------------------------------------
  Port   Name     Assignment  Details      Speed Len Parity Protocol
-------------------------------------------------------------------------
   1    Serial 1        User  Row/Col       9600  8  None   RS232 NH
   2    Serial 2    Disabled  --           38400  8  None   RS232 NH
   3    Serial 3    Disabled  --           38400  8  None   RS232 NH
-------------------------------------------------------------------------
   4    Serial 4    Disabled  --           38400  8  None   RS232 NH
   5    Serial 5    Disabled  --           38400  8  None   RS232 NH
   6    Serial 6    Disabled  --           38400  8  None   RS232 NH
-------------------------------------------------------------------------
   7    Serial 7    Disabled  --           38400  8  None   RS232 NH
   8    Serial 8    Disabled  --           38400  8  None   RS232 NH
   9    Serial 9    Disabled  --           38400  8  None   RS232 NH
-------------------------------------------------------------------------
  10   Serial 10    Disabled  --           38400  8  None   RS232 NH
  11      SDI-12      Sensor  --            1200  7  Even   RS232 NH
 *12         USB        User  Row/Col    1.1/2.0  -  ----   Serial
-------------------------------------------------------------------------
  13    Ethernet    Disabled  --          ------  -  ----   Network
  14       Wi-Fi    Disabled  --          24 Mbs  -  ----   Network
-------------------------------------------------------------------------
```

5.10.1 Serial Ports 1 – 10

n <ENTER> where n is 1 to 10
The menu should look like this: 

```
Serial 1 Configuration
----------------------
1. Disable
2. Output:      Row/Col, 5 sec
3. Speed:       9600
4. Protocol:    8,None,RS232 NH
5. Modem:       No
6. Exit
```

Item 1 Enable / Disable the port
Item 2 Select an output format if real-time data is required*
Item 3 Set Baud (300 – 57600)
Item 4 Set bits, parity, format (RS232, 422, 485) and handshake
Item 5 Enable / Disable Modem function

5.10.2 SDI-12 Port

Settings for the SDI-12 port cannot be changed. There are no adjustments to be made.

5.10.3 USB Port

12 <ENTER>
The menu should look like this: 

```
USB Configuration
-----------------
1. Disable
2. Output:      Row/Col, 5 sec
3. Exit
```

Item 1 Enable / Disable the port
Item 2 Select an output format if real-time data is required.*

*See section 5.11 for examples

5.10.4 Ethernet Port

The Ethernet connection setup cannot be changed while using a Telnet session. The logger must be connected by the USB or RS232 serial cable. Also, log files cannot be downloaded over the Telnet connection; however, it is possible to use the "View Log" menu to examine stored data.

Requirements for network access:

1. Access is by Telnet only.
2. The NovaLogger requires a static IP address and port number. Ask your IT department to set these up on the local area network (LAN). Port 23 is often used for Telnet.
3. Dynamic Host Configuration Protocol (DHCP) is not supported.
4. The NovaLogger supports only one user connection on each port at any one time.
5. Network access can be protected by setting a password for the NovaLogger. If no password is entered you may not be able to open a Telnet session.

Connect to the NovaLogger using either the RS232 or USB Serial connection method. Launch the terminal program and type mm<ENTER> to access the NovaLogger menu system.

Step 1 Set the Telnet Password

From the Main Menu, type
6<ENTER> Configure Station
1<ENTER> Station Settings
5<ENTER> Telnet Password: (enter your password)

Step 2 Configure the Ethernet Port

From the Main Menu, type
6<ENTER> Configure Station
4<ENTER> Ports
13<ENTER> Ethernet
If item 4 is "Switch to Manual Configuration" then type
4<ENTER> The menu should look like this:

```
Ethernet Configuration
----------------------
1. Disable
2. Output:      None
3. Internet Gateway Control: Disabled
4. Telnet Port: 23
5. Switch to Automatic Configuration
6. IP Address:  0.0.0.0
7. Subnet Mask: 0.0.0.0
8. Gateway:     0.0.0.0
9. DNS:         0.0.0.0
10. Exit
```

Item 1 Toggle the Ethernet port on or off.
Item 2 Select an output format for real-time data if desired (see Section 5.11 for options).
Item 3 Not available with the current firmware.
Item 4 Use the port number assigned by the IT department.
Item 5 Not available with the current firmware.
Item 6 Enter the static IP address assigned by your IT department.
Item 7 Use 255.255.255.0 unless your IT department determines otherwise.
Item 8 Use the Gateway address assigned to your network router.
Item 9 Use 0.0.0.0 unless your IT department determines otherwise.

Finish entering the Ethernet parameters and then exit out of the menus until asked whether you are ready to reboot. Select "Y" to apply the new settings.

Step 3 Connect to the Ethernet Port

Connect the NovaLogger to your LAN and turn on power. Open a Telnet application on a computer and then enter the IP address, select Telnet, and enter the port number. Click to start the connection. When connected, type mm<ENTER> to access the Main Menu.

5.11 Select the Output Format for Real-Time Data

Real-time data can be output from various ports available on the logger. This function is used to send data to display software or onto a network. Data is transmitted on a port after exiting all menus.

From the Main Menu, type
6<ENTER> Configure Station
4<ENTER> Ports
n<ENTER> Where n is a port number such as Serial 1, USB, or Ethernet
2<ENTER> The menu should look like this:

```
Output Format Menu
------------------
1.  No Output
2.  Current Observations
3. *Row and Column
4.  Aloha
5.  WS16 Row/Col
6.  Exit Menu
```

1<ENTER> No Output

-OR-
2<ENTER> Current Observations
Complete Weather Station Example

```
                    ====================
                    | Current Conditions |
================================================================================
  Station: NL32                                          03/15/2018  08:03:25
================================================================================

WIND              :  NNW at 0.0 mph
10-Min PEAK       :  9.2 mph
WIND CHILL        :  70.6 F
TEMPERATURE       :  70.6 F
TODAY'S LOW/HIGH  :  Low:   68.7 F at 07:24   High:   70.6 F at 08:03
HUMIDITY          :  3 %
TODAY'S LOW/HIGH  :  Low:      2 % at 07:57   High:      3 % at 08:03
HEAT INDEX        :  70.6 F
DEW POINT         :  -12.8 F
BAROMETER         :  28.27 inHg
TODAY'S LOW/HIGH  :  Low: 28.26 inHg at 07:57   High: 28.27 inHg at 08:03
PRECIPITATION     :  Past Hr: 0.00 in   Today: 0.00 in   This Month: 0.00 in

================================================================================
```

-OR-
3<ENTER> Row and Column

```
03/15/2018, 08:05:30, 0, 70.716, 0, 28.266, 3.1581, -12.698, 70.716, 70.776, 326.92
03/15/2018, 08:05:35, 0, 70.716, 0, 28.266, 3.1642, -12.698, 70.716, 70.805, 326.92
```

-OR-
5<ENTER> WS16 Row/Col

```
03/15/2018, 08:06:50,   0.00,   0.00,  28.27,   3.16,  70.86, 326.92,  70.78, -12.62
03/15/2018, 08:06:55,   0.00,   0.00,  28.27,   3.07,  70.95, 327.27,  70.78, -12.62
```

WS16 Row/Col format is designed to be used with 195-NL32STR Graphical Display Software.

NOTE: Aloha format (option 4) is not available on the NovaLogger.

After selecting an output format you will be prompted to choose an output frequency (3 to 60 seconds).

6 INSTALLATION

The NL32 NovaLogger must be mounted indoors or in a weather-tight enclosure. The system should include a back-up battery (12V typ.) capable of operating the logger for an extended period when there is a power outage. Where AC power is not available a solar panel is needed to keep the back-up battery charged.

All cables that connect to the NovaLogger should have a "drip-loop" below the level of the enclosure, so that rain water will not follow the cable to the connection terminals. Use cable ties to support the weight of each cable so that there is no tension on the wires that are connected to the logger. Any cables that include a shield wire should connect the shield(s) to a common earth grounding point. Use the GND screw terminal on the front of the NovaLogger to connect the logger to the common earth grounding point. **Failure to provide earth grounding could lead to damage to the sensors and logger.**

To connect wiring to the terminals, use a small flat-blade screwdriver to press down on the terminal's spring-loaded button and insert the wire. To remove a wire, press the button to release the wire before gently pulling it out.

6.1 Analog Sensors

6.1.1 Voltage and Thermistor Sensors

Channels A01 to A15 are voltage inputs with the following ranges: 25mV, 50mV, 100mV, 250mV, 500mV, 1V, 2.5V, and 5V. Channels A01 to A15 also accommodate NTC J-curve thermistor sensors (10 kohm at 25ºC, linearized two lead).

Refer to the "Input" column of the Sensor Configuration table (See Section 5.8) to determine whether any sensors connect to channels A01 through A15. In the example below the Pressure, Humidity and Temperature sensors connect to A01, A02, and A03 respectively.

| Sensor Configuration |

	Name	Type	Model	Input	Cal.	Status
1.	WS	*Wind Speed	200-WS-01/02	WND SPD2	0.000	Healthy
2.	RN	*Precipitation	Tipping Bucket Gauge	RAIN	0.010	Healthy
3.	BP	*Pressure	110-WS-16BP	A01	0.000	Healthy
4.	RH	*Humidity	110-WS-16TH	A02	0.000	Healthy
5.	TP	*Temperature	225-501/110-WS-16TH	A03	0.000	Healthy
6.	WD	*Wind Direction	200-WS-02E/05E	WND DIR2	0.000	Healthy

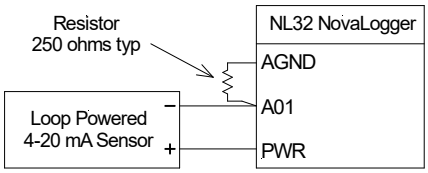
(Primary sensors are indicated by a '*' next to the type)

Connect the ground of the sensor to any of the available AGND terminals. Connect the signal output of the sensor to the appropriate channel, and then choose an appropriate excitation power terminal (3.3V, 5V or PWR) for the sensor. The PWR terminals are the same voltage as the logger power supply, typically 12-15 volts unregulated. Connect the shield wire to the common earth grounding point.

NOTE: The Battery Saver feature is not available in the current firmware version. This means the power is not switched to the 3.3V SW, 5V SW, and PWR SW terminals, but is on continuously.

6.1.2 Current Output Sensors

Sensors with current outputs such as 4-20 mA may be connected to channels A01 through A15 **as long as an appropriately-sized resistor is connected from the signal input to an AGND terminal**. For instance, a 250 ohm resistor connected from the input to AGND will convert a 4-20 mA current signal to a 1 to 5 volt signal. The calculation from Ohm's law is simple:



Current x Resistance = Voltage
0.004 Amps x 250 ohms = 1 volt
0.020 Amps x 250 ohms = 5 volts

6.1.3 Pyranometers

The SOLAR input is used for connecting self-powered current output pyranometers. This input is rated for signals from microamperes to 100 milliamps. Check the instruction manual of the pyranometer to determine the polarity of the sensor. Connect the positive output to the SOLAR input, and the negative output to an AGND terminal. *Note: Amplified pyranometers (with a 0-5V output, for instance) should be connected to one of the voltage input channels A01 thru A015.*

6.1.4 Wind Speed and Direction

There are two wind speed inputs, suitable for AC and DC pulse anemometers with outputs ranging from microvolts to 5 volts. Connect the signal output of the anemometer(s) to either WND SPD1 or WND SPD2 (according to the Sensor Configuration Table) and the sensor ground to DGND. If there is a shield wire connect it to the common earth grounding point.

WND DIR1 and WND DIR2 connect resistance (potentiometer) type sensors. Connect the sensor excitation wire to WND EXC and the sensor ground to DGND.

6.2 Digital Sensors

6.2.1 Tipping Bucket Rain Gauge

A rain gauge with dry contact closure output is connected to the RAIN input. Connect the rain gauge ground to DGND.

6.2.2 SDI-12 Sensor

There is one port for SDI-12 sensors; however, the current firmware does not support SDI-12. Consult the factory to add sensors using this protocol.

6.2.3 Serial Output Sensors

Serial Ports #1 through #10 may be used for sensors with serial output. WindSonic Options 1, 2 and 3 as well as the WindObserver series wind speed and directions sensors are compatible.

To add a sensor, from the Sensor Configuration screen select Add, then select Wind Speed (Item 2) from the Sensor Types menu. Select the 200-1390-PK-026 sensor (Item 7). Enter the port settings and units to match the sensor.

```
WndSonic:   WD = 34.0 deg
            WS = 1.52 m/s
            PK = 2.71 m/s
```

Sample Data: The WindSonic outputs both wind direction and wind speed. The NovaLogger keeps track of the peak speed.

NOTE: See Appendix D for information about using Transparent Mode with serial output sensors.

6.3 Program Additional Sensors

NovaLynx has pre-programmed all sensors that were ordered with the NovaLogger. Additional sensors can be added to the Sensor Configuration Table provided their output is compatible with the logger. Plug & Measure™ technology applies to several sensors available from NovaLynx. Sensors that are not listed may be set up as generic sensors. (See Appendix C for a list of Plug & Measure™ sensors.)

Data from all the sensors are output from the logger in the order they appear in the Sensor Configuration Table. An exception is that derived parameters are inserted following the primary sensor whose data is used. If the ordering of the data in the output file is important then keep in mind that the sensors must be added in the correct sequence. A new sensor cannot later be inserted between two existing sensors. To re-order the list it may be necessary to delete existing sensors up to the level where a new sensor is added, then re-enter the original sensors below that level.

Any changes to the Sensor Configuration Table will require the logger to erase existing logged data. Always download the logger before making changes to the configuration if there is any data you wish to save.

6.3.1 Plug & Measure™ Sensors

1. Refer to Appendix C to determine whether your sensor is listed.
2. Select the type of sensor from the listing of types, such as temperature, humidity, pressure, etc.
3. Select the specific model number of the sensor.
4. Select an available input channel. The NovaLogger presents a list of possible channels based on the sensor model number that was entered.
5. Depending on the sensor model, the wizard may ask for the sensor's calibration factor.
6. If the sensor uses a serial port, the wizard will present a configuration menu for setting the port parameters, such as baud rate, parity, and data length.

NOTE: Often different models of a sensor have the same output characteristics even though the model number is different. If any sensor has the same output range / units as a listed sensor then the listed sensor may be selected for setup purposes.

6.3.2 Generic Sensors

Generic sensors can report data as a simple voltage or current reading. If the logged data is going to be post-processed (in a spreadsheet, for instance) then the raw output (volts or mA) is a good option as there will be less rounding error in the computations.

1. To scale the output in volts, select the appropriate range (100 mV, 1V, 2.5V, or 5 Volt) which best matches the sensor's full scale output.
1. To scale the output in mA select Item 3 if a 250 ohm resistor is connected. If using a different resistor, select Item 7 and enter the value of the resistor used.
2. To scale in any other engineering units select Item 6 "Parameterized Generic". The next section explains how to calculate the required set-up information.

```
Sensors: Generic
----------------
 1. 5 Volt (FS)
 2. 1 Volt (FS)
 3. 4-20mA (FS)
 4. 2.5 Volt (FS)
 5. 100 mVolt (FS)
 6. Parameterized Generic
 7. 4-20mA (FS) (Resistor)
```

6.3.3 Parameterized Generic Sensors

Refer to the "Sensor Types" table below to determine whether the sensor category and units are available for the sensor being connected. Using a Sensor Type and Unit that is on the list helps document the data when it is displayed or uploaded. If there are no suitable units then the Generic / V label can be applied, but of course one must remember what it really represents. There is no option to add units to this listing.

Sensor Types	
1. Generic	V, mV
2. Wind Direction	deg
3. Temperature	F, C, K, R
4. Humidity	%
5. Pressure	inHg, hPa
6. Solar Radiation	W/m^2
7. Evaporation	in, ft, mm, cm, m
8. Soil Moisture	%
9. Water Level	in, ft, mm, cm, m
10. Ambient Light	cd/m^2
11. Quantum	uM/s/m^2

There are several steps to the process of adding a generic sensor including some calculations. Once the sensor is set up there is no going back to view or edit the parameters, so it is useful to create and save a worksheet on which to make the calculations and record the settings. Make a photocopy of the Generic Sensor Worksheet (below). **OR BETTER YET**, **Download** the NovaLogger Generic Sensor Worksheet from our website:

https://novalynx.com/store/pc/195-NL32-Data-Logger-3p1048.htm

NovaLogger Generic Sensor Worksheet

Step 1 **Refer to the sensor data sheet and record the calibration range and units**

Minimum Output	**A**		**Units**
Maximum Output	**B**		

Step 2 **Refer to the sensor data sheet and record the electrical output range in Volts**

Minimum Volts	**C**		**Units**
Maximum Volts	**D**		Volts

Step 3 **Determine the A/D converter range**

Range	**E**		Volts

Step 4 **Calculate the logger gain**

Gain = E / (D - C)	

Step 5 **Calculate the logger offset**

Offset = (C / E * Gain * (B - A)) * -1	

Step 1 Determine the sensor calibration range

The sensor calibration range is two numbers representing the minimum reading and maximum reading of the sensor expressed in the units chosen from the list above. Suppose the sensor's output ranges from 5 to 15 inches, but the desired output is in millimeters. In that case convert both numbers to millimeters (5" = 127mm, 15" = 381mm). Enter the Minimum Output (Box A) and Maximum Output (Box B) and units in the worksheet.

Some data sheets do not express the range as a minimum and maximum reading. The Minimum Output is often expressed as an "offset" or "intercept". The Maximum Output can be calculated from the "sensitivity" of the sensor

Example: Silicon Cell Pyranometer, 0-2.5 V, sensitivity 2.0 mV per Wm^{-2}

Maximum Output = 2.5V / 0.002V = 1,250 Wm^{-2}

Step 2 Determine the electrical output range

Find the electrical output range of the sensor in the data sheet. If needed, convert the information to volts before recording in the worksheet.

Example 1: The data sheet range is 0 – 250 mV. Enter as 0 and 0.25 in worksheet boxes C and D.

Example 2: The data sheet range is 4-20 mA. If the resistor you are using is 250 ohms, the current will be converted to a 1 – 5 volt signal. Enter as 1 and 5 in the worksheet boxes C and D.

Step 3 Determine the A/D converter range

The logger will use the Maximum Electrical output (from Box D) to decide which range to use on the A/D converter. The choices are:

.025 V
.050 V
.100 V
.250 V
1.00 V
2.50 V
5.00 V

Refer to the Maximum Volts (Box D) in your worksheet and choose the range that most closely fits (equal to or larger than the Maximum Volts). Write the A/D range in Box E.

Step 4 Calculate the logger gain

Gain = E / (D - C)

Where the letters "C", "D" and "E" refer to the boxes referenced above.

Step 5 **Calculate the logger offset** (*NOTE: If Box C = zero then the offset is zero*)

Offset = (C / E * Gain * (B - A)) * -1

Where the letters "A", "B", "C", and "E" refer to the boxes referenced above.

Step 6 **Program the logger**

A. Upload the logger if it contains any data you want to save.

B. From the Main Menu, type

6<ENTER> Configure Station

3<ENTER> Sensors

1<ENTER> Sensor Configuration

A<ENTER> Add Device

Do you want to off-load the existing log memory before proceeding? [Y or N]:

Continue? [Y or N]:

1<ENTER> Generic

6<ENTER> Parameterized Generic

Enter the gain: **(Enter the GAIN from the worksheet. Round if needed)**

Enter the offset: **(Enter the OFFSET from the worksheet. Round if needed)**

Enter the maximum voltage the sensor will output: **(Enter the Maximum Volts from Box D)** *Exception: if the Maximum Volts is .025 then enter .02 instead (bug fix).*

The "Sensor Types" menu will display. **Enter the sensor Type and Units** that you chose when you completed Step 1 of the worksheet. The choice will be reflected in the next question that is asked (Example: Temperature in Celsius)

Enter the Temperature (C) value for when the sensor outputs its minimum voltage: **(Enter the Minimum Output from Box A)**

Enter the Temperature (C) value for when the sensor outputs 5.00V: **(Enter the Maximum Output from Box B)**

Select Channel [1-15] or Quit [Q]: **(Select an available channel)**

Enter sensor name [maximum 8 characters]: **(Enter a name)**

Is this the primary Temperature sensor? [Y or N]: **(If the data will be used for calculating a derived sensor value enter "Y", otherwise "N").**

C. The Sensor Configuration table will display. If you made a mistake entering any parameters then delete the sensor and start over.

Q<ENTER> Quit Sensor Configuration. The following messages will display:

Configuration has changed.

Deleting log memory, please wait...

NOTE: Logging of data is suspended until the logger is rebooted.

3<ENTER> Exit

7<ENTER> Exit

Configuration has changed, reboot DCP station now? [Y or N]:

Y<ENTER> *Station reboots…*

NOTE: A clever way to document your setup is to copy / paste the information from your terminal window into a text document.

Step 7 Verify the calibration

From the Main Menu, type
2<ENTER> View Live Data
2<ENTER> Formatted Data by Sensor Name

Locate the newly added sensor and reading. The reading is updated periodically. Use a voltage source to input a signal to the logger on the input channel selected for the generic sensor. It is best to input at least two signals, one at 20% and the other at 80% of the range. Check the data to verify the calibration is correct.

If you downloaded the NovaLogger Generic Sensor Worksheet from our website and entered the calibration information, it will have calculated a range of test points and expected results for each point. Enter your measurements from as many points as you choose in the column labeled "Measured". The % Full Scale Error will be calculated and a graph will show the results.

NovaLogger Generic Sensor Worksheet

Step 1 Refer to the sensor data sheet and record the calibration range and units

Minimum Output	A	-40	Units
Maximum Output	B	60	Deg C

Step 2 Refer to the sensor data sheet and record the electrical output range in Volts

Minimum Volts	C	0	Units
Maximum Volts	D	0.25	Volts

Step 3 Determine the A/D converter range

Range	E	0.25	Volts

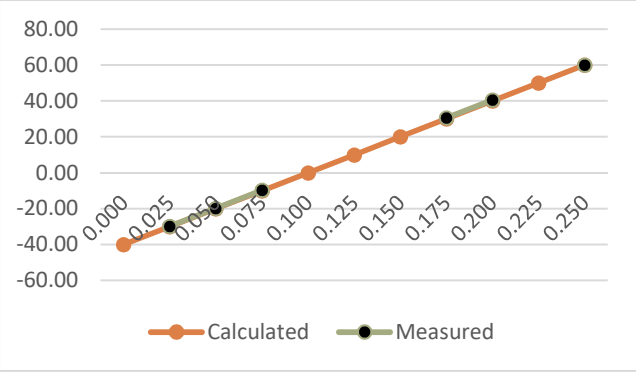
Step 4 Calculate the logger gain

Gain = E / (D - C)	1

Step 5 Calculate the logger offset

Offset = (C / E * Gain * (B - A)) * -1	0

% FS Test Point	Test Volts	Calculated	Measured	% FS Error
0	0.000	-40.00		
10	0.025	-30.00	-29.95	0.1%
20	0.050	-20.00	-19.86	0.1%
30	0.075	-10.00	-9.79	0.2%
40	0.100	0.00		
50	0.125	10.00		
60	0.150	20.00		
70	0.175	30.00	30.52	0.5%
80	0.200	40.00	40.61	0.6%
90	0.225	50.00		
100	0.250	60.00	59.95	0.0%



6.4 Derived Sensors

Derived sensors are values calculated by the NovaLogger using data from existing "Primary" sensors. Designate a sensor as "Primary" when it is added to the Sensor Configuration table or at a later time by selecting the Update Device [U] option. Refer to the table below to determine which Primary sensors are required for each derived sensor.

Derived Parameter	Name Extension	Required Primary Sensors
Peak Wind	[name].PK	Wind Speed
Wind Chill	[name].WC	Temperature
		Wind Speed
Dew Point	[name].DP	Temperature
		Relative Humidity
Heat Index	[name].HI	Temperature
		Relative Humidity
Solar Radiation Accumulation	[name].SRA	Solar Radiation

The derived sensors are displayed in all the real-time formats and can be included in the logged data if desired. To enable logging of derived parameters, from the Main Menu type

6<ENTER> Configure Station

2<ENTER> Logger Settings

3<ENTER> Log Derived Values

NOTE: Changing logging of derived data will cause
the contents of the log to be deleted.
Do you still want to change this setting?

Y <ENTER>

Should derived values (like dew point) be logged?

Y <ENTER>

Sample of logged data including derived parameters:

DATE	TIME	TEMP.TP	RH.RH	RH.DP	RH.HI	SOLAR.SR	SOLAR.SRA	WIND.WS	WIND.PK	WIND.WC
MM/DD/YYYY	HH:MM	C	%	C	C	W/m^2	KJ/m^2	m/s	m/s	C
5/29/2019	14:10	35.376	82.852	32.013	60	496.39	148.91	31.999	32.008	35.376
5/29/2019	14:15	35.377	82.851	32.014	60	496.38	148.91	31.99	32.008	35.377
5/29/2019	14:20	35.376	82.851	32.013	60	496.38	148.92	31.999	32.008	35.376

6.5 Sensor Calibration

To adjust the zero offset of a sensor, from the Main Menu, type

6<ENTER> Configure Station

3<ENTER> Sensors

1<ENTER> Sensor Configuration

U<ENTER> Update Device

3<ENTER> Change calibration value

Please enter calibration number or Q to Quit: 5

Sensor 1's calibration value has been changed to 5.000

```
Update Sensor Menu
------------------
1. Change device name
2. Change input channel
3. Change calibration value
4. Make primary
```

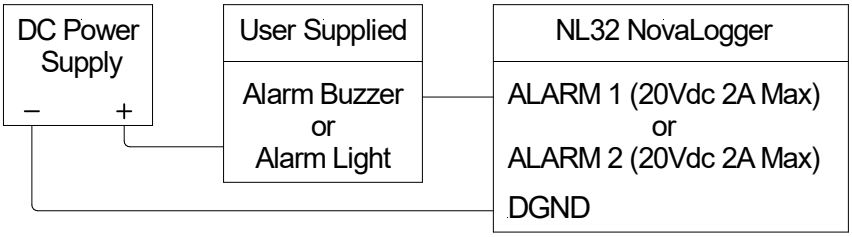
7 SET ALARMS

The ALARM 1 and ALARM 2 push terminals on the NovaLogger are open collector circuits that switch the connection to DGND (digital ground reference) when an alarm threshold is reached. Alarms can only be set for sensors that have already been added.

From the Main Menu, type
6<ENTER> Configure Station
5<ENTER> Alarms

```
                        ----------------------
                        | Alarm Configuration |
-------------------------------------------------------------------------------
 #  Sensor         Type    Output  Low_THR  High_THR  On_Delay  Off_Delay
-------------------------------------------------------------------------------
 1. Temp           Incl      A1     32.00    45.00       5         30
 2. Inactive
 3. Inactive
```

Typical Alarm Connection
If needed, replace the alarm buzzer or light with a relay if you need to switch more than 2 amps or are driving an AC circuit.



Alarms can be added or deleted from the list. When adding, a series of questions will guide you through the process. Limit current into the open collector circuit to 2A DC maximum.

8 UPLOAD LOGGED DATA

The data from the logger can be retrieved over an RS232 or USB serial connection. The logger cannot be downloaded over the Ethernet connection because Telnet does not allow file transfers. A typical method for collecting the logged data is to transfer it to a USB flash drive. There are 3 methods for uploading data to a USB flash drive.

8.1 Push-button USB Flash Drive Upload

The simplest method is to insert a USB flash drive (not included) into the logger and press the upload button. The button will blink green while the transfer is being made. The new data since last download will be copied to the USB flash drive. When the transfer is finished, the transfer button will stay solid green for a few seconds and then turn off. (If the transfer is unsuccessful, the button will blink amber color to indicate the failure.) Remove the USB flash drive after the LED turns off. A file will have been added with the year and month in the file name:

If the file is opened in Excel, the information will be sorted to columns as shown:

NOTE: The sensor labeled "Pot" in this example is a potentiometer that simulates a sensor. It is connected to the 5V reference on the logger. By turning the thumbwheel on the pot the voltage to the input is varied, as shown by the readings.

DATE	TIME	Pot.V
MM/DD/YYYY	HH:MM	V
4/1/2019	14:50	0.04135
4/1/2019	14:55	1.6204
4/1/2019	15:00	2.8635

8.2 Continuous USB Flash Drive Upload

The USB flash drive will be left connected to the logger while it is operating. Accumulated data will be appended to the log file in the USB flash drive once an hour. The USB flash drive can be removed when needed to copy the file to a computer, then reconnected to the logger. The logger will update the flash drive with any data collected while the flash drive was removed.

From the Main Menu type
6<ENTER> Configure Station
2<ENTER> Logger Settings
4<ENTER> Automatically offload data to USB:

Auto offload is currently Disabled
Do you want to change this setting? (Y/N) y
Should the logger automatically offload data to a USB flash drive? (Y/N) y
Auto-offload setting changed.

Be sure to insert the USB flash drive into the logger and leave it there so that the data can be periodically updated. Remove the USB flash drive to copy it to your computer, then replace it. The file name will include the year and month (YYYYMM).

NOTE:
1) *The logger will append new data at the end of each hour.*
2) *The file will continue to grow until the end of the month, at which time a new file will be created.*

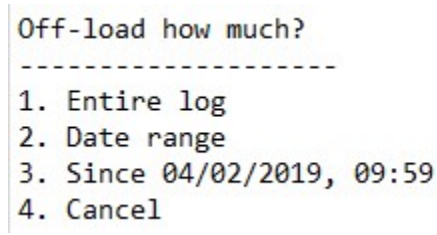
8.3 On-demand USB Flash Drive Upload

This method requires connecting a computer to the logger. The connection can be through the RS232 port, the USB communications port, or an Ethernet connection. A terminal program is required to open the menu of the logger. Be sure to install the USB flash drive in the logger before uploading.

From the Main Menu type:
4<ENTER> Off-load Data

Select the amount to off-load

2<ENTER> USB Flash Drive:



The transfer may take several minutes to complete.
Transferring data to the USB flash drive...
162 Records Transferred

The file will appear on the flash drive with the year, month and day in the name (YYMMDD):

8.4 Upload Files to a Computer

The NL32 NovaLogger uses the Xmodem protocol to transfer files to a computer. Xmodem works only with a direct RS232 or USB serial connection to the NovaLogger. It does not operate over the Ethernet port.

First, the computer establishes communication using a terminal program to open the logger's menu system, then the Xmodem protocol is invoked. The logger waits while the terminal program is switched to receive mode, then the transfer starts. Once the transfer is complete the logger returns to the menu system.

From the Main Menu type:
4<ENTER> Off-load Data

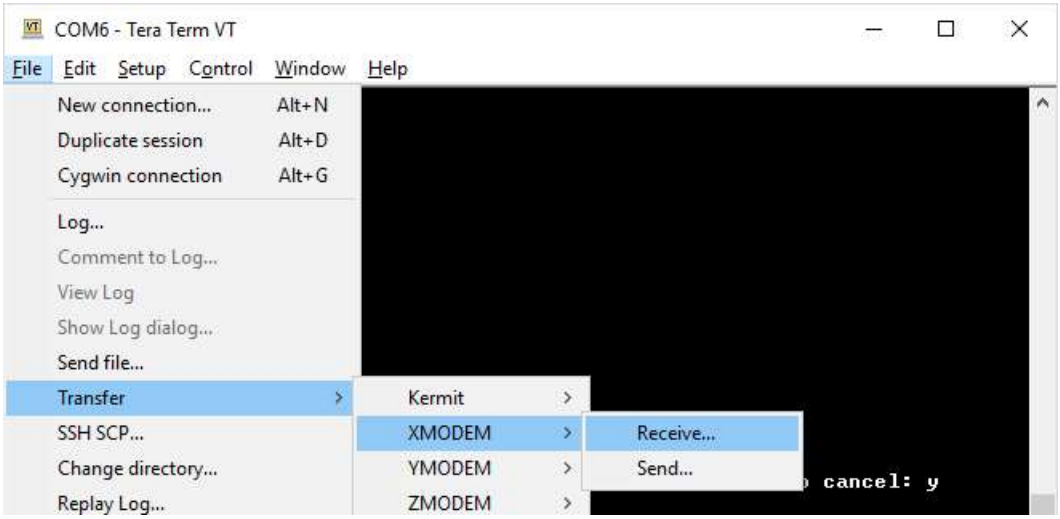
Select the amount to off-load

```
Off-load how much?
--------------------
1. Entire log
2. Date range
3. Since 04/02/2019, 09:59
4. Cancel
```

1<ENTER> Xmodem File Transfer:

Enter 'Y' to begin the Xmodem File Transfer or anything else to cancel: y
Transferring data via Xmodem File Transfer...

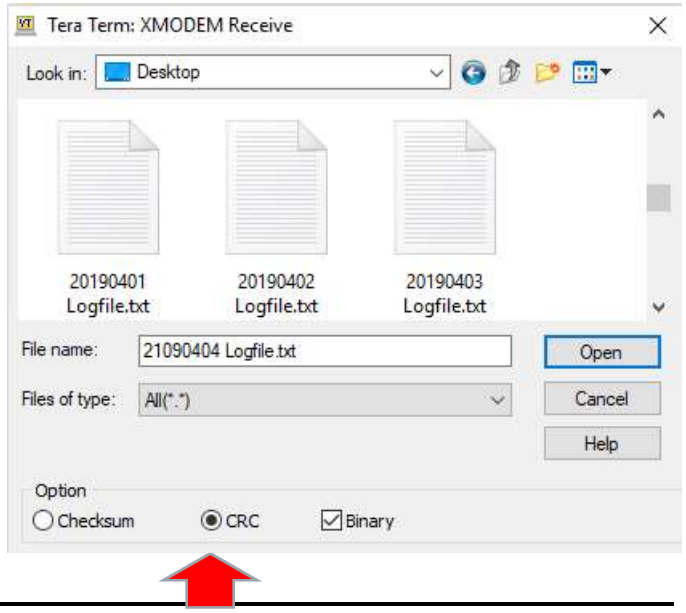
At this point you must switch the terminal program to the receive mode.



You will be asked for a file name. Add the extension you prefer, such as ".txt" or ".csv"

Important! Select the "CRC" radio button before you click "Open"

A dialog box will open showing the progress of the transfer. When transfer is complete the dialog box will close.



9 MAINTENANCE

The NovaLogger requires no calibration or periodic maintenance. If the STATUS LED indicates a fault, check the Main Menu for an indication of the failure. Contact NovaLynx if a fault is indicated and cannot be cleared by power cycling the logger.

Clean the enclosure with a damp cloth if needed.

Replace the internal calendar clock backup battery every 7 years (return to NovaLynx for service).

APPENDIX A – CONNECTOR PINOUT

Serial Port 1 DB9

Pin	Description
1	N/C
2	RS-232 Transmit
3	RS-232 Receive
4	N/C
5	DGND
6	N/C
7	RS-232 RTS
8	RS-232 CTS
9	Input power switched

Serial Port 1 Connector

Pin	Description
1	+5V Switched
2	N/C
3	RS-232 Transmit
4	RS-232 CTS
5	RS-232 Receive
6	RS-232 RTS
7	RS-232 control
8	+3.3V Switched
9	Digital signal reference
10	Input power switched

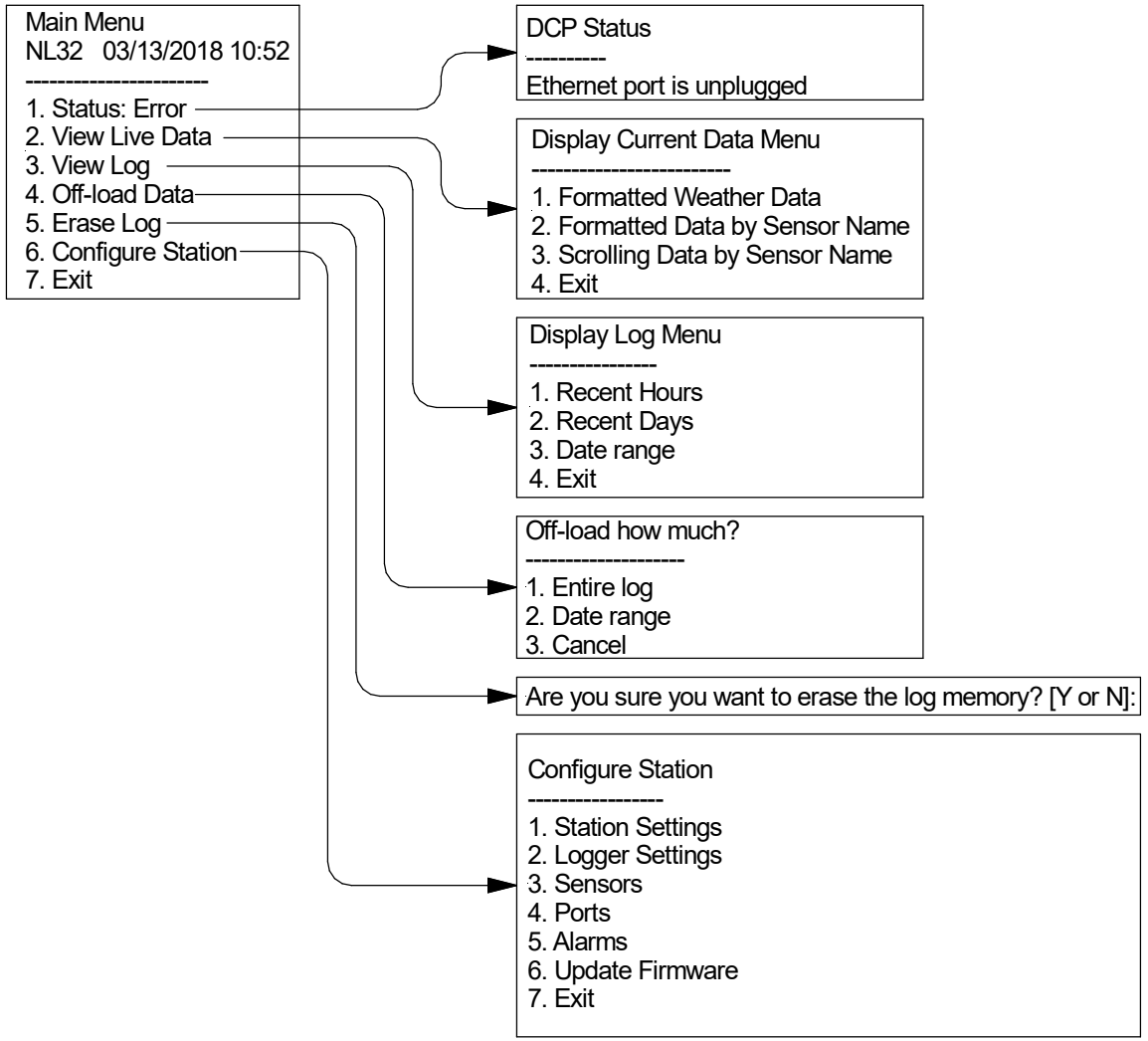
Serial Port 2 Connector

Pin	Description
1	+5V Switched
2	N/C
3	RS-232 Transmit
4	RS-232 CTS
5	RS-232 Receive
6	RS-232 RTS
7	N/C
8	N/C
9	Digital signal reference
10	Input power switched

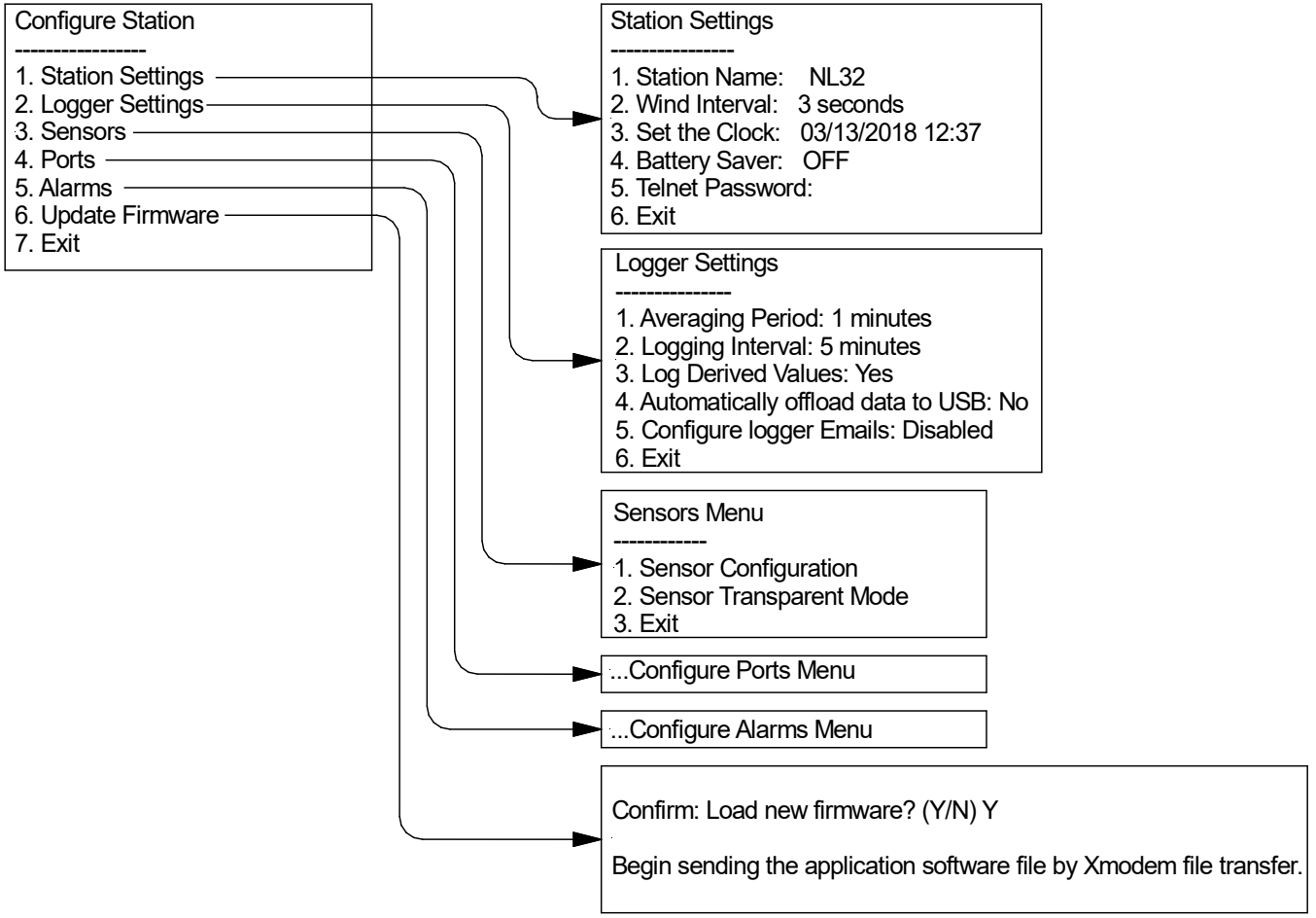
Peripheral Port Connector

Pin	Name	Description
1	5V SW	5 VDC switched power output
2	PWR	Input power as an output
3, 5, 31, 33	PWR SW	Input power switch as an output
7,9,11,13,15,17,19	AGND	Reference for analog inputs
25,27,29	DGND	Reference for digital inputs
21, 23	WND EXC	Excitation output for wind direction sensor
4	A01	Voltage/thermistor input channel
6	A02	Voltage/thermistor input channel
8	A03	Voltage/thermistor input channel
10	A04	Voltage/thermistor input channel
12	A05	Voltage/thermistor input channel
14	A06	Voltage/thermistor input channel
16	A07	Voltage/thermistor input channel
18	A08	Voltage/thermistor input channel
20	SOLAR	Current (pyranometer) input
22	WND DIR1	Wind direction sensor resistance input
24	WND DIR2	Wind direction sensor resistance input
26	WND SPD1	Wind speed sensor pulse inputs
28	WND SPD2	Wind speed sensor pulse inputs
30	RAIN	Rain gauge pulse input
32	ALARM 1	Open collector outputs
34	ALARM 2	Open collector outputs

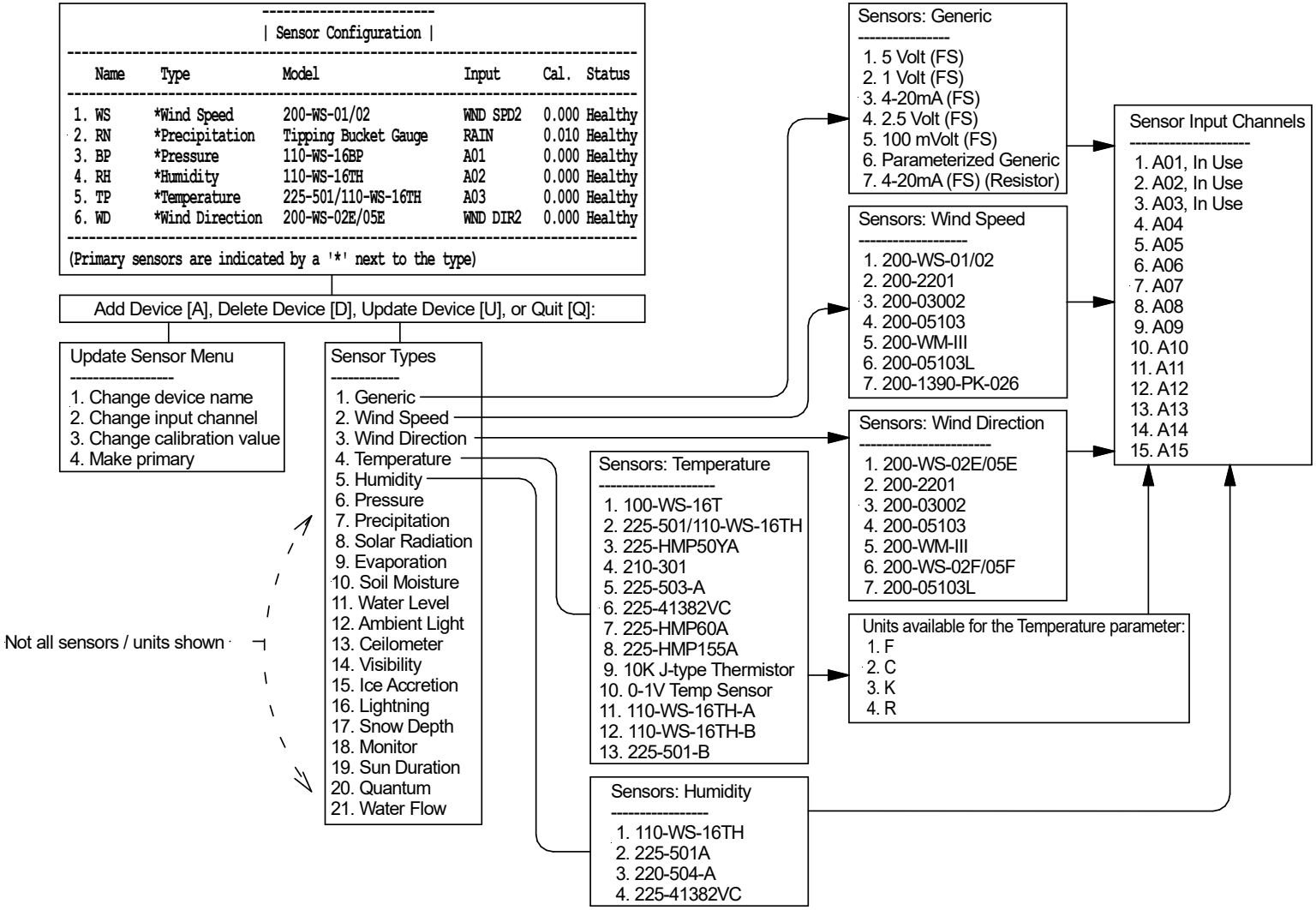
APPENDIX B1 – MAIN MENU



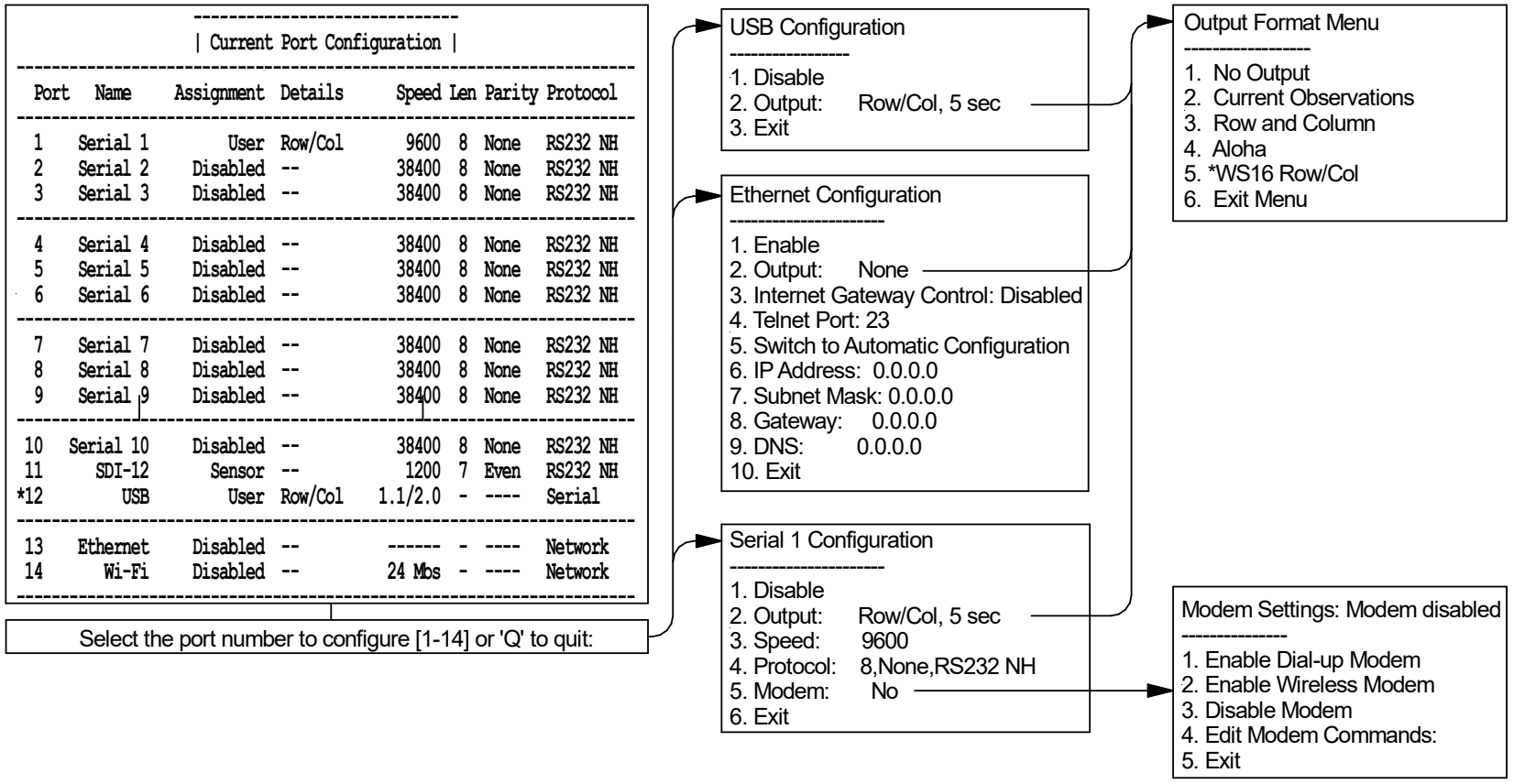
APPENDIX B2 – STATION CONFIGURATION MENU



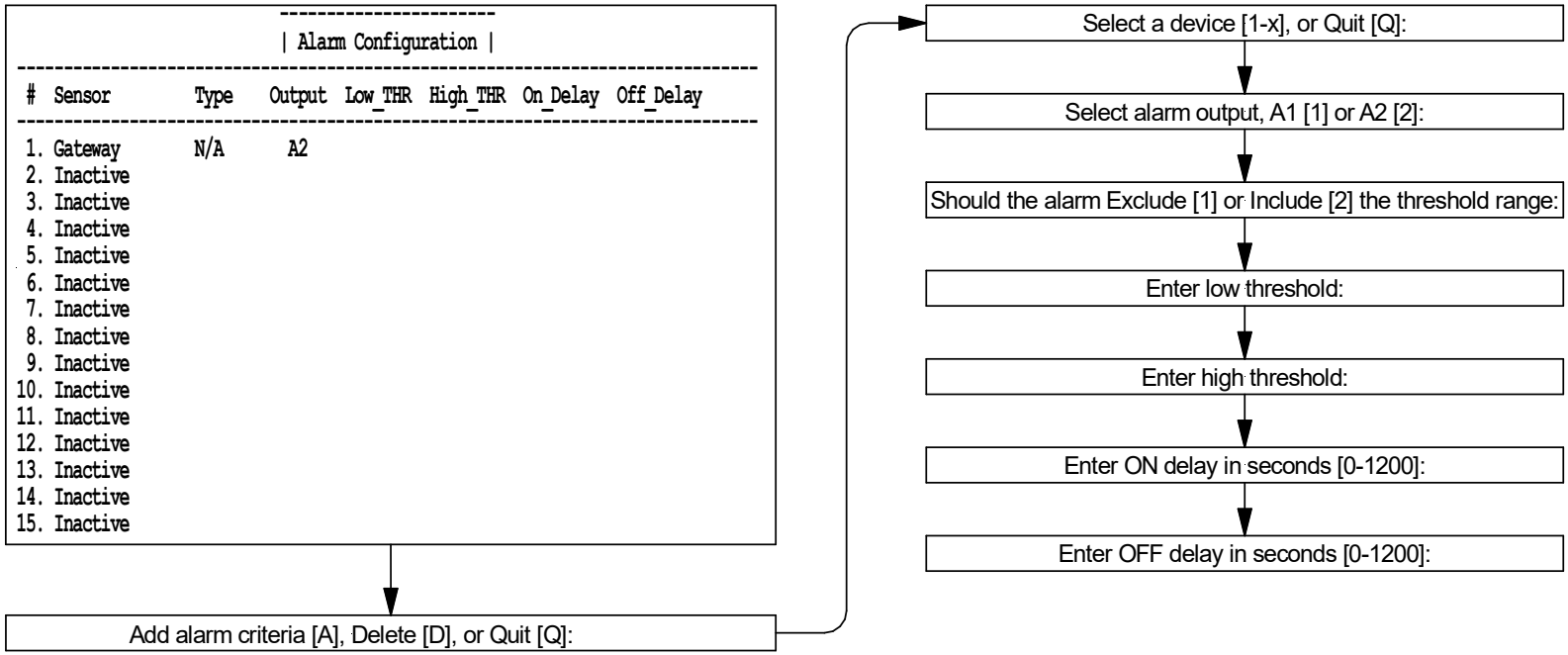
APPENDIX B3 – SENSOR CONFIGURATION MENU



APPENDIX B4 – PORT CONFIGURATION MENU



APPENDIX B5 – ALARM CONFIGURATION MENU



APPENDIX C – PLUG & MEASURE™ SENSORS

NL32 Designation	OEM Make/Model	Electrical Range			Measurement Range		
1. Generic Sensors							
5 Volt (FS)	5 Volt (FS)	0	5	Volts	0	5	Volts
1 Volt (FS)	1 Volt (FS)	0	1	Volts	0	1	Volts
4-20mA (FS)	4-20mA (FS) Use 250 ohm resistor sig-gnd	4	20	ma	4	20	mA
2.5 Volt (FS)	2.5 Volt (FS)	0	2.5	Volts	0	2.5	Volts
100 mVolt (FS)	100 mVolt (FS)	0	100	mV	0	100	mV
Parameterized Generic	Parameterized Generic	various					
4-20mA (FS) (Resistor)	4-20mA (FS) Selectable resistor sig-gnd	4	20	mA	contingent		Volts
2. Wind Speed							
200-WS-01/02	NovaLynx 200-WS-01/02	0	80	Hz	0	100	mph
200-2201	NovaLynx 200-2201	0	84	Hz	0	100	mph
200-03002	RM Young 03002	0	30	Hz	0	51	mph
200-05103	RM Young 05103	0	90	Hz	0	19.7	mph
200-WM-III	Climatronics Mark III (discontinued)	0	69	Hz	0	100	mph
200-05103L	RMY 5103LM (4-20mA use 100 ohm ws-gnd)	4	20	mA	0	100	m/s
200-1390-PK-026	Gill Wind Observer II, WindSonic	serial data output (speed & direction)					
3. Wind Direction							
200-WS-02E/05E	NovaLynx 200-WS-02E/05E	0	3.3	Volts	0	360	Deg
200-2201	NovaLynx 200-2201	0	3.3	Volts	0	360	Deg
200-03002	RM Young 03002	0	3.3	Volts	0	360	Deg
200-05103	RM Young 05103	0	3.3	Volts	0	360	Deg
200-WM-III	Climatronics Mark III (discontinued)	4	20	mA	0	360	Deg
200-WS-02F/05F	NovaLynx 200-WS-02F/05F	0	3.3	Volts	0	360	Deg
200-05103L	RMY 5103LM (4-20mA use 100 ohm wd-gnd)	4	20	mA	0	360	Deg
4. Temperature							
100-WS-16T	NovaLynx 100-WS-16T	337,400	2486	Ohms	-40	60	°C
225-501/110-WS-16TH	Vaisala HMP155D, 225-501B	337,400	2486	Ohms	-40	60	°C
225-HMP50YA	Vaisala HMP60A, 225-HMP60A	0	1	Volts	-40	60	°C
210-301	NovaLynx 210-301	0	3	Volts	0	300	°F
225-503-A	Vaisala HMP155A, 225-503-B	0	1	Volts	-40	60	°C
225-41382VC	RM Young 41382VC	0	1	Volts	-50	50	°C
225-HMP60A	Vaisala HMP60A	0	1	Volts	-40	60	°C
225-HMP155A	Vaisala HMP155A	0	1	Volts	-40	60	°C
10K J-type Thermistor	10K J-type Thermistor NTC	337,400	2486	Ohms	-40	60	°C
0-1V Temp Sensor	0-1V Temp Sensor	0	1	Volts	Programmable		
110-WS-16TH-A	thermistor	337,400	2486	Ohms	-40	60	°C
110-WS-16TH-B	Vaisala-HMP60A	0	1	Volts	-40	60	°C
225-501-B	thermistor	337,400	2486	Ohms	-40	60	°C
5. Humidity							
110-WS-16TH	Vaisala HMP60A	0	1	Volts	0	100	%RH
225-501A	Vaisala HMP155	0	1	Volts	0	100	%RH
220-504-A	Vaisala HMP155	0	1	Volts	0	100	%RH
225-41382VC	RM Young 41382VC	0	1	Volts	0	100	%RH
6. Pressure							
110-WS-16BP	NovaLynx WS-16BP	0	5	Volts	956.6	1041.3	mb/hPa
230-276-6	Setra 276 600 mb	0.1	5.1	Volts	600	1100	mb/hPa
230-276-8	Setra 276 800 mb	0.1	5.1	Volts	800	1100	mb/hPa
230-400	Vaisala 100A 230-PTB1105	0	5	Volts	800	1060	mb/hPa
230-405	Vaisala 100B, 230-PYB1104	0	5	Volts	600	1060	mb/hPa
230-278-6	Setra 278 600 mb, 230-278.6	0	5	Volts	600	1100	mb/hPa
230-PTB330-2	Vaisala PTB330-2	serial data output (barometric pressure)					
230-PTB330-3	Vaisala PTB330-3	serial data output (barometric pressure)					
230-PTB330-1	Vaisala PTB330-1	serial data output (barometric pressure)					
230-600V	RM Young 61302V	0	5	Volts	500	1100	mb/hPa

APPENDIX C (CONTINUED)

NL32 Designation	OEM Make/Model	Electrical Range			Measurement Range		
7. Precipitation							
Tipping Bucket Gauge	Tipping Bucket Gauge	switch closure			inches or mm, scalable tip value		
8. Solar Radiation							
240-120 SP-Lite2	Kipp&Zonen SP Lite	0	80	mV	0	1000	Wm^{-2}
240-8101	Schenk Star 8101	0	22.5	mV	0	1500	Wm^{-2}
240-200SZ	Licor LI 200 (SOLAR input)*	0	90	uA	0	1000	Wm^{-2}
100-6450	Davis Inst SR6450	0	3	Volts	0	1796	Wm^{-2}
240-CSD3	Kipp&Zonen CSD3 (for solar radiation)	0	1	Volts	0	1000	Wm^{-2}
240-CMP3	Kipp&Zonen CMP Series*	0	20	mV	0	2000	Wm^{-2}
240-SP-110	Apogee SP-110*	0	400	mV	0	2000	Wm^{-2}
240-110 NR-Lite	Kipp&Zonen NR Lite 2 (offset amp required)*	-25	25	mV	-2000	2000	Wm^{-2}
240-100	REBS Net Radiometer (offset amp required)*	-5	15	mV	-500	1500	Wm^{-2}
* At the time this manual was written these sensors / configurations were not verified. Use with caution.							
9. Evaporation							
255-100	NovaLynx 255-100	0	5	Volts	0	10	inches
10. Soil Moisture							
250-120V	Automata AquaTel (discontinued)	0	5	Volts	0	100	%
11. Water Level							
280-WL400-3	WL400-3	4	20	mA	0	3	feet
280-WL400-15	WL400-15	4	20	mA	0	15	feet
280-WL400-30	WL400-30	4	20	mA	0	30	feet
280-WL400-60	WL400-60	4	20	mA	0	60	feet
280-WL400-120	WL400-120	4	20	mA	0	120	feet
280-WL400-250	WL400-250	4	20	mA	0	250	feet
280-WL400-500	WL400-500	4	20	mA	0	500	feet
280-325-5	WL325-5, 280-330	0	5	Volts	0	~16.3	feet
280-325-6	WL325-6, 280-330	0	5	Volts	0	~19.6	feet
280-325-8	WL325-8, 280-330	0	5	Volts	0	~26.1	feet
280-325-20	WL325-20, 280-330	0	5	Volts	0	~65.1	feet
12. Ambient Light	no sensors						
13. Ceilometer	no sensors						
14. Visibility	no sensors						
15. Ice Accretion	no sensors						
16. Lightning	no sensors						
17. Snow Depth	no sensors						
18. Monitor							
Board Power Monitor	Board Power Monitor	Internal					
Device Power Supply	Device Power Supply	0	5	Volts	0	5	Volts
Logger Power Supply	Logger Power Supply	0	5	Volts	0	5	Volts
Analog 5V Reference	Analog 5V Reference	Internal					
19. Sun Duration							
240-CSD3	Kipp&Zonen CSD3	0	1	Volts			
20. Quantum							
240-SU-100 UV	Apogee SU-100 UV	0	35	mV	0	175	$\mu mol\ m^{-2}\ s^{-1}$
21. Water Flow	no sensors						

APPENDIX D – TRANSPARENT MODE

Sensors that output serial data can be directly accessed via Transparent Mode for purposes of checking/changing their programming. The sensor must be "Added" to the sensor configuration table before they will appear in the Serial Devices list (see Section 6.2.3).

The commands in the session below apply to WindSonic sensors. Other sensors will respond to different commands.

From the Main Menu type
6<ENTER> Configure Station
3<ENTER> Sensors
2<ENTER> Sensor Transparent Mode

```
                              ------------------
                              | SERIAL DEVICES |
-------------------------------------------------------------------------------
    NAME     TYPE             MODEL                     INPUT      CAL.  STATUS
-------------------------------------------------------------------------------
 1. WND     *WIND SPEED       200-1390-PK-026           SER10      0.000 HEALTHY
-------------------------------------------------------------------------------

SELECT A DEVICE TO COMMUNICATE WITH, OR QUIT [Q]: 1


BEGINNING TRANSPARENT SESSION WITH WND:
---------------------------------------
ENTER "END" OR "END" TO END THE SESSION.

Q,,000.02,M,00,2C                                   Data from the sensor
Q,,000.02,M,00,2C
*******                                             *< ENTER> to enter configuration mode
CONFIGURATION MODE

D3                                                  D3< ENTER> to read out the configuration
D3
M2,U1,O1,L1,P1,B3,H1,NQ,F1,E3,T1,S4,C2,G0,K50,      Sensor configuration string
Q                                                   Q< ENTER> to quit configuration mode
Q
WINDSONIC (GILL INSTRUMENTS LTD)                    Sensor initialization reports

2368-110-01

RS232 (CFG)

CHECKSUM ROM:E6D1 E6D1 *PASS*
CHECKSUM FAC:09F2 09F2 *PASS*
CHECKSUM ENG:17FB 17FB *PASS*
CHECKSUM CAL:CC55 CC55 *PASS*

Q,,000.04,M,00,2A                                   Data from the sensor
Q,,000.02,M,00,2C
END                                                 END<ENTER> to quit transparent mode


ENDING TRANSPARENT SESSION WITH WND.
```