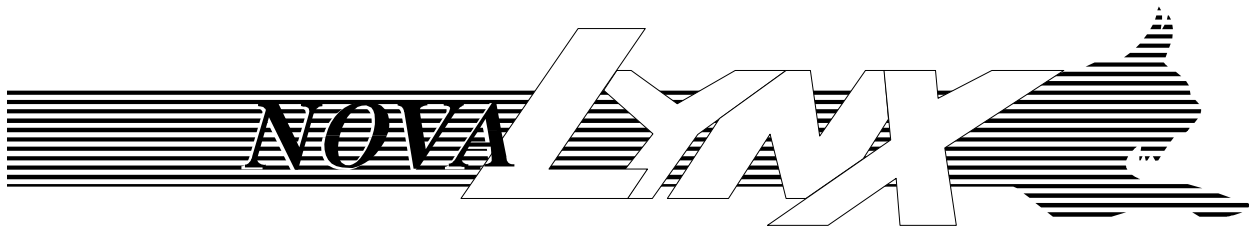


NOVALYNX CORPORATION

MODEL 110-WS-25
MODULAR WEATHER STATION

INSTRUCTION MANUAL



REVISION DATE: JUNE 2016

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.

Address

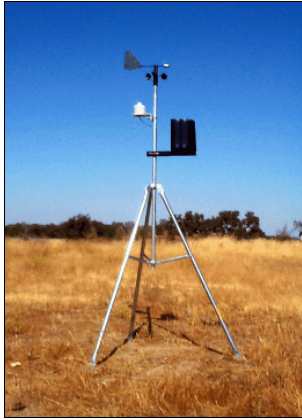
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TABLE OF CONTENTS

Section No.	Page No.
1.0 INTRODUCTION.	<u>1</u>
2.0 DESCRIPTION.	<u>2</u>
Data Logger.	<u>2</u>
Sensors.	<u>2</u>
Wind Speed and Direction ~ 200-WS-02F.	<u>2</u>
Barometric Pressure ~ 100-WS-25BP (optional on portable stations).	<u>2</u>
Temperature and Relative Humidity ~ 110-WS-25TH.	<u>2</u>
Rain ~ 110-WS-25RG (optional on portable stations).	<u>3</u>
3.0 CONFIGURATION AND OPERATION.	<u>3</u>
Data Logger.	<u>3</u>
Navigation Buttons.	<u>3</u>
Secure Digital™ Card Slot.	<u>3</u>
Menus.	<u>3</u>
Setting the Time and Date.	<u>4</u>
Data Logging.	<u>5</u>
Starting and Stopping Logging.	<u>5</u>
Memory Card Requirements.	<u>5</u>
Data.	<u>5</u>
4.0 INSTALLATION.	<u>6</u>
Tripod Towers.	<u>6</u>
Lightning Protection and Grounding.	<u>7</u>
Power Connections.	<u>7</u>
Main Memory Battery Backup.	<u>7</u>
RS232 Interface.	<u>7</u>
Testing the Connection.	<u>8</u>
Sensor Installation.	<u>8</u>
Data Logger.	<u>9</u>
Advanced Information.	<u>10</u>

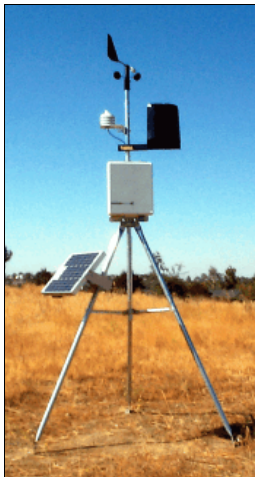
MODEL 110-WS-25 EQUIPMENT CONFIGURATION AND IDENTIFICATION



110-WS-25
Modular Weather Station



110-WS-25DL-D Desktop Data Logger with Display
with AC Power Adapter and Serial Output Cable



110-WS-25N
Modular Weather Station
with Optional Solar Panel Charger



110-WS-25DL-N Data Logger in NEMA Enclosure
with 12V 7AH Battery & AC Charger, Surge Protection



110-WS-25P
Portable Weather Station



110-WS-25DL-PA or PB
Data Logger in Carrying Case
with 12V 7AH Battery & AC Charger

NovaLynx Corporation

Model 110-WS-25 Weather Station Instruction Manual

1.0 INTRODUCTION

The **110-WS-25 Modular Weather Stations** are meteorological systems designed to be a “user friendly” solution for data storage and real-time monitoring of weather conditions.

This manual covers all three versions: Desktop, NEMA, and Portable. The data logger and general operation is the same on all versions.

The standard sensor package includes 6 weather parameters: wind speed and direction, temperature and relative humidity, barometric pressure, and precipitation, (additional optional sensors can be added), a 5-foot tripod and 5-foot vertical mast for sensor mounting, and a data logger with LCD display. The portable systems have a 3-foot tripod with 6-foot mast. Pressure and rain sensors are optional.

No computer is required for setup and viewing data. A simple menu interface using the LCD display and three front panel buttons makes setup easy.

Data is recorded directly to a Secure Digital (SD™) card, providing convenient data downloads and storage for many months of data. The data logger is compatible with standard SD cards up to 2GB. Logging at 1 minute intervals, a 2GB card will store over 5 years of data. A new file is created and saved to the card each day.

An RS232 serial output is standard and allows real time viewing of the data on a PC with any terminal emulator program, for example HyperTerminal, Putty, or the optional 110-WS-25STR Graphical Display Software.

Using the stored recorded data is simple. The SD card is removed from the logger, inserted into the SD card reader, then plugged in to the USB port on your computer (Windows, Macintosh, and Linux). This will then show up as a drive. To view and graph the data, click on the file corresponding to the day of interest. Microsoft Excel, OpenOffice.org, or any spreadsheet program can be used to view, graph, and analyze your data.

Typical data sample showing one line:

```
2016-06-15 13:51:50,4.2,10.1,190,,,,,,,,,0.04,223,12.14,,,,,57.807,67.471,28.700,,192
```

2.0 DESCRIPTION

The WS-25 Weather Station has been set up and configured for the six standard sensors: speed, direction, temperature, humidity, barometric pressure, and rainfall. It has been shipped for a plug and play operation.

Data Logger

The WS-25 data logger's easy-to-use interface includes a 16-character by 2-line backlit LCD screen, which displays current information and is used for configuring the data logger. A simple menu-driven interface using the LCD and three front panel buttons makes setup easy. A bright back-light makes the data logger easy to use at night. A Secure Digital (SD™) card slot makes recording and accessing data easy.

Sensors

The standard WS-25 sensors have been designed to be rugged, compact, and lightweight. They interface directly to the data logger without the need for additional signal conditioning.

Wind Speed and Direction ~ 200-WS-02F

The wind sensor combines a three-cup anemometer and a wind vane on a single axis. The anemometer is a contact-type wind sensor which, when rotated by the wind, triggers a series of momentary switch closures that are directly related to wind speed. The wind vane uses a 20K ohm potentiometer to sense direction changes. Depending on the position of the potentiometer wiper, an analog voltage is output that corresponds to the position of the vane. By orienting the vane to North (360 degrees) during installation, wind can be easily calculated from the output voltage. The resolution of the wind vane is 1 degree (azimuth display) or 16 compass points (on LCD display only).

Barometric Pressure ~ 100-WS-25BP (optional on portable stations)

The barometric pressure sensor is set for sea level when it leaves the factory. It will read absolute pressure. Barometric pressure varies with elevation, the data logger can be set up to read corrected to sea level pressure for the elevation at which it is installed. This is done adding the correct offset in inches in the analog setup menu. You will need to know the correction in inches for the elevation at your location before you change it. Instructions are provided in the manual.

Temperature and Relative Humidity ~ 110-WS-25TH

The WS-25TH is a combination temperature and relative humidity sensor installed a solar radiation shield. Temperature and humidity are sensed using a sensor element which changes voltage with temperature and humidity fluctuations. (The warm-up time to stabilize is 10 minutes.)

Rain ~ 110-WS-25RG (optional on portable stations)

The 8 inch rain gauge with mast mounting arm provided with the WS-25 is a traditional tipping bucket design. Resolution is 0.01 inches (0.254 mm) per tip.

3.0 CONFIGURATION AND OPERATION

Data Logger

Navigation Buttons

▼ Scrolls through display screens and allows user setup menus. Moves values in the negative direction.

SELECT Press to enter 'Setup' menu.

▲ Scrolls through display screens and allows setup menus. Moves values in the positive direction.

All buttons respond to a single press. Holding a button will not cause multiple actions to occur.



Secure Digital™ Card Slot

The data logger has a spring-loaded memory card slot. To insert a Secure Digital™ (SD™) card, place the card face up into the slot on the front panel and press the card inwards until the card clicks into place. To remove card, press the card slightly inward and the card will release.

The card should not be removed by pulling it out without first pressing it inwards. If a card is pulled out in this manner, both the memory card and the card socket may be damaged.

Menus

On the data logger display, the primary menus are: **Main Setup Menu**, **Wind Channels**, **Analog Channels**, and **Counter Channels**. Submenus of the **Main Setup Menu** are: **Date Setup**, **Time Setup**, **Anemometer Setup**, **Wind Vane Setup**, **Log Interval**, **Counter Setup**, **Analog Setup**, **Channels to Log**, **RS232 Setup**, **Wind Vane Setup**, **Site Name Setup**, **Sync. Setup**, and **Restore Defaults**. The wind data logger has three keys: ▼ which moves backwards or down (depending on the screen); **SELECT** which selects, sets, or moves to the next character; and ▲ which moves forwards or up (depending on the screen). Since the WS-25 logger has been pre-configured, there is no need to go into the sensor setup menus.

Setting the Time and Date

Using the 'Time' and 'Date' screens, one can both view and set the current date and time. The wind data logger incorporates a real-time clock that keeps accurate time while power is disconnected. The clock does not automatically adjust for daylight savings; however it does automatically adjust for leap years. The date format used throughout the wind data logger is YYYY-MM-DD.

See the **CONFIGURATION AND OPERATION Table** below for sample screen shots and detailed instructions for changing time and date. The same method is used with all data logger setup screens.

	Display Screen	Description
Status Screens	Date: 2013-07-13 Time: 13:00:00	Current date and time. Date is setup using the Date Screen in the Main Setup Menu. Time is setup using the Time Screen in the Main Setup Menu. Time is in 24-hour format.
	Status: NOT RDY 00000/00060 sec	The Status Screen can be viewed by pressing the ▼ key.
	Status: LOGGING 00000/00060 sec	Displays LOGGING when a Secure Digital™ card is inserted. Displays NOT RDY when no memory card is inserted or there is an error accessing the card. The first number shows the number of time (seconds) since the last write to the memory card. The second number shows the logging interval.
Main Setup	Main Setup Menu <- SELECT ->	Press the SELECT button to enter the Main Setup Menu. Use the screens in the Main Setup Menu to configure and calibrate the wind data logger. Use the ▼ and ▲ buttons to change user calibrated values and SELECT to set values.
	Logging Disabled while in setup!	Briefly displays to remind user that system is offline during setup.
Date Setup	Date: 2013-07-21 <- Set ->	The Date Setup Screen will display. Press the SELECT button to set the date.
	Date: 201 <u>3</u> -07-21 - Set +	The last digit of the year is underlined. Press ▼ to decrease the year or ▲ to increase the year. When year is correct, press SELECT to set the year and move to the month. Set the month and day using the same method. Press SELECT to return to the Date Setup Screen.
Time Setup	Time: 15:31:30 <- Set ->	Press ▲ to advance to the Time Setup Screen. Press SELECT to set the time.
	Time: 1 <u>5</u> :31:30 - Set +	Note that the last digit of the hour is underlined. Press the ▼ to decrease the hour or ▲ to increase the hour. When the hour is correct, press the SELECT button to set the hour and move to the minutes. Set the minutes and seconds using the same method. Press SELECT to return to the Time Setup Screen.

1 minute logging at the top of the minute :00 has been selected rather than free running

Data Logging

The WS-25 data logger can record measurements directly to an industry standard Secure Digital™ or Multi-Media Card™. The data logger records both raw and processed values in a simple text format that can be opened with any spreadsheet or text editor.

Starting and Stopping Logging

Logging commences after the memory card is inserted into the data logger and terminates after it is removed. Use the Logging Status screen to verify that the data logger is recording. If a memory card is inserted but the data logger shows “NOT READY” then there is a problem and the data logger WILL NOT record anything. Check to be sure the card is fully inserted and meets the memory card requirements outlined below.

Memory Card Requirements

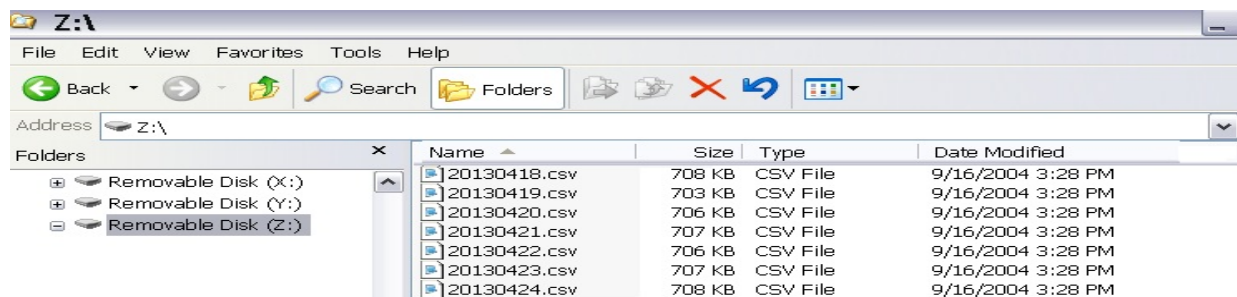
The WS-25 data logger is compatible with all sizes of SD (Secure Digital™) or MMC (Multi-Media Card™) cards; however, it will not work with Secure Digital High Capacity (SDHC) cards.

There is no need to format the SD card for this data logger mode.

Data

The WS-25 data logger generates one file per calendar day. The file name is YYYYMMDD.CSV (ex. 20160713.CSV) where YYYY is the four-digit year, MM is the two-digit month, and DD is the two-digit day. Each file is stored in the main directory or folder of the SD or MMC. The data logger also writes two other files that contain meta information about the channels being logged. For most applications these files can be ignored. The file consists of one record per line. On most computers, a single file can be opened in a text editor by simply double clicking on its icon.

The data logger records Comma Separated Variable (CSV) files to the memory card. CSV data can be used by nearly any spreadsheet software. First launch the program, then use the ‘Open’ command in the File menu to select the CSV file created by the data logger. (The date modified column has no function and can be ignored.)



Microsoft Excel, Gnumeric, and Open Office.org Calculator are all good spreadsheet programs. Gnumeric and OpenOffice.org Calc are free and can be downloaded from the Internet.

2016-06-15 00:02:30,1.9,3.0,19,,,,,,,,,0.00,88,12.18,,,,,71.829,28.556,965.721,,67
2016-06-15 00:02:31,2.3,2.3,16,,,,,,,,,0.00,91,12.14,,,,,71.829,28.556,965.455,,120

4.0 INSTALLATION

Installation of the WS-25 is simple and straightforward, thanks to its modular design and terminal-strip connections.

1. Set up the tripod and vertical mast, and secure it.
2. Mount the sensors Wind, RH/T, Rain Gauge on the tripod.
3. Connect the sensor cables wires to the data logger.
4. Apply power the WS-25 Logger.
5. Confirm and/or set the correct date and time.
6. Scroll thru the channels to verify the proper readings on the display.
7. Insert the SD memory into the logger. (Data is logged once a minute. This can be changed as needed.)
8. A RS232 serial output is available for direct connections to a PC.
9. Done.

Refer to the “Quick Start” instruction booklet for sensor wiring connections, power connections, and other special information.

Tripod Towers

The five-foot tripod tower provided with the WS-25 is constructed of steel tubing for durability and strength. Horizontal bracing is a feature of the tripod tower. The tripod's foot brackets can be bolted onto a concrete foundation or a wooden platform. The wind speed and direction sensor mounts on top (the tapered end) of the five-foot aluminum sensor mast. The solar radiation shield (for the temperature and humidity sensor) and the rain gauge mounting arm are supplied with u-bolts to clamp onto this mast. For stability, we recommend that the mast be inserted into both of the tripod's collar clamps. Guy kits are recommended for areas of high winds and ground kits are recommended for areas with lightning activity.

The WS-25P Portable Stations include a 3-foot tripod, with two 3-foot mast that connect together end to end.

Caution: When installing the wind sensor, make sure that the sensor and cable are well clear of any power lines.

Lightning Protection and Grounding

A copper lightning protection ground lug, located on the data acquisition NEMA module, this is the path to ground for all of the lightning protection circuitry in the WS-25N.

Connect a heavy copper wire to this lug the other end connects to a grounded outlet or water pipe or Earth ground. In areas subject to severe lightning activity, we recommend that you install a grounding rod.

Power Connections

The WS-25 runs on 12Vdc power. It can be operated from a standard AC/DC power adapter connected to a 110-240 Vac outlet, or from a 12Vdc battery on NEMA and portable versions.

Main Memory Battery Backup

The WS-25 main memory has a lithium battery backup so setup parameters, as well the date and time stored data, will be retained even if the primary power source is interrupted.

RS232 Interface

An RS232 interface is available, but not needed. It is used when connecting the optional real time graphical display software to a PC.

The standard text data can be viewed on any terminal program. A new line on data will be sent out every minute.

Sample data

```
2016-06-15 00:02:30,1.9,3.0,19,,,,,,,,,0.00,88,12.18,,,,,71.829,28.556,965.721,,67
2016-06-15 00:02:31,2.3,2.3,16,,,,,,,,,0.00,91,12.14,,,,,71.829,28.556,965.455,,120
```

The WS-25 serial data communication between the user and the WS-25 is accomplished using RS232 communications protocol designed for short-distance use.

The standard 6-foot serial interface cable that connects the data logger to the computer is terminated with a 9-pin "D" connector. The serial cable can be extended up to 200 feet.

For computers without a serial port, a USB-to-Serial converter may be used. When installing the converter, be sure to note the Com port number it is assigned.

Certain communications parameters must be specified in the computer to enable the two devices to communicate. Using a communications software program such as HyperTerminal, TeraTerm, or Putty, set them as follows:

Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Emulation	ANSI

Testing the Connection

Once the WS-25 is connected to the computer, the connection can be tested by turning the power on to the WS-25. If the RS232 connection is sound, a line of data will show every minute.

2016-06-15 16:02:30,1.9,3.0,19,,,,,,,,,0.00,88,12.18,,,,,71.829,38.556,29.721,,67

A RS232 Output Tester Light is supplied with the unit. If the serial output is functioning, the red light should flash every minute.

If the WS-25 is functioning but you see nothing on the PC screen, the wrong serial port may be selected. Try selecting Com 3 or another functioning serial port. You can see a list of available ports in Computer > System Properties > Device Manager > Ports.

Sensor Installation

Install the sensors in their chosen locations. Run cables from the sensors to the data logger location, with no cable exceeding the maximum allowable length listed below.

Sensor	Maximum Cable Length
Wind*	200' (66m)
T/RH*	150' (82m)
Rain*	200' (66m)
Barometric Pressure**	10' (3m)
Solar Radiation* (optional)	100' (33m)
*Std cable length 40' **Std cable length 18"	

When the sensors have been installed and the cables run, connect and test them as described in the following sections. Refer to the hook-up drawing at the back of this manual to verify wire colors and physical connections.

Data Logger

The data logger is configured at the factory for the following sensors. English US units are the default, but metric units will be programmed on request. The units can be changed to English or metric, as needed, in the sensor setup menus.

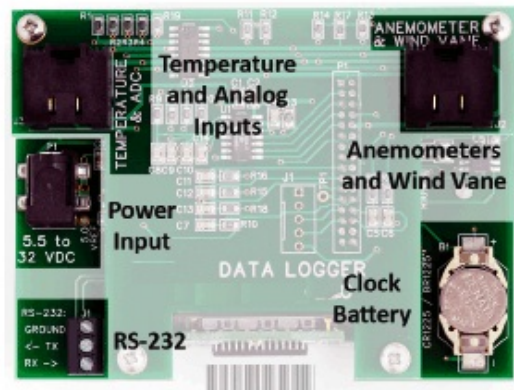
1. Wind speed and direction
2. Barometric pressure (*optional on WS-25P portable stations*)
3. Temperature and Relative Humidity
4. Rain Gauge (*optional on WS-25P portable stations*)

CLOCK BATTERY BACKUP

The data logger's real-time clock uses a 3-volt lithium coin cell battery to maintain the clock while power is disconnected. CR1225, BR1225, or any 3-volt 12.5 by 2.5 mm battery may be used. These are common watch batteries and should be available from most stores.

The clock battery has an estimated 10 to 15 year life span in the Wind Data Logger. If your data logger "freezes" or does not retain its date and time without power, then the battery likely needs to be replaced. To replace the battery, use a small screwdriver or toothpick to pop the old battery out of the battery holder. Insert a new battery with the writing side up.

Data Logger circuit board.



Advanced Information

These are the NovaLynx WS-25 DEFAULT SETTINGS for programming each channel using standard WS-25 sensors with English units.

Anemometer 0

m = +0001.2500 WS-02F (for m/s m = +0.567, for knots m = +1.10, for kmh m = +2.00)
b = +0000.0000
I = WIND SPEED
u = MPH (u = M/S, u = KTS, u = kmh)

Anemometer 1

m = +0001.2500
b = +0000.0000
I = WIND SPEED
u = MPH

Anemometer 2

m = +0001.2500
b = +0000.0000
I = WIND SPEED
u = MPH

WIND VANE SET UP

Linear *
Dir Offset 000°

Log Interval
Log Sec 00060

Counter Setup
Counter 0 OK As Is
Counter 1 OK As Is

Counter 2

m = +0000.0100 WS-25RG (for millimeters m = +0000.250)
b = +0000.0000
I = RAIN TODAY
u = IN (u = mm)

ANALOG SET UP

Analog 0 OK As Is
m = +0008.000
b = +000.0000
I = INPUT VOLTAGE
u = VDC

Analog 1 OK As Is
m = + 0001.000
b = + 0000.0000
I = WIND DIR
u = VDC

Analog 2
m = +0598.8020
b = +0000.0000
I = SOLAR RAD
u = W/M

Analog 3 Aux. temp only
m = +0180.000 For degrees C m = +0100.0000
b = -0459.6900 For degrees C b = -0273.1500
I = AUX TEMP
u = °F For degrees C u = °C

Analog 4
m = +0070.9092 For degrees C m = + 0039.394
b = -0022.0000 For degrees C b = -0030.0000
I = TEMPERATURE
u = °F For degrees C u = °C

Analog 5
m = +0030.3030
b = +0000.0000
I = HUMIDITY
u = %

Analog 6 * The b value will be different on each sensor
m = +0006.4375 for millibars m = +0218.0000, for millimeters m = 0163.5134
b = +0003.6600 * for millibars* b = +0124.5400, for millimeters * m = 00090.9
I = BARO.PRESSURE
u = IN for millibars u = mb or hpa, for millimeters u = mm

Analog 7
m = +0001.0000
b = +0000.0000
I = EXT ADC
u = VDC

Channels to Log (these 7 are enabled, the others are disabled)
Anemometer 0 (wind speed)
Counter 2 (rainfall daily total)
Wind Direction (wind direction)
Analog 0 (battery voltage or DC power input)
Analog 4 (temperature)
Analog 5 (humidity)
Analog 6 (barometric pressure)

RS232 Enabled
Baud: 9600

SITE NAME
WS25

Data Record Format Information on Memory Card

There are no description headers generated on the stored data. 23 Fields are generated, but only the ones being used are saved. The ,, is where the missing fields would appear if they were needed.

Sample Data with the **6 Standard Sensors connected WS-25DL** 1 min logging, English units
Date and Time, Speed, Gust, Spd count,,,,,,,,, Rain, WDir, inVolts, Temp °F, Hum %, BP inhg, cksum
2016-06-15 02:19:00, 0.3, 0.9, 19,,,,,,,,, 0.00, 351, 12.14,,,,, 83.1, 26.7, 28.473,, 230
2016-06-15 02:20:00,0.7,1.2,28,,,,,,,,,0.00,351,12.14,,,,,83.1,26.7,28.465,,95
2016-06-15 02:21:00,0.9,1.4,31,,,,,,,,,0.00,351,12.14,,,,,83.1,26.7,28.465,,8

Sample Data with the **4 Standard Sensors connected WS-25P**, 1 min logging, English units
Date and Time, Speed, Gust, Spd count,,,,,,,,, WDir, Input Voltage, Temp °F, Humidity %, cksum
2016-06-15 17:58:00, 4.9, 22.2, 277,,,,,,,,, 249, 13.08,,,,, 73.301, 18.088,,, 198
2016-06-15 17:59:00,2.7,12.6,128,,,,,,,,,269,13.04,,,,,73.387,18.310,,,36
2016-06-15 18:00:00,3.2,3.5,83,,,,,,,,,315,13.08,,,,,73.474,18.458,,,44

Many WS-25DL are setup in metric units with m/s, °C, millimeters and millibars. Refer to the Quick Start As Shipped sheet for your exact setup.

Converting Wind Speed Pulse Count to Average Wind Speed

The 'Wind Pulses' screen in the Main Display Loop shows the number of anemometer revolutions since the last write to the memory card. The pulse count information can easily be converted to average wind speed using the following formula:

$$\text{Average Wind Speed} = ((WCx/\text{sample_interval}) * \text{anemo_m}) + (\text{anemo_b})$$

Example using the following snippet of data from the data logger WS-02 sensor and a sampling interval of 60 seconds recording in MPH:

2016-06-15 16:11:00,18.0,19.4,810

As seen in the data snippet above or the reading from the data logger 'Wind Pulse' screen, WC0 = 810. This information can then be used with the formula above:

$$\text{Average MPH} = ((810/60) * 1.25) + 0.0 = 16.87 \text{ MPH}$$

A complete data logger manual with internal PCB schematics is available upon request.