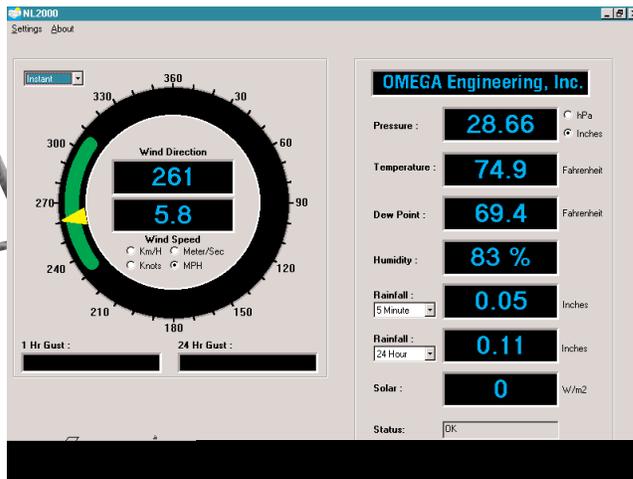


# User's Guide



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# WMS-16 Complete Weather Station

# INTRODUCTION

Congratulations on your purchase of a WMS-16 Weather Station, and welcome to the world of modular, user friendly weather data collection. The WMS-16 has been carefully designed with the user in mind, and we are confident that it will provide you with convenient and accurate weather data for years to come.

The WMS-16 is a state-of-the-art, microprocessor-based weather station that provides capabilities unequaled in similarly priced instruments. In its standard configuration, measurements for wind speed, direction, temperature, humidity, and precipitation are collected and processed by the control module.

Any, or all, of these weather parameters can be included by simply adding the appropriate sensors. The exact configuration is determined by the user based on demands of the intended application.

## Data Output, Display, and Logging

Real-time weather data is output by the WMS-16 over its RS-232 interface, and this data can be readily viewed by either using a PC based communications program or with the optional software for the WMS-16. In addition to current weather information, the WMS-16's data logging capability allows up to 45 days of data taken at 15 minute intervals to be stored in memory for later retrieval.

Special consideration has been given in the design of the WMS-16's display of current weather data to ensure ease of understanding by the first-time or casual user.

## Current Observations

This display is a one-page report of current weather conditions, with each parameter clearly labeled and readily located on the screen.

In addition to the measured parameters, the WMS-16 also calculates values for wind chill and dew point based on the combination of weather factors that govern those characteristics. The WMS-16 also reports specific aspects of the measured parameters, including peak wind speed, wind direction variation, hourly temperature change, maximum and minimum daily temperature, barometric pressure changes, maximum and minimum daily pressure, relative humidity change and daily and monthly precipitation accumulation.

## Data Logging

The time interval between recordings is user determined for periods ranging from one minute to sixty minutes. This logged data can be retrieved for display or copied to a floppy or hard

disk for permanent storage using the options available on the main menu.

When retrieved for viewing, the logged data is displayed as date and time stamped single line, tab delineated entries. Logged data can be retrieved in either hourly or daily blocks.

For permanent storage, the data logged by the WMS-16 can be copied to a magnetic disk. The format of the logged data has been designed to be compatible with most commercial spreadsheet software coma delineated (Excel, Lotus 1-2-3, and Quatro Pro among others).

## The Control Module

The heart of the WMS-16 is the control module. The control module conditions and processes the signals generated by the attached sensors and outputs them via the RS-232 interface at a default rate of 9600 bits per second other bit rates are user selectable.

In addition to the RS-232 interface connector, connections are provided on the control module's rear panel for all of the weather sensors.

Power is provided by an external 12V source, and the WMS-16 comes equipped with a 12V wall transformer for powering the station from a standard 110V outlet. A 12V battery can be wired into the module to provide emergency power in the event of a loss of main power. This battery will provide backup power allowing data logging and output to continue uninterrupted. A fully charged 12V, 7 amp-hour battery will run the WMS-16 for three to four days.

## Sensors

The standard sensors used with the WMS-16 have been designed to be rugged, compact, and light-weight. They interface directly to the control module without the need for additional signal conditioning. These sensors are accurate and reliable, and any combination can be used.

## Wind

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 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 North (360°) during installation, wind can be easily calculated from the output voltage. The resolution of the wind vane is 1° (azimuth display), or 16 compass points (cardinal points display).

## Barometric Pressure

Barometric pressure is sensed using a piezoresistive sensing element. This element responds to changes in barometric pressure with a corresponding change in resistance. This resistance is converted to a voltage from which the microprocessor calculates the barometric pressure at the elevation at which the barometer is located.

Since air pressure varies with elevation, the barometric pressure must be set for the elevation at which the barometer is installed. This value is set simply using a screwdriver. Instructions are provided in the Installation Section of this manual.

## Temperature and Relative Humidity

The WMS-16 is designed to accommodate a combination temperature/ relative humidity sensor. For maximum accuracy, the sensor should be isolated from the effects of sunlight a factor that can cause misleading temperature and humidity measurements. The Model WMS-16-THS Naturally Aspirated solar shield is provided to give this protection.

Temperature is sensed using a thermistor element whose resistance changes in response to temperature fluctuations. Relative humidity is sensed by changes in the dielectric constant of a thin polymer film as it absorbs moisture or sheds it to the surrounding air.

## Rain

The rain gauge used with the WMS-16 is a traditional tipping bucket design. Resolution is 0.01 inches.

## Using the Data

Once the weather data generated by the WMS-16 has been logged and saved-either within the control module or on an external media-it can easily be manipulated by a number of commercially available software packages. The format of the columnar, coma-delimited data was carefully designed to make it compatible with the most widely used spreadsheet programs. The data can be imported easily into these programs and from there analyzed or manipulated, making the information generated by the WMS-16 much more than simply a collection of numbers.

A number of enhancements to the WMS-16 are planned for the future that will make the WMS-16 even more responsive to your needs. The EEPROM in which the operating firmware is stored can be electronically updated to simplify future firmware upgrades.

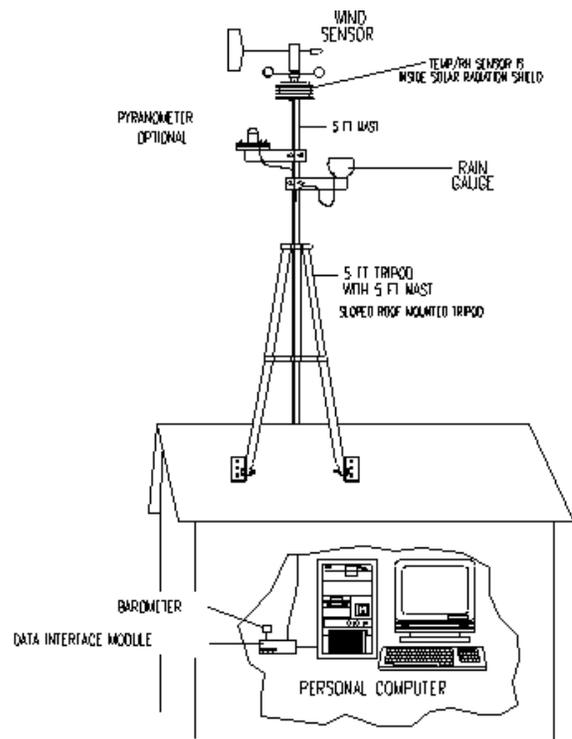


Figure 1

# INSTALLATION

Installation of the WMS-16 is simple and straight forward, thanks to its modular design and terminal-strip connections. Figure 1 shows the control module's rear panel and the locations of the various connections. An auxiliary battery can be used as an alternative power input if you do not intend to use the provided wall transformer.

## Installation Considerations

Prior to installing the WMS-16, you should be aware of several important points that must be taken into consideration when choosing a site for the control module and sensors.

## Control Module

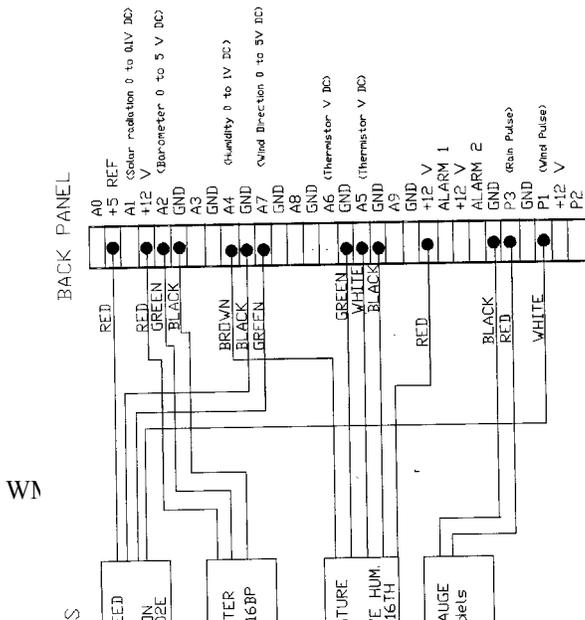
The control module should be located as close as possible to the computer that will be used to communicate with the WMS-16. RS-232 communications (the communication protocol used with the WMS-16) is designed for use over short distances, and the cable connecting the control module to the computer should not be longer than 30 feet (10 meters). Longer lengths may work.

If this arrangement is not feasible and a longer cable run is required, an RS-232 to RS-422 converter can be added to allow longer cable runs.

## Barometric Pressure Module

The Barometric Pressure Module is designed to be mounted indoors. This arrangement assumes that the barometric pressure indoors and outdoors is equal. The Barometric Pressure Module is provided with a short cable that connects directly to the control module.

WMS-16 HOOK-UP DIAGRAM



## Tripod Tower

The five foot tripod tower provided for the WMS-16 is constructed of steel tubing for durability and strength. Horizontal bracing is a feature of the tripod tower. The tower's foot brackets can be bolted onto a concrete foundation or a wooden platform. The wind speed and direction sensor mounts on top of the mast. The solar radiation shield with 6" mast and coupling are made to clamp on the five-foot aluminum mast. The rain gauge mounting arm is supplied with a u-bolt to clamp onto this mast. For stability, it is recommended that the mast be inserted into both of the collar clamps. Guy kits are recommended for areas of high winds and ground kits are recommended for areas with lightning activity.

## Lightning Protection and Grounding

Caution: When installing the wind sensor, make sure that the sensor and cable are well clear of any power lines. A lightning protection ground screw is located on the control module's rear panel. It is the path to ground for all of the lightning protection circuitry in the WMS-16. Connect this screw to a grounded outlet or water pipe. In areas subject to severe lightning activity, we recommend that you install a grounding rod.

## Power Connections

The WMS-16 can be operated from either standard 110VAC outlet, or from an external 12V battery.

### Standard Outlet

A wall transformer is provided with the unit for operating from an 110VAC outlet. An optional wall transformer is available for operating from a 220V/50Hz power source. The wall transformer provides a nominal 12VDC.

### External Battery Power

An auxiliary power connection is provided on the rear panel of the control module for connecting an external 12VDC battery. This battery can be used as the main power source. Remember though, that if the auxiliary power connector is used for main power, there will be no backup power source. A fully charged 12V, 7 amp-hour battery will run the WMS-16 for three to four days. With the backup battery in place, the WMS-16 will continue collecting and logging data during a power outage. The WMS-16's main memory has a lithium battery back up and the setup parameters and any stored data will be saved if the primary power source is interrupted.

## RS-232 Interface

The WMS-16 is an interactive device that not only outputs data but is capable of responding to user commands. These commands are entered through the computer which also displays the current data and any additional data requested by the user. Communications between the user and the WMS-16 is accomplished using RS-232 communications protocol designed for short-distance use.

The interface cable that connects the control module to the computer is terminated with a sub-miniature "D" connector. Depending on the connectors available on your computer's serial port a 25-pin to 9-pin adapter may be required.

Connect the RS-232 cable between the control module and the computer's serial port. (number 1 or 2)

Certain communications parameters (number of data bits, parity, etc.) must be specified in the computer to enable the two devices to communicate with one another. They should be set as follows:

|             |          |
|-------------|----------|
| Baud rate   | 9600     |
| Data Bits   | 8        |
| Stop Bits   | 1        |
| Parity      | None     |
| Handshaking | Xon/Xoff |

Under this protocol the computer sends ASCII character DC3 (19 decimal, 13H) to the WMS-16 to halt its transmission, and DC1 (17 decimal, 11H) to resume.

## Testing the Connection

Once the WMS-16 is connected to the computer, the connection can be tested by briefly disconnecting and then re-connecting the main power at the control module.

1. Unplug the wall transformer from the control module's rear panel.
2. Leave power disconnected for several seconds, then plug the power cable in again.

If the RS-232 connection is sound, an Omega header and/or the Software version will appear on the screen (Figure 2).

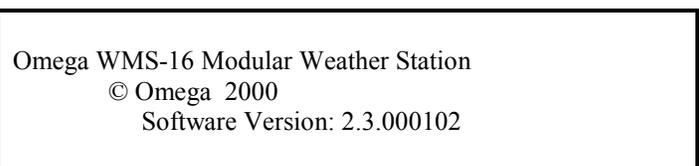


Figure 2

## Sensor Installation

Install the sensors in their chosen locations, bearing in mind the installation considerations noted earlier. Run cables from the sensors to the control module location, with no cable exceeding the maximum allowable length listed in Table 1.

When the sensors have been installed and the cables run, connect and test them as described in the following sections. Refer to Figure 1 for connection locations on the control module's terminal strip.

Table 1: Maximum Sensor Cable Lengths

| Sensor          | Max. Cable Length |        |
|-----------------|-------------------|--------|
| Wind            | 250               | (76m)  |
| T/RH            | 250               | (76m)  |
| Rain            | 900               | (275m) |
| Barometer       | 10'               | (3m)   |
| Solar Radiation | 100               | (33m)  |

## WMS-16 Module Setup

The WMS-16 Module has been configured at the Omega factory to work with the following sensors:

1. Wind speed and Direction
2. Barometer
3. Temperature and Relative Humidity
4. Rain Gauge

To verify the sensor setup press "Esc" to go to the main menu. Then select item 1. Station setup. From the Setup Menu select 6. Add or remove sensors. Press "Y" to continue. The sensor configuration page will appear showing all of the presently enabled sensors. It shows the sensor models and calibration factors.

| Omega WMS-16 Modular Weather Station |                |       |             |
|--------------------------------------|----------------|-------|-------------|
| © Omega 2000                         |                |       |             |
| Sensor Configuration                 |                |       |             |
| Sensor Type                          | Model          | Input | Calibration |
| 1. Wind Speed                        | WMS-01/02      | P1    |             |
| 2. Precipitation                     | All Models     | P3    | 0.0100      |
| 3. Pressure                          | WMS16-BP       | A2    |             |
| 4. Humidity                          | 225-050Y(U)/40 | A4    |             |

|                   |         |    |
|-------------------|---------|----|
| 5. Temperature    | WMS-16T | A5 |
| 6. Temperature    | WMS-16T | A6 |
| 7. Wind Direction | WMS-02  | A7 |

Add sensor [A], delete sensor [D], or quit [Q]:

The instructions in Appendix 1 direct you through the enabling procedure for each type of sensor should any sensor that you plan to use not be enabled.

## Wind Speed and Direction

Wire the wind sensor's signal cable into the terminal strip on the control module's rear panel as shown in Figure 1. Call up the main screen (Figure 3.) on the display terminal by pressing "Esc" for main menu. Press "2" for Current Observations at the main menu. Then press "1" for observation display (Figure 4).

Turn the Anemometer cups by hand and note the wind speed displayed on the screen. This value should change as you spin the cups.

Turn the wind vane so that the tip is aligned with the two vertically positioned set screws on the base of the sensor. The wind direction shown on the screen should indicate North (0°). Turn the vane in increments around the full 360°, noting the change in the wind direction readings. These should agree with the present position of the vane.

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### Main Menu

1. Station setup
2. Current observations
3. Display log by hours
4. Display log by days
5. Data download
6. Clear logging memory

Enter your selection (1-6):

Figure 3 Main Screen

## Barometric Pressure Module

Wire the three wires of the barometric pressure module into the terminal strip on the WMS-16 module as shown in Figure 1.

Since pressure varies with elevation, the barometric pressure sensor must be adjusted to read correctly at the elevations at which it is installed. This is done using the offset adjustment screw located on the side of the barometric pressure module.

To set barometric pressure offset, for sea level, you must first obtain a reliable barometric pressure for your location. The barometric pressure range is 28.25 to 30.75. This can be found by contacting the nearest airport or weather service facility. Nominal barometric pressure is 29.6 inches of mercury.

Call up the main screen (Figure 4) on the display terminal by pressing “Esc” for main menu. Press “2” for Current Observations at the main menu. Then press “1” for observation display (Figure 4).

While watching the main screen, slowly turn the offset adjustment screw. Clockwise will decrease the pressure reading. You may have to turn the adjustment 3 to 10 revolutions before the display starts to change. Turn the pot slowly in single turn increments, then wait for the screen to update, every five seconds. If the value is moving away from the correct value obtained above, turn the screw in the opposite direction. Continue turning the screw until the displayed value agrees with the value obtained from the airport or weather service.

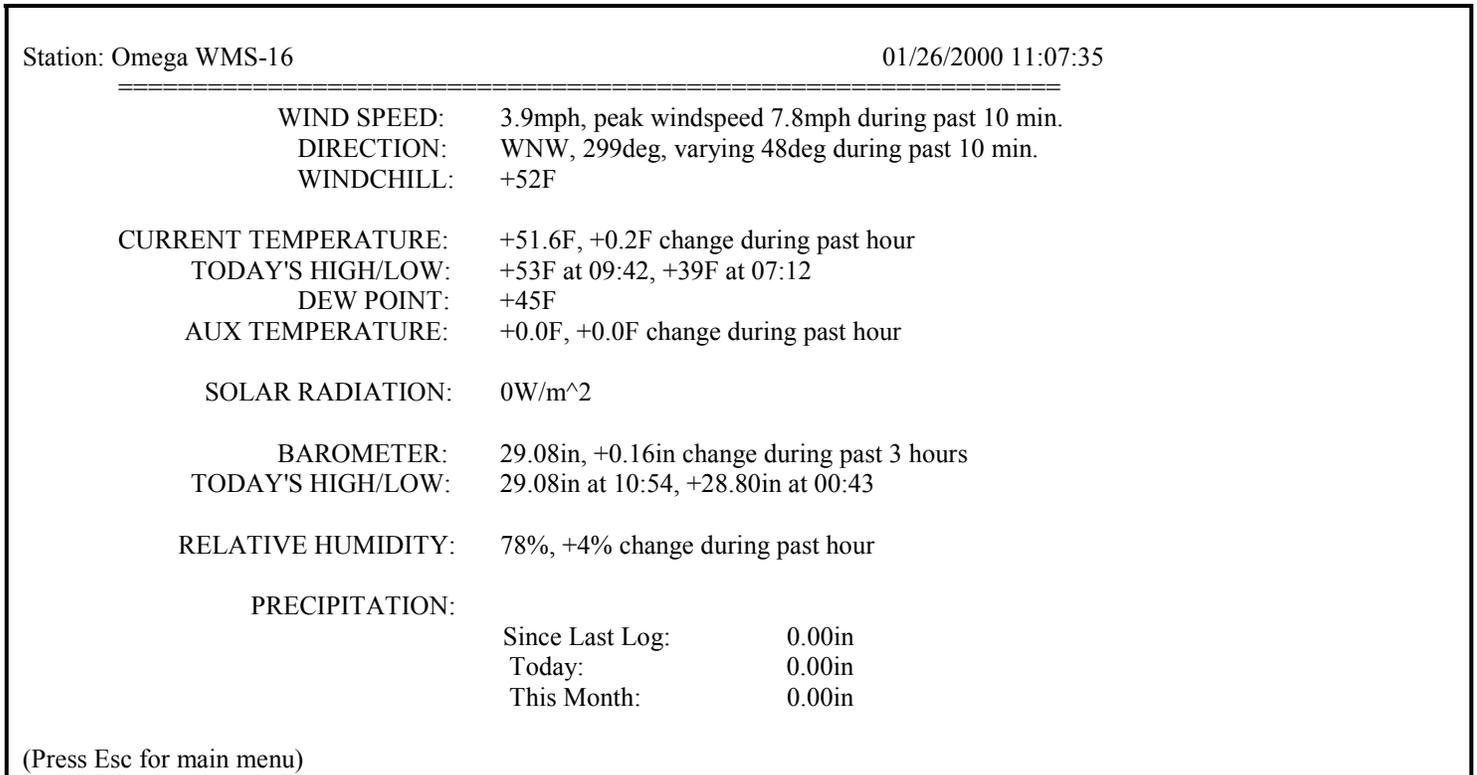


Figure 4 WMS-16 Observation Screen

## Temperature/Humidity Sensors

Wire the cable from the Temperature/Humidity sensor into the terminal strip on the WMS-16 module as shown in Figure 1.

Call up the main screen (Figure 3) on the display terminal by pressing “Esc” for main menu. Press “2” for Current Observations at the main menu. Then press “1” for observation display (Figure 4).

Obtain current values for temperature and humidity from the nearest airport or weather service facility, and see that the values shown on the main display agree approximately with them.

To simulate a change in temperature and humidity, lean close to the sensor (or to the solar shield) and breathe onto the sensor until you see a corresponding increase in the displayed temperature and humidity values.

Once the main menu is present proceed with the station setup procedures as described in the next section.

## Station Setup

Press “Esc” to get to the main menu. Press “1” at the main menu to initiate the Station Setup procedure. This procedure allows you to specify certain operational parameters that the WMS-16 uses in its calculations and on its display. Run Station Setup when using the weather station for the first time. After that, ignore it – unless you wish to change one or more of the settings.

When you press “1” at the main menu, the parameters available for customizing appear as items 1 through 8.

## Station Name

1. Type the name of the station.
2. The station name may be any series of alphanumeric characters up to 50 characters long. After the station name is entered press “Enter” and select the next item.

## Units of Measure

Press 2, Units of measure. A warning message will appear stating, “ Changing units will cause data to be logged in the new units of measure”. You should clear logging memory to avoid mixed data values. Do you want to continue? [Y or N]: If you want to change units of measure press ”Y” and the menu will ask you English or Metric? Select E or M and press “Enter”.

The menu will ask if you are sure you want to delete log file [Y or N] if you have changed units then answer “Y” if not “N”. and press “ Enter”.

| PARAMETER     | ENGLISH | METRIC |
|---------------|---------|--------|
| Speed         | Mph     | M/s    |
| Direction     | Deg     | Deg    |
| Temperature   | °F      | °C     |
| Humidity      | %       | %      |
| Barometer     | Inhg    | Mb     |
| Precipitation | inches  | mm     |

Table 2

## Averaging Period

Press 3, Averaging period. The averaging period is user selectable over the range from 1 minute to 60 minutes. The stored data will be the average of the data measured at five-second intervals over the user selected averaging period. If the

## OPERATION

The WMS-16 Weather Station collects and logs data automatically, requiring little user input. Ultimate control, however, is provided by the interactive user interface, which allows the user to direct the WMS-16 to perform certain specific functions by choosing one of the six options offered on the main menu (Figure 3).

## Software

The firmware contained in the WMS-16 has all of the programs required to use the weather station with a P.C. operating in the communications mode (such as HyperTerminal in Windows). Communication between the WMS-16 and the P.C. is made by connecting the RS-232 cable to either COMPORT 1 or COMPORT 2. In order to facilitate getting started if you are using Windows you may open the HyperTerminal program with all of the proper communication settings for communicating with the WMS-16.

The communications parameters required to interface the WMS-16 to an RS-232 data link are as follows:

|           |      |
|-----------|------|
| Baud rate | 9600 |
| Data Bits | 8    |
| Stop Bits | 1    |
| Parity    | None |

averaging period is less than the logging period the average logged will be for a period of time at the end of the logging period equal to the averaging period. If the averaging period is longer than the logging period then the data stored will be a running average that reaches back in to previous logging periods.

Enter the number of minutes desired and press “Enter”.

## Logging Period

Press 4. Logging Period. The menu will ask you to enter a number between 1 and 60 minutes. Enter your selection and press, “enter”.

The number of days of data that can be stored in the memory is a function of the logging period, the magnitude of the data reported and the number of sensors activated. With the standard complement of sensors (wind speed, wind direction, temperature, relative humidity, barometric pressure and precipitation) the memory will fill in about 45 days if the logging period is fifteen minutes. Once the memory is full it “wraps” that is it continuously over-writes the oldest data in the memory with new data.

## Date & Time

Press 5, Date & Time. The menu will direct you to enter the current date in the following format: [MM/DD/YYYY]. When the proper date has been entered press, “Enter”. The menu will direct you to enter the current time in 24 hour format [HH:MM]. When the proper time has been entered press, “Enter”.

## Add or Remove Sensors

Press 6. Add or remove sensors. The menu displays the following warning, “You must off-load data before changing sensor configuration. Logging memory will be automatically cleared if changes are made. Do you want to continue/ [Y or N]:”. Enter, “Y” and the Weather Port WMS-16 Station Sensor configuration will appear. If all of the sensors that you intend to use are shown as being configured then press “Q” and “Enter”. If you wish to add or delete a sensor then Press “A”: for add or “D” for delete and follow the instructions presented on the menu.

## Power Outage Warning

The data entered using the Station Setup procedure is automatically stored in the system’s memory. The data will remain in tact even if there is a power outage. All data collected will also remain in tact if there is a power outage. However, the system will not report or log data during periods of power outage. When reviewing data logs, gaps in the store data can be attributed to power outages.

## Current Observations

Press “2” at the main menu to access the most frequently used screens. These are the current observations screens, and they are shown in Figure 4 (Main Text Display Screen) and Figure 7 (Row and Column Display Screen). The current observations screens show the values currently being measured by the station’s sensors. These values are updated every five seconds and provide a running record of weather conditions. The topmost line on the line on the Main Text Display Screen shows the station name, current date, and time.

| Display Format Menu                    |              |        |             |        |           |        |        |
|--|--------------|--------|-------------|--------|-----------|--------|--------|
| 1. Observation display                 |              |        |             |        |           |        |        |
| 2. Row and column display              |              |        |             |        |           |        |        |
| 3. RTU output message                  |              |        |             |        |           |        |        |
| 4. Return to main menu                 |              |        |             |        |           |        |        |
| Enter your selection [1 – 4]: 2        |              |        |             |        |           |        |        |
| Please wait 5 seconds for next display |              |        |             |        |           |        |        |
| 01/26/2000,                            | 11:08:00,    | 3.90,  | 0.00,       | 29.07, | 78.85,    | 51.52, | 301.99 |
| 01/26/2000,                            | 11:08:05,    | 4.50,  | 0.00,       | 29.07, | 78.42,    | 51.52, | 264.46 |
| 01/26/2000,                            | 11:08:10,    | 2.40,  | 0.00,       | 29.07, | 78.00,    | 51.52, | 260.95 |
| 01/26/2000,                            | 11:08:15,    | 5.40,  | 0.00,       | 29.07, | 77.09,    | 51.49, | 297.86 |
| 01/26/2000,                            | 11:08:20,    | 6.00,  | 0.00,       | 29.07, | 77.24,    | 51.46, | 334.95 |
| 01/26/2000,                            | 11:08:25,    | 3.30,  | 0.00,       | 29.07, | 77.73,    | 51.46, | 299.36 |
| 01/26/2000,                            | 11:08:30,    | 4.20,  | 0.00,       | 29.06, | 77.31,    | 51.43, | 266.13 |
|  | (Wind Speed) | (Rain) | (Barometer) | (Temp) | (R/Humid) | (Dir)  |        |

Figure 7 Row and Column Presentation of Current Data

you wish to view more than a full day's data, or fractions of days (two-and-a-half days), chose the selection, "4" Display Log by Days, retrieves data in daily blocks with a minimum retrievable block of one full day's data.

After selecting "3" from the main menu, specify the number of hours of data to be retrieved.

The data will be displayed in the format shown in Figure 8. The data is organized as follows:

- The top line shows date and time at the right margin.
- The weather data is organized into columns, with an abbreviation for each parameter and the units of measure used (selected through the setup menu) shown at the top of the column.
- TIME- The time at which the data was logged; this time is based on the time that was set through the setup procedure (see Station Setup): in military time (24-hour clock).
- WS- Wind speed: in miles per hour or meters per second.
- WD- Wind direction in degrees.
- PK- Peak wind speed: in miles per hour or meters per second. This is the highest wind speed measured over any two second interval.
- BP- Barometric pressure: in inches of mercury or millibars. This is the average pressure measured during the logging period.
- T1- Temperature measured by the temperature/RH probe: in degrees Fahrenheit or degrees Celsius.
- RH- relative humidity measured by the temperature/RH probe: in percent
- T2- Temperature measured by an auxiliary probe (if used); in degrees Fahrenheit or degrees Celsius.
- SR- Solar radiation; in watts per square meter.
- RF- Precipitation (rainfall) accumulated during the logging period: in inches or millimeters.

The logging interval is selected by the user. The range is one minute to sixty minutes. A maximum of 18 records can be displayed on a single screen, so if more than 18 periods were requested the data will be continued on subsequent screens.

- To view the next screen, simply press the space bar. Each successive screen may be viewed by pressing the space bar. You may

## Weather Trends

The current observations text screen displays several weather features in addition to the current sensor readings. These values show the extent to which the measured parameters have varied over an extended period:

- Peak wind speed, with the highest value recorded during the past 10 minutes displayed
- The high and low temperatures for the day (based on measurements taken since 12 midnight), and the changes in temperature in the past hour.
- The high and low barometric pressure for the day (based on measurements taken since 12 midnight), and the change in barometric pressure over the past three hours.
- The change in relative humidity over the past hour.
- Three values for precipitation accumulation, with totals for the past logging period, for the current day (rainfall since 12 mid-night), and for the current month (rainfall since the first of the month, according to the date set through the Station Setup procedure.
- Caution; If power is interrupted the stored trend values, will be cleaned, and reset to the current, starting day & time. All three precipitation totals will go to 00.00 and today's hi/low will become the current temperature.

## Display Log By Hours

Press "3", at the main menu to view the WMS-16's stored data and to specify the amount of data to be retrieved in hours. If

not, hover, return to a previous screen, you must return to the main menu and begin the retrieval procedure anew.

If you want to further manipulate or obtain a printed copy follow the procedure described in the Data Download section below.

Enter number of hours to view: 1

| DATE  | TIME  | WS  | PK  | WD  | T1    | T2   | RH | BP    | RF   | SR               |
|-------|-------|-----|-----|-----|-------|------|----|-------|------|------------------|
| M/D   | H:M   | mph | mph | deg | F     | F    | %  | inHg  | in   | W/m <sup>2</sup> |
| 02/01 | 15:18 | 0.7 | 2.1 | 318 | +57.2 | +0.0 | 56 | 29.32 | 0.00 | 0                |
| 02/01 | 15:19 | 0.1 | 0.6 | 329 | +57.2 | +0.0 | 56 | 29.32 | 0.00 | 0                |
| 02/01 | 15:20 | 1.9 | 3.2 | 323 | +57.2 | +0.0 | 57 | 29.31 | 0.00 | 0                |
| 02/01 | 15:21 | 1.9 | 3.6 | 283 | +57.2 | +0.0 | 59 | 29.31 | 0.00 | 0                |
| 02/01 | 15:22 | 1.8 | 3.6 | 284 | +57.2 | +0.0 | 59 | 29.32 | 0.00 | 0                |
| 02/01 | 15:23 | 2.6 | 4.5 | 320 | +57.2 | +0.0 | 59 | 29.31 | 0.00 | 0                |
| 02/01 | 15:24 | 2.0 | 3.0 | 317 | +57.2 | +0.0 | 59 | 29.31 | 0.00 | 0                |
| 02/01 | 15:25 | 1.8 | 2.7 | 312 | +57.2 | +0.0 | 59 | 29.31 | 0.00 | 0                |
| 02/01 | 15:26 | 2.3 | 3.6 | 320 | +57.1 | +0.0 | 59 | 29.31 | 0.00 | 0                |
| 02/01 | 15:27 | 2.0 | 3.0 | 309 | +57.1 | +0.0 | 60 | 29.31 | 0.00 | 0                |
| 02/01 | 15:28 | 2.4 | 4.5 | 304 | +57.1 | +0.0 | 60 | 29.31 | 0.00 | 0                |
| 02/01 | 15:29 | 4.2 | 5.4 | 296 | +57.1 | +0.0 | 60 | 29.31 | 0.00 | 0                |
| 02/01 | 15:30 | 1.6 | 3.2 | 284 | +57.1 | +0.0 | 61 | 29.32 | 0.00 | 0                |
| 02/01 | 15:31 | 2.9 | 4.5 | 292 | +57.1 | +0.0 | 61 | 29.31 | 0.00 | 0                |
| 02/01 | 15:32 | 2.1 | 4.2 | 266 | +57.2 | +0.0 | 61 | 29.31 | 0.00 | 0                |
| 02/01 | 15:33 | 3.1 | 4.2 | 292 | +57.2 | +0.0 | 62 | 29.31 | 0.00 | 0                |
| 02/01 | 15:34 | 3.8 | 5.1 | 267 | +57.2 | +0.0 | 61 | 29.31 | 0.00 | 0                |
| 02/01 | 15:35 | 2.3 | 4.5 | 282 | +57.2 | +0.0 | 62 | 29.32 | 0.00 | 0                |

Press any key to continue or Esc key to exit:

Figure 8 Data Log Display

## Display Log by Days

This procedure is identical to the Display Log by Hours option with the exception that data is retrieved in multiples of one day.

This displayed data is in the same format as the logged data retrieved by hours. See Figure 8 and the preceding section, Display Log by Hours, for a detailed explanation of the data format.

To display logged data sorted by days:

- Press "4" at the main menu.
- Enter the number of days to be retrieved (any number from 1 to 100).
- The first 18 data records will be displayed in the format shown. A maximum of 18 records can be displayed on a single screen, so the remaining data must be continued on succeeding screens.
- To view the next screen, simply press the space bar. Each successive screen may be viewed by pressing the space bar. You may not, however, return to a previous screen, you must return to the main menu and begin the retrieval procedure anew.

If you want to further manipulate or obtain a printed copy follow the procedure described in the Data Download section below.

## Data Download

Selection “5” on the main menu “Data download” – allows you to save a permanent record of the WMS-16’s stored data. The data retrieval procedure is dependent on the communications software program used. Using Microsoft HyperTerminal, saving the program to disk is accomplished as follows:

- Press “5” at the main menu.
- Then press “Y”

transfer is a nondestructive readout. The format of downloaded data is shown in Figure 9.

- Now going to the top of the HyperTerminal screen click on “Transfer”.
- Click on “Receive File”; make sure the protocol is XMODEM; enter the directory and folder name where you want to store the data.
- Click on “Receive” and enter the file name, e.g. weather01.
- Click on “OK” and download will start.

Transfer time from a full memory may take up to eleven minutes due to the error checking and the de-convolution of the binary data to ASCII format. The down loaded file can be entered into a spreadsheet or word processing program for viewing or manipulating. Note that the total contents of the memory is downloaded each time the Memory Download procedure is invoked. The data

| Omega Base Station |       |      |     |    |       |       |       |       |        |
|--------------------|-------|------|-----|----|-------|-------|-------|-------|--------|
| DATE               | TIME  | WS   | PK  | RF | BP    | RH    | TP    | TP    | WD     |
| 17 Feb             | 17:53 | 0.25 | 1.5 | 0  | 28.96 | 79.25 | 48.06 | 70.94 | 318.69 |
| 17 Feb.            | 17:54 | 0    | 0   | 0  | 28.96 | 79.31 | 48.06 | 70.88 | 314.62 |

Figure 9 WMS-16 Data Download

## Clear Logging Memory

The final selection on the main menu lets you erase the stored data from the WMS-16’s memory and begin logging fresh data.

Once the WMS-16’s available memory is filled with data, incoming records will replace the oldest stored data, and that data will be erased. The CLEAR LOGGING MEMORY option, on the other hand allows you to clear the entire memory.

Remember: once the memory is cleared, the data cannot be retrieved (unless it has been copied to a disk using the DATA DOWNLOAD option).

To clear the logging memory:  
 Press “9” at the main menu (CLEAR LOGGING MEMORY).  
 The following message appears: Are you sure you want to delete log file [Y or N]:  
 If you want to continue, type “Y”.  
 The following message will appear: Erasing Data Memory.  
 Please wait.

When the memory is erased, the WMS-16 returns to the current observations screen and data logging resumes

Enter the type of alarm function you wish to use Exclusive (Alarm switch is closed when the reported sensor value is outside of the low and high values selected.) or Inclusive (Alarm switch is closed when the reported sensor value is between the low and high values selected.).  
 Enter Output: A1 [1] or A2 [2].  
 Enter low threshold.  
 Enter high threshold.  
 Enter on delay in seconds [0-1200]. It is the time that the sensor value is in the alarm condition before the alarm switch activates.  
 Enter off delay in seconds [0-1200]. It is the time that the alarm switch drops out of the alarm condition before the alarm switch deactivates.  
 After entering this information the Setup menu reappears and to add additional alarms the process must be repeated.

#### Part B: Interfacing to the Alarm Circuit

An intermediate relay is recommended as the alarm interface to the device being controlled by the alarm. The intermediate relay provides isolation from any voltage or current spikes that might be associated with the device being controlled, e.g. a pump motor starting. Further, it is possible to use a programmable time relay in order to insure that the alarm does not go into a dithering state. A typical implementation is shown in Figure 11.

## ALARMS

There are six user programmable alarms on the WMS-16. They can be assigned to either of two alarm switches. (ALARM 1 and ALARM 2) which provide a switched connection to ground. Electrical connection is made to the terminal strip at the positions labeled ALARM 1 and ALARM 2. The maximum current sinking capability of these switches is 2amps.

## SETTING UP THE ALARMS

Part A: Selecting the Sensor to be alarmed and the Alarm Thresholds and the On and Off Delays for each Alarm

Press ENTER to get to the MAIN MENU.  
 From the MAIN MENU press number 1. STATION SETUP  
 From the STATION SETUP menu press number 7. ENTER ALARM THRESHOLDS.  
 Select ADD, DELETE or QUIT. If you select Add, the next menu will display the list of sensors that are currently activated.  
 To add an alarm, enter the sensor number.

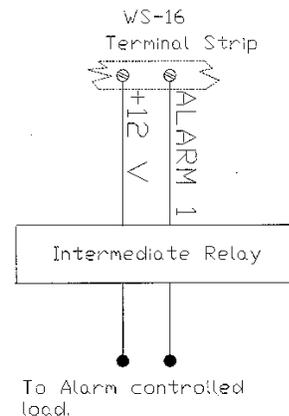


Figure 14 Alarm Setup

## Interfacing the WMS-16 with a Telephone Modem

The WMS-16 has a modem compatible firmware, which makes it possible to connect a standard telephone modem, with a speed capability of at least 9600 baud, between the WMS-16 and a telephone line so that the WMS-16 can be accessed remotely via telephone from a computer.

The serial cable from the WMS-16 is plugged into the modem. The modem at the WMS-16 is configured for auto answer and

to always have DCD on. The modem is then plugged into a telephone line and it is ready to be called from a remote location.

In order to call the WMS-16 from a remote computer the computer needs to have a communications program such as HyperTerminal or Procom. The communications parameters for the communications program are ASI, 9600, 8-N-1.

When the computer calls the WMS-16, the WMS-16's modem will go off-hook and the WMS-16, will begin transmitting to the remote computer. All of the WMS-16's functions are available from the remote computer. This includes observing real time data, looking at the hourly or daily logs, down loading data, and changing setup parameters such as logging period.

## **APPENDIX 1      WMS-16**

The WMS-16 is configured at the factory for the sensors it is shipped with. The following information is provided to aide the user to make changes in the as delivered setup.

Instructions for setting up the WMS-16 with the following sensors.

### **Wind Speed and Direction**

Connect the wind sensor=s signal cable to the terminal strip on the back of the control module. This sensor has a four conductor shielded cable. The RED wire is connected to the +5 REF terminal; The BLACK wire is connected to a GROUND terminal; the GREEN wire (wind direction signal) is connected to the A7 terminal and the WHITE wire (wind speed signal) is connected to the P1 terminal. The WMS-16 is now ready for wind speed and wind direction initializing.

### **INITIALIZATION OF WIND SPEED AND DIRECTION SENSORS**

Press EXC to get the MAIN MENU.

From the MAIN MENU press number 1. STATION SET UP.

From the Station Set Up menu press number 6. ADD OR REMOVE SENSORS. Then press Y, then ENTER.

From the Sensor Types Menu select 2. WIND SPEED.

From the Wind Speed Sensors Menu select 1. (WS-01/02). Then press ENTER.

From the Sensor Input Channel select number 1, P1 (Pulse Counter). Then press ENTER.

The Sensor configuration screen is displayed and it will show:

| Sensor type | Model    | Input | Calibration |
|-------------|----------|-------|-------------|
| Wind Speed  | WS-01/02 | P1    |             |

If you intend to add another sensor select A. If you do not want to add another sensor select Q. You will be asked if you are sure that you want to erase memory. If you have added or deleted a sensor select Y if not select N and press ENTER.

To initialize the Wind Direction sensor Press EXC to get the MAIN MENU.

From the MAIN MENU press number 1. STATION SET UP Then press ENTER

From the Station Set up menu press number 6. ADD OR REMOVE SENSORS. Then press Y, then ENTER.

From the Sensor Type Menu select number 3. Wind Direction. Then press ENTER

From the Wind Direction Sensor menu select number 1. (WS-02) then press ENTER.

From the Sensor Input Channel menu select number 11. ANALOG INPUT A7. Then Press ENTER.

The Sensor Configuration menu appears and it will show:

| Sensor type    | Model    | Input | Calibration |
|----------------|----------|-------|-------------|
| Wind Speed     | WS-01/02 | P1    |             |
| Wind Direction | WS-02    | A7    |             |

## **Temperature (thermistor) and Relative Humidity (capacitive sensor) Installation**

Connect the combination temperature and relative humidity sensor's cable to the terminal strip on the back of the control module. This sensor has a five conductor cable. The RED wire is connected to the +12 REF terminal. The BLACK wire is connected to a GROUND terminal. The BROWN wire (humidity signal) is connected to the A4 terminal. The WHITE (temperature signal) is connected to the A6 terminal and the GREEN wire is connected to a GROUND terminal.

### INITIALIZATION OF TEMPERATURE AND RELATIVE HUMIDITY

#### INITIALIZATION OF THE AUXILIARY TEMPERATURE SENSOR.

Press EXC to get the MAIN MENU.

From the MAIN MENU press number 1. STATION SET UP.

From the Station Set Up menu press number 6. ADD OR REMOVE SENSORS. Then press Y, then ENTER.

From the Sensor Type Menu select number 4. Temperature. Then press ENTER.

From the Temperature Sensors Menu select number 1. (WMS-16T). Then press ENTER.

The menu then asks: Enter temperature offset or press Q to quit. Press Q.

From the Sensor Input Channel Menu select number 9. A5. Then press ENTER.

If you intend to add another sensor select A.

If you do not want to add another sensor select Q.

You will be asked if you are sure that you want to erase memory. If you have added or deleted a sensor select Y if not select N and press ENTER.

If you selected AA@ to add the Relative Humidity Sensor then press Y, then ENTER.

From the Sensor Types menu select 5. (Humidity)

From the Humidity Sensors menu select 1. (25500504(U)/40). Then press ENTER

From the Sensor Input Channel select 8. (A4). Then press ENTER

The Sensor Configuration menu appears and it will show:

| <u>Sensor type</u> | <u>Model</u> | <u>Input</u> | <u>Calibration</u> |
|--------------------|--------------|--------------|--------------------|
| Humidity           | WMS-16-PN    | A4           |                    |
| Temperature        | WMS-16T      | A5           |                    |

If you intend to add another sensor select A. If you do not want to add another sensor select Q.

You will be asked if you are sure that you want to erase memory. If you have added or deleted a sensor select Y if not select N and press ENTER.

## **Barometric Pressure Installation**

Connect the barometer cable to the terminal strip on the back of the control module. This sensor has a three conductor cable. The RED wire is connected to a +12V terminal. The BLACK wire is connected to a GROUND terminal and the GREEN wire is connected to terminal A2.

## INITIALIZATION OF THE BAROMETER

Press EXC to get the MAIN MENU.

From the MAIN MENU press number 1. STATION SETUP.

From the Station Set Up menu press number 6. ADD OR REMOVE SENSORS. Then press Y, then ENTER.

From the Sensor Type menu select number 6. (Pressure). Then press ENTER.

From the Pressure Sensors menu select number 1. (WMS-16BP). Then press ENTER.

The menu asks: Enter pressure offset or press Q to quit. Press Q.

Pressure            WMS-16BP            A2

If you intend to add another sensor select A. If you do not want to add another sensor select Q.

You will be asked if you are sure that you want to erase memory. If you have added or deleted a sensor select Y if not select N and press ENTER.

## **Rain Gauge Installation**

Connect the rain gauge cable to the terminal strip on the back of the control module. This sensor has a two conductor cable. Connect one conductor to a GROUND terminal and the other conductor to terminal P3.

### INITIALIZATION OF THE RAIN GAUGE

Press EXC to get the MAIN MENU.

From the MAIN MENU press number 1. STATION SETUP.

From the Station Set Up menu press number 6. ADD OR REMOVE SENSORS. Then press Y, then ENTER.

From the Sensor Type menu select 7. (Precipitation).

From the Precipitation menu select 1. (All models). Then press ENTER.

From the Sensor Input Channel select 3. (Pulse Counter 3). Then press ENTER.

The screen directs you to: Enter tip resolution or press [Q] to quit. Press 0.01. For metric use 0.254. Then press ENTER.

The Sensor Configuration menu appears and it will show:

| <u>Sensor type</u> | <u>Model</u> | <u>Input</u> | <u>Calibration</u> |
|--------------------|--------------|--------------|--------------------|
| Precipitation      | All models   | P3           | 0.01               |

Changing units on the SETUP menu will not change the reported value for rainfall. That change must be made from the ADD OR REMOVE SENSORS menu.

## **Installation of Auxiliary Temperature Sensor**

The auxiliary temperature sensor is a thermistor attached to a two conductor cable. Connect one conductor to A5 terminal and the other conductor to a GROUND terminal.

#### INITIALIZATION OF THE AUXILIARY TEMPERATURE SENSOR.

Press EXC to get the MAIN MENU.

From the MAIN MENU press number 1. STATION SET UP.

From the Station Set Up menu press number 6. ADD OR REMOVE SENSORS. Then press Y, then ENTER.

From the Sensor Type Menu select number 4. Temperature. Then press ENTER.

From the Temperature Sensors Menu select number 1. (WMS-16T). Then press ENTER.

The menu then asks: Enter temperature offset or press Q to quit. Press Q.

From the Sensor Input Channel Menu select number A6. Then press ENTER.

If you intend to add another sensor select A.

If you do not want to add another sensor select Q.

You will be asked if you are sure that you want to erase memory. If you have added or deleted a sensor select Y if not select N and press ENTER.

## **Installation of Solar Radiation Sensor**

Connect the solar radiation sensor to the terminal strip on the back of the control module. This sensor has a two wire cable. Attach the WHITE conductor to the A1 terminal and the BLACK conductor to a GROUND terminal.

#### INITIALIZATION OF THE SOLAR RADIATION SENSOR

Press EXC to get the MAIN MENU.

From the MAIN MENU press number 1. STATION SETUP.

From the Station Set Up menu press number 6. ADD OR REMOVE SENSORS. Then press Y, then ENTER.

From the Sensor Type menu select number 8. Solar Radiation. Then press ENTER.

From the Solar Radiation menu select number 1. Model 240-140. Then press ENTER.

Next enter the calibration factor from the calibration sheet, which was supplied with the sensor.

Then press ENTER.

Then select Channel A2.

The Sensor Configuration menu appears and it will show:

## SPECIFICATIONS

### DATA ACQUISITION MODULE

**Reporting Units:** English or Metric, all measurements  
**Operating Power:** 10-16 Vdc  
**Power Consumption:** 60 mA maximum  
**Serial Port:** 9-pin d-sub connector, selectable baud rate, flow control  
**Memory:** 128KB RAM, non-volatile (45 days at 15 minute intervals with 6 sensors)

### OPERATING TEMPERATURE

**Transducers:** -40° to 140°F (-40° to 60°C)  
**Data Acquisition Module** -40° to 140°F (-40° to 60°C)

### TIMEKEEPING

**Format:** MM/DD and HH:MM  
**Accuracy:** ± 30 seconds/month

### BAROMETRIC PRESSURE

**Range:** 28.25 to 30.75 inches Hg  
**Measurement Span:** 2,50 inches Hg (85 hpa)  
**Resolution:** ±0.01 inch Hg or ±0.3 hpa  
**Altitude Offset:** 0 to +10,000 feet, screwdriver adjustable

### WIND SPEED

**Range:** 0 to 125 mph (0-57 m/s)  
**Resolution:** >0.1 mph  
**Accuracy:** ± 3% for sustained 2 second average  
**Starting Threshold:**  
    WMS-16-2E: 1.2 mph  
    WMS-16-5E: 0.5 mph  
**Time Constant:** 2 seconds

### WIND DIRECTION

**Range:** 0-360°  
**Resolution:** > 1°  
**Accuracy:** ± 3%

### TEMPERATURE

**Range:** -40° to +140°F Resolution: > .1°F

**Accuracy:** ± 1°F

### RELATIVE HUMIDITY

**Range:** 0-100% RH  
**Accuracy:** ± 3% midscale, ± 6% @ 20% & 90% RH

### RAIN GAUGE

**Resolution:** 0/01"/tip  
**Accuracy:** ± 2% up to 3"/hour  
**Max Rate:** Unlimited

### SOLAR RADIATION (Optional)

**Sensor:** Photodiode detector  
**Spectral Response:** .4 to 1.1 microns  
**Sensitivity:** 100mV / 1000w/m<sup>2</sup> approx  
**Accuracy:** ± 5%

## ORDERING INFORMATION

|                  |  |
|------------------|--|
| <b>WMS-16</b>    | <b>Modular Weather Station</b>   |
| WMS-16D          | includes the following components:<br>Data Acquisition Module, includes DOS<br>Software diskette, serial & aux battery<br>cables |
| WMS-16P          | 115 VAC Power Supply   |
| WMS-16-2E        | Wind Speed/Direction Sensor, 40'' cable  |
| WMS-16TH         | outdoor Temperature & relative Humidity<br>Sensor, 40' Cable   |
| WMS-16THS        | Solar Radiation Shield for temp/rh sensor  |
| WMS-16BP         | Barometric Pressure Sensor, 18'' Cable<br>(Note; sensor always to be near base unit)   |
| WMS-16RC         | Rain Gauge, includes mounting arm &<br>40'Cable  |
| WMS-16TM         | 5' Tripod & 5'Sensor Mast (8' total)   |
| <b>WMS-16EPA</b> | <b>High Sensitivity Modular Weather<br/>Station</b>  |
| WMS-16-5E        | same as above but with:<br>High Sensitivity Wind Sensor, 40' Cable   |

**Options:**

- WMS-16SR**     **Solar Radiation Sensor**, includes mounting arm and 40' cable
- WMS-16T**     **Auxiliary Air Temperature Sensor**, 40' Cable
- WMS-16TWS**   **Water or Soil Temperature Sensor**, 40' Cable
- RG-2501/40**   **Tipping Bucket Rain Gauge**, 40' Cable
- WMS-16PE**     **Power Supply 220 VAC**
- WMS-ENCL-16A** **NEMA-4X Enclosure Assembly**, includes mounting brackets, 12V 7AH battery and 10 watt solar panel battery charger
- WMS-ENCL-16B** **NEMA-4X Enclosure Assembly**, includes mounting brackets, 12V 7AH battery and 110Vac/60Hz battery charger
- WMS-16MAC**   **Telephone Modem AC Powered**
- WMS-16MDC**   **Telephone Modem DC Powered**
- WMS-16STR**   **Software, Windows Graphical**

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OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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