# WatchDog®

# 2000 Series
# Weather Stations

## PRODUCT MANUAL

Model #'s
2900ET, 2800, 2700, 2550



# Spectrum®
## Technologies, Inc.

# QUICK START

# CONTENTS

# General overview

Thank you for purchasing a WatchDog 2000 Series Weather Station. The stations are completely weatherproof and feature 12-bit resolution for higher accuracy. The stations can be accessed at different times by multiple users because the data is not cleared from memory following a download. The 2000-Series weather stations can communicate via direct-wire, radio or telephone connections.

Current weather conditions, historical data, and computed parameters are easily viewed on the station's LCD screen. The station LCD can also be programmed to display a variety of plant disease infection potentials. The arrow keys can be used to program the station's logging interval and assign sensors to the external sensor ports. You can also scroll through the sensor readings, Degree Day/Chill Hour calculations and set your temperature ranges.

# Model 2800 Stations

The model 2800 station is equipped with 9 external sensor ports. It can be connected to any WatchDog external sensor. This station is unique in that it has no internal sensors. It is not possible to collect data for air temperature, relative humidity, and wind speed/direction. Therefore, the station cannot calculate Growing Degree Days, Chill Hours, Wind Chill, Dewpoint, Evapotranspiration or any Disease Models.

Although a rain collector is not included as a standard sensor, it can be added as an optional external sensor.

# Package Contents

Your 2000 Series Weather Station package should contain the following components:

Manual
Weather Station
Parts Box
        Wind Vane
        Wind Cups
        4 AA Batteries
        Ground Screw
        Mounting Hardware—used to attach station to
pole
Alan Wrench
Other tools needed, but not included:
Phillips screwdriver
Ground screw bottom clamp

# Specifications

**Data capacity**
8800 data intervals. For example, for a 30-min interval, the station will run for 183 days before wrapping data.
**Size**
**2900ET, 2700**: 12 in (30 Cm) H x 8.5 in (21.5 cm) W x 12 in (30 cm) D.
**2550, 2800**: 10 in (26 cm) H x 8.5 in (21.5 cm) W x 3.5 in (8.5 cm) D.
**Weight (with rain collector and anemometer)**
6.4 lbs (2.9 kg)
**Power Source**
4 AA batteries
**Battery Life**
10 months with alkaline batteries, 12 months with Lithium
**Available External Sensor ports**
6 (5 on model 2900ET, 9 on model 2800)
**Included Sensors**
The following table lists the specifications for sensors that are included with the different models of weather station.

# Specifications (cont.)

**Operating Temperature Range**: -22° to 130°F (-30° to 55°C)

| Sensor | Available on | Measurement | Accuracy |
|---|---|---|---|
| Wind Speed | All but 2800 | 0, 2-150 mph 0, 3-241 km/h | ±2 mph (±3 km/h), ±5% |
| Wind Direction | All but 2800 | 1° increments | ±4° |
| Air Temperature | All but 2800 | -32° to 100°C -25° to 212°F | ±0.6°C ±1°F |
| Relative Humidity | 2550, 2700, 2900ET | 10% to 100% @5° to 50°C | ±3% |
| Dew Point | 2550, 2700, 2900ET | -73° to 60°C -99° to 140°F | ±2°C ±4°F |
| Rainfall | 2600, 2700, 2900ET | 0.01" (0.25mm) resolution | ±2% at < 2 in (5 cm) / |
| Solar Radia- | 2900ET | 1-1500 W/m$^2$ | ±5% |

For a Weather Station to be compatible with the SMEC300 sensor, SpecWare software version 9.04 or later is required. See the following table for the earliest compatible firmware and number of sensors that can be used per station type are listed below.

| Weather Station | Firmware Version | Number of Sensors | Available Channels |
|---|---|---|---|
| 2550, 2700 | 6.9 | 2 | A, D |
| 2800 | 3.2 | 2 | A, D |
| 2900ET | 6.9 | 1 | A |

**External Sensors**

The following table lists the available optional sensors. All sensors include a 6-foot cable with pin-type connector. To connect an external sensor to the logger, plug the sensor cable into the logger port that has been programmed for that particular sensor. If the sensor is not connected, the message "sensor error" will appear on the LCD display for the respective logger port until the sensor is connected.

| Item # | Sensor Description |
|---|---|
| 3666 | Leaf Wetness |
| 3667 (6ft), 3667-20 (20ft) | External (Soil) Temperature |
| 3670i | Silicon Pyranometer |
| 3668i 3668i3, 3668i6 | Quantum Light |
| 3669 | Soil Moisture Transducer |
| 6470-6 (6ft), 6470-20 (20ft) | WaterScout SMEC 300 Soil Moisture/EC/ Temp Sensor |
| 6460 (6ft), 6460-20 (20ft) | WaterScout SM 100 Soil Moisture Sensor |
| 6450WD (6ft), 6450WD20 (20ft) | Watermark Soil Moisture Sensor |
| 6452-20, 6452-ADPT | 20cm ECHO Soil Moisture Sensor |
| 6451 | Irrigation On/Off |
| 3671 | Barometric Pressure |
| 3673, 3674 | Input Cable for User Supplied Sensor |
| 3664 | 20 ft. Sensor Extension Cable |

# Anemometer setup



Apart from the anemometer, the WatchDog Weather Station comes fully assembled and ready to mount. The anemometer arm is attached to the enclosure back plate with two clamps. After positioning the arm, the screws should be tightened to secure it in place.

A plastic envelope containing a screw and a star washer are included with the station. The star washer should be used under the screw holding the bottom anemometer clamp. Once the arm is positioned, the self-tapping screw should be screwed into the arm through the hole drilled in the clamp. These parts improve resistance to electrostatic discharge.

Push the wind cups onto the bottom of the shaft flush with the bottom of the assembly and tighten the set screw. When released, the cups should drop slightly. If the cups do not spin freely, loosen the set screw and lower the cups slightly. The gap between cup hub and assembly should be about 1/16 inch.



Push the wind vane onto the top of the shaft and calibrate (see Calibrating the Anemometer p. 23 for calibration procedure).

*Anemometer clamped to back plate (unpainted clamps substituted for visibility)*

# Station Installation

The weather station should be located in an open, unobstructed, grassy area to ensure accurate measurement of wind, rainfall, sunlight, and evapotranspiration.

Mounting hardware is provided to attach the weather station to a 4" x 4" treated wooden post or to a mast/pole up to 1.25 inches in diameter. The mounting pole should be securely anchored perpendicular to the ground.

If you are using the mounting tripod (item # 3396TP), open it and place it where the weather station is to be located. The tripod feet can also serve as mounting brackets if the unit is located on a solid surface. Slide the 3' post through both center screw clamps, adjust the height as desired and tighten the screws such that the post is perpendicular to the ground. Finally, attach the weather station to the post with the u-bolts.



*Weather Station mounted on tripod*

**Important:** Secure the external sensor wires to the mounting pole with a plastic tie. This will ensure that the sensor wires do not become disconnected while recording.

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# Connection Options

The WatchDog weather station communicates with a PC through either the **Computer** or **AUX** port which are located under the LCD and keypad. The communication options are separated into 3 main categories.

**Direct Communication**
There are 3 options for connecting directly to the station.
1. PC interface cable - The cable that accompanies the SpecWare software. Connects to the **Computer** port.
2. A 75-ft Direct Connect Cable (item 3660-75SP) - This cable has a modular (telephone-type) connector on one end and a 9-pin RS-232 connector on the other. Comes with surge protection and connected to the station through the **AUX** port.
3. Short-Range Modem Pair - The weather station can be hardwired up to 4000 feet from a PC with a twisted-pair cable and a short-range modem pair. Powered with an A/C adapter and connected to the station through the **AUX** port.

**Caution**: Extended lengths of cable can attract lightning. It is recommended that these cables always be connected to surge protectors. This provides upgraded protection against voltage surges caused by nearby lightning strikes.

**Wireless Radio Communication**
There are 2 options for contacting the station by a wireless radio connection. The short-range transceiver can communicate up to 1000 ft. The mid-range radio has a range of 2 miles. Both wireless options require line of sight between the base and remote radios. See the **WatchDog Wireless Modem** user's guide for additional details.

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**Long-range (telephone) Communication**

If the weather station will be located further than 2 miles from the base PC and/or it is not possible to achieve line-of-sight with the station, the only other remote connection option is via a land-line or cellular telephone connection. These modems are not waterproof and require a power source other than the station's AA batteries. If electricity from a local utility is not available, this power will need to come from a battery. It is common for this battery to be charged by solar panels so that station does not need to be visited on a frequent basis. Contact Spectrum Technologies for additional details on these options.
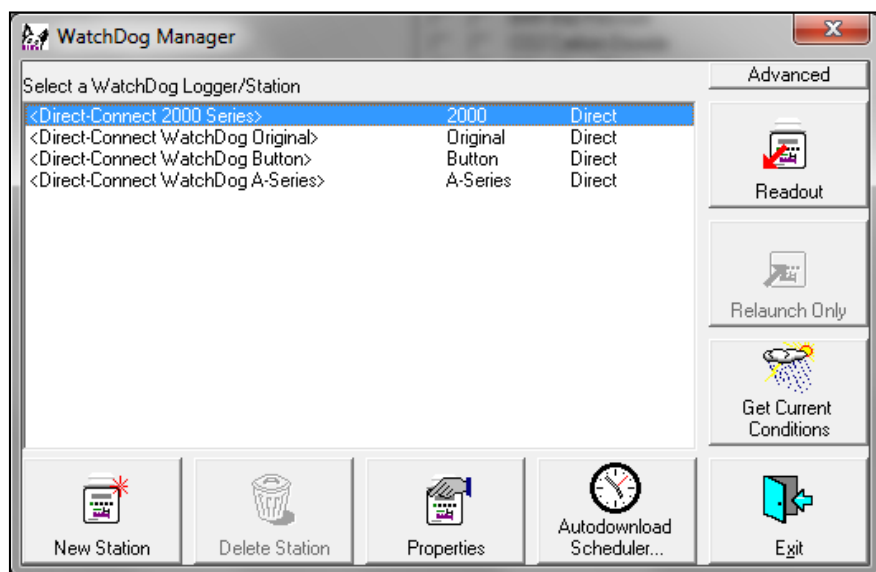
# Configuring the Weather Station

The 2000-Series weather station does not have a button or switch for powering up and down. Instead, the device is operational whenever the batteries are installed. The stations are shipped with default logging settings that can be modified with SpecWare software or with the station's keypad. Once the station is configured, it will retain those settings even after the battery is removed or replaced.

Stations sold after January 2012 include a built in clock with an independent battery. These stations are set to USA Central time, and need to be reset for other locations. The clock will continue to keep time when the AA batteries are removed.

One notable feature of the WatchDog 2000-Series weather stations is that they do not need to be re-launched after being downloaded. This allows greater flexibility for stations that are accessed by multiple users. Although, the station stores data on a pre-set interval, the sensor readings displayed on the LCD are refreshed every 20 seconds.

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# Configuring the Weather Station with SpecWare

The 2000-Series weather stations can be configured in the **WatchDog Manager** screen of SpecWare software (see SpecWare9 User's Guide for details). Click new station. Configuration through the software is necessary to change the station name, enable/disable Disease Models or set parameters for the Alarm Output Module. Remember to identify the WatchDog type as 2000-series.

# Configuring the Weather Station with the Keypad

For the 2000 Series weather stations, SpecWare software is not necessary to configure the station. The keypad can be used to select all essential configuration options. Configurable parameters are; sensor type, logging interval, Degree Day calculation method and latitude and altitude (model 2900ET only). Configuration through the software is necessary to change the station name, enable/disable Disease Models or set parameters for the Alarm Output Module.

The keypad sequences to set each parameter are as follows.

### Setting the Logging Interval

If set for a 30-minute logging interval, the station can hold 183 days of data. Changing the logging interval will also change the frequency that the station's memory wraps around and writes over older data.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Use the arrow keys to scroll to the 'Log Interval' option.

> SET LOG INTERVAL
> Press SET

4. Press **Set**.

> Set Log Interval
> Interval=30 min

5. Use the arrow keys to scroll to the desired port.
6. Press **Set**. LCD will return to the 'Current Values' screen.

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**Setting the Sensor Type**
Although the keypad can be used to assign a sensor to an external port, this should only be done when initially starting the station, re-starting a station whose memory has been cleared, or for adding a sensor to a previously unused port. If a port's sensor assignation is changed without first downloading the station, all data read from that port, including historical data read before the change, will be translated to engineering units as if the new sensor had always been connected.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Use the arrow keys to scroll to the 'Sensor Type' option.

> SET SENSOR TYPE
> Press SET

4. Press **Set**.

> Select Port Now
> Select Port (↑↓)

5. Use the arrow keys to scroll to the desired port.

> Select Port Now
> Port B Press Set

6. Press **Set** to select the port.

> Set Port B Sensor
> Select Type (↑↓)

7. Use the arrow keys to scroll to the desired sensor type.

> Set Port B Sensor
> PAR Light

8. Press **Set** to select the sensor type. LCD will then return to the 'Current Values' screen.

### Setting Geographic Data for the ET Report

In addition to temperature, relative humidity, wind speed and solar radiation data, the Penman-Monteith algorithm used by the 2900ET statopm uses the station latitude and altitude to compute reference ET. These are input as follows:

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Use the arrow keys to scroll to the 'ET Values' option.

> SET ET VALUES
> Press SET

4. Press **Set**.

> Set LATITUDE Now
> Select LAT (↑↓)

5. Use the arrow keys to scroll to the desired latitude. Take care that N precedes the latitude angle if the station is in the northern hemisphere.

> Set LATITUDE Now
> LAT=N45$^o$ Hit Set

6. Press **Set** to set the latitude angle.

> Set ALTITUDE Now
> Select ALT (↑↓)

7. Use the arrow keys to scroll to the desired altitude.

> Set ALTITUDE Now
> ALT=500Feet

8. Press **Set** to set the altitude. LCD will return to the 'Current Values' screen.

**Selecting the Degree Day Calculation Method**
The weather station has 2 options for calculating Degree Days (see Degree Days/Chill Hours, p. 31). The weather station must measure air temperature for this option to be available. The desired method is selected as follows:

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Use the arrow keys to scroll to the 'DD Calc Method' option.

> SET DD CALC METHOD
> Press SET

4. The current calculation will be displayed.

> DD TYPE = ACTUAL
> Press SET

5. Press **Set** to make this option modifiable.

> DD TYPE = ******

6. Use the arrow keys to select the desired method.

> DD TYPE = S SINE

7. Press **Set** to select the method. LCD will return to the 'Current Values' screen.

# Other Keypad Operations

The most common use of the keypad is to view the weather station's current sensor readings, calculated parameters, and archived data. Pressing the **Display** key once brings the LCD display to life. The screen will initially display descriptive information about the station. The screen then displays current conditions. Current conditions are refreshed every 20 seconds. Pressing the **Display** key a second time will deactivate the display. The station continues to record data when the display is not active. To conserve battery power, the display goes off after 2 minutes of inactivity. The weather station only records the measurements from the sensors. Parameters calculated and displayed on the LCD by the firmware (such as Growing Degree Days) are only retained in the Daily Archive (see Daily Archive, p. 25).

In addition to being able to configure parameters needed by SpecWare, the keypad is also used to set the date/time, calibrate the wind vane, reset the running rain counter, configure the radio and select options for parameters calculated and displayed by the station's firmware.

The keypad sequences to set each parameter are described on the following pages.

**Setting the Date and Time**
It is necessary to use the keypad to set the date and time for the data being stored in the long-term memory.  This is the <u>only</u> keypad function that is reflected in the logged data that can't be handled via a software connection.

1. Press **Display**.
2. Press **Set**.

| Select Parameter |
| To Be Set (↑↓) |

3.  Press the down arrow key once to reach the 'Time & Date' screen.

| TIME & DATE |
| Press SET |

4.  Press **Set**.

| 09-22-12 11:45AM |
| Press SET |

5.  Press **Set**.

| **-22-12 11:45AM |

6. Enter the month using the arrow keys. Press **Set**.
7. Enter the day. Press **Set**.
8. Enter the year. Press **Set**.
9. Enter the hour. Press **Set**.
10. Enter the minutes. Press **Set**.
11. Enter AM or PM. Press **Set**.
12. LCD will return to the 'Current Values' screen.


Stations sold after January 2012 include a built in clock with an independent battery. The clock will continue to keep time when the AA batteries are removed.

**Setting the Display Units**
This option determines whether the LCD will show data in English or metric units.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Use arrows to scroll to 'Display Units'.

> DISPLAY UNITS
> Press SET

4. Press **Set**.

> UNITS = English
> Press Set

5. Press **Set**.

> UNITS = *******
> Press Set

6. Use the arrow keys to choose whether data is displayed in English or metric units.
7. Press **Set**. LCD will return to the 'Current Values' screen.

Note: The unit system used by the 2000-Series Weather Station can be modified by both the keypad <u>and</u> by SpecWare. Although it is advisable to have both the software and firmware using the same unit system, it is not required. SpecWare is equipped to handle situations where it receives data in a different unit system. However, if you use SpecWare to change any of the weather station's configuration parameters (i.e. logging interval), the data logger will also be reconfigured to use the unit system used by SpecWare.

**Setting the Degree Day Counter**

The weather station can be programmed to compute De-gree Days for a selected base and upper temperature. This feature is distinct from the Degree Day report in SpecWare.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Scroll to 'Deg Day Count' screen.

> DEG DAY COUNT
> Press SET

4. Press **Set**.

> Counter:  DISABLED
> BASE=55 UPPER=55

5. Press **Set**.

> Counter:  ********
> BASE=55 UPPER=55

6. Use arrow keys to scroll to "StartNow" option. This will start the degree day counter.   The other option is DISABLED.
7. Press **Set**.
8. Choose the base temperature using the arrow keys.
9. Press **Set**.
10. Choose the upper temperature limit using the arrow keys.
11. Press **Set**. LCD will return to the 'Current Values' screen.

**Caution:** Be careful when entering a parameter update screen for the degree day counter when the counter is enabled.  If the **Set** key is pressed, the counter status will become modifiable and the archives WILL BE ERASED. If this is not desirable, press one of the arrow keys in-stead of the **Set** key to exit the screen.

**Setting the Chill Hour Counter**

The weather station can be programmed to compute Chill Hours for a selected base temperature. This feature is distinct from the Chill Hours report in SpecWare.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Scroll to the 'Chill Hours' screen.

> CHILL HOURS
>     Press SET

4. Press **Set**.

> Counter:  DISABLED
> BASE=55

5. Press **Set**.

>   Counter:  ********
> BASE=55

6. Use arrow keys to scroll to "StartNow" option. This will start the chill hour counter. The other option is DISABLED.
7. Press **Set**.
8. Choose base temperature using the arrow keys.
9. Press **Set**. LCD will return to the 'Current Values' screen.

**Caution:** Be careful when entering a parameter update screen for a chill hour counter when that counter is enabled. If the **Set** key is pressed, the counter status will become modifiable and the archives WILL BE ERASED. If this is not desirable, press one of the arrow keys instead of the **Set** key to exit the screen.

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## Configuring the Wireless Radio Address

The numerical address of the remote transceiver must be entered into SpecWare software to facilitate wireless communication. The weather station can set the address to be the same as the station's serial number.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Scroll to the 'Configure Radio' screen.

> CONFIGURE RADIO
> Press SET

4. Press **Set** to bring up the configuration screen.

> Press SET Again
> To Config Radio

5. Press **Set** again to configure radio.
6. When finished, the screen will go back to Current Values.

## Calibrating the Wind Vane

When the weather station is initially placed in the field or moved, the wind direction must be calibrated. The following procedure will allow you to establish accurate wind direction readings.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Scroll to the 'Set North' screen.

> SET NORTH
> Press SET

4. Press **Set** to bring up the calibration screen. The

> Hold Vane North
> Press SET Again

pointer of the weather vane should be pointed north.
5. Press **Set** again to complete calibration.
6. When finished, the screen will briefly display "DONE" then go back to Current Values.

### Resetting the Rain Counter

The weather station maintains two rain counters (see LCD Screens, p. 28); rain since midnight and total accumulated rainfall. The second counter can be reset to zero at any time. For example, to track weekly rainfall accumulations, the counter could be zeroed every Monday morning.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Scroll to the 'Reset Rain' screen.

> RESET RAIN
>     Press SET

4. Press **Set** to bring up the configuration screen.

> Press SET Again
> To Reset Rain

5. Press **Set** again to reset rain counter to zero.
6. When finished, the screen will go back to Current Values.

### Resetting the Disease Models

This option restarts the disease model calculations and should be done at the beginning of the season.

1. Press **Display**.
2. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

3. Scroll to the 'Reset Disease' screen.

> RESET DISEASE
> Press SET

4. Press **Set** to reset the disease model.
5. The screen will go back to Current Values and the disease model will be reset.

# Daily Archive

The weather station features an archive that allows you to look at historical data for that location without downloading the data. The archive is regularly updated whenever the data logger is actively collecting data. The daily archive retains the last 30 days of data. If the battery power runs low, the station's firmware will stop measuring and archiving data until the battery is replaced.

The archive is accessed by pressing the **Current/ Archive** key. The arrow keys are then used to scroll to the archived day of interest. Once a day is selected, the LCD will cycle through all the information stored for

```
DAILY ARCHIVE
Select Day (↑↓)
```

```
8/14/12
READING VALUES...
```

that day. This includes high/low temperature, high/low relative humidity, total rainfall, the degree day and chill hour counters (if enabled), and a summary of any active disease models. If the Degree Day/Chill Hour Counter was not active on a particular day, the screen will display "No Data" for that day.

**Note:  If the Degree Day counter is disabled or reset, the entire archive for that counter will be erased. Disabling the Degree Day counter does not affect the storing of data in memory and, thus will not affect any of the SpecWare report functions.**

# Battery Replacement

The 2000 Series weather stations are powered by 4 AA batteries. This will provide enough power for 1 year of continuous use with lithium batteries, or 10 months with alkaline. The battery compartment is accessed by removing the thumbscrews on the upper cover of the WatchDog (above the LCD). Upon installation of the batteries, the LCD should illuminate and the logger resume functioning. The LCD will prompt you to set the date and time (see Setting the Date and Time, p. 19).

Whenever the battery is replaced, the time and date must be reset immediately so the data is time-stamped correctly. However, all settings related to Degree Days, Chill Hours and IPM parameters (disease models, DIF, etc.) remain stored in the meter's memory even when the batteries are removed.

# Clearing the Logger's memory

The memory of the 2000-Series weather station is not automatically cleared when the station is downloaded or the batteries are replaced. The station can be cleared manually through SpecWare software. This may be desired if, for example, the station is being shut down for the season or is being moved to a new location.

Once the command is sent from SpecWare to clear the memory, the data erasure is carried out automatically by the logger itself. The PC interface cable can then be disconnected without affecting the process. A data erasure will take several minutes to complete and the station cannot be contacted in the interim. Once the memory is cleared, it is impossible to recover. SpecWare provides warning messages to prevent an accidental clearing of the memory. See the SpecWare user's guide for more details.

# LCD Screens

The following figures give examples of some of the various weather station LCD screens. Not all screens will be available on all models.

*-Initial information screen*

```
2900 v6.9 SN3971
Codes: P003 B000
```

This is the first screen that appears when the **Display** button is pressed. The first line gives the model number, version number and serial number. The second line indicates whether a disease model has been activated. This screen is from a Model 2700 version 2.0, serial number 10. The apple disease model enabled. This screen is visible for 2 seconds before proceeding to the date/ time/batter screen (below).

*-Time, Date, Battery Level*

```
09-08-12  07:09PM
BATTERY AT 90%
```

This screen shows the current date, time and battery strength. The current date is 09-08-12 and the time is 07:09 PM. The battery is at 90%.

*-Rain*

```
RAIN TODAY 00.15
SINCE RSET 01.23
```

This screen shows the current status of both rainfall counters. The top counter is the amount of rain since midnight. The lower counter is the amount of rain since the counter was last reset (See Resetting Rain Counter, p. 24).

*-Wind*

```
Wind N 10 MPH
HI 12 MPH 09:45AM
```

This top line shows the current wind speed and direction. The second line shows the high wind speed for the day and the time it occurred. (See Calibrating the Wind Vane, p. 23).

*-Temperature/Wind Chill*

```
Air Temp 36.2°F
Wind Chill 28.9°F
```

This screen shows the current air temperature and wind chill. Note that wind chill is not defined for air temperatures greater than 50°F. In that case, wind chill will be the same as air temperature.

*-Relative Humidity/Dew Point*
This screen shows the current relative humidity as well as the dew point temperature.

```
Air RH 23.6%
Dew Point 36.0°F
```

*-Daily High and Low Values*
For temperature and RH, a screen is available that displays the current high and low values for the day, along with the times at which they occurred.

```
HI 74°F 01:58 PM
LO 66°F 03:05 AM
```

*-External Sensor Ports*
Data for sensors connected to an external port are displayed with the sensor port on the first line and the sensor type and measurement on the second line.

```
Port F:
Solar 225 W/m^2
```

*-Degree Day Counter*
This screen shows the information for the Degree Day Counter . This counter is using a temperature range of 50 to 86°F. So far, it has accumulated 2125 degree days since the counter was started or reset on July 3. Degree Days calculated by the station are not saved in downloadable memory.

```
DDay 50-86°
Since 07/12 2125
```

Note: SpecWare uses stored temperature data to produce its own Degree Day reports.

*-Evapotranspiration*
This screen is only available with model 2900ET. It displays two reference evapotranspiration (ET) values. The top line is the total reference ET from the previous calendar day. The bottom line is a value which represents the total amount of ET accumulated in the last 24 hours. For example, if it is currently Tuesday at 8:00am. The lower line will give the amount of ET accumulated from 8:00am Monday to 8:00am Tuesday. ET calculated by the meter are not saved in memory.

```
ET YDAY=0.32 in
ET 24HR= 0.21 in
```

Note: SpecWare uses stored weather data to produce its own ET reports.

# Degree Days/ Chill Hours

**Degree Days**
Temperature is a key factor contributing to the development of plants, insects and plant diseases. Degree Days are a way to quantify the amount of heat that is available, which is a function of the time the temperature is within a given temperature range. For example, if the base temperature is determined to be 40 degrees and the actual temperature is 41 degrees for 24 consecutive hours, one Degree Day is said to have accumulated (41 – 40 = 1 degree for 24 hours or 1 day). Degree Days indicate the developmental stage of a pest generation. This allows for more precise pesticide recommendations.

The station's firmware has two options for calculating Degree Days, the Actual Degree Day Method and the Single Sine Method.

**Actual Degree Day Method**
Rather than simply using high and low temperature data for an entire day, the Actual Degree Day Method integrates the data at smaller time steps. Degree Day subtotals are calculated at 15 minute intervals to produce Degree Quarter-Hours (DQH), which are then summed over a full day. DQH are calculated as follows:

$$DQH = T_{avg} - T_{base}$$

Where $T_{avg}$ is the average temperature over the 15-minute interval and $T_{base}$ is the base temperature. If the average temperature is greater than the upper limit of the temperature range, the upper temperature limit is used instead of the average temperature when calculating DQH. If the average temperature is less than the base temperature, DQH is set equal to zero for that interval.

**Single Sine Method**
The Single Sine Method uses the day's maximum and minimum temperatures to generate a sine curve. This approximates the pattern of temperature variation during a typical day. The area between this curve and the lower threshold temperature represents the accumulated Degree Days for that day.

**Chill Hours**
Chill hours are calculated as the amount of time spent below a base temperature. Chill hours accumulations are used to estimate dormancy for tree fruit.

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# Rain Collector Adjustment

If rain collector is not reading correctly (or at all)

1. 1.  Launch the logger or weather station so you can see the rain measurements on the LCD (this step is not necessary if the rain collector is attached to a WatchDog 2000 Series Mini or Weather Station).

2.  Check the inside of the rain bucket for debris such as leaves that may be blocking the grid at the bottom of the bucket.  Remove the rain bucket from the base and check for any obstacles (spider webs, debris, etc.) that may be preventing the tipping spoon from moving freely.  If the hole beneath the grid gets clogged with dirt, the cotter key can be removed to allow it to be cleared.

3. Manually move the tipping spoon back and forth several times. Check the LCD after it has updated to see if these tips have been recorded.  Do this several times.

4. If the tips are being counted, skip to step 5.

If the LCD is not showing any or all of the manual tips of the spoon, it may be that the magnetic sensor on the tipping spoon is too far from the read switch or that the sensor cable is bad.  There are 2 cams on the base of the rain collector that can be rotated to move the tipping spoon closer to or further away from the read switch.  Make this adjustment and check if the LCD shows that the logger can detect manual tips of the spoon.  If so, proceed to step 5.  If not, the sensor may need to be sent in for service.

5. If all the tips are being counted, replace the rain bucket and trickle a known amount of water into the bucket.  84 ml of water should register 0.1 inches of water (2.5 mm).  This is equivalent to 10 tips of the tipping spoon.  The best results are attained when the water is added slowly.  It is recommended that the water be put in a ziplock bag which is then punctured with a pin to allow the water to slowly enter the rain bucket.

If the reading on the LCD is slightly high or slightly low, the sensor can be calibrated.  When the spoon tips, it lands on screws on either side. If sensor is reading high, lower the screws.  If it is reading low, raise the screws. It is recommended to adjust the screws a quarter turn and again run a known amount of water through the bucket to determine if additional adjustment is necessary.

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# Warranty

This product is warranted to be free from defects in material or work-manship for one year from the date of purchase. During the warranty period Spectrum will, at its option, either repair or replace products that prove to be defective. This warranty does not cover damage due to improper installation or use, lightning, negligence, accident, or unauthorized modifications, or to incidental or consequential damages beyond the Spectrum product. Before returning a failed unit, you must obtain a Returned Materials Authorization (RMA) from Spectrum. Spectrum is not responsible for any package that is returned without a valid RMA number or for the loss of the package by any shipping company.

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**DECLARATION OF CONFORMITY**

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Spectrum Technologies, Inc.
3600 Thayer Court
Aurora, IL 60504  USA

Model Numbers: 3350WD2, 3345WD2, 3340WD2, 3330WD2, 3320WD2,
3315WD2
Description:    WatchDog Weather Station
Type:          Electrical equipment for measurement, control, and laboratory use
Directive:     2004/108/EC
Standards:     EN 61326-1:2006
               EN 61000-4-2:1995, including A1:1998 and A2:2001
               EN 61000-4-3:2002
               EN 55011:2007

Michael J. Dunning, Weather Products Manager          March 25, 2009

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