WatchDog®

WeatherTracker 320/330 Apple/Pear and Grape Alert

PRODUCT MANUAL

Item # 3504, 3512

Spectrum® Technologies, Inc.

CONTENTS

This manual will familiarize you with the features and operation of your new WeatherTracker. Please read this manual thoroughly before using your instrument. For customer support, or to place an order, call
Spectrum Technologies, Inc.
(800) 248-8873 or (815) 436-4440
between 7:30 am and 5:30 p.m. CST
FAX at (815) 436-4460
E-Mail at info@specmeters.com

General overview

Thank you for purchasing a Pest Alert WeatherTracker. This device will allow you to conveniently monitor temperature and leaf wetness throughout the growing season. Current conditions and historical data are easily viewed on the station's LCD screen. See the model descriptions below.

The internal electronics calculate Growing Degree Days (GDD) for up to three degree day counters. For example, one counter can be activated at planting while another can track the development of insects. The station also calculates the number of Chill Hours, the total amount of hours during which temperatures have been below a specified low temperature. The arrow keys allow you to scroll through temperature and leaf wetness data as well as set your temperature ranges.

MODEL #	CROP	DISEASE MODEL
320	Apples	Apple Scab
325	Tomatoes Carrots Asparagus	Tom-Cast
330	Grapes	Powdery Mildew, Black Rot

Station Installation

The WeatherTracker has the versatility to be located in any micro-climate for recording weather data. Hardware is included for attaching it to a 1" to 1¼" outside diameter mast (pipe). Use a 5' - 10' length of conduit or pipe as the mast mount. When purchasing and/or cutting the mast to size, plan on placing 1½' - 2' of the mast into the ground. It can also be mounted to a wooden post with the screws that are provided.

The radiation shield protects the temperature sensor from solar radiation and other sources of reflected heat. If other sensors are included, secure the sensor

Figure 1: WeatherTracker mounted on 1" conduit

wires to the mast just below the display module with a plastic tie. This will make the wires less vulnerable to being accidentally severed during the season.

Meter Operation

The WeatherTracker does not have a button or switch for powering up and down. Instead, the device is operational whenever the battery is installed. The battery connection can be accessed by removing the face plate (fig. 2). The cover may be difficult to remove. Exercise care when replacing the plate to ensure the buttons are not damaged. When replacing or reinstalling the battery, the time and date must be reprogrammed (see Setting Date and Time p. 6). The Current Conditions screen is updated every 20 seconds.
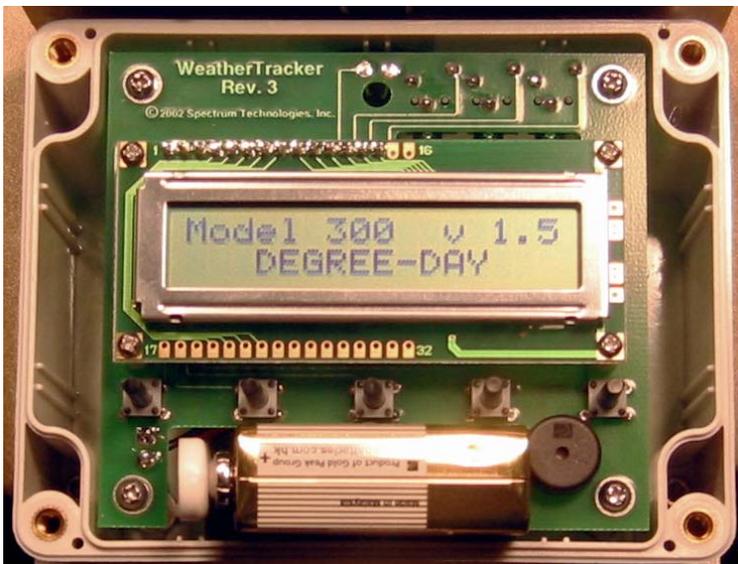

Figure 2: WeatherTracker Battery Compartment

Getting Started

New meters, or meters that have been out of service, must be configured before being placed in the field. This section takes you through the configuration process. After setting the time, unit system, or calculation parameters, the display will revert to the Current Values screen (see **Screens**, p.12)

Install Battery (see **Meter Operation** pg. 5) for instructions on installing the battery.

Setting Date and Time:
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**.

```
09-22-03 11:45AM
Press SET
```

5. Press **Set**.
6. Enter the month using the arrow keys.

```
**-22-03 11:45AM
Press SET
```

7. Press **Set**.
8. Enter the day.

9. Press **Set**.
10. Enter the year.
11. Press **Set**.
12. Enter the hour.
13. Press **Set**.
14. Enter the minutes.
15. Press **Set**.
16. Enter AM or PM.
17. Press **Set**.

Setting Display Units:

If the display is off, press **Display** to turn it on.
1. Press **Set**.

> Select Parameter
> To Be Set (↑↓)

2. Use arrows to scroll to display units.

> DISPLAY UNITS
> Press SET

3. Press **Set**.
4. Use the arrow keys to choose the desired units.
5. Press **Set.**

Setting Degree Day Counters:

Caution: Be careful when entering a parameter update screen for a degree day 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.

If the display is off, press **Display** to turn it on.

> Select Parameter
> To Be Set (↑↓)

1. Press **Set**.

> DEG DAY COUNT #1
> Press SET

2. Scroll to Degree Day Counter #1 screen.
3. Press **Set**.

> Counter: DISABLED
> BASE=55 UPPER=55

4. The counter will say DISABLED.
5. Press **Set**.
6. Use arrow keys to scroll to "Start Now" option. This will start the degree day counter.   The other option is DISABLED.
7. Use arrow keys to scroll to BASE.
8. Press **Set**.
9. Choose the base temperature using the arrow keys.
10. Press **Set**.
11. Choose the upper temperature limit using the arrow keys.
12. Press **Set**.

Setting Chill Hour Counter:

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.

If the display is off, press **Display** to turn it on.

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

1. Press **Set**.

```
  CHILL HOURS
   Press SET
```

2. Scroll to the Chill Hour screen.
3. Press **Set**.

```
Counter: DISABLED
BASE=40
```

4. The counter will say DISABLED.
5. Press **Set**.
6. Use arrow keys to scroll to "Start Now" option. This will start the degree day counter. The other option is DISABLED.
7. Use arrow keys to scroll to BASE.
8. Press **Set**.
9. Choose base temperature using the arrow keys.
10. Press **Set**.

Resetting Disease Models

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

If the display is off, press **Display** to turn it on.
1. Press **Set**.

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

2. Scroll to the Reset Disease screen.

```
RESET DISEASE
Press SET
```

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

Archives

Daily Archive

The Daily Archive retains the last 30 days of data. If the battery power runs low, the WeatherTracker will stop measuring and archiving data until the battery is replaced.

After using the arrow key to select a certain day from the Daily Archive, the WeatherTracker will then cycle through all the information stored for that day. This will include a screen with the high and low temperatures for that day, any active degree day counters and the average readings for any sensors connected to the device. If a currently active Degree Day Counter was not active on that day, the screen will say "No Data".
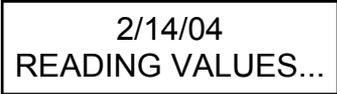
Displaying Archives

If the display is off, press **Display** to turn it on.
1. Press Current/Archive once to bring up the daily archive.

> DAILY ARCHIVE
> Select Day (↑↓)

2. Use the arrow keys to scroll to the date of interest.
3. The unit will automatically scroll through all the screens for that date.

> 2/14/04
> READING VALUES...

4. Press Current/Archive again to bring up monthly summaries.
5. Use the arrow keys to scroll through the past 12 months of data.

Screens

The following figures give examples of what each of the various weather monitor screens look like.

-Initial information screen

```
Model 330  v 1.9
Grape IPM Alert
```

This is the first screen that comes up when you turn on the logger. It gives the model number, version number and model description. This screen is from a Model 330 version 1.9 Grape Pest Alert Tracker.

-Current Values

```
Air Temp 74°F
Leaf Wet    Hours 05
```

This screen shows the current air temperature and status of the leaf wetness sensor (Dry or Wet) and the cumulative number of hours for the day. The current temperature on this screen is 74°F. The leaf wetness sensor is wet, and there is a total number of 5 leaf wetness hours for the day.

-Daily High and Low Values

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

This screen shows the high and low temperature for the day, along with the times at which they occurred. This screen shows a high temperature of 74°F at 01:58 PM and a low of 66ºF at 03:05 AM.

-Degree Day Counter

```
DD #1 50-86°   16
 Since 07/03 2125
```

This screen shows the information for Degree Day Counter #1. This counter is using a temperature range of 50 to 86°F. So far it has accumlated 16 Degree Days (DD) for today's date and has accumulated 2125 since the counter was started or reset on July 3.

-Time, Date
-Battery Level

```
09-08-02  07:09PM
 BATTERY AT 90%
```

This screen shows the current date, time and battery strength. The current date is 09-08-02 and the time is 07:09 PM. The battery is at 90%.

-Disease Name
-Index Values

```
 BLK ROT=NONE  PM:
ASC=NONE CON=100
```

This screen shows the current disease risks. This screen will be different for each of the models. (See more detailed descriptions on pgs. 15-21) This screen shows no risk for Black Rot, no risk for ascospore in-fection, and a conidial index of 100.

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 WeatherTracker calculates Degree Days using the integral method. Degree Day values 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.

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.

Apple Scab

The model 320 WeatherTracker indicates the infection risk for Apple Scab and Sooty Blotch/Flyspeck. The computations are based on the number of hours of leaf wetness within a specified temperature range.

For Apple Scab the approximate infection severity is indicated as NONE, LITE, MED, or HEVY (none, light, medium, or heavy). The Weather Tracker uses two models: the Mills Apple Scab model as modified by A.L. Jones 1980, and the Washington State University (Mills 1944). The Mills model, as modified by Jones, requires fewer hours of leaf wetness at average temperatures 47°F or below to signal a risk for infection than does the Washington State model. Both of these models denote a Light, Medium, or Heavy infection risk depending on the number of hours of leaf wetness at a given average temperature. A modified Mills table is shown on the following 2 pages.

Sooty blotch is a disease complex (i.e. it is composed of more than 1 pathogen) of two fungi, Peltaster fruticola and Leptodontium elatius. Flyspeck is caused by another fungus, Zygiophiala jamiacacenis. Both fungi are dispersed by rainfall and their spores germinate in water (Jones and Sutton 2001). The WeatherTracker displays the cumulative number of leaf wetness hours. Different areas of the USA may require different numbers of leaf wetness hours to enter a level of infection risk. The southern region generally uses a 250 hour limit, and the northern region, 300 leaf wetness hours. The hours are displayed below "SBFS" on the LCD.

Infection Severity Screen

```
SBFS  MILLS=LITE
220hrs  WSU=LITE
```

This screen shows the infection risk for the day, which for this example is light for both the Mills and WSU models for Apple Scab. The Sooty Blotch/Flyspeck leaf wetness hours are below the limits of concern. The risks are calculated daily.

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Apple Mills Table

Approximate numbers of hours of wetting required for primary apple scab infection at different air temperatures			
Average	Degree of Infection (hrs)		
(°F)	Light	Medium	Heavy
78	13	17	26
77	11	14	21
76	9.5	12	19
63 to 75	9	12	18
62	9	12	19
61	9	13	20
60	9.5	13	20
59	10	13	21
58	10	14	21
57	10	14	22
56	11	15	22
55	11	16	24
54	11..5	16	24
53	12	17	25
52	12	18	26
51	13	18	27

Apple Mills Table

Approximate numbers of hours of wetting required for primary apple scab infection at different air temperatures			
Average	Degree of Infection (hrs)		
(°F)	Light	Medium	Heavy
50	14	19	29
49	14.5	20	30
48	15	20	30
47	15	23	35
46	16	24	37
45	17	26	40
44	19	28	43
43	21	30	47
42	23	33	50
41	26	37	53
40	29	41	56
39	33	45	60
38	37	50	64
37	41	55	68
33 to 36	48	72	96

Grape Powdery Mildew

The model 330 WeatherTracker predicts two infectious stages, an ascospore stage and a conidial stage (Thomas, Gubler, and Leavitt 1994; Weber, Gubler, and Derr 1996) Ascospores are released in the spring from the structure in which the disease overwintered. Conidial spores are the result of an ascospore infection. Ascospores cause primary infections and conidial spores cause secondary infections. Your State Agricultural Extension Service can advise you about which stage is important in your area.

Ascospore Infection risk is determined using the daily average temperature and the hours of leaf wetness. A modified Mills Table (2/3 the original Mills leaf wetness value) is used to determine the development of a **'Heavy' Ascospore Infection**, the point at which treatment should begin.

Three consecutive days with 6 consecutive hours of temperatures between 70°F and 85°F are required to initiate the **Conidial Index**. Thereafter, the index increases by 20 with each day having six consecutive hours between 70°F and 85°F. The index decreases by 10 on days with less than six consecutive hours in the range of 70°F to 85°F and on days with a maximum temperature greater than 95°F. The index will always be between zero and 100.

Infection Severity Screen

```
 BLK ROT=NONE PM:
ASC=NONE CON=010
```

This screen shows the risk for Black Rot and Powdery Mildew. The Powdery Mildew ascospore infection is none, and the conidial index is 10.

Grape Mills Table

Daily Average Temperature (F)	Hours of Leaf Wetness required for heavy ascospore infection (2/3 original Mills value)
42	40
43	34
44	30
45	27.3
46	25.3
47	23.3
48-49	20
50	19.3
51	18
52	17.3
53	16.7
54-55	16
56-57	14.7
58-59	14
60-61	13.3
62	12.7
63-75	12
76	12.7
77	14
78	17.3

Conidial Index:
  0 - 30 = **Light** infection risk
 40 - 50 = **Medium** infection risk
 60 - 100 = **Heavy** infection risk

Grape Black Rot

Black Rot is a disease caused by the fungus *Guignardia bidwelli*. It overwinters in in old mummified berries. In spring, the primary inoculum is released which starts the initial round of infection. Those initial spores are dispersed by rain and wind. After the initial infection period, secondary infections are spread by rain splash. This model predicts infection periods of Black Rot based upon the Spotts model.

This model uses **temperature** and **leaf wetness** period to estimate the onset of an infection period. The temperature is compared with the period of leaf wetness needed to produce an observable infection. If the wetness period exceeds the required period for that temperature, the word **RISK** will appear

Infection Severity Screen

```
BLK ROT=RISK PM:
ASC=NONE CON=010
```

This screen shows a risk for Black Rot as well as Powdery Mildew. This screen shows a risk for Black Rot.

Temperature (F)	Hours of Leaf Wetness
50	24
55	12
60	9
65	8
70	7
75	7
80	6
85	9
90	12

Source R.A. Spotts, Ohio State University
Data represent Concord, Catawba, Aurora and Baco Noir.

Tom-Cast

The model 325 WeatherTracker uses **Tom-Cast**, a tomato disease forecasting program designed to predict Early Blight, Septoria Leaf Spot, and Anthracnose. (Pitblado ~1985; Bolkan and Reinert 1994) **Tom-Cast** calculates a disease severity value (**DSV**) to predict the development of these diseases.

An increasing number of leaf wetness hours and a higher temperature cause the **DSV** to increase at a faster rate. A **Cumulative DSV** of 15 to 20 is usually viewed as the threshold for initiating a spray program. Contact your State Agricultural Extension Service for further information regarding disease management in your area.

Infection Severity Screen

```
TOMCAST DSV
DAY=2  ACCUM=010
```

This screen shows the DSV values for the day as well as the accumulated DSV values. The daily DSV on this screen is 2 and the number of DSV's accumulated since the reset is 10.

Disease Severity Value Chart					
Average Temp During Leaf Wet Hours (ºF)	**Hours of Leaf Wetness per Day**				
55-63	0-6	7-15	16-20	21 +	
64-69	0-3	4-8	9-15	16-22	23+
70-78	0-2	3-5	6-12	13-20	21+
79-84	0-3	4-8	9-15	16-22	23+
Daily DSV =	**0**	**1**	**2**	**3**	**4**

References

Bolkan, M. A. and W. R. Reinert. (1994). Developing and Implementing IPM Strategies to Assist Farmers: An Industry Approach. Plant Disease, 78:545-550.

Jones, A. L., et al. (1980). A Microcomputer-based Instrument to Predict Primary Apple Scab Infection Periods. Plant Disease. 64:69-72.

Pitblado, R.E. (1985). A Weather-timed Fungicides Spray Program for Field Tomatoes in Ontario. TOM-CAST, The Model. Ridgetown College of Agricultural Technology. Ridgetown, ON.

Spotts, R. A., (1977). Effect of Leaf Wetness Duration and Temperature on the Infectivity of Guignardia Bidwelli on Grape Leaves. Phytopathology 67:1378-1381.

Thomas, C. S., W. D. Gubler, and G. Leavitt. (1994). Field Testing of a Powdery Mildew Disease Forecast Model on Grapes in California. Phytopathology, 84:1070 (abstract)

Weber, E., D. Gubler, and A. Derr. (1996). Powdery Mildew Controlled with Fewer Fungicide Applications. Practical Winery & Vineyard, January/February.

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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